PERIOPERATIVE USE OF AN ANESTHESIA VENTILATOR FOR AEROSOLIZED VASODILATOR: THE ROLE OF RESPIRATORY CARE.

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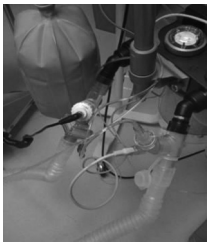
BACKGROUND: A small fraction of patients undergoing complex cardiac surgery are at risk for acute intraoperative right heart dysfunction. Current evidence suggests that aerosolized inhaled epoprostenol (Flolan® (PGE2) GlaxoSmithKline, Research Triangle Park, NC) is less expensive than nitric oxide and has similar efficiency for decreasing intraoperative pulmonary vascular resistance. METHOD; Perioperatively, both anesthesia staff and Respiratory Therapy require specialized training regarding the use of PGE2 with the anesthesia ventilator (Apollo®, Drager Medical, North America, Telford, PA) (AV). A vibrating mesh type of nebulizer, Aeroneb®, (Galway Business Park, Dangan, Galway, Ireland), (ANEB) kit and control unit is connected to the inspiratory port. One PALL® filter (PALL Medical, East Hills, NY) is then connected to the expiratory port and one disk filter is connected to the AV circuit to protect the AV gas analyzer. Four concentration based doses of PGE2 are used during therapy: 20,000 ng/mL, 10,000 ng/mL, 5,000 ng/mL, 2,500 ng/mL. Each is prepared as a salt based compound reconstituted in a glycine buffer diluent. Because the glycine buffer is sticky, AV performance is monitored closely for filter occlusion, inadvertent positive end expiratory pressure (auto-PEEP), end tidal CO2 (ETCO2) and tidal volume (VT). The PGE2 starting dose is 20,000 ng/mL, PGE2 is infused into the ANEB at a fixed 8 cc/hr rate. The ANEB control unit is set-up to run continuously. RESULTS: Perioperatively, we have safely treated more than 75 adult patients with PGE2 at The University of Chicago Medical Center. PGE2 is usually started toward the end of the case as cardiopulmonary bypass is being weaned. No intraoperative problems reported with regards to mean arterial pressure. No issues with regard to AV function, ETCO2 monitoring, measured VT, clogged filters or auto-PEEP reported during the intraoperative procedure. The use of other types of nebulizers utilize an external gas flow, which may have an effect on AV function and gas analyzer. CONCLUSION: Respiratory Therapy is an essential contributor in the safe administration of PGE2 during the perioperative period. PGE2 delivered by continuous ANEB is a safe effective substitute for nitric oxide. More prospective studies are needed to better determine optimal strategies for perioperative PGE2 delivery.

Sponsored Research - None



Apollo Ventilator with Aeroneb inline

1381900

ADHERENCE OF PRESCRIBED MDI BRONCHODILATOR DOSES BY RESPIRATORY THERAPISTS ON MECHANICALLY VENTILATED PATIENTS.

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BACKGROUND: Metered-dose inhaler (MDI) is a drug-delivering aerosol device frequently used on mechanically ventilated patients. Among other factors, the doses of bronchodilator administered in a clinical setting may be determined by the physician's order and the patient's changing condition. The purpose of this study was to determine the correlation of the prescribed doses and the doses administered by the therapists to mechanically ventilated patients. METHODS: University and hospital IRB approvals were obtained for this study. Mechanically ventilated patients receiving MDI bronchodilator treatments were included in this study. Respiratory therapists were selected in random order and they were blinded to the purpose of the study and collection of data. The data collected were the type of MDI medications prescribed, the number of puffs ordered by the physician and the actual number of puffs administered by the therapists. Descriptive analysis was done to interpret the data. RESULTS: Seventeen therapists were observed administering the MDI bronchodilator. Each of the therapist was observed three times for a total count of 51 treatments. Of all 51 treatments, the physician ordered albuterol sulfate and a prescribed dose range of 2 to 4 puffs. All therapists administered the MDI dosages within this range. The breakdown of the doses administered showed: 2 puffs (32), 3 puffs (8) and 4 puffs (11). Eleven therapists used 3 or 4 puffs of MDI bronchodilator for at least one of the three treatments observed. Six therapists administered 2 puffs consistently for all three treatments observed. CONCLUSIONS: The respiratory therapists in this study adhered to the range of prescribed MDI doses. However, the range of prescribed MDI bronchodilator doses (2 to 4 puffs) was lower than that recommended by several studies (3+ puffs). The therapist should assess the patient and administer the appropriate bronchodilator doses for maximum benefit to the patient.

Sponsored Research - None

1415619

PROBIOTIC ADJUNCTIVE SUPPLEMENTATION IN SURGICAL CRITICAL CARE.

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Background:Clostridium difficile(C.diff.)infection remains a problem in the Surgical Intensive Care Unit (SICU).When Infection from C. diff. occurs it is not uncommon for patients to have co-morbid Health Care Associated Pneumonia (HCAP). Probiotics have been purported to reduce the severity of antibiotic induced colitis from C. diff. and possibly the incidence of HCAP.Hypothesis:We hypothesized that the addition of probiotics in addition to evidenced based algorithms in the treatment of infection in the SICU will allow for decreased ventilator days, decreased ICU length of stay LOS).Design: Prospective Masked Randomized Control Trial of Culturelle (Amerifit) Lactobacillus GG (LGG) (75mg Lactobacillus rhamnosus ATCC #53103, 20 billion CFU's) vs. placebo given orally or by Gastric/PEG tube. Setting: 40 bed SICU in a 1000 bed University Affiliated Urban Hospital Methods:(n=74)Subjects were enrolled In the SICU and had diarrhea defined as greater than three loose stools in a twenty four hour period.Immunocompromized subjects were excluded. Subjects who consented in the study received either Lactobacillus or a placebo, were enrolled within seventy two hours of experiencing symptoms of diarrhea and remained in the study until discharge.Standard treatment algorithms were used for management of Diarrhea, Infection, HCAP, Daily Ventilator Bundle assessment/weaning.Demographic and Clinical Data were collected including Apache II scores, Respiratory/ Stool/ other Cultures,SICU LOS,Ventilator days, use of antibiotics and resolution of HCAP/ diarrhea.Results:Total subjects (n=74).Subjects with APACHE II scores < 20 on ventilators with diarrhea and pneumonia who completed treatment (n=21); Mean Vent days of 14 in the Lactobacillus treated group vs.18 days in the placebo group.The Mean SICU LOS of the Lactobacillus group was comparable at 30 vs. 29 in the placebo group.Conclusion: There were no identifiable negative effects associated with Probiotic supplementation, an identifiable advantage to Probiotic supplementation was resolution of diarrhea.Probiotic supplementation did appear to have a positive impact on our study population as evidenced by decreased Ventilator days (Mean of 4) with very little impact on SICU LOS.We were not able to meet our study target of one hundred and eighty patients for statistical significance. Further large scale multi-center studies are needed to validate our observations.

Sponsored Research - None

Comparison of Subjects(n=21) Lactobacillus (LGG) vs Placebo (Mean APACHE II / Mean LOS/Mean VENT DAYS

Placebo APACHE II (n=10) mean =12	Placebo, mean= LOS 29 days	Placebo, vent days=18
LGG APACHE II ,(n=11) mean =14	LGG, mean LOS=30	LGG, mean vent days=14

1414573

DELIVERY OF ALBUTEROL BY PRESSURIZED METERED-DOSE INHALER AND JET NEBULIZER VIA MASK WITH HIGH FLOW NASAL CANNULA IN PLACE REDUCES AEROSOL DELIVERY.

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Background: During high flow nasal cannula (HFNC) therapy, jet nebulizer or pressurized metered-dose inhaler (pMDI) may be administered by mask with the cannula in place (with HFNC) or removed. We quantified aerosol drug delivery with or without a HFNC using either pMDI or jet nebulizer. Methodology: An upper airway model of a 9 month-old infant (SAINT) with an absolute filter (Respirgard II) distal to the trachea was connected to a breathing simulator (Harvard Appartus) set to simulate pediatric parameters (Vt of 100 mL, RR of 30 breaths/min, and I:E ratio of 1: 1.4). Oxygen at 3 l/min was administered through an infant HFNC (Optiflow, Fisher & Paykel) attached to the nares of the model. Aerosol drug was administered using: 1) Misty-neb jet nebulizer (Allegiance Healthcare) powered by air at 8 l/min using pediatric aerosol facemask (B&F Medical) to deliver albuterol sulfate (2.5 mg/3 mL NS) and 2) Four actuations of Ventolin HFA pMDI (90 μg/puff) were administered via valved holding chamber with mask (AeroChamber plus with Flow-Vu). Aerosol was administered to the model with and without the HFNC in the nares (n=3). Drug was eluted from the filter and quantified using spectrophotometry (276 nm). Independent t tests were performed ($p < 0.05$). Results: Table shows mass and % of albuterol dose (mean ± SD) deposited distal to the trachea. Removing HFNC from the nares before aerosol treatment increased drug delivery with the jet nebulizer ($p = 0.024$) and pMDI ($p = 0.003$). Deposition % was greater with pMDI than jet nebulizer, with or without nasal cannula in place. Conclusions: During HFNC therapy, aerosol delivery via mask over cannula is less efficient than removing the cannula during administration. When delivering medical aerosol by mask, the benefit of increased aerosol delivery must be weighed against the risk of lung derecruitment when nasal prongs are removed.

Sponsored Research - None

	Jet Nebulizer		pMDI	
	With HFNC	No HFNC	With HFNC	No HFNC
Inhaled Mass (μg)	72.8 ± 5.8	151.3 ± 38.1	21.8 ± 1.0	142.4 ± 32.3
Inhaled Dose %	2.9 ± 0.2	6.1 ± 1.5	6.0 ± 0.3	39.5 ± 8.9

1417741

ON-TIME AVAILABILITY OF METERED DOSE INHALERS: A QUALITY PROJECT COMPLETED BY RESPIRATORY CARE AND PHARMACY TO ENSURE MEDICATION IS AVAILABLE IN A TIMELY FASHION.

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Having patient medications available on-time is important for safe and effective patient care. The Respiratory Care Department at Mayo Clinic in Arizona identified an issue with the availability of respiratory medications for patients with new respiratory treatment orders or for patients who had been transferred from another nursing unit within the hospital. Of particular concern was metered dose inhaler (MDI) availability. Since MDIs are not stored in the nursing unit Pyxis and must be delivered from the Pharmacy with each new order, the MDI was frequently not available for therapists to provide to the patient. Treatments were often delayed while therapists tried to get the medication from the Pharmacy. Additionally, when patients were transferred from one nursing unit to another, MDIs were not transferred with them and the therapists spent time looking for the medication. The group used multiple quality tools to identify the root cause of why the medication was not available. A fishbone diagram was used to identify potential causes of the problem. A data collection form was developed and information for 30 MDIs on 28 patients with new orders or who had been transferred was collected. Analysis showed that 47% of the MDIs were not available when the treatment was due. Using a Pareto chart to identify the frequency of each cause, it was determined that the most frequent cause was the pharmacy not sending the MDI on time. A process management chart indicating the process followed by Respiratory Care was completed. The pharmacy was contacted to review the information gathered from the project and to help identify a solution. All orders are entered electronically through the Cerner electronic medical record (EMR) system. It was identified that several methods of creating, correcting, or reordering medications are available. Regardless of the ordering method, therapists are notified via Cerner that a new medication has been ordered. It was discovered that unless orders were entered in a specific manner, the orders were not presenting to the pharmacy properly which caused the delay in medication delivery. As a result of the project, the Cerner notification process for the pharmacy was reworked. Therapists were educated on the proper method for ordering. Follow-up data collection on 20 MDIs was completed and analysis has shown that the on-time availability of MDIs has improved 70% from the baseline.

Sponsored Research - None

1406614

COST-BENEFIT ANALYSIS OF A DOSIMETRIC NEBULIZER USING CIRCULAIRE AND A TRADITIONAL VIXONE NEBULIZER.

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Aerosol administration via small-volume nebulizers are still being used by selected patient-population. In the economic market, several nebulizer designs have become available, with each incorporating unique features that will potentially establish it as the preferred choice in aerosol delivery. With the continuous rising cost of health care services, clinicians are faced with the task of identifying opportunities for cost reduction in respiratory care. PURPOSE: The purpose of this study was to conduct a cost-benefit analysis of dosimetric nebulization using the Circulaire system and the traditional VixOne nebulizer. The desired outcome was to elevate awareness of the potential impact of the Circulaire, and how its adoption might reduce costs and enhance productivity in respiratory care. METHODS: A retrospective study using existing data collected from an urban tertiary adult hospital with a Level II Trauma Center was completed. DATA ANALYSIS: Descriptive statistics were run for each variable. The total cost of a full-time Registered Respiratory Therapist (RRT) with benefits per hour was calculated. The average number of RRTs per 12-hour shift, average number of nebulizer treatments by an RRT per 12-hour shift, average costs of traditional VixOne nebulizer and the Circulaire system were also calculated. RESULTS: Descriptive statistics indicated the annual cost of delivering aerosol therapy using the traditional VixOne nebulizer at 9-minutes treatment time to be $114,263.25 per year. The Circulaire was compared at two different treatment times of 5-minutes and 3-minutes, and the annual costs were $137,422.50 per year and $116,982.50 respectively. A sensitivity analysis was also conducted, and the treatment load was increased by 30%, with a reduction to 5 RRTs per shift. Data indicated an annual savings of 8% with the Circulaire at 5-minutes treatment time, and 21% with the Circulaire at 3-minutes treatment time. CONCLUSION: The use of the Circulaire system at 5-minutes or 3-minutes treatment time can reduce department expenditure by reducing labor costs.

Sponsored Research - None

1414226

MEDICATION COMPATIBILITY: IMPLICATIONS FOR COMBINATION THERAPY.

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Rationale: Aerosolization and inhalation is an accepted and ubiquitous option for the delivery of numerous pharmaceuticals. Patients with complex pulmonary problems may receive up to four medications for inhalation in several intervals throughout the day. Patients and healthcare practitioners will combine many of these medications in a single nebulizer cup to shorten treatment times. Although the combining of inhaled medications is quite common the compatibility of all nebulized medications has not been fully investigated. Objective: The purpose of this project was to expand upon current medication compatibility knowledge. Methodology: A review of the available literature was conducted to determine the compatibility of common inhaled pulmonary medications. The following databases/sites were utilized for this review: CINAHL, Pubmed, Google Scholar, Cochran Collaboration. The researchers created a matrix to record the types of compatibility accepted and published in the available literature. Results: The literature search numerous assessment techniques to assess medication compatibility, e.g. visual inspection, pH change, high-pressure liquid chromatography, temperature change, aerosol particle size change, precipitation formation, drug recovery, chemical compatibility, differential scanning calorimetry, differential thermal analysis, mass spectroscopy, solid state stability, surface oxidation, radio-labeled techniques, flourescence spectroscopy, FDA approval. No medication combination has been verified by assessment options. Table 1 demonstrates the medication combinations and the compatibility level. Blank spaces in the table indicate areas without any assessment of compatibility. Table 1 medications represent those with documented compatibility and test information. Medications without any documentation of compatibility were not included in this table. Also, medications believed to be compatible but failing to identify the test used to assess compatibility were not included. Conclusion: The literature review revealed an enormous void in medication compatibility information related to aerosolized pulmonary medications. It is not known from this review if combining these medications leads to any adverse events. We suspect many of these medications can be safely combined without incident. However, it seems reasonable to require at least one form of medication compatibility assessment prior to mixing.

Sponsored Research - None

1407542

A RETROSPECTIVE LOOK AT THE RESPONSE OF PATIENTS TO INHALED EPOPROSTENOL(FLOLAN) NEBULIZED WITH AN AERONEB SOLO AS COMPARED TO NITRIC OXIDE.

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Background: Inhaled Flolan is a drug modality that has recently become more attractive as an alternative to Nitric Oxide for the treatment of pulmonary hypertension and refractory hypoxemia. In an effort to offset the prohibitive cost of Nitric Oxide institutions have been using inhaled Flolan as a substitute. Most results have shown that inhaled Flolan is at least equivalent to Nitric Oxide in decreasing mean pulmonary artery pressure (MPAP). We started using inhaled Flolan in our refractory hypoxia patients first, subsequently branching out to our cardiac surgery population. We hypothesized that inhaled Flolan would be at least equal to Nitric Oxide in 1) decreasing pulmonary artery pressures and 2) improving Pao2/Fio2 (P/f) ratios. Method: Inhaled Flolan was initiated in the cardiac operating room at a dose of 50 ng/kg/min for increased MPAP after resumption of normal circulation in post cardiac surgery patients. Also, Flolan was used to increase p/f ratios in our refractory hypoxemia patients. Flolan was delivered to an Aeroneb solo vibrating mesh nebulizer via a Bbraun syringe pump. As the patient's condition improved Flolan was weaned down in increments of 10 ng/kg/min. Flolan results were compared to a patient population that received Nitric Oxide the year before. Results: When results are compared between Flolan and Nitric Oxide there is no significant difference in P/f improvement and virtually no difference between the two drugs when comparing MPAP improvement. P/f improved on average by 124% with NO and 98% with Flolan. MPAP decreased on average by 29% with NO and 31% with Flolan. Average cost for NO was $2428/day and for Flolan cost were $211/day. Conclusion: Inhaled Flolan appears to be at least as effective as Nitric Oxide when used to decrease MPAP or to increase P/f ratio in refractory hypoxemia. With the decrease in cost, inhaled Flolan seems to be an attractive alternative to Nitric Oxide.

Sponsored Research - None

NO vs Flolan Comparison

	Pao2/Fio2 ratio		n	% improvement	MPAP		n	% Improvement	Cost/day	
	Pre	Post			Pre	Post			NO	Flolan
Flolan	82	163	35	98%	42	29	51	31%	$2428	$211
NO	87	195	16	124%	38	27	63	29%		

1415504

EVALUATION OF AEROSOLIZED MILRINONE THROUGH A VENTILATOR BREATHING CIRCUIT FROM A VIBRATING-MESH NEBULIZER.

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BACKGROUND: Administration of intravenous (IV) Milrinone is commonly used in patients to manage cardiac ventricular dysfunction, low cardiac output, and increased pulmonary vascular resistance (PVR) following cardiac surgery. Systemic hypotension can occur at IV Milrinone dosages which achieve maximum PVR dilation. In an effort to minimize the systemic hypotension side effects, a pre-clinical trial bench evaluation of inhaled aerosolized Milrinone was performed. METHODS: Milrinone (0.5mg/ml) was introduced into a vibrating-mesh nebulizer from a syringe pump set at two infusion rates, 12ml/hr (Sample A) and 6ml/hr (Sample B). Three 30 minute tests were performed at two pump infusion rates. The nebulizer was added to the dry-side of a humidifier column on a 72" dual-heated adult ventilator circuit, connected to a standard dual chamber test lung via an 8.0mm endo-tracheal tube (ETT). Between the test lung and the end of the ETT, two viral/bacteria filters were inserted in series to collect nebulized Milrinone precipitate. Ventilator settings were FiO2 0.60, PRVC mode, rate - 12, TV - 500ml, IT - 1.0, PEEP 5 cmH20, Rise time 0.15 seconds and compliance compensation ON. The compliance setting on the Michigan instruments test lung was 0.06 ml/cmH2O with resistor number 3 in use. The Milrinone was extracted from the 12 filters using a methanol bath and concentration was determined by High-Performance Liquid Chromatography (HPLC). RESULTS: As shown in the table, the average amount of Milrinone collected on the filter proximal to the breathing circuit Y-piece for samples A and B were 477.2mcg and 216.1mcg, respectively. The total percentage of Milrinone recovered on the filter at the end of the ETT was 15.74% for Sample A and 14.41% for Sample B. Milrinone was not recovered on the second filter in any of tests (distal to the breathing circuit Y-piece). CONCLUSION: Consistent concentrations of nebulized Milrinone were delivered to the end of an ETT using the apparatus described. The percentage of nebulized Milrinone (0.5gm/ml) available at the end of an ETT for deposition and absorption by the lung is consistent with other routine aerosolized inhaled medications (Ari A., Respiratory Care, 2010). The total amount of Milrinone administered via the vibrating-mesh nebulizer is dependent on the set infusion rate of the pump. Further clinical trials are needed to determine the safety and efficacy of nebulized Milrinone.

Sponsored Research - None

	Sample A		Sample B	
	12ml/hr for 30 min	% drug recovered	6ml/hr for 30 min	% drug recovered
	mcg	at filter	mcg	at filter
Run 1	450.3	15.01	253.4	16.89
Run 2	467.4	15.58	211.4	14.09
Run 3	498.9	16.63	183.5	12.23
Average	472.2	15.74	216.1	14.41
Std	20.2	0.82	28.8	2.34

1435168

COMPARISONS OF THE RAM CANNULA WITH HIGH FLOW NASAL CANNULA (HFNC) ON AEROSOL DRUG DELIVERY IN A SIMULATED NEONATAL LUNG MODEL.

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Background: Aerosol delivery through HFNC has been described with in vitro models. The RAM cannula, which is used for support of ventilator-dependent patients, has not been characterized for aerosol delivery. The purpose of this study is to compare HFNC with RAM cannula on aerosol drug delivery in a simulated neonatal lung model. Method: An in-vitro airway/lung model, using the DiBlasi newborn upper airway model attached to a collecting filter and test lung, was passively ventilated with a ventilator (Respironics Esprit) using the RAM cannula (Premie RAM Cannula, Neotech) or during active simulated spontaneously breathing newborns using a sinusoidal breathing pump with a HFNC (Fisher& Paykel) placed in the nares of the model. Based on the RAM manufacturer's recommendations, two ventilator settings were utilized with the RAM cannula; PIP 15 cmH2O, PEEP 5 cmH2O, Ti 0.5 sec, RR 40/min; and PIP 30 cmH2O, PEEP 8 cmH2O, Ti 1 sec, RR 48/min. Breathing parameters used with HFNC include RR 50, Vt 8ml, and I:E ratio 1:2. A vibrating mesh nebulizer (Aeroneb Solo, Aerogen) was placed at the inspiratory inlet of a heated humidifier (Fisher&Paykel) in which the temperature was held constant at 37 °C. Albuterol sulfate (2.5mg/3mL) was administered through either HFNC and the RAM cannula connected to the HFNC and ventilator circuit, respectively. Drug deposited on a filter distal to the model's trachea was eluted and analyzed via spectrophotometry. Independent and paired sample t-test were used for data analysis ($p<0.05$). Results: Deposition of inhaled dose (expressed as mean mass and % of nominal dose ± SD) is shown in the table below. Comparisons of the RAM cannula with HFNC showed that the RAM cannula delivers significantly less aerosols than HFNC at both 3 lpm ($p=0.002$) and 6 lpm ($p=0.022$). Using minimum setting with the RAM cannula increases dose efficiency ($p=0.033$) during mechanical ventilation. Decreasing flow rate from 6 to 3 L/min increases aerosol delivery with HFNC ($p=0.119$). Conclusion: Regardless of the settings, aerosol delivery via HFNC is more efficient than the RAM cannula in a simulated neonatal lung model.

Sponsored Research - None

Cannulae Type	RAM		HFNC	
Settings	Min Setting	Max Setting	3 lpm	6 lpm
Inhaled mass (mcg)	16.53 ± 2.90	10.03 ± 2.05	39.96 ± 5.52	28.63 ± 8.61
Inhaled mass %	0.66 ± 0.11	0.40 ± 0.08	1.60 ± 0.20	1.14 ± 0.34

1410406

EFFICIENCY OF AEROSOL DELIVERY DEVICES IN MECHANICALLY VENTILATED PATIENTS WITH ARTIFICIAL AIRWAYS.

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BACKGROUND: Artificial airways such as tracheostomy tube (TT) and endotracheal tube (ETT) are commonly used for aerosol therapy as part of long-term airway management in critically ill patients. Since the primary focus of previous research was the ETT, there is no evidence in the literature about the delivery of inhaled medications administered with different aerosol devices in mechanically ventilated patients with TT. The purpose of this study was to quantify the efficiency of aerosol devices in a lung model of an intubated and mechanically ventilated adult with tracheostomy. METHOD: An in-vitro lung model was constructed to simulate mechanically ventilated adults with either TT (Portex) or ETT (Mallincrodt) of 8 mmID with both bronchi of the manikin connected to a Y adapter which was attached to a passive test lung through a collecting filter (Respirgard II, Vital Signs). A ventilator delivered adult breathing parameters (Vt: 450 mL, RR: 20/min, PEF; 40 L/min and I:E ratio: 1:3) to the airway. Drug on the filter was eluted and analyzed with spectrophotometry (276 nm). Descriptive statistics, paired sample t-test and independent sample t-test were used with $p<0.05$ considered significant. RESULTS: Table shows the mean % (± SD) of emitted (pMDI) and nominal (SVN) dose delivered distal to the trachea with each device. Tracheal dose via TT is marginally greater with ETT using JN and pMDI ($p=0.226$ and $p=0.106$, respectively). Delivering aerosols with pMDI increased lung dose up to 3 fold compared to JN with both TT and ETT ($p=0.0001$ and $p=0.001$, respectively). CONCLUSION: Aerosol drug delivery via ETT is less than TT, while delivery efficiency of pMDI via either airway is greater than that of JN in this model of simulated mechanically ventilated adults.

Sponsored Research - None

	Tracheostomy Tube (TT)		Endotracheal Tube (ETT)	
Aerosol Devices	JN	pMDI	JN	pMDI
Lung Dose (%)	3.89 ± 0.56	14.73 ± 0.10	3.18 ± 0.14	11.59 ± 1.90

1410405

COMPARISON OF ALBUTEROL DELIVERY USING TWO DIFFERENT NEBULIZER POSITIONS DURING HIGH FREQUENCY OSCILLATION AND CONTINUOUS POSITIVE EXPIRATORY PRESSURE IN A SPONTANEOUS BREATHING ADULT LUNG MODEL.

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BACKGROUND: Continuous high frequency oscillation (CHFO) and continuous positive expiratory pressure (CPEP) is used for atelectasis and retained secretions but may compromise aerosol delivery. MetaNeb device (Hill-Rom) with CPEP and CHFO with low and high oscillation has an integrated jet nebulizer (Salter) to administer aerosol. Our goal was to quantify aerosol delivery using nebulizer with CPEP and CHFO (low and high frequency) at two different nebulizer positions and compare to standard nebulizer alone. METHOD: An upper airway teaching mannequin was connected at the bronchi with absolute filter (Respirgard II) to one chamber of a test lung (Michigan Instruments) while the other chamber was ventilated to simulate spontaneous breathing at respiratory rate 15 bpm, inspiratory flow rate 30 L/min, I:E ratio 1:1.3. Albuterol (2.5 mg/3 mL) was nebulized with nebulizer alone, and with CPEP and CHFO (high and low frequency) with nebulizer integrated in the manifold (as designed) and placed between manifold and mouthpiece (optional position) (n=3). Drug was eluted from the filter and analyzed using spectrophotometry (276 nm). ANOVA and paired t-test were performed ($p \leq 0.05$). RESULTS: The table shows the mean inhaled (±SD) % of albuterol delivered distal to the trachea. In the integrated position, aerosol delivery was less than 0.42% in all modes. The optional nebulizer position increased delivery compared to integrated nebulizer position in CHFO with low and high frequency as well as CPEP ($p=0.017$, $p=0.013$ and $p=0.006$ respectively) but was less than nebulizer with mouthpiece ($p=0.0001$). Nebulizer with mouthpiece was more efficient than any condition tested with CHFO and CPEP ($p=0.0002$).CONCLUSION: Placement of nebulizer between manifold and mouthpiece (optional position) increased aerosol delivery efficiency by an order of magnitude during CHFO and CPEP.

Sponsored Research - None

	Nebulizer with Mouthpiece	Traditional Nebulizer Position			Optional Nebulizer Position		
		CHFO Low	CHFO High	CPEP	CHFO Low	CHFO High	CPEP
Inhaled Mass (µg)	139.19 ± 17.0	5.86 ± 3.46	2.18 ± 2.06	10.75 ± 3.03	70.06 ± 11.91	32.17 ± 6.29	83.03 ± 10.13
Inhaled Mass (%)	5.57 ± 0.68	0.23 ± 0.14	0.09 ± 0.08	0.42 ± 0.12	2.80 ± 0.47	1.28 ± 0.24	3.32 ± 0.40

1126235

A COMPARISON OF METERED DOSE INHALER DRUG DELIVERY AND PLACEMENT WITH AND WITHOUT THE NEOFLOW™ SENSOR.

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Background: Delivery of bronchodilators via metered dose inhaler (MDI) is common in neonatal mechanically ventilated patients. Use of Neoflow™ at the airway is preferred, but impact on aerosol delivery has not been reported. Recent Ventilator Associated Pneumonia initiatives promote maintaining circuit integrity even during delivery of inhaled medications. Removal of the Neoflow™ sensor to deliver MDI to this patient population may lead to increased risk of VAP and safety risks related to ventilator setting augmentations. Method: Using a Dräger Evita XL set in PC 20/5 x 30 x 21%, 8 puffs (720mcg) of albuterol was delivered via MDI spacer (Airlife Dual Minispacer™) placed in the inspiratory limb of a neonatal heated wire circuit (37 ± 1 ° C) both distal (6 inches) and proximal to the wye with and without the Neoflow™ sensor. Drug was collected on a nonconductive respiratory filter distal to a 3.5 mm ETT and attached to a passive test lung. The same circuit was used for all trials (n=3); they were performed in the order listed. Samples were eluted from the filters using an ethanol/water mixture. Absorbance at 276 nm was used to estimate the amount of albuterol in the eluent. Results: See table below Conclusion: No trend was found on deposition with the Neoflow™ sensor present or absent from the circuit, and no difference between distal or proximal position. Further studies are needed to standardize delivery method and quantify dose delivered with and without Neoflow.™

Sponsored Research - None

Table shows results of each run with ug of albuterol also expressed as mean ± SD.

Neoflow	Spacer Location	µg albuterol on filter	Mean	SD
Present	Proximal	2.78		
Present	Proximal	6.17	6.28	3.55
Present	Proximal	9.88		
Absent	Proximal	6.48		
Absent	Proximal	22.22	15.23	8.01
Absent	Proximal	16.98		
Present	Distal	5.25		
Present	Distal	11.73	10.91	5.30
Present	Distal	15.74		
Absent	Distal	8.95		
Absent	Distal	4.63	8.74	4.02
Absent	Distal	12.65		

1418096

META-ANALYSIS OF THE IMPACT OF STATINS ON THE MORTALITY AND THE EXACERBATION RATE OF PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE.

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Background: Medical therapy of Chronic Obstructive Pulmonary Disease (COPD) currently aims to reduce the exacerbation rates and to improve the quality of life. Only longterm oxygen administration has been shown to modify the mortality of the disease. In this meta-analysis of case-control and cohort studies we accumulated current evidence regarding the impact of statins on the survival rate of these patients. Methods: A systematic search in the electronic databases of the Cochrane Library, Medline and Scopus was conducted by two independent authors (May 2012). Case control and cohort studies on the impact of statins on the mortality and the exacerbation rate of patients with COPD. Data on total mortality and exacerbation rates were extracted and missing data were obtained from authors. Relative risk (RR) for total mortality and the exacerbation rate were calculated for each study and pooled. Results: 12 Case-control studies and cohorts, evaluating 231978 patients met the inclusion criteria. Statin administration was associated with a decreased risk of all-cause mortality (relative risk 0.635, 95% confidence interval 0.579 to 0.697) and a decreased exacerbation rate (relative risk 0.472, 95% confidence interval 0.304 to 0.732). Conclusion: Statistically significant reduction of the all-cause mortality and the exacerbation rate of COPD was found in patients who were receiving statins. 1A level of evidence cannot be deduced by our study, but our results enhance the level of evidence and encourage the conduction of clinical trials.

Sponsored Research - None

1432777

ENHANCED AEROSOL DRUG DELIVERY VIA VIBRATING MESH NEBULIZER DURING NON-INVASIVE VENTILATION.

Michael McPeck; McPeck Consulting Services, Huntington Beach, CA

BACKGROUND. To facilitate aerosol drug delivery during NIV with an oro-nasal face mask, and single-limb circuit with intentional leak port, a specialized mask elbow, with a port for an electronic mesh nebulizer (NIVO/Pro-X, Philips Respironics), has been developed. Because SVNs are relatively inefficient and add extraneous gas flow to the circuit,this study sought to determine if the NIVO, interfaced between the mask and the leak port, would provide greater aerosol delivery than the SVN. METHODS. A face model/respiration simulator was ventilated via an oro-nasal mask with a Philips Respironics V60 bilevel ventilator at 3 different settings: CPAP 5, bi-level10/5 and bi-level 15/8 cmH2O. 3 mL of Technetium (99mTc)-radiolabeled 0.083% albuterol inhalation solution (2.5 mg) was nebulized via SVN powered by air at 8 L/min and with the NIVO vibrating mesh nebulizer. In separate test runs, the SVN and NIVO were connected to the mask elbow, effectively placing them between the mask and the leak port of the patient circuit. Nebulizers and HEPA filters were measured in a radioisotope calibrator to determine radioactivity. Filters connected to the 'mouth' of the face model were analyzed for captured 99mTc-albuterol to determine Inhaled Aerosol (IA), which was plotted against the treatment time. RESULTS. All test runs were done in duplicate; averaged and compared by t-test. For all 3 NIV settings IA was greater with the NIVO than the SVN: 14.6% vs 7.2% for CPAP 5 cmH2O (p=0.061), 14.3% vs 6.4% for bi-bevel of 10/5 cmH2O (p=0.094), and 15.4% vs 3.4% for bi-level of 15/8 cmH2O (p=0.004). The IA was delivered in a mean of 4.7 mins with the NIVO vs 6.7 mins for the SVN. Mean (±SD) Retained Charge was 54.9 (±3.2)% for the SVN and was 3.8 (±0.5)% for the NIVO indicating that a much greater mass of the drug with which the device had been charged was actually emitted and not left behind in the nebulizer after it ceased generating aerosol. CONCLUSION. These data confirm the hypothesis and support the use of the Philips Respironics NIVO electronic mesh nebulizer for aerosol drug delivery during NIV. Compared to an SVN, when charged with 2.5 mg/3 mL of albuterol, the NIVO interfaced to the NIV mask elbow delivered a greater drug mass in all 3 configurations studied. {Mr McPeck was Respiratory Care Director at Long Beach Memorial Medical Center, Long Beach CA, when he commenced this study. Study was organized and facilitated by Strategic Dynamics, Inc., Scottsdale, AZ}.

Sponsored Research - I was subcontracted by Strategic Dynamics, Inc. to design and conduct a study on behalf of Philips Respironics to determine the aerosol delivery performance of their mesh nebulizer attachment for one the NIV masks. I billed my time and aerosol laboratory supply costs to Strategic Dynamics.

1419034

THE EFFECT OF FOUR AEROSOL DELIVERY TECHNIQUES ON AEROSOL DEPOSITION.

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BACKGROUND: Respiratory therapists have adapted the small volume nebulizer (SVN) to the side hole of the air entrainment mask (AEM) to give an aerosol treatment to patients on an FiO2 > 0.4. OBJECTIVE: To evaluate the aerosol deposition of this method and to investigate available options to deliver an aerosol treatment to patients on > 40% oxygen. METHODS: In an in vitro study we compared the aerosol delivery of four techniques. Technique one adapts the nebulizer T-piece to the side hole of the AEM. Technique two adapts the nebulizer T-piece to the corrugated tube attached to the AEM. The FiO2 for the first and second techniques was set at 0.4. Technique three used a standard aerosol face mask and SVN. Technique four used a simple face mask with two valves, connected to a reservoir bag and nebulizer by a wye connector, run at 15 L O2/min. Three mL of saline was nebulized in the SVN for eight minutes in each of 5 trials per technique. An airway manikin's trachea was connected to a lung simulator that simulated a spontaneously breathing adult (f=20, VT = 500 mL). Aerosol delivery was assessed by the residual gravimetric method by collecting the aerosol on a dry inhalation filter that was attached between the end of the manikin's trachea and test lung. One-way ANOVA and Tukey'sHSD were used to analyze the data. $P < 0.05$ was considered significant. RESULTS: The mean ± SD weight change of the inhalation filter values for the four techniques, respectively, were 24.84±23.44 mg, 6.66±1.83 mg, 189.42±39.25 mg and 6±1.72 mg. There were significant differences in filter weight change between technique 3 and the first, second, and fourth techniques. Deposition of saline in techniques 1, 2, and 4 were, respectively, 0.82%, 0.22%, and 0.2%. The deposition in technique 3 was 6.31%. Deposition using technique 3 was similar to what the literature showed as an effective deposition percent. CONCLUSION: Aerosol delivery was significantly less when techniques 1,2, and 4 were used to deliver an aerosol treatment. The third technique had significantly higher aerosol delivery to the inhalation filter than the other techniques. Thus, those three techniques should not be used to deliver an aerosol treatment because the percent aerosol delivered was < 1%.

Sponsored Research - None

1406726

EFFECTS OF BYPASS HEAT-AND-MOISTURE EXCHANGER ON AEROSOL OUTPUT DURING MECHANICAL VENTILATION.

Andy Doan, David Chang; University of South Alabama, Mobile, AL

BACKGROUND: Bypass heat-and-moisture exchanger (BMHE) has been used to administer small-volume nebulizer (SVN) therapy to mechanically ventilated patients. Unlike the traditional heat-and-moisture exchanger (HME), BHME does not require disconnection of the ventilator circuit for in-line SVN therapy. The purpose of this study was to determine the effectiveness of BHME for administering medicated aerosol therapy via a mechanical ventilator. METHODS: IRB approval was not needed for this bench study. A ventilator (PB-7200) was set up in the laboratory using a volume-controlled mode at a tidal volume of 600 mL, frequency of 15/min, PEEP of 5 cm H2O, peak flow of 60 L/min, FIO2 of 21%. An SVN was connected to a Tee-piece 14" away from the test lung on the inspiratory side of the ventilator circuit. For the experimental data, a BHME was placed between the wye adaptor and the test lung. One unit dose of albuterol sulfate was placed in the SVN running at an air flow rate of 8 L/min. Nebulization continued for one minute after the SVN began to sputter. For the control data, the BHME was removed and the steps followed the similar procedure. Data collection included 10 separate trials on the experimental and control groups. The weight differences of filters for the control and experimental groups were used for t-test analysis. DATA: For the control group without BHME, The mean weight differences for the control (withour BHME) and experimental (with BHME) groups was 0.112 g and 0.09184 g, respectively. The t-test on these 10 pairs of data showed no significant differences ($p<0.05$ level). CONCLUSIONS: The aerosol output with a BHME does not show significant difference in comparison to the setup without an HME. Since the BHME allows SVN therapy without breaking the circuit, it should be considered an advantage for mechanically ventilated patients requiring HME and SVN therapy, especially in conditions of high airway pressures or PEEP.

Sponsored Research - None

1416348

THE DEMAND AND HELPFUL OF INTERDISCIPLINARY LEARNING TRAINING COURSE FOR NOVICE REGISTERED RESPIRATORY THERAPIST.

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Background: There was two years on job training program for the novice registered respiratory therapist (RRT) was conducted by Department of Health of Taiwan since July 2007. This program was divide three stages (first stage was three months, second stage was nine months, and third stage was one year) to learn the holistic interdisciplinary cooperation to integrate respiratory care. Due to this purpose, we arranged six interdisciplinary learning training courses for the novice RRT, like physician-round in intensive care unit (ICU), physician-nurse case meeting, family members of the forum, ventilator weaning rate review meeting, case report of ICU, and review of equipment maintenance. After the end of each stage training, they was demand to fill the questionnaire with Likert 5 point scale for the demand and helpful of six course for novice RRT. Materials and Methods: There were thirteen novices RRT join the program from July 2007 to Jan. 2012 and got thirty questionnaires when they finished each stage (stage1 n=10, stage 2 n=13, stage 3 n=7). The questionnaire uses Likert 5 point scale to define the degree of demand or helpful. We used descriptive statistics to compare the degree of demand or helpful of six course in each stage and ANOVA test to defined the degree of demand or helpful of six course among three stages. Result: The degree of demand and helpful of six courses in each stage showed that the physician-round in ICU is the highest (the average value of demand in three stages is 4.6, 4.62, and 4.71, the average value of helpful in three stages is 4.5, 4.92, and 4.71). After ANOVA test to compare the demand and helpful of six courses in each stage, showed novices in the stage 2 have higher score than other stage except physician-round in ICU and physician-nurse case meeting in demand and the case report of ICU in helpful. They are not statistic significance except family members of the forum in demand ($p=0.013$) and ventilator weaning rate review meeting in helpful ($p=0.008$), Scheffe post hoc tests showed novice in stage 2 have more demand and helpful in six courses. Conclusion: In our study, these two years on job training program with six interdisciplinary learning training courses showed more fit the novice's demand and helpful. These training procedures are to make the novice quickly skillful in care patients and to assure the patient safety. Owing to limited in one hospital, the further study needs multicenter assessment.

Sponsored Research - None

1416304

THE IMPACT OF COMPLETING AUTHENTIC TASKS ON THE DEVELOPMENT OF CRITICAL THINKING SKILLS.

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Background: Competent Respiratory Therapists must possess critical thinking skills. There is a need to identify effective instructional strategies that facilitate the development of critical thinking skills in respiratory care students. This quasi-experimental research study applied the APLUS (Activate, Plan, Learn, Use, Show) instructional design model to support authentic learning tasks in Respiratory Care education to determine the impact of completing authentic tasks on the development of critical thinking skills. Methods: Fifty-one students enrolled in accredited Respiratory Care programs participated in this study. The Health Sciences Reasoning Test (HSRT) was used to measure critical thinking skills. The treatment group consisted of 24 participants who completed the authentic task along with traditional learning tasks. The control group consisted of 27 participants who completed only traditional learning tasks. Descriptive statistics, one-way ANOVA, and MANOVA were used for data analysis at the significance level of 0.05 ($p<0.05$). Results: Pretest mean score was 18.1±3.9 for the treatment group and 17.1±4.7 for the control group. Posttest mean score was 18.9±3.9 for the treatment group and 16.1±5.7 for the control group. The difference in mean scores pre- and posttest were not statistically significant for either the treatment ($t(23) = -0.59$, $p = 0.56$) or the control group ($t(26) = 1.09$, $p = 0.29$). Applying ANOVA to control for the effects of the co-variables of age, prior college experience, and GPA on total HSRT scores, there were statistically significant differences in total critical thinking posttest scores between the treatment and control groups ($F(1, 46) = 5.585$, $p = .02$). When the MANOVA statistic was applied to control for the effects of the pretest on each of the sub-scale scores, there was a statistically significant difference between the treatment and control group ($F(1, 48) = 12.14$, $p = .001$). Conclusions: Completing the authentic learning task slightly improved overall critical thinking scores. The degree to which the participants' critical thinking scores improved becomes more pronounced when the effects of pretesting, age, prior college experience, and GPA are statistically controlled. Further study is needed with a larger sample size and over a longer study period to understand the full effect of authentic learning tasks on the development of critical thinking skills.

Sponsored Research - None

1327510

STUDENT PERFORMANCE AFTER USE OF AN OXYGEN THERAPY COMPUTER-BASED LEARNING MODULE.

Kimber A. Haug, Mary L. Yacovone, Salvatore A. Sanders; Health Professions, Youngstown State University, Youngstown, OH

Background: Research suggests that non-respiratory care health care professionals' knowledge about oxygen administration is insufficient. Computer-based self-learning modules and simulations have been effective tools in the education of health care professionals. Hypothesis: We hypothesized that participants who completed a computer-based learning module about oxygen therapy, developed by one of the authors, would show a significant improvement in their knowledge about oxygen therapy and oxygen delivery devices. Methods: We recruited adult volunteers from an undergraduate nursing orientation class that included oxygen therapy in the course syllabus. Participants' knowledge was assessed before and after completion of an oxygen therapy learning module created with Adobe Captivate® using an instrument designed to assess knowledge about oxygen therapy and oxygen administration devices. The test instrument consisting of eleven items was assessed for content validity by respiratory therapists prior to administration. The test items remained the same, but the order of the items was changed in the post-test version of this instrument. A paired-samples t test was used to determine if changes in the pre- and post-test scores were statistically significant. Results: A total of 45 participants completed the pre-test, but only 23 of these completed the learning module and the post-test (N=23). Pre-test scores ranged from 0 to 6 (54.55%), while post-test scores were higher, ranging from 3 (27.27%) to 9 (81.82%). The average score on the pre-test was 3.74 (34%) (SD=1.39), and the mean post-test score was 6.77 (61.55%) (SD=1.54). The increase in participants' scores was statistically significant ($t(22) = -8.18$, $p<0.05$). Conclusions: This study suggests that knowledge about oxygen therapy and administration devices was not sufficient in this group of nursing students and that a significant gain in such knowledge, occurred with their use of a computer-based learning module about oxygen therapy.

Sponsored Research - None

1417291

THE STRUCTURE AND IMPLEMENTATION OF RESPIRATORY THERAPY ORIENTATION FOR CLINICAL STAFF IN ACUTE CARE HOSPITALS.

Kimberly Johnson, Sarah M. Varekojis, F. Herbert Douce, Laurie Rinehart-Thompson; The Ohio State University, Columbus, OH

BACKGROUND: Few reports exist that describe RT department orientation for new clinical staff. The purposes of this study were to describe how RT departments have structured new staff orientation to verify competency and meet Joint Commission standards. METHODS: This study utilized online survey research methodology, distributing a link to the AARC's Management and Education Section email lists. Respondents indicating responsibility for new clinical staff orientation in an acute care hospital were able to complete the survey. Participants were asked to indicate how competency was assessed for 37 of the 69 competencies outlined in the AARC's 2015 & Beyond initiative, and for the Commission standards in the Human Resources section of the 2010 Hospital Accreditation Program Standards. RESULTS: 2,907 members received a survey invitation, 449 accessed the online survey, and 333 met the inclusion criteria. 55% were from community hospitals, 30.1% from academic/teaching, 4% from Children's hospitals. 226 (77%) indicated new staff therapists receive individualized orientation programs based on needs or past experience. 36 of the 37 included competencies were most frequently assessed via observation of skill. Only 8 of 37 competencies were not assessed by greater than 25% of respondents. Assessment of the Commission standards was through mixed methods, most commonly computer based learning, lecture, and handouts. All of the Commission standards were assessed by greater than 95% of respondents. Probationary periods of 60-90 days were frequently reported as a timeframe for new staff to demonstrate competency. CONCLUSION: There is some consistency in both the competencies assessed and in the methods used to assess competency among RT departments. While scope of practice likely dictates whether competencies are included or not, there may be a need to incorporate additional competencies into orientation programs in the future. There does appear to be an opportunity to incorporate additional methods of not only assessing competency but also measuring some of the additional 2015 and Beyond competencies not addressed in traditional orientation programs, specifically through the use of simulation technologies.

Sponsored Research - None

1418340

RESPIRATORY CARE STUDENT EMPLOYMENT DECISIONS AND EXPERIENCES WITH HORIZONTAL VIOLENCE BEHAVIORS IN THE CLINICAL SETTING.

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BACKGROUND: Incivility between coworkers such as inappropriate language, retaliation methods and aggressive behaviors contribute to the growing problem of a hostile work environment in the healthcare setting. Hostile work environment behaviors are associated with the term horizontal violence. The purpose of this research project was to determine the relationship between a respiratory care student's choice of employer and experiences of horizontal violence in the clinical setting. METHOD: A convenience sample of respiratory care students currently enrolled in an accredited respiratory care program in the state of Oklahoma was recruited on site in classrooms at two schools. A modified questionnaire from the nursing "Horizontal Violence Survey" (Dumont, Meisinger, Whitacre, & Corbin, 2012, p. 9-10) was used which included survey questions measuring experiences with horizontal violence. Other items specific to clinical experiences and the choice of employer were added. Data analysis included descriptive statistics and correlational analysis to investigate relationships between clinical experiences and choice of employer. RESULTS: Findings showed a small positive correlation ($r(68) = 0.283$, $p = 0.02$) between the student's choice of employer and how experiences of horizontal violence personally affected the student during the clinical setting. No significant correlation was found between the student's choice of employer and personal experiences with horizontal violence behaviors during clinical setting. A mean score of 5.17 ($N = 70$, $SD = 1.29$) indicates students' experiences with horizontal violence behaviors in the clinical setting will be a factor when choosing employment. Students somewhat agreed ($M = 3.83$, SD 1.31) the addition of horizontal violence awareness training in the curriculum would better prepare them for clinical rotations. Written comments indicated students were able to recognize horizontal violence behaviors, but not the severity or implications. CONCLUSION: Study results suggest an opportunity for respiratory care program faculty to develop curriculum addressing horizontal violence and coping strategies at the clinical sites, and provide hospitals information for recruitment of respiratory care students as future employees.

Sponsored Research - None

1418596

ARE PRE-CLINICAL WORKSHOP DAYS BENEFICIAL IN PREPARING RESPIRATORY CARE STUDENTS FOR CLINICAL ROTATIONS.

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Background: A variety of strategies can be employed to promote student success in the clinical setting. Clinical simulations have become widespread in allied health training programs and provide an avenue to extend student learning in a controlled environment. On the first day of each clinical semester, students participate in a "Pre-Clinical Simulation Workshop Day". The goal of the workshop is to promote the development and application of clinical procedures and problem solving / critical thinking skills. The objective is to determine whether respiratory care students perceive that training with multiple simulation models in a workshop format is beneficial in promoting problem-solving and critical thinking skills. Method: Second year, respiratory care students (n=70) participated. Multiple simulation models (high-fidelity manikins, anatomical manikins, standardized patients, computer clinical simulations) are utilized to provide a replica of the patient care environment in the human patient simulation/standardized patient laboratory. The workshop design includes student rotating thru 5-6 stations in small groups. Clinical instructors from all clinical affiliates serve as station leaders. At each station, the student group is given a brief scenario. Students, as a team, are to perform the ordered therapies and identify and solve clinical problems that may develop. At the completion of each station, each group undergoes a debriefing. At the conclusion of the day, both students and CI participate in a general debriefing of the day's activities. Students complete a Likert scale survey. Results: Survey questions were grouped into 3 categories. Responses (either strongly agree or agree) for critical thinking/problem-solving and for improving technical clinical skills were 94.3% and 96.4% respectfully. In Fall semester workshop stations (n=35) utilizing standardized patients which center on combining clinical skills and patient communication / directions, responses were positive (96.2%). Conclusions: The students perceive that the Pre-Clinical Simulation Workshop Day provides a positive venue to develop and apply patient management, problem-solving and critical thinking skills in a controlled clinically simulated environment.

Sponsored Research - None

1429694

COPD SCREENING BY RESPIRATORY THERAPY STUDENTS AT THE YMCA SENIOR EXPO.

Georgianna Sergakis, Crystal Dunlevy, Sarah Varekojis; The Ohio State University, Columbus, OH

Background: COPD is now the third leading cause of death in the United States. Community screenings are critical in order to screen and educate at-risk individuals. Respiratory Therapy (RT) students in the course, RT 420: Pulmonary Rehabilitation and Continuing Care, investigate respiratory care in settings outside of the acute care environment. The course includes topics such as pulmonary disease management, tobacco dependence counseling and cultural competence. The culminating course experience was a COPD screening event at the YMCA Senior Expo. This service learning experience allowed students to apply course concepts and provide a valuable community service. The purpose of the study was to explore student reflections following a service-learning experience in this community setting. Method: Twenty-two undergraduate RT students facilitated a COPD screening and submitted written commentary following the event. The authors applied inductive analysis and ultimately reached consensus on three category topics: awareness, health communication, and functional health. Results: All of the RT students described their experience as positive and valuable. Most reported growth in the areas of communicating health information and interpersonal interactions with older adults. Students noted functional health definition variations in the elderly participants, decreased alarm for living with pulmonary disease symptoms and increased interest in improving health. Conclusions: Service-learning as a teaching and learning strategy was appreciated by RT students and contributed to deeper understanding of the complex social and professional issues in respiratory care. Promoting community involvement in this way is mutually beneficial for both the student and the community. Made possible by a grant from The Ohio State University Area Health Education Center (AHEC)

Sponsored Research - Made possible by a grant from The Ohio State University Area Health Education Center (AHEC)

1432481

COPD SCREENING AND HEALTH COACHING FOR CLIENTS AT THE YMCA SENIOR EXPO.

Georgianna Sergakis, Sarah Varekojis, Crystal Dunlevy; The Ohio State University, Columbus, OH

BACKGROUND: Community screenings are critical to identification of populations at-risk for COPD in order to provide secondary and tertiary prevention strategies and improve quality of life, decrease exacerbations, and slow progression of the disease. The purpose of the project was to involve undergraduate students in service learning, to offer personalized telephonic health coaching (HC) sessions on appropriate topics, and to evaluate the effectiveness of the personalized health coaching sessions. METHODS: RT students at a large mid-western university conducted health screenings at a local YMCA Senior Expo. Participants completed a health history questionnaire, height, weight, blood pressure, spirometry, and exhaled CO measurements. Interested participants were enrolled in the study and were contacted by health sciences students trained in HC. RESULTS: Thirty-six participants in June and November 2011, and 13 consented to telephonic HC. Two were male, and 9 (69%) were 60 years or older. Eleven of 13 (85%) were overweight or obese, and 7 (54%) had pre-hypertension or hypertension. One had a history of pulmonary disease, while 5 reported experiencing respiratory symptoms in the last 4 weeks. Four were current smokers and 3 were former smokers. Only 1 never smoker reported experiencing respiratory symptoms in the last 4 weeks, while 2 current and 1 former smoker denied experiencing respiratory symptoms in the last 4 weeks. 3 of the 13 (23%) had COPD screening scores 5 or greater, 2 of which were current smokers and the other was a former smoker. Only 3 of 13 completed telephonic HC sessions, ranging from 2 – 5 sessions. Topics included tobacco cessation, nutrition, diabetes. When contacted to arrange HC sessions, 2 declined because they were asymptomatic, 3 would prefer in person HC, and 1 was too busy. 6 were not contacted, some because the phone had been disconnected. CONCLUSIONS: Despite active engagement through YMCA activities, these older adults still demonstrated a need for HC in several areas. Other approaches to deliver HC, like small group or individual face-to-face meetings are recommended. Made possible by a grant from The Ohio State University Area Health Education Center (AHEC)

Sponsored Research - Made possible by a grant from The Ohio State University Area Health Education Center (AHEC)

1432464

A PILOT STUDY OF PATIENT-CENTERED COPD EDUCATION: EFFECT ON DISEASE KNOWLEDGE AND HOSPITAL READMISSION.

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BACKGROUND: The high incidence of COPD readmission and corresponding economic burden is cause for national concern. Research related to pulmonary disease management supports that clinical practice guidelines and discharge protocol implementation have the potential to decrease the number of exacerbations and reduce hospital readmissions. OBJECTIVE: The purpose of this study was to investigate whether COPD disease management education and an individualized COPD action plan delivered prior to discharge from a large mid-western medical center would increase patient knowledge and reduce hospital readmissions within 30 days. METHODS: This descriptive pilot study examined COPD knowledge, symptom severity and 30-day readmission rates of in-patients admitted for COPD exacerbation. RTs administered a knowledge questionnaire and a COPD Assessment Test (CAT) to identify knowledge deficits and quantify the severity of COPD symptoms. The RTs delivered a tailored education session, followed by a post-test COPD knowledge evaluation. In addition, a COPD action plan was created. Data analyzed using descriptive statistics and paired t-tests as appropriate. RESULTS: Eight eligible subjects (3 female, 5 male), with a mean age of 68 years were enrolled in the pilot study. Sixty-three percent had multiple readmissions within the past year. Only 3 participants had received prior COPD education. The Cronbach's alpha for the knowledge instrument was 0.693; which reflected acceptable internal consistency. Pre-test knowledge scores for this sample reflected deficits in the areas of medication and symptom management; which were also areas of highest priority to the patients. A paired t-test indicated a statistically significant change from pre-test to post-test knowledge score (p=.01). The severity of COPD symptoms ranged from medium to very high. Based on chart review, no subjects were readmitted to the hospital within the 30 day readmission window. CONCLUSION: Data suggests the personalized educational session positively influenced overall COPD patient knowledge. Each participant expressed their gratitude for the personalized attention and found the session beneficial. Further exploration is recommended using a larger sample. Standardization of the COPD discharge protocol is recommended.

Sponsored Research - None

1435289

DETERMINING THE LEVEL OF ALCOHOL POISONING AWARENESS AMONG UNDERGRADUATES AT THE OHIO STATE UNIVERSITY.

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BACKGROUND: According to the Centers for Disease Control and Prevention, excessive alcohol consumption is the third leading cause of preventable death in the United States. More than 90% of alcohol consumed by people under the age of 21occurs in the form of binge drinking, and the proportion of binge drinkers is highest in the 18 to 20-year old age group. Alcohol poisoning is a medical emergency resulting from high blood alcohol levels that suppress the central nervous system. Signs and symptoms include loss of consciousness, hypotension, hypothermia, and respiratory depression, any of which may cause death. Each year on college campuses nationwide, > 150,000 students develop alcohol-related health problems. The purpose of this study was to determine the level of alcohol poisoning awareness among undergraduate students enrolled at OSU, more specifically, whether students were aware that it is important to monitor the respiratory rate (RR) of someone who has had too much to drink and to know the number of breaths/minute that necessitates a 911 call. METHODS: 207 undergraduate students participated in 15 focus groups conducted in residence halls, Greek houses, and random locations across campus. Focus groups elicited responses to eight questions developed by a group of respiratory therapy students and faculty, and evaluated by undergraduate students and faculty from various disciplines in order to determine content validity. Responses were summarized. RESULTS: 81% of students reported being worried about the safety of a friend who had consumed too much alcohol; 51% would wait to call 911 even if they thought that their friend needed medical intervention. While 72% of students reported that they have checked the RR of a friend who had too much to drink, 89% were unaware that a RR < eight breaths/minute should prompt a 911 call. CONCLUSIONS: Undergraduate students should be made of both the importance of monitoring RR when alcohol poisoning is suspected and the number of breaths/minute that should prompt a 911 call.

Sponsored Research - None

1416266

OPINIONS OF RESPIRATORY THERAPISTS ON THEIR WORK EXPERIENCE AS CLINICAL PRECEPTORS.

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BACKGROUND: RT programs commonly assign students to precept with staff respiratory therapists in the clinical areas. Most of these staff therapists do not receive additional compensation for their role as preceptors. The purpose of this study was to evaluate the opinions of staff respiratory therapists who also served as unpaid clinical preceptors. METHODS: IRB approvals were obtained from the university and hospital. A 10-item questionnaire (Table 1) with a 5-level Likert Scale was developed and administered via an online surveying tool. The link of the electronic survey was sent to 50 staff respiratory therapists who served as unpaid clinical preceptors. The names of the survey respondents were not collected by the surveying tool. A descriptive evaluation was done to interpret the data. RESULTS: Twenty seven of 50 therapists (54%) completed the online survey. Some major findings of this study were described below. Of all therapists, the years of clinical experience and years served as preceptor ranged from 1 to >20 years. Eleven therapists (40.7%) precepted 3 or more students per shift. Twenty one therapists (77.8%) reported similar workload as other non-preceptors. Fourteen of the respondents (51.9%) did not feel overworked or overwhelmed serving as preceptors. Eighteen (66.7%) felt ineffective in providing quality patient care during busy days with heavy workload when serving as preceptors. Fifteen (55.6%) reported that they had sufficient time to precept students with a regular workload. Twenty six respondents (96.3%) felt stressful as preceptors when students showed lack of interest or motivation to learn. Twenty five respondents (92.6%) viewed merit pay increase a suitable compensation for their additional work as preceptors. CONCLUSIONS: RT program personnel and hospital RT manager should evaluate and balance the workload among staff therapists and those also served as unpaid clinical preceptors. RT programs should also device a strategy to encourage student's interest and motivation to learn during clinical rotations. A merit pay increase should be considered as a way to compensate for the additional preceptor work performed by staff therapists.

Sponsored Research - None

1415092

THE IMPLEMENTATION OF AN IN-SCHOOL EDUCATION PROGRAM FOR CHILDREN WITH ASTHMA DEVELOPED BY RESPIRATORY THERAPY STUDENTS.

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Background: A 2009 community needs assessment for the East Central Health District (ECHD) of Georgia determined there was a strong need for education for children with asthma. Senior respiratory therapy students from the Georgia Health Sciences University, under faculty guidance, developed an In-School Asthma Education Mini-Camp, for children ages 5- 14. The Asthma Mini-Camp program was implemented in three counties (Richmond, Warren and Emanuel). Methods: Lesson plans were developed for children ages 5-14 by senior respiratory therapy students. The plans covered anatomy, triggers, peak flow monitoring and medications. Each plan included a short lecture and an activity that reinforced the lesson. All asthmatic children were provided with a peak flow meter and holding chamber and were instructed in the use of each. Senior Respiratory Therapy students taught the program and junior students assisted with the activities. All lesson plans and activities were detailed in manuals to allow replication of the program in following years. The mini-camps were designed to last two hours. However, each school had different time constraints. School A allowed a 2 hour session for asthmatic students. School B requested all students attend the program during PE classes over a 2 day period. School C had small groups of asthmatic students attend the program during multiple sessions in one day. The senior students attended debriefing sessions with faculty and utilized blogs to recommend changes in the program and analyze their feelings about the Mini-Camp program. Results: 14 senior students and 9 junior students participated in the asthma mini-camps. 149 students with asthma and 304 non-asthmatic students attended the mini-camps. Respiratory therapy students reported a greater understanding of the need for asthma education among children and parents. They also reported a need for flexibility, creativity and visual aids in the delivery of the program. The students felt smaller groups worked best for the delivery of the asthma mini-camps. Conclusion: An asthma in-school education program requires flexibility in working with schools and in the delivery of the program. It can provide a real life learning experience for both the participants and the RT students. The asthma mini-camp project will be continued and delivered to several schools in the ECHD this fall.

Sponsored Research - W.G. Raoul Foundation

1417450

DEATH ANXIETY AMONG RESPIRATORY CARE STUDENTS.

Kevin P. Collins, S. Gregory Marshall; Respiratory Care, Texas State University, San Marcos, TX

Kevin P. Collins, S. Gregory Marshall, Respiratory Care, Texas State University, San Marcos, Texas Background: This longitudinal study assessed respiratory care (RC) students' level of death anxiety at five different points in their respiratory care education as measured by the revised Collett-Lester Fear of Death and Dying Scale (CL-FODS). The CL-FODS was administered as pre- and post-tests prior to the first clinical rotation and as a post-clinical assessment following each of three clinical rotations (N=36). The null hypothesis states there will be no difference in the death anxiety level as measured by the CL-FODS for respiratory care students between pre-test and post-clinical assessments. Methodology: In this exempted IRB study, students were administered the CL-FODS pre-test prior to presentation of a didactic module on death and dying. Students were post-tested immediately following instruction. As clinical rotations were completed the following next three semesters, students were reassessed using the CL-FODS at the conclusion of each clinical rotation. The CL-FODS contains thirty-two test questions with eight questions in each of four categories asking students to assess their feelings of "Your Own Death," "Your Own Dying," "The Death of Others," and "The Dying of Others" using a 5-point Likert scale. The post-clinical instrument contained the same thirty-two questions with an additional question inquiring whether the student had experienced a patient death and dying situation during the clinical rotation. If the answer to the experience question was affirmative, then four additional questions were asked to gain demographic perspective of the student's death or dying experience. Repeated measures ANOVA and post-hoc analysis were utilized to analyze the data at an alpha level of 0.05. Results: ANOVA analysis of the mean differences between subjects from five different intervals (p=0.01) demonstrated a significant difference between the means of pre-, post-, post-clinical CL-FODS test scores. Post-hoc analysis revealed statistical significance between Pre-Test/Post Clinical Spring and Post-Clinical Fall/Post Clinical Spring scores and the null hypothesis was rejected. Conclusion: The study suggests exposure of RC students to death and dying didactic education with continued clinical death and dying experiences may result in a decreased death anxiety score among respiratory care students.

Sponsored Research - None

Results of Analysis of Variance and Post Hoc tests comparing differences between Pre, Post, Post-Clinical Test Scores of CL-FODS.

	Mean	Standard Deviation	N
Pre-Test	99.16*	32.12	36
Post-Test	98.77*	32.71	36
Post-Clinical Summer	93.91*	33.03	36
Post-Clinical Fall	93.97*	40.69	36
Post-Clinical Spring	80.88*	43.24	36
Post Hoc Analysis			
Pre-Test – Post-Test	p = .927		
Pre-Test – Post Clinical Summer	p = .031		
Pre-Test – Post Clinical Fall	p = .228		
Pre-Test – Post Clinical Spring	p = .003		
Post-Test – Post Clinical Summer	p = .279		
Post-Test – Post Clinical Fall	p = .406		
Post-Test – Post Clinical Spring	p = .016		
Post-Clinical Summer – Post Clinical Fall	p = .990		
Post-Clinical Summer – Post Clinical Spring	p = .029		
Post-Clinical Fall – Post Clinical Spring	p = .004		
*p = .01			

1418266

RT-ICU RESOURCE ENHANCES MULTIDISCIPLINARY TEAM APPROACH AND IMPROVES VENTILATOR OUTCOMES: A RETROSPECTIVE STUDY 2008-2011.

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Evidence-based studies have demonstrated that a multidisciplinary team approach improves patient outcomes, particularly ventilator length of stay (LOS). In January 2008, a respiratory care initiative called RT-ICU resource was created to complement our new multidisciplinary and Intensivist program. The team is composed of respiratory therapists, intensivists, nurses, pharmacists, case managers, dietitians, physical/occupational/speech therapists and spiritual care coordinator. This observational study was aimed to identify and track sustainable ventilator outcomes since the inception of full-time, 24/7 coverage of RT-ICU resource and intensivists beginning January 2009. Ongoing collaborative efforts enhance process changes at bedside. METHODS: Retrospective cohort study of all adult, mechanically ventilated patients in our ICU from 2008-2011 (n=2176). A data collection team called Ventilator Outcomes Resource Team Exchange (VORTEX) created a user-friendly ventilator tracking form called the "BLUE SHEET". Nine ventilator outcomes were examined with a focus on LOS. All statistical analysis was done using SAS (9.1.3) software. An independent t-test and Wilcoxon rank-sum test was used to test differences for parametric and non-parametric continuous variables, while a chi-square test was used for intergroup comparisons among categorical variables. DESIGN: 359-bed, community hospital in Northern California. 28-bed"open" MICU/SICU. Process improvements included: A) Daily physician-led multidisciplinary rounds. B) Development and implementation of spontaneous breathing trial protocol. C) Increased RT-ICU staffing by 0.5 FTE resulting in better unit coverage. E) Annual skills lab for physicians and ICU multidisciplinary team focusing on airway management and invasive & non-invasive positive pressure ventilation. F) Continuing education on palliative and end-of-life ventilator care. RESULTS: Mean ventilator LOS decreased significantly by 2.12 days per patient from 2008-2009 (p=0.003). Low ventilator LOS was sustained through December 2011 (Table 1). Approximate savings from 2008-2009 were $1.5 million (based on national averages). CONCLUSION: Establishing a 24/7 RT-ICU resource, integrated with an intensivist-led multidisciplinary team, is cost-effective and associated with sustained positive ventilator outcomes.

Sponsored Research - None

Table 1. Ventilator Outcomes 2008-2011

	2008	2009	2010	2011
	n=456	n=576	n=557	n=587
Mean Ventilator LOS (Days)	5.54*	3.42*	3.66	2.92
Median Ventilator LOS (Days)	2.23**	1.10**	1.00	1.09
Weaned (Extubated)	340 (74.56%)	422 (73.26%)	413 (74.15%)	380 (64.74%)
Unplanned Extubation	8 (1.75%)	3 (0.52%)	16 (2.87%)	17 (2.89%)
Expired on the Ventilator	44 (9.65%)	55 (9.54%)	42 (7.54)%	48 (8.17%)
Transferred or DONOR NETWORK	8 (1.75%)	17 (2.95%)	25 (4.49%)	16 (2.72%)
NPPV/BiPAP <24h post extubation	9 (1.97%)	18 (3.13%)	8 (1.44%)	5 (0.85%)
Discontinued Life Support (END-OF-LIFE)	19 (4.17%)	43 (7.46%)	32 (5.74%)	56 (9.54%)
Reintubated <24h post extubation	5 (1.10%)	17 (2.95%)	17 (3.05%)	39 (6.64%)
Tracheostomy	23 (5.00%)	6 (1.04%)	7 (1.26%)	24 (4.09%)

*Mean LOS; p=0.003
**Median LOS; p=0.001

1432548

THE EFFECTS OF INSUFFLATION CATHETER SIZE ON PRESSURE AND VOLUME WITHIN A TEST LUNG WHEN PERFORMING THE APNEA TEST.

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Background: The apnea test (AT) is used to support the diagnosis of brain death by establishing the absence of a respiratory drive. Previous case reports document the occurrence the spontaneous pneumothoraces while performing the AT with varying sizes of endotracheal tubes (ETT) and insufflation catheters (IC). Furthermore, the most widely accepted guideline for performing the AT does not specify what size of IC to use with different ETT sizes. What pressures and volumes are generated within the lungs when performing the AT with varying IC sizes? The null hypothesis is that there is no significant difference in pressure or volume within the lungs between varying IC size to ETT ratios (IC:ETT) while performing the apnea test. Method: This bench top, IRB approved study used a manikin, RespiTrainer Advance, connected to a QuickLung test lung that provided a measured pressure and calculated volume within the test lung. The test lung was set to a compliance of 50 ml/cmH2O and a resistance of 5 cmH2O/L/sec. Endotracheal tubes with an internal diameter (ID) of 6.0-10.0 were orally intubated into the manikin and advanced to 2 cm above the carina. Insufflation catheters, sizes 10-16 French, and cut oxygen supply tubing were advanced to the end of the ETT. Oxygen was delivered at 6-15 Liters/min into the test lung through the IC. Once the pressure within the test lung stabilized, pressure and volume were recorded. The IC:ETTs were determined by dividing the external diameter (ED) of the IC and the ID of the ETT. The MANOVA and Tukey's statistical methods were used to analyze data at an alpha level of 0.05. Results: The MANOVA method demonstrated a significant difference with a p value of 0.04 between the varying IC:ETTs. The Tukey's method identified IC:ETTs > 0.70 had significantly different pressures and volumes within the test lung from IC:ETTs < 0.70 with a $p < 0.05$ for each delivered oxygen flow rate. Conclusions: As a result of obtaining a MANOVA p value of 0.04 when evaluating the IC:ETTs, the null hypothesis was rejected. The IC:ETTs from 0.5 to 0.70 did not show a significant difference between IC:ETTs < 0.5 for pressure and volume. Selection of an IC with an ED < 70% of the ID of an ETT may prevent excessive pressure and volumes within the lungs while performing the apnea test. The selection of an appropriate sized IC should be included in the guidelines for performing the AT.

Sponsored Research - The manikin (RespiTrainer Advance) and test lung (QuickLung) were obtained with financial assistance through an internal institutional research enchancement grant. Texas State University-San Marcos provided the grant.

1418451

HOOKED ON HOOKAH: AN EMERGING SOCIAL SMOKING TREND AMONG COLLEGE STUDENTS.

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Background: Hookah smoking is a communal form of social smoking that has grown in popularity among college students. The flavored tobacco, novel experience and social utility have been primary drivers in its usage. Hookah bars are often strategically located around college campuses. Research has indicated that hookah smoking as compared to cigarette smoking has 40 times more tar, 2 times more nicotine and 10 times more carbon monoxide. Methods: Mixed method research was conducted during the fall semester 2011 to assess attitudes, beliefs and behavioral practices of University of Tampa (UT) students regarding hookah smoking. This research was guided by the theory of reasoned action. Random intercept interviews were conducted on campus with UT students, including both hookah smokers and nonsmokers. A survey was then distributed to students via email to improve the understanding of whether personal or social indicators were stronger predictors of intention to smoke, as well as to identify descriptive characteristics of hookah smokers on campus. Results: Seven hundred and forty-six students participated in the online survey. Of these, 468 (63%) have tried hookah smoking and 166 (36%) of those who have tried hookah smoking are current (past 30 days) hookah smokers. The majority of reported ever smokers were female, Caucasian and 18 years of age. One hundred seventy-six students (24%) reported having smoked other substances beside flavored tobacco in a hookah device. Personal factors were the strongest predictor of intention to smoke. Conclusion: The prevalence of hookah smoking among UT students is higher than any previous estimate in a college population reported in the literature. Understanding of the factors that lead to the intention to smoke hookah will help in the development of health educational campaigns and health promotion programs aimed at deterring UT students from smoking hookah and to dispel myths surrounding the safety of its usage.

Sponsored Research - None

1412435

INFORMATION SITE FOR STAFF RESOURCE.

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BACKGROUND: UC San Diego Hospital employs over 120 Respiratory Care Practitioners (RCPs) across two sites. We continually introduce new technology and related policy. This creates a challenge in ensuring all RCPs have the resources needed when setting up and managing equipment. Our Clinical Specialists serves as a primary resource for RCPs. In their absence; we encounter situations in which staff may not have immediate access to instructional references. We investigated staff preferences regarding the type of reference systems we should have on-hand, designed a system, and reassessed if the program was being used. METHOD: An initial survey was distributed to RCPs to assess the need for additional resources should the Clinical Specialist be unavailable. The survey also asked what modalities and equipment the RCPs needed help in setting up and managing. Based on this survey, we developed a web based instructional program on topics requested by staff. This program, along with a web hit counter, was placed on the UC San Diego Respiratory Care web site so the program could be accessed through clinical workstations at the point of care. After a 90 day period, a repeat survey was sent to the RCP staff asking if they had used the site as a resource. RESULTS: The survey indicated there had been times when RCPs needed information on how to manage or setup equipment and 43% responded there had been a time when there was no resource immediately available. The repeat survey showed that 94% of the responding RCPs had used the site. The web hit counter also revealed that the info site had been accessed 1300 times over a 10 month period. CONCLUSIONS: The survey results indicate there was a need for additional resources for the RCPs in the absence of the Clinical Specialist. The repeat survey and the large number of hits on the web hit counter demonstrated RCPs see a value in the site being immediately available. Point of Care web based programs are an option to consider as a technical reference for RC staff.

Sponsored Research - None

1416652

USING ORAL CARE POLICY TO REDUCE OR PREVENT VENTILATOR ASSOCIATED PNEUMONIA IN THE LONG TERM ACUTE CARE HOSPITAL SETTING.

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BACKGROUND: With hospital acquired infections being a contributing cause of death in the United States, hospitals are seeking employable techniques for staff to use in combating this issue. Research studies have been conducted on the prevalence and prevention of Ventilator Associated Pneumonia (VAP) through interventions such as patient positioning, prevention of aspiration and oral care. At Baylor Specialty Hospital, a Long Term Acute Care Facility, we examined the use of and oral care policy and procedure (PnP) that incorporated risk scoring, associated interventions such as compressive oral care and vigilant respiratory care assessment. METHOD: A non-experimental retrospective analysis of ventilator days and reported VAP cases was conducted for a six year period. All subjects included in the study were 18 years of age or greater. Those included in the analysis required long term ventilator management and had a tracheostomy on admit to the facility. The PnP included a risk scale that allowed for scoring patients regarding their respiratory acuity. According to the patients score assigned interventions such as comprehensive oral care and respiratory assessments were provided. RESULTS: Results of the retrospective review revealed that the VAP rate prior to the review for our facility was <20% for 2003. Rates are calculated using the National Healthcare Safety Network and Center for Disease Control, reflecting a national method for VAP surveillance and calculation. Upon implementation of the PnP in 2004 only one case of VAP was identified the first year of the review. The remaining 5 years revealed a 0% VAP rate. January 2004 to December 2010 there were 6261 ventilator days. CONCLUSIONS: VAP can be reduced with a comprehensive oral care PnP. The success BSH has demonstrated with a 0% VAP rate is attributable to strict adherence to its specific oral care policy and multidisciplinary approach that encourages staff accountability with resulting improved patient outcomes.

Sponsored Research - None

1344792

MODELING OF RESPIRATORY ANATOMICAL EFFECTS ON EXPIRATORY AIRFLOW AND ACOUSTICS IN HUMAN NASAL AIRWAYS.

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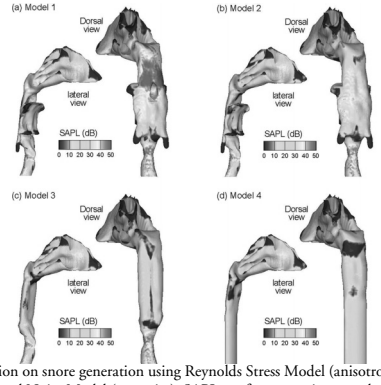
The intricate anatomy of the respiratory tract is believed to induce complex flow characteristics during exhalation before the air enters the nasal airways. However, this upstream effect on breathing resistance and sound production remains largely un-quantified within the upper respiratory airway. Specially, we hypothesize that the airway constriction due to the hanging uvula is one major cause that initiates flow instabilities and sleep disorders. The objective of this study is to systematically assess the effect of the larynopharyneal anatomical details on the expiratory airflow and acoustic characteristics in human nasal airways by means of numerical methods. To achieve this objective, a physiologically realistic extrathoracic airway was developed that extends from the nasal nostrils to the upper trachea based on human medical images. Both Reynolds Stress Model (RSM) and Large Eddy Simulations (LES) were employed to simulate the laminar, transitional and fully turbulent flow regimes for a spectrum of flow rates covering 4 - 45 L/min. We found large effect from the laryno-pharyngeal geometries on the exhaled airflows that enter the nasal cavity. In particular, the variation of the uvula position may significantly alter the breathing resistance. Abrupt pressure drops has been observed to result from the uvula-related airway obstruction when the human subject takes a supine position. Results of this study indicate that the uvula position is a major cause for sleep disorders such as snoring or obstructive sleep apnea syndrome.

Sponsored Research - None



Effect of uvula-obstruction on snore generation using Reynolds Stress Model (anisotropic turbulence) and Broadband Noise Model (acoustics). SAPL: surface acoustic power level.

1413364

THE ASSESSMENT OF CUFF PRESSURE MEASUREMENTS UTILIZING THREE CLINICAL TECHNIQUES.

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Rationale: The minimal occluding volume technique (MOV), the minimal leak technique (MLT), and direct pressure measurement (DPM) are ways to manage the cuff of an artificial airway. All three techniques are included on national board exams and are used daily by Respiratory Care Practitioners. The MOV and the MLT are bedside techniques that manage cuff pressures without the aid of a manometer. DPMs are also performed at bedside utilizing a manometer. The purpose of the research is to determine which of the technique provides the most accurate and most consistent cuff pressure measurement. Methodology: Students in the Department of Respiratory Care at Texas State University-San Marcos volunteered to participate in performing 2 MOV and 2 MLT techniques. The techniques were performed on a manikin receiving mechanical ventilation through a 7.0 endotracheal tube. Following the performance of these techniques, researchers then measured the cuff pressure set by the student using a cuff manometer. Next students attempted to set cuff pressure at 30 cmH2O at peak inspiration using the DPM technique. Following their attempt researchers once again measured and recorded their results. Results: Mean results were calculated for the MOV, MLT, and DPM techniques. The MOV technique averaged 16 cmH2O with a range varying from 2 cmH2O to 34 cmH2O. The MLT technique displayed a lower mean pressure measurement. Its recorded mean resulted in 10 cmH20 with a range of 2cmH2O to 22 cmH2O. Of the three techniques, DPM was the most consistent. Mean pressure measurements were 30 cmH2O with a range of 26 cmH2O to 32 cmH2O. Conclusion: Although all three techniques have been shown to be effective in cuff pressure measurements, our research demonstrated great variations between practitioners. As expected, DPM proved to be the most consistent form of cuff pressure measurement. The MLT and MOV techniques demonstrated a wide range of numbers as different respiratory care students performed each technique. While all three methods are accepted in clinic practice, practitioners should be aware of the inconsistencies between individuals performing these maneuvers. Our results stress the importance of continuing education and repeated practice if the MLT and MOV maneuvers are included in the policy and procedure for cuff pressure monitoring. When performing a MLT or MOV technique we recommend verifying pressure measurements via a cuff manometer periodically throughout the shift.

Sponsored Research - None

1407499

ADHERENCE OF RECOMMENDED PROCEDURE FOR ACAPELLA THERAPY BY RESPIRATORY THERAPISTS.

Vincent Mwavu, David Chang; University of South Alabama, Mobile, AL

BACKGROUND: Vibratory PEP therapy has been used to mobilize secretions in different health care setting. Its effectiveness mainly depends on the proper teaching and couching by the therapist and correct use of this device by the patient. The purpose of this study was to evaluate the adherence of recommended procedure for Acapella therapy by respiratory therapists in one metropolitan hospital. METHODS: IRB approvals were obtained from the university and hospital. The recommended 12-step procedure for Acapella therapy published by the UCSF Medical Center was used in this study. The researcher used this 12-step procedure and developed a checklist (Table 1) for use in direct observation of staff therapists providing the therapies. The staff therapists were selected in random and they were blinded to the data collection of this study. For each of these 12 steps, it was scored as "observed" or "not observed." Under "not observed," notations might be made for later data interpretation. A descriptive method was used for interpretation of data. RESULTS: A total of 30 therapists were studied under direct observation for adherence of the 12-step procedure. The results were provided in Table 1. Major findings of this study included the following steps: Step (3), 25 of 30 therapists (83.3%) did not provide aerosol drug delivery in conjunction with the Acapella. Step (8), 9 of 30 therapists (30%) did not emphasize the importance of inhaling slowly, breath holding, and suppressing the urge to cough. Step (9) 8 of 30 patients (26.7%) could not exhale for 3 to 4 sec due to pain or under mild sedation. Step (10) 17 of 30 patients (56.7%) could not perform the number of breaths or "huff" coughs due to pain, under mild sedation, or being too sick and weak. CONCLUSIONS: For the institution in this study, the therapists should evaluate the feasibility of combining aerosol drug delivery with Acapella therapy. The therapists should also emphasize to the patients the correct breathing techniques with an Acapella device. For patients who are unable to use the Acapella due to changing medical conditions, the therapists should recommend an alternative to Acapella therapy.

Sponsored Research - None

1416495

PREDICTING RE-INTUBATION IN PATIENTS WHO SELF EXTUBATIONS IN THE ICU.

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Introduction: In an effort to improve quality and safety in ICUs, general and specific outcomes from mechanical ventilation should be known. One outcome that should be assessed is the number of planned or unplanned extubations, thus self-extubations (SE). Predicting which patients will require early re-intubation may lead to lower SE related complications. This abstract report the characteristics and outcomes of patients who experience SE and describes predictors of patients who may benefit from early reintubation after SE. Study Design: We conducted a retrospective comparative study to describe SE at our institution and to determine predictors of re-intubation. Our Institutional Review Board deemed this study exempt. Results: Calendar years 2008 and 2009 there were 6,288 mechanically ventilated patients at our institution. There were 169 episodes of SE comprising 2.8% of patients mechanically ventilated. There were 5,167 physician ordered extubations during this same period. The remaining 1,121 ventilated patients either expired or were discharged home or to another facility while dependent on the ventilator. Nine episodes of SE were lacking documentation on the need for re-intubation, they were excluded from all analyses. Gender, age and BMI were all similar. There was a difference noted in the mean ventilator day between ordered and self-extubations, 3.3 and 3.9 days respectively (p=.032). BMI data was missing for 311 patients in the ordered extubation group. We imposed the mean on these patients. Demographics and baseline characteristics of patients who required re-intubation within 24 hours after their episode of SE (n=46) as compared to those who successfully liberated themselves (n=114). There was no difference between the groups in gender, age or BMI. The duration of necessity for mechanical ventilation was different between the two groups. Those who were successfully liberated had a significantly lower mean ventilator duration than those who required re-intubation, 3.3 versus 5.6 days (p=.005). There was no difference seen between level of sedation, method of sedation, sedation agitation scale score, time of day (7pm-7am) or the use of BiPAP post SE. (Table 1) Conclusion: Patients who self-extubate who are on the ventilator greater than five days and are receiving greater ventilator support have a higher incidence of re-intubation. Other clinical interventions or patient characteristics have little impact on re-intubation.

Sponsored Research - None

Table 1

	Odds Ratio	95% CI	p-value
Sex	1.279	.510-3.204	.600
Age	1.004	.978-1.030	.767
BMI	1.015	.967-1.066	.547
Ventilator Day	1.249	1.091-1.431	.001
Restraint Use	.665	.270-1.636	.375
Vent Severity	.227	.087-.590	.002
BiPAP Use	3.008	.549-16.472	.024
Sedation Drip	1.326	.188-9.355	.777
7p-7a	1.146	.473-2.777	.763
Agitation	.892	.343-2.321	.815

1351570

BENCH STUDY OF THE SONARMED AIRWAVE TO DETECT FIXED AIRWAY OBSTRUCTIONS AT VARYING LOCATIONS WITHIN AN ENDOTRACHEAL TUBE.

Charline Don, Garner G. Faulkner II, John Newhart, Richard M. Ford; Respiratory Care, UC San Diego Health System, San Diego, CA

BACKGROUND: The SonarMed Airwave (SonarMed Inc, Indianapolis IN) is a relatively new technology designed to provide direct, real time monitoring of obstructions within the endotracheal tube (ETT) using acoustic reflectometry. The identification of a partially obstructed ETT before complete obstruction is vital to ensure one does not face the risks associated with a loss of a patent artificial airway. In this study we wanted to test the accuracy of the device to detect the percent of obstruction for both single and dual fixed obstructions that did not change in size but did so in regards to their position within the ETT. METHOD: We performed a bench study using a #8 ETT. For our fixed obstructions we utilized two identical round discs of ABS plastic with a 1/8-inch hole in the center. The discs were slightly larger than the inner diameter of the ETT to facilitate secured placement. A single disc was placed within the ETT at positions 27cm, then at 18cm, and finally at the measured 11cm mark. Next, two identical discs were simultaneously placed within the ETT at different locations. Obstructions were placed first at the 18cm and 11cm marks and then at 27cm and 18cm and finally at the 27cm and 11cm. The Airwave device was attached to the ETT and digital data was captured and recorded for each disc position. RESULTS: When a single obstruction was placed, the Airwave monitor read the obstruction percent to only differ by 2% no matter where the single obstruction was located (See data table below). When identical dual obstructions were placed within the ETT at the same time, the obstruction percent differed by +/- 3 to 15% of what the original single obstruction read (See data table below). CONCLUSION: The SonarMed Airwave monitoring device showed a consistency within the manufacturers specification of +/- 15% obstruction accuracy even when dual obstructions were present within the ETT. The ability to directly identify and measure obstructions within the ETT could be extremely beneficial in aiding to improve patient safety in the ICU setting.

Sponsored Research - None

Single and Dual Obstruction Data During Airwave Bench Study

Type of Obstruction Placed	Position of Obstruction Within Endotracheal Tube	Percent Obstruction Displayed on Airwave Monitor
Single	27cm	55%
Single	18cm	55%
Single	11cm	57%
Dual	27cm & 18cm	58% & 40%
Dual	27cm & 11cm	58% & 44%
Dual	18cm & 11cm	59% & 50%

1427657

SONARMED AIRWAVE ABILITY TO MONITOR ENDOTRACHEAL TUBE DISPLACEMENT WHEN USED DURING AIRWAY PRESSURE RELEASE VENTILATION.

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BACKGROUND: The SonarMed Airwave (SonarMed Inc, Indianapolis IN) is a relatively new device that uses acoustic reflectometry to monitor displacement of an endotracheal tube (ETT). Previous bench studies have shown the success of the device when using conventional modes of ventilation; however there has been little research on how well the device works using unconventional modes of ventilation such as Airway Pressure Release Ventilation (APRV). The purpose of this bench study was to determine if given the ventilatory pattern seen in APRV with brief release times, the Aiwave could accurately detect ETT displacement. METHOD: The Airwave was tested on an adult circuit attached to a Drager V500 ventilator. This was attached to a number eight endotracheal tube (ETT) placed in a simulated airway made of Polyvinyl chloride. The simulated airway was then attached to a test lung. The initial ventilator settings were APRV: P-High 25, P-Low 0, Time-High 4.3 seconds and starting with a Time-low (T-Low) of 0.7 seconds. The ETT was positioned at 24 cm and subsequently zeroed. The ETT was pulled out 1 cm at a time from 24-21 cm and then pulled out completely then advanced 1 cm at a time from 24-27 cm. This method was then repeated using a T-low setting of 0.6 and 0.5 seconds. The measurements the monitor read were documented after each movement and the device calibrated after each trial. RESULTS: The data table reflects that at each T-Low setting the device was able to detect that the tube was being withdrawn and advanced each centimeter. When the ETT was advanced to 3 cm, the end of the tube hit the small orifice of the test lung, which prompted the device to read “ETT too Low”, “Small Passageway” and alarmed appropriately. CONCLUSION: The SonarMed Airwave was able to detect movement of the ETT very precisely and alarmed appropriately even when there was only a brief interruption period of 0.5 seconds. Utilization of this device could be extremely useful in determining airway displacement even during the presence of a nonconventional type of ventilation such as APRV.

Sponsored Research - None

Airwave Monitor Displacement Readings at Varying Time-Low Settings

Time Low Setting (T-Low)	Reading after 1cm withdrawal	Reading after 2 cm withdrawal	Reading after 3 cm withdrawal	Reading after 1 cm advanced	Reading after 2 cm advanced	Reading after 3 cm advanced
0.7 sec	1 cm	2 cm	2.8-3 cm	0.9 cm	1.9 cm	"Small Passageway"
0.6 sec	1 cm	1.9-2 cm	2.8-2.9 cm	0.9 cm	1.8-1.9 cm	"Small Passageway"
0.5 sec	1-1.1 cm	2 cm	2.8-2.9 cm	1-1.1 cm	1.8-1.9 cm	"Small Passageway"

1429215

COMPARISON BETWEEN STANDARD AND EMPIRIC SPIROTIGER(R) SETUP IN PATIENTS WITH CYSTIC FIBROSIS.

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Background. Several studies have shown that improved respiratory muscles strength and better exercise capacity due to their training improve distance at the 6 minutes Walk Test, quality of life and reduce dyspnoea. Lately, it has been commercially available a new portable device, Spirotiger®, that trains respiratory muscles throughout isocapnic hyperpnea, that improves pulmonary functions as reported with athletes. Now, its use has been thought suitable also for patients suffering from respiratory disease, such as Cystic Fibrosis (CF). So far, the device setup has been prompted on parameters derived by healthy subjects and it might not be appropriate for patients with CF. Aim.To evaluate differences in the setup between derived formula and patients measured parameters. Methods. 47 CF patients (46.8% men) in clinically stable conditions were enrolled. FEV1 (Forced Expiratory Volume in the 1st sec.), FVC (Forced Vital Capacity), RR (Respiratory Rate), MVV (Maximal Voluntary Ventilation) were collected according to ATS/ERS procedure. RR, MVV, RMV (Respiratory Minute Volume) and the required bag volume have been compared with standard and empiric formulas. Sample was described and then processed using Wilcoxon matched-pairs signed-ranks test with significance set at 5%. Results. Patients age ranged from 18 up to 45 yrs (25±37.47) with mean BMI of 21.20±2.65 Kg/m2. Mean predicted %FEV1 was 73.53±24.9. Through standard formulas as provided by the manufacturer, a mean MVV of 138.49±410.99 l/min, a mean RMV of 83.09±6.59 l/min, a mean bag volume of 2.36±0,.26 l and a mean RR of 27.80 ± 9.75 were found. Through the empirical setup, mean MVV was 106.04±43.88 l/min, mean RMV was 63.62±26.33 l/min, mean bag volume 1.77±0.55 and mean RR 28.04±9.63. Difference of means between standard and empiric formulas for RR (p=0.83) was not statistically significant, while for MVV (p<0.0001), RMV (p<0.0001) and the bag volume (p<0.0001) means were statistically different. Mean differences were not closed to zero for RMV and MVV, respectively -19.46 l/min and -32.44 l/min thus arguing an overall distortion that might be have clinical impact. Conclusions. Given such differences, suitability of standard and empirical formulas need to be tested not only on patients with CF but also with other pulmonary disease. In order to assess whether Spirotiger® could have some effects on respiratory muscle training, further studies are urgently required taking into account such variability.

Sponsored Research - None

1432072

THE OUTCOME OF 2,499 OUT-OF-OPERATING ROOM ENDOTRACHEAL INTUBATIONS AT A LARGE URBAN MEDICAL CENTER.

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Introduction: Emergency endotracheal intubation (ETI) is a potentially life-saving procedure frequently performed outside of the operating room (OR). Compared to elective surgical patients, difficult intubation (DI), hypoxemia, and hemodynamic instability occur more often in the outside the OR setting. Our primary goal was to describe the experience of a large academic medical center with out of OR intubations with particular attention to the occurrence of airway related complications, including DI. Methods: Medical records were retrospectively reviewed (July 2008 – June 2011) for ETIs performed outside the OR at Harborview Medical Center, a university-affiliated 413-bed municipal medical center and regional Level 1 trauma center in Seattle, WA. Pediatrics or records with incomplete data were excluded. DI was defined as: > 3 attempts at direct laryngoscopy (DL), > 2 attempts at DL with Eschmann use, any DL needing rescue by other means, > 1 attempts at videolaryngoscopy (VL) with Eschmann use, > 2 attempts at VL, any need for a flexible fiberoptic bronchoscope (FOB), any need for a surgical airway, or the occurrence of any ETI-related complication (systolic blood pressure < 90 mmHg, hypotension requiring treatment, heart rate < 60, oxygen saturation < 90%, or aspiration). Data are presented as number of patients (%) unless otherwise indicated. Results: A total of 2,499 intubations were included. Data regarding location, intubating service, patient type, and indication for intubation are presented in table 1. Intubation was accomplished by DL alone in 2,168 (87) cases and with the aid of an Eschmann in another 59 (2). Rescue by VL was needed in 12 (0.5) cases. VL alone was successful in 241 (10) cases and required the aid of an Eschmann in another 12 (0.5). FOB was only used in 2 (0.08) cases as the initial airway management technique, but was used as a VL rescue 6 (0.24) times. 5 patients (0.2%) required surgical airways. Overall, the incidence of difficult airways was 6% (n=166) of which 107 (64.5%) were difficult intubations and 59 (35.5) easy, but having encountered airway related complications. Conclusions: In a setting of multiple specialists performing oustide the OR intubations in a large urban academic medical center, incidence of DI due to airway management or intubation-related complications is low. While DL remains the most common initial airway management technique of choice, FOB appears to have been largely replaced by VL.

Sponsored Research - None

1434025

EFFECT OF MEAN AIRWAY PRESSURE ON INTRACUFF ENDOTRACHEAL TUBE CUFF PRESSURE IN AN ARTIFICIAL AIRWAY MODEL.

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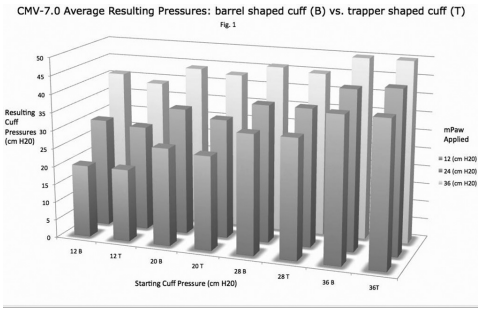
Background: Endotracheal tube (ETT) cuff pressure ideally should be kept within an optimal range (20-30 cmH2O) to seal the trachea during positive pressure ventilation. Cuff pressures too low will allow for pharyngeal content migration below the ETT cuff and a possible volume loss during ventilation. Conversely, an ETT cuff pressure too high may compromise capillary circulation and damage the airway mucosa. Changes in ventilatory strategy may affect mean airway pressure (mPaw) and also native intracuff ETT cuff pressures (Pcuff). The purpose of this study was assessing to what extent mPaw alters Pcuff in an artifical airway model. Method: The artificial airway consisted of a 30 mL syringe with an inner diameter of 2.5 cm into which an ETT were introduced for testing. We studied 2 different ETT types (barrel-shaped and taper-shaped cuff). Pcuff was adjusted to 12, 20, 28 and 36 cm H2O prior to application of positive pressure ventilation. Ventilation using a conventional mechanical ventilator (CMV) and a high frequency oscillator ventilator (HFOV) were used to generate a mPaw of 12, 24 and 36 cmH2O for each native Pcuff condition and nadir and peak Pcuff were recorded and mean Pcuff calculated for 4 different sets of the 2 types of ETT studied. Results: Overall results demonstrated that mPaw significantly affects native Pcuff. The extent by which mPaw affects native Pcuff appears however, to be independent of the type of ETT studied (barrel-shaped and taper-shaped cuffs) and how mPaw is generated (CMV vs. HFOV). We also found that the effects of mPaw on native Pcuff varies, with the augmented Pcuff being the greatest for low native Pcuff and minimal for high native Pcuff (Figure 1). Conclusion: The results of this study demonstrate the dynamic nature of ETT cuff pressure measurement and the potential for ventilatory strategy to affect native Pcuff. Our results suggest the need to either continuously monitor Pcuff or measure it whenever a major change in ventilatory strategy affecting mPaw is implemented or during circuit disconnects to maintain a safe ETT cuff pressure to avoid complications. Our results need now to be confirmed in vivo.

Sponsored Research - None



1434099

BENCH EVALUATION OF A NOVEL TRACHEOSTOMY SPEECH DEVICE.

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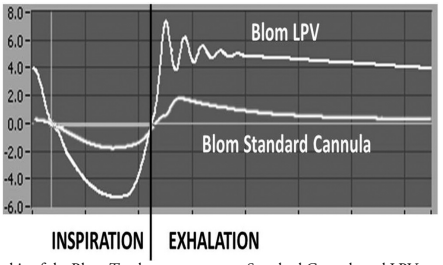
BACKGROUND: A challenge for tracheostomy patients is the inability to speak. Today there are several commercially available speaking valves and devices that are designed to alleviate this challenge. A common issue with speaking devices is that they can cause increased inspiratory and expiratory airway resistance. It has been established that expiratory resistance > 5 cm H20/L/s can cause difficulty with passive exhalation, leading to air trapping* and that typical inspiratory resistance is ~ 2.5 cmH2O/L/s*. The Blom Tracheostomy Tube System (Blom) is a product that consists of a standard inner cannula and a Low Profile Valve (LPV) speech cannula. LPV speech cannula is novel soft flexible inner cannual with one way valve that allows inspiration through the tube lumen and exhalation through the fenestration while the cuff is inflated. We wanted to examine the resistance to inspiratory and expiratory flow of the Blom Tracheostomy Tube System. METHODS: A calibrated oxygen flow meter was connected to a high pressure oxygen source with flow set to 0.5 L/s while monitoring back pressure to calculate resistance. We examined resistance to flow in both inspiratory and expiratory directions of each of the 2 separate inner cannulas. The Blom tracheostomy tube system was adapted to the ASL 5000 with a simulated adult breathing a rate of 18 with tidal volume of 300ml. Graphic of the airway pressure was examined for differences between the standard cannula and the LPV speech cannula. RESULTS: The Blom standard inner cannula had a resistance of 3 cmH2O/L/s for both inspiratory and expiratory phase. The Blom LPV speech cannula had a resistance of 12 cmH2O/L/s for both inspiratory and expiratory phases. See graphic for airway pressure tracings showing a swing of ~2 cmH20 and ~6 cmH2O for the standard and LPV cannula respectively in a simulated patient. CONCLUSION: The Blom Tracheostomy Tube System with the LPV speech cannula is an innovative design for speech with cuff up and no speaking valve. Clinicians should make sure that the patient population choosen for this device will tolerate the higher than average resistance* of this speaking device. Patients will need adequate expiratory muscle strength to overcome the resistance that it produces. Further studies will need to be done to determine that best patient population that would be suited for this device. *Hess, D. Facilitating Speech in the Patient with a Tracheostomy. Resp Care 2005:50(4):519-525

Sponsored Research - None



Airway Graphic of the Blom Tracheostomy system Standard Cannula and LPV speech cannula.

1435572

CHARACTERISTICS OF HIGH FLOW OXYGEN DELIVERY IN CRITICAL CARE, A REVIEW OF PATIENT DATA COLLECTION OVER A ONE YEAR PERIOD IN A TERTIARY MEDICAL CENTER.

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BACKGROUND High flow oxygen therapy (Hi-Flo) from previous studies appears to be associated with patient comfort, less dyspnea and lower respiratory rate. Our study examines a year long pilot of Hi Flo utilization in a mixed medical and surgical ICU setting and specific patient characteristics associated with treatment success and failure. METHOD We collected data on 240 patients who received high flow oxygen therapy in our medical, surgical and cardiac intensive care units for a period of a year. Data collected included primary diagnosis, number of days on Hi Flo and intubation and extubation status. Demographic data including age, hospital LOS and discharge diagnoses were obtained utilizing DRG coding data upon discharge. Descriptive statistics was used to summarize the outcomes. Success with Hi-Flo treatment was defined as the patients without intubation and survival to discharge or extubation without reintubation. Failure of Hi-Flo was defined as patients with intubation, mortality at discharge, or extubation with reintubation RESULTS The average Hi-Flo duration was 3.04 days. 42% of patients were on mechanical ventilation. 30% patients were intubated after an average of 2-day Hi-Flo therapy. 12% of patients were extubated and stayed in ICU for an average of 3 days. 55% of total patients had successful Hi-Flo treatment and 45% of patients had failed Hi-Flo treatment. 55% of successful group and 65% of failure group were patients with diagnosis of pneumonia. 35% of successful group and 26% of failure group were patients with a diagnosis of chronic obstructive pulmonary disease (COPD). 53% of successful group and 43% of failure group were diagnosed with congestive heart failure (CHF). Higher percentages of patients discharged with diagnoses of CHF and COPD 53% and 35% respectively were associated with treatment success. Diagnoses which appeared to be associated with treatment failure included pneumonia and pneumonitis 65% and 27% respectively. CONCLUSION More than half of the total patients had a successful outcome after treated with Hi-Flo oxygen therapy. About forty percent Hi-Flo treated patients were on mechanical ventilation. One third of Hi-Flo treated patients were intubated. Further statistical analysis is warranted to confirm whether COPD and CHF patients have higher successful Hi-Flo treatment.

Sponsored Research - None

1408880

SPEED OF MOVING ORAL ENDOTRACHEAL TUBES USING VARIOUS SECURING DEVICES.

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INTRODUCTION: Prevention of pressure ulcers is a priority in health care. Artificial airways cause pressure ulcers, repositioning the endotracheal tube (ETT) decreases the chances of developing pressure ulcers. METHODS: An adult intubation head (Laerdal) was orally intubated with an 8.0 mm ID ETT (Hi-Lo, Covidien). Of the 15 devices/techniques included, 6 were excluded due to their design that prevented lateral tube movement. The excluded devices were: AMBU (Velcro), AMBU (silicone strap), Thomas, Precision Medical, Portex Quickstrap. Three commercially available devices; Marpac 320 without headstrap, Hollister Anchor Fast, Dale Stabilock, and 6 non-commercial techniques; Lillihei, a modified Lillihei, HyTape, and cotton twill tape using 3 different knots (cow, rolling, and clove hitches) were evaluated for speed in moving the ETT from one corner of the mouth to other. For the commercial devices, the manufacturer's instructions were read and adhered to, for the non commercial methods simulated clinical practice was used. This action was repeated 10 times for each method. RESULTS: Means ± standard deviations of the times for all techniques/devices were determined and compared using one-way analysis of variance (ANOVA). Significant differences existed across devices/techniques ($p < 0.001$, see table). Two commercial devices were the fastest (Marpac and Hollister). Both devices used a similar design with one device having a position lock feature, the other did not. With the knotted twill procedure, the cow hitch was the fastest. No statistical difference existed between Marpac, Hollister, Cow Hitch, and Clove Hitch or between Hy Tape and the modified Lillihei method. CONCLUSION: Repositioning is permitted using a myriad of slides, clips, or quick releases. The most common feature in the devices that did not allow for motion was a bite block that centered the airway within the mouth. All of the taping methods (Hy Tape, Lillihei, and modified Lillihei) required a significant degree of disassembly. The longer times coincide with an increase in complexity for the securing method.

Sponsored Research - Hollister

1414165

EVALUATION OF THE VARIOUS TUBE SECURING METHODS TO STABILIZE AN ORAL ENDOTRACHEAL TUBE SUBJECTED TO A TUG.

Daniel F. Fisher[1], Andrew Marchese[2], Joseph Kratohvil[1], Robert M. Kacmarek[1]; [1]Department of Respiratory Care Services, Massachusetts General Hospital, Boston, MA; [2]Massachusetts Institute of Technology, Cambridge, MA

BACKGROUND: Accidental extubation is a serious complication with endotracheal tubes. Numerous commercial and non-commercial devices/methods are available for securing an endotracheal tube (ETT). METHODS: An adult intubation mannequin (Laerdal) was orally intubated with an 8.0 mm internal diameter endotracheal tube (ETT; Hi-Lo, Covidien). The ETT was secured using 1 of 10 commercially available devices, or, 1 of 6 non-commercial techniques; total 16 different approaches. After securing, the cuff was inflated to 25 cm H2O. The ETT was connected to a nylon line. The opposite end of the line was threaded through a pulley and attached to a 578 g weight. The weight was dropped from a height of 3 feet stopping abruptly at 32 inches to produce a jolt of approximately 5.7 N. on the ETT (repeated 5 times). The distance the ETT moved was recorded. Following the fifth drop and measurement, the cuff was deflated, the ETT repositioned, and the securing method refastened. This process was continued for 5 cycles. Four separate devices were used in each evaluation resulting in 100 drop measurements RESULTS: There were 1583/1600 measurements due to 17 extubations. Data was analyzed using the Kruskal-Wallis test; there is a significant difference between devices ($p < 0.001$). To account for the initial stretch of the neck securing material the first drop from each cycle was removed and the data reanalyzed. There were 1263/1280 measurements. Movement remained significant ($p < 0.001$) Mean movement for commercial (0.1 ± 0.35 cm) and non-commercial (0.1 ± 0.21 cm) techniques/devices significantly differed ($p < 0.001$). The tube holder that had the least movement was Anchor Fast (0.009 ± 0.03 cm) and the tube holder with the greatest movement was Precision Medical (0.656 ± 0.87 cm; $p < 0.001$) Table 1. CONCLUSION: There is significant variation in the ability of the various commercial techniques/devices to keep the ETT stable during a rapid jolt. One of the contributing factors to this variation is the material used to secure the ETT.

Sponsored Research - Hollister

1414074

INTUBATION SUCCESS RATE USING GLIDESCOPE® VIDEO LARYNGOSCOPE IN PEDIATRIC CRITICAL CARE TRANSPORT.

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BACKGROUND: Although the literature suggests video laryngoscopy improves intubation success rates with adults, a dearth of information is available in the pediatric population. This study assessed the role of the GlideScope® video laryngoscope (GVL) in facilitating successful intubations by a pediatric critical care transport team. We hypothesize that GVL will reduce failed intubation rates compared to direct laryngoscopy (DL). METHODS: Prior to the initiation of the study, staff received didactic and simulation based instruction with the GVL and demonstrated competency through a minimum of 5 successful intubations in patients > 10 kg and one intubation in patients ≤ 10 kg in a controlled operating room setting. All patients <18 years of age transported by our pediatric critical care team were eligible. Patients requiring tracheal intubation were consented and randomized into either the GVL intubation group or intubation by DL using a Miller blade prior to transport. Therapists were permitted a maximum of 3 attempts per technique. Tracheal intubation was confirmed by auscultation, chest excursion, end-tidal CO2 detection, and/or chest x-ray. Two tailed z-test determined differences in the proportion of successful first intubation attempts and overall successful intubation rate. Statistical significance was established at $p < 0.05$. RESULTS: Nineteen patients were enrolled. No difference in first-time successful intubation rate was detected $p = 0.57$. Overall intubation success rate was greater with direct laryngoscopy, $p = 0.002$ (Figure 1). CONCLUSIONS: Overall intubation success rates are significantly worse with GVL when compared to Miller blade in the pediatric critical care transport setting.

Sponsored Research - None

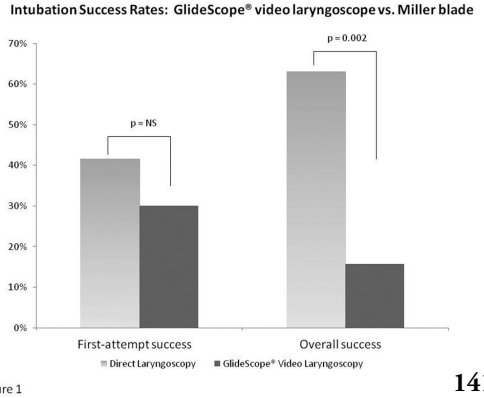

Figure 1

1417209

BIOMASS BURNING DURING SUGARCANE HARVESTING IS MARKED HARMFUL FOR NASAL MUCOSA OF SUGARCANE WORKERS AND RESIDENTS OF URBAN AREAS THAT SURROUND THE BURNING FIELDS.

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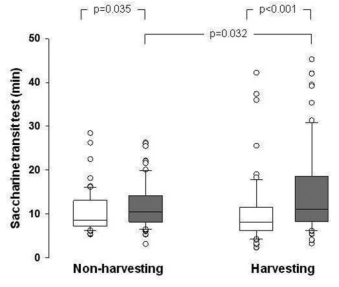
Background: Biomass burning produces toxic gases and suspended particle that contribute for high levels of air pollution and can have negative effects on human health. Methods: We aimed to assess the effects of biomass burning during sugarcane harvesting on nasal mucociliary clearance (NMCC) by saccharine transit test (STT), mucus properties by high flow clearability and contact angle, and total and differential cells countings, cytokine expression of TNF-α, IL-4, IL-6, IL-8 e IL-10 in nasal lavage (NL), arterial pressure, heart rate, respiratory rate, pulse oximetry, body temperature, exhaled carbon monoxide-CO, airways discomfort symptoms and respiratory events of sugarcane workers and residents that live near to sugarcane fields. We evaluated 154 young non-smokers (18-42 y.o.), residents (n=73) and sugarcane workers (n=81) at two time-points: (a) non-harvesting: 4-months of non exposure to biomass burning and (b) harvesting: after 8-months of exposure. Results: Sugarcane workers compared with residents were younger (29 and 24 years respectively, P<.001) and with lower body mass index (27±5 and 24±4 respectively, P<.001). At harvesting, sugarcane workers compared with residents presented lower mean blood pressure (93±10 and 97±9 mmHg respectively, P=.042), heart rate (63±11 and 76±14 bpm respectively, P<.001), IL-4 (0.3±0.6 and 0.4±0.5 pg/ml respectively, P=.001), ciliated cells (52±14 and 64±19% respectively, P<.001), goblet cells (4±5 and 13±14% respectively, P<.001), and higher pulse oximetry (98±1 and 97±1% respectively, P=.024), number of total cells (32±30 and 24±29 cells respectively, P=.040), neutrophils (2±3 and 1±2% respectively, P<.001), eosinophils (0±1 and 0±0% respectively, P<.001), macrophages (40±13 and 21±16% respectively, P<.001) and IL-6 concentration in NL (4.0±3.7 and 2.8±3.4 pg/ml respectively, P=.026). There were no significant differences in mucus physical properties, concentrations of IL-8 and TNF-α and lymphocytes in NL between the two groups and along the study. Conclusions: Biomass burning induces changes in the first defense barrier of the respiratory system in urban and rural population. However, the magnitude of the nasal mucosa inflammation was greater in sugarcane workers compared with residents of the urban área. In addition, this study showed that in the first expositions of young healthy sugarcane workers, these negative effects on mucociliary function seem to be totally reversible.

Sponsored Research - None



1351720

A RETROSPECTIVE REVIEW OF TRACHEOSTOMY DECANNULATION PRACTICES AMONG MEDICAL SPECIALTIES.

Lindsey Kreisher, Jhaymie L. Cappiello, Michael Gentile, Jan Thalman, Neil MacIntyre; Duke University Hospital, Raleigh, NC

Background: Tracheostomies are performed for patients requiring prolonged mechanical ventilation. These tracheostomies are most often temporary. Current literature is suggestive of benefits to a centralized tracheostomy service to provide efficient management of the temporary tracheostomy. Resistance to centralization of a tracheostomy management service may exist if medical specialties have significant differences in their decannulation practice. We sought to determine if differences in decannulation practices among the medical specialties existed at our institution. Methods: IRB approval was obtained to perform a retrospective review of adult patients who received a tracheostomy for prolonged mechanical ventilation and were decannulated between January 2009 and December 2011. Patients were subsequently grouped by their primary care service: Medicine, Neurosciences, and Surgical. Cardiothoracic surgery and ENT patients were excluded due to their services' treatment plans that included specialized tracheostomy care. Tracheostomy decannulation data reviewed per service included; number of decannulations, total length of tracheostomy days (LOTD) (mean ± SD), and length of tracheostomy post ventilation (LTPV) (mean ± SD). Results: See Table Conclusion: Among the three groups of medical specialties, there was no significant difference in decannulation practice. The influence of a centralized tracheostomy service could address the needs of all temporarily tracheostomized patients in these three service areas.

Sponsored Research - None

	Medicine	Neurosciences	Surgery
Number of Patients	21	47	74
LOTD	23 ± 12	22 ± 13	21 ± 12
LTPV	12 ± 8	15 ± 12	14 ± 10
One Way ANOVA for LTPV: P= 0.584 F=0.5387			

1417373

CREATION, IMPLEMENTATION AND EVALUATION OF SECRETION CLEARANCE AND BRONCHODILATOR PROTOCOL.

Peter Saunders, Jeff Ford, Chris Kircher, Matt Davis, Rob Smith, Maria Madden, Hamid Reza, Marlin Martin, Gigi Coviello, Brenda Singer; Respiratory Care Services, University of Maryland Medical Center, Baltimore, MD

Background:Respiratory Care Services at the University of Maryland Medical Center were tasked to develop a protocol to evaluate patients needing secretion clearance and bronchodilator therapy. With a protocolized approach, the respiratory therapist would classify patients in such a manner that would assure necessary care was provided, a plan of care was developed and unnecessary treatments were alleviated. We constructed a scoring method that included patient history, chest x-ray, breath sounds and other indicators. The patients were scored and assigned a therapy level which included treatment modality and frequency. Knowing certain patient populations may require different strategies; therapies were tailored to either a spinal cord/neuro or a general ICU category. The original protocol order is initiated by a physician and the RT is able to modify that order with each re-evaluation. All scoring as well as charting for individual therapies are available to the healthcare team through the computerized flow sheet and are part of physician rounds. Method:The protocol was piloted in the Cardiothoracic ICU and the NeuroTrauma ICU. To evaluate therapist satisfaction with the protocol and their ability to work with the healthcare team to make changes to the plan of care, a 10 question survey was devised. The questions focused on the staff's opinions regarding secretion clearance and bronchodilation pre and post protocol implementation and overall therapist autonomy. Results:When asked if, prior to initiation of the protocol, there was a well communicated and coordinated approach to orders governing therapy, 65% responded that they disagreed and 21% were neutral. Regarding ease of ordering and modification, again therapists felt this was not the case with 69% in disagreement. Post initiation of the protocol 82% felt that there was an increase in their ability to apply assessment skills. 65% agreed that there was a more consistent approach to communication between therapist and physician teams. 82% agreed that treatment modalities were more appropriately selected. Similar results were also achieved when asked about therapist autonomy and more efficient use of time. Conclusions:Use of secretion clearance and/or bronchodilation therapist driven protocols under physician order can better coordinate patient care, better utilize the respiratory therapist's time, save money by reducing unnecessary treatments and raises the level of therapist autonomy.

Sponsored Research - None

1418699

DEVELOPMENT AND IMPLEMENTATION OF A PROCESS IMPROVEMENT PLAN FOR ALPHA-1 ANTITRYPSIN DEFICIENCY TARGETED SCREENING.

John S. Rinck, Jennifer Ely, Elaine Hurst; Pulmonary Diagnostics, Sparrow Hospital, Lansing, MI

BACKGROUND: Alpha-1 antitrypsin deficiency (AATD) is a genetic risk factor for pulmonary disease that often goes undiagnosed. Early diagnosis can improve patient outcomes by including preventive measures such as smoking cessation, monitoring, and appropriate therapy while lung function is still preserved. This report describes a three phase AATD testing and educational project instituted at our outpatient pulmonary function laboratory at Sparrow Health System in Lansing, Michigan between March and August 2011. METHOD: Phase I [Start up]: planning and development of an inexpensive, simple testing process that could easily be used in a primary care physician (PCP) setting. Phase II [PCP Education]: extending education and outreach to PCPs within the Sparrow network of hospital affiliations. Brochures were distributed to physician practices whenever AAT test results were mailed to the patient's PCP, providing guidance and education on epidemiology, genetics, diagnosis, and treatment. Lunch-and-learn sessions were provided to physicians at the satellite locations. Phase III [Sustainability and Penetration]: education and integration of AATD testing into 12 counties served by Sparrow Health System. RESULTS: Over 110 COPD patients were tested. Positive test results for AATD were processed with education material back to the patient and follow-up instructions guiding future care. Implementation of the protocol assured that there would be increased awareness and understanding of the meaning of test results. All physicians were notified of test results and received education (>90 in total). Outreach to all Sparrow affiliates is progressing. CONCLUSIONS: There are COPD patients who have pulmonary function studies performed but who may not receive complete treatment and follow up. The creation of a protocol to test, inform, educate, and treat patients who met ATS Guidelines for AATD testing became the focus of this endeavor. Implications for the Respiratory Care community: ease of testing, exposure to advanced pulmonology knowledge, an entry point for patient testing and follow up. Implications for patients: an informed COPD population, increased AATD knowledge, access to advanced counseling, treatment choices. Implications for PCPs: increased knowledge and awareness, application of evidence based medicine, exposure of undiagnosed or misdiagnosed pulmonary disease, treatment options, access to experts and treatment centers.

Sponsored Research - None

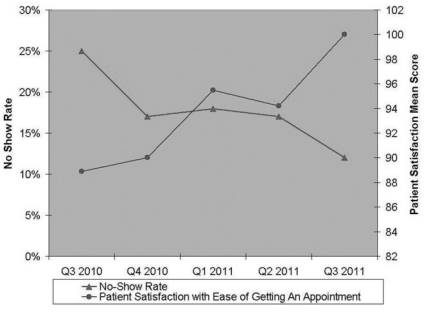
1415665

THE IMPACT OF A REMINDER PHONE CALL ON NO-SHOW RATES OF PATIENTS SCHEDULED FOR PULMONARY FUNCTION TESTING.

Bonnie Gehlert, Cheryl A. Hoerr, Carrie Byrd, Pandee Goodson, Amelia Payne-Rulo; Respiratory Therapy, Phelps County Regional Medical Center, Rolla, MO

BACKGROUND: Outpatients scheduled for pulmonary function testing (PFT) are surveyed to determine satisfaction and to help pinpoint areas in need of improvement. In 2010 we experienced a significant decrease in patient satisfaction with the ease of getting an appointment. Sixteen appointments were available every week which was considered sufficient for a department doing 45-50 studies per month. The purpose of this project was to determine the cause behind the dissatisfaction and to develop/implement a solution which would improve patient satisfaction scores. METHOD: A work group consisting of the PFT staff and a representative from department management was convened to study the issue and propose solutions. Adding an additional day of testing was considered but was not the group's first choice as it would increase the department's salary expenses. During analysis the work group found that the no-show rate for scheduled patients was between 20% - 25% (Range: 7% - 33%); the no-shows were blocking appointment times that could have been available for other patients. The work group collaborated with Volunteer Services to develop a process for a reminder phone call to patients the day before their appointment. A script was developed and approved by Legal Services. Volunteer Services receives a listing of scheduled patients with their contact information from the Respiratory Department the day before the appointments are scheduled and calls to remind patients of their appointment. RESULTS: The no-show rate has dropped from 25% to 12%, a 50% decrease in no-show rates. Patient satisfaction scores have shown themselves to be inversely related to no-show rates: as no-show rates have decreased, patient satisfaction scores with ease of getting an appointment have increased. Additionally we estimated a salary expense savings of approximately $85/month as a result of eliminating non-productive time spent waiting for patients who never showed up for their appointment. CONCLUSION: Reminder phone calls to outpatients scheduled for Pulmonary Function Testing decreases no-show rates, increases patient satisfaction, and reduces non-productive therapist time.

Sponsored Research - None



1403804

THE RESULTS OF AN INDOOR AIR QUALITY (IAQ) POLICY CHANGE ON ELEVATED CO2 LEVELS IN SCHOOL.

Kitty Hernlen, Susan Johnson, Randall Baker; georgia health sciences university, Augusta, GA

Background: Increased indoor carbon dioxide (CO2) levels can impact the central nervous system leading to daytime sleepiness and decreased concentration. According to the American Association of Heating Refrigerating and Air-conditioning Engineers (ASHRAE), the upper level of indoor carbon dioxide levels is 1500 ppm. A previous study found higher than normal CO2 levels in classrooms at a middle school in rural Georgia. This study was designed to determine if the implementation of IAQ measures would reduce these CO2 levels. Methods: The ASHRAE standard 62-2001 recommends 700 ppm above the outdoor concentration as the upper limit for occupied classrooms. CO2 measurements were obtained using a pSense AZ 77535A portable CO2 monitor which also recorded relative humidity and temperature. On April 19, 2011, measurements were obtained outside the school as well as in 32 classrooms. Outside CO2 measure was 780 ppm, RH 71% and temperature 20.2 C. An IAQ policy change that prohibited air vents from being blocked or turned off was implemented in August 2011. A follow-up walk thru following the same procedure was conducted on November 17, 2011 to assess the results of the IAQ changes. Outside CO2 levels at that time was 775 ppm, RH 79% and temperature 17.8 C. Results: Paired t-tests were used to examine whether temperature, relative humidity and CO2 changed from pre-test to post-test,. To examine whether blocking of the vents or closing of at least one vent in the room changed from pre- to post-test, the McNemar's test was used. An improvement in the CO2 levels was seen with the CO2 levels dropping significantly from pre- to post-test ($p<0.0001$). A rise in relative humidity in the rooms was seen from pre- to post-test ($p=0.0010$) with no different in temperature seen in the rooms from pre- to post test. A significant change in the blocked vents from pre- to post-test was seen with more vents that were blocked at pre-test being un-blocked at post-test than the reverse. However, a greater proportion of vents that were open at pre-test were closed at post-test rather, which is concerning. Conclusion: CO2 levels did drop as a result of the policy change to not block vents but the mean post-test CO2 levels remained above the recommended levels. A significant number of vents were turned off reflecting a disregard for the policy change. Reinforcement of the policy needs to be performed by the school.

Sponsored Research - W.G. Raoul Foundation

Table 1: Paired t-test differences in room data.

Variable	Pre-test		Post-test		t-value	p-value
	Mean	SD	Mean	SD		
Temperature	23.2	0.9	22.8	0.9	79%	0.0856
Relative Humidity	49.7	5.4	53.8	7.7	-3.63	0.0010
CO2	3358.0	1090.8	2285.0	646.6	6.39	<0.0001
	N	%	N	%		
Blocked Vents	25	76%	5	15%		
Vents Off	12	36%	26	79%		

1418190

THE EFFECTS OF ABNORMAL BLOOD PRESSURE ON ARTERIAL SAMPLER FILLING TIMES.

Aaron Cortes, Chelsea Dalessandro, Tina Glade, Sophia Shirdon, Jen Uhlir, F. Herbert Douce; Respiratory Therapy, The Ohio State University, Columbus, OH

BACKGROUND: Sampler filling time begins with the initial flash of blood in the needle hub until the preset sampler volume is obtained. Previous research has analyzed the correlation between mean arterial pressure (MAP) and arterial sampler filling time, but failed to include abnormal blood pressures. Purpose: To determine if the time required to fill an arterial sampler is an accurate indication of a successful arterial blood sample in hypertensive and hypotensive adults compared to those with normal BP. Hypotheses: MAP and arterial sampler filling time will have a negative correlation; venous sampler filling time will be significantly longer than arterial filling time. METHODS: This study included four groups: three arterial groups, hypertensive, hypotensive or normal and one group received a venipuncture. During the arterial and venipuncture procedures, sampler filling time, blood volume and PO2 were measured. Additionally, BP and SpO2 were measured for the arterial groups. We used a Pearson correlation coefficient to determine the relationship between MAP and sampler filling rate. We determined if there was a significant difference between arterial and venous groups using ANOVA with an alpha level of 0.05 and Tukey's post hoc. RESULTS: Our subjects included: 13 hypotensive, 6 normotensive, 6 hypertensive and 15 venous (N=40). The mean sampler filling times were 220.4 sec/mL for venous and 18.1sec/mL for arterial. There was a significant difference between mean arterial filling time and mean venous filling time (p=0.0001). There were no significant differences in mean sampler filling rates between arterial subgroups (p=0.997). The correlation between MAP and filling rates was 0.062 (p=.384). CONCLUSION: There is a significant difference between arterial and venous filling rates. There was no relationship between filling times and abnormal MAPs. Regardless of arterial blood pressure, arterial sampler filling time can be used as an indicator of a successful arterial puncture at the bedside.

Sponsored Research - None

Group	N	Mean Filling Time (sec)	SD
Hypotensive	13	19.8	5.8
Normotensive	6	13.3	4.0
Hypertensive	6	21.1	10.3
Venous	15	220.4	102.2

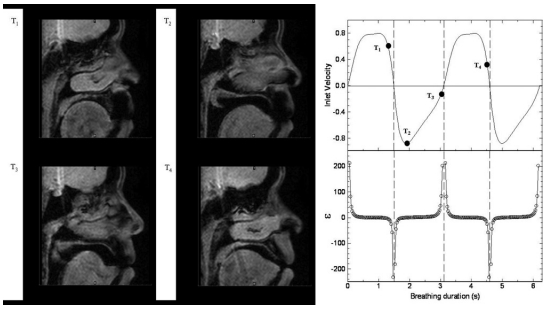
1425133

NASAL-PHARYNGEAL TISSUE COMPLIANCE AND AIRFLOW PATTEN DURING TIDAL BREATHING USING REAL-TIME MRI AND COMPUTATIONAL FLUID DYNAMICS.

Jinxiang Xi[1,2], Xiawei Ou[3]; [1]Department of Systems Engineering, University of Arkansas at Little Rock, Little Rock, AR; [2]Department of Mechanical and Biomedical Engineering, Central Michigan University, Mount Pleasant, MI; [3]Department of Radiology, University of Arkansas for Medical Science, Little Rock, AR

The respiratory airway varies both in morphology and dimension during a respiratory cycle due to tissue compliance, which in turn induces variations in airflow pattern and inhaled aerosol dynamics within. In this study, the tissue compliance in the nasal-pharyngeal airway was quantified using dynamic MR imaging during tidal breathing under both quite (before excise) and active (after exercise) physical conditions. The dynamically deforming 3-D airway morphologies were rendered with 10 increments during inhalation and another 10 increments during exhalation, which were then discretized for computational analysis. Both Lower-Reynolds k-ω Turbulence model and large eddy simulations (LES) were employed to simulate the laminar, transitional and fully turbulent flow regimes under both quite and active tidal breathing activities. We found that the maximum intranasal tissue compliance is within the range 3-9%, and does exhibit noticeable discrepancy between quite and active breathing conditions. The pharyngeal tissue was much more compliant subject to physical activities, i.e., maximum tissue compliance being 5% under quite breathing and 9% under active breathing. The resultant airway change due to tissue compliance significantly alters the inhaled and exhaled airflow patterns in comparison to those within rigid airway geometries. Specifically, the normal stress upon the airway surface and the breathing resistance were calculated and compared between the cases with and without tissue compliance. Results of this study indicate that the pharyngeal tissue compliance is a major cause for obstructive sleep apnea or respiratory distress syndromes.

Sponsored Research - None



Upper airway morphology change during quite breathing obtained using real-time MRI.

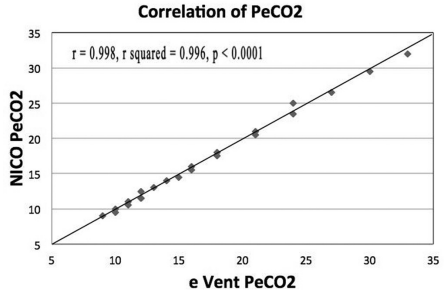
1413365

COMPARISON OF MEAN EXPIRED CO2 MEASUREMENTS USING THE EVENT INSPIRATION 7I VENTILATOR VOLUMETRIC CAPNOGRAPHY VS THE RESPIRONICS NICO2 MONITOR.

Mark S. Siobal, Leo Bandian; Anesthesia, SFGH/UCSF, San Francisco, CA

Background: Calculation of VD/VT requires a mean expired CO2 (PeCO2) measurement. The eVent Medical Inspiration 7i ventilator is equipped with integrated volumetric CO2 monitoring and calculates PeCO2. We compared PeCO2 from the Inpsiration 7i Ventilator measurements and compared it to PeCO2 measurements from the Respironics NICO2 monitor during simulated ventilation. The Inspiration 7i ventilator evaluated was equpied with a PeCO2 feature not yet available use in the USA. Method: The Inpsiration 7i ventilator set to Vt = 500mL, RR = 10, PEEP = 10 cm H2O, Insp. Time = 0.75 sec., Insp. Flow = 50 L/min, and FiO2 = .50 was attached to a single chamber of a Michigan Instruments Test Lung. The ventilator flow sensor and mainstream CO2 sensor, and the NICO2 monitor combined CO2 / flow sensor were calibrated and attached between the ventilator circuit and test lung chamber. 100% CO2 bleed-in to the test lung chamber was adjusted until an end tidal CO2 (ETCO2) of 35 mm Hg was displayed on the NICO2 monitor. PeCO2 calculated by NICO2 monitor and PeCO2 calculated from the ventilator measurements were recorded. Ventilation of the test lung was then changed in increments of 1 L/min by increasing the RR by 2 breaths per minute increments up to a RR of 30. PeCO2 calculated by the NICO2 monitor and PeCO2 calculated from the ventilator measurements were recorded at each step after a 5 minute stabilization period. The proximal and distal position of the ventilator CO2 sensor, and the NICO2 combined CO2 / flow sensor were then reversed and the measurements were repeated. A total of 22 measurements were recorded and compared. Results: There was a very strong correlation between Inpsiration 7i ventilator and NICO2 monitor measurements of PeCO2 (r = 0.998, r squared = 0.996, p < 0.0001) with minimal bias and excellent precision (+ 0.5 ± 0.9 mm Hg). Conclusion: PeCO2 calculated by the Inpsiration 7i ventilator are in strong agreement with PeCO2 measurements from the NICO2 monitor during simulated ventilation. In-vivo comparison of the two PeCO2 measurements needs to be validated.

Sponsored Research - None



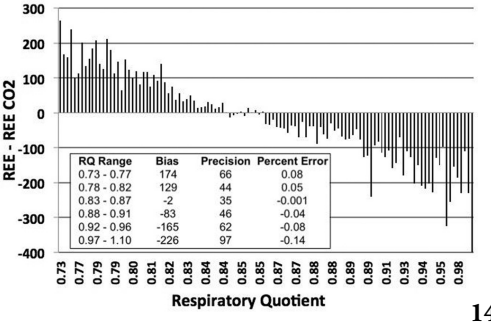
1433293

ACCURACY OF RESTING ENERGY EXPEDITURE CALCULATED BY A MODIFICATION OF THE ABBREVIATED WEIR EQUATION IN MECHANICALLY VENTILATED ADULT ICU PATIENTS.

Mark S. Siobal[1], Hanna Hammoudeh[1], Michael Snow[2]; [1]Anesthesia, SFGH/UCSF, San Francisco, CA; [2]Medical Graphics Corporation, St. Paul, MN

Background: Resting energy expenditure (REE) can be determined by indirect calorimetry using a metabolic analyzer and calculation by the abbreviated Weir equation whereby: REE = [3.9 (VO2) + 1.1 (VCO2)] 1.44. By substituting the measured VCO2 / 0.85 for the measured VO2, REE based on VCO2 (REE CO2) can be calculated without measuring VO2 directly when the respiratory quotient (RQ) is equal to 0.85. We compared REE and REE CO2 measured by the CCM Express metabolic analyzer in mechanically ventilated ICU patients to determine accuracy of the REE CO2 calculation. Method: Results from routine metabolic studies in 67 medical and surgical ICU patients receiving mechanical ventilation were reviewed retrospectively. Data from a total of 116 measurements were compared. All studies were performed when the patient's FIO2 was between 0.35 and 0.60. The measured RQ ranged between 0.73 and 1.1. Studies were performed using the manufacturers standardized procedure. The review of patient data was approved by the Committee on Human Research at the University of California San Francisco. Results: The correlation between REE and REE CO2 was very strong (r = 0.99, r squared = 0.98). Bias and precision was -15 ± 126 kcal / 24 hrs by Bland – Altman analysis. There was a distinct pattern of agreement when the difference of REE and REE CO2 were compared to RQ whereby as RQ approached 0.70 the percent error (mean bias / mean REE for the range of RQ) became more positive and as RQ approached 1.0 the percent error became more negative. Conclusion: There was strong agreement between REE and REE CO2 measured by the CCM Express metabolic analyzer. Further study is required to determine if the accuracy of the REE CO2 measurement is maintained when performed at FiO2 > 0.60 and if volumetric CO2 measurements of VCO2 can be used to accurately calculated REE CO2 without measuring VO2.

Sponsored Research - Medical Graphics Incorporated was consulted regarding study design



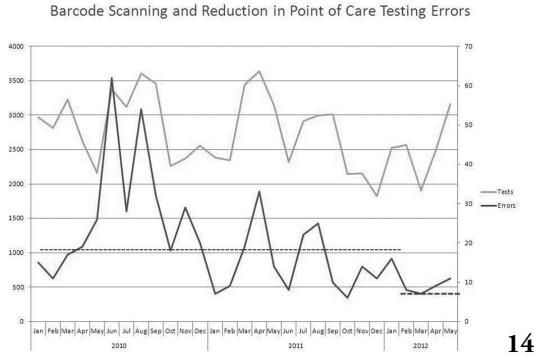
1433260

BARCODE SCANNING: DOES IT REDUCE ERRORS MADE DURING POINT OF CARE TESTING?

Jenni L. Raake, Thomas Cahill, Jerry Edens, Clarence Karnes, Joseph Westrich; Respiratory Care, Cincinnati Childrens Hospital, Cincinnati, OH

Background: Errors occurring during point of care laboratory testing (POCT) are often related to patient misidentification. Subsequently, results are not transmitted to the chart. Our hospital uses the iSTAT POCT system. Prior to technology enhancements, Respiratory Therapists were manually entering their hospital identification number and the patient identification number into the chart. In 2010, we measured this manual process and noted that it yielded 178 errors while performing 32,318 POCT procedures. In February 2012, the hospital instituted enhancements which incorporated barcode scanning technology and patient armband with barcodes. We evaluated the recent process enhancements to determine if barcode scanning has reduced the volume of POCT errors. Methods: We reviewed laboratory reports for the ICUs from 2010 through the 1st 5 months of 2012 which showed the volume of POC tests (79,487) and the number of reported errors (560). We also projected out the volume of tests and the number of errors for 2012 based on the volume of tests and errors made over the last two years. Results: Since the introduction of barcode scanning, we have performed 7,560 POCT procedures with 35 errors reported. When compared to prior years, we noted a 40% reduction in POCT errors. Based on previous years and current number of procedures, projected volumes for 2012 are 30,312 POCT tests with a projected volume of 122 errors, also projecting a 40% reduction in POCT errors. Conclusions: Based on the results of our study, barcode scanning of the patient armband has helped to reduce the number of errors during the POCT process. This reduction in errors has lead to an increase in patient safety

Sponsored Research - None



1434800

PATIENT ADHERENCE TO NASAL CONTINUOUS POSITIVE AIRWAY PRESSURE.

Tim Op't Holt, Justin Feller; Cardiorespiratory Care, Univ of South Alabama, Mobile, AL

Background: Continuous positive airway pressure (CPAP) is the standard treatment for obstructive sleep apnea (OSA). An autotitrating CPAP program has been implemented at the Victory Health Partners (VHP) clinic for over two years. There are many health problems associated with OSA and the most effective treatment is CPAP. Objectives: We evaluated the prevalence of symptoms while using nasal CPAP. We also determined how adherent patients are to their nasal CPAP. Methods: A short survey was conducted to determine patient symptoms and adherence to their nasal CPAP following home CPAP titration and prescription at the VHP clinic in Mobile, AL. The survey included three parts: sociodemographic issues, symptom prevalence, and the adherence to nasal CPAP. We contacted patients who had received CPAP at the VHP clinic for a phone interview. If the patients were not able to be contacted by phone within three attempts, we mailed a postcard to them with information on why we were doing the survey along with a callback number. Results: The VHP clinic has provided CPAP to 48 patients. Of the 48 patients, 11 patients participated in the survey. 64% were males and 36% were females with an average age of 47 ± 11.7 years. Among respondents, there was a 91% decrease in snoring, a 73% decrease in night-time awakenings, 91% are less fatigued when they awaken in the morning, 64% experience a better quality of sleep, 64% have a decrease in daytime sleepiness, and 18% say that they have not noticed any changes of alertness while driving. Of the 11 patients, none have experienced morning headaches or memory loss. In the next section we determined the adherence of CPAP. Results demonstrated that 36% of the VHP clinic patients have been using their nasal CPAP either 1-6 months or more than a year. 73% of the patients use their nasal CPAP every night and 73% say they wear their nasal CPAP more than 6 hours a night. Conclusion: By conducting this survey, we have an understanding of the effectiveness of the Victory Clinic CPAP program. In this study, we found that the nasal CPAP mask is comfortable and effective in treatment patients with OSA.

Sponsored Research - None

1417253

SUPRANORMAL PULMONARY FUNCTION TESTING VALUES IN A MILITARY POPULATION.

Michael J. Morris, Anthony A. Cochet, Pedro F. Lucero, Lisa L. Zacher; Pulmonary/Critical Care Service, Brooke Army Medical Center, Fort Sam Houston, TX

Background: The objective of this study is to determine a difference in the proportion of reported supranormal pulmonary function tests between active duty military personnel and their non-active duty population. Up to 25% of the pulmonary evaluations performed on these soldiers presenting with dyspnea are normal. Given the emphasis on cardiovascular fitness in the military, some clinicians have hypothesized that this leads to an increase in the number of supranormal PFTs. We hypothesized that a comparison of PFTs performed in the military medical system would identify no difference in the ratio of supranormal to normal PFTs between the active duty and non-active duty population. Methods: A retrospective chart review was conducted of all beneficiaries who underwent pulmonary function testing at Brooke Army Medical Center from 2006-2011. Patients were included in the analysis with either an FVC or FEV1 >115% predicted and both values greater than 100% predicted. Comparative analysis was performed for patients ages 18 to 50 based on active duty status. Further analysis was performed on all ages to determine the distribution of findings. Results: A total of 13,609 interpreted pulmonary function tests were queried. Of those, 4303 were active duty patients; 9306 were non-active duty patients. From the total PFTs, 912 (6.7%) were identified as supranormal. When subdivided, 175(12.4%) of non-active duty patients age 18-50 were supranormal; 356(4.7%) of non-active duty patients age >50 were supranormal; and 381(9.4%) of active duty age 18-50 were supranormal. Conclusions: The results of this study, based on pulmonary function testing dating back to 2006, reveals no significant difference in the proportion of supranormal to normal PFTs in the active duty population over the non-active duty population. Based on these findings, we conclude that no assumption should be made that supranormal pulmonary function is more common in military personnel. These results also indicate that the interpretation of normal PFTs in active duty personnel undergoing evaluation for dyspnea should not differ from the civilian patient base.

Sponsored Research - None

PFT Values

	AD 18-50	Non-AD 18-50	Non-AD 50-90	All Patients	P value
Spirometry	N = 381	N = 175	N = 356	N = 912	
FEV1 (actual)	4.15 ± 0.83	3.49 ± 0.65	2.85 ± 0.78	3.52 ± 0.97	NA
FEV1 (% pred)	112.9 ± 8.3	112.8 ± 9.1	116.3 ± 10.8	114.2 ± 9.6	< 0.001
FVC (actual)	5.10 ± 1.03	4.31 ± .80	3.68 ± 0.99	4.40 ± 1.17	NA
FVC (% pred)	115.3 ± 7.6	115.7 ± 9.6	114.4 ± 9.6	115.0 ± 8.8	0.20
FEV1/FVC	81.6 ± 5.0	81.0 ± 5.0	77.7 ± 6.0	80.0 ± 5.7	< 0.001

1434684

EFFECT OF PATIENT CONTACT TIME ON CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP) COMPLIANCE RATES FOR PATIENTS DIAGNOSED WITH OBSTRUCTIVE SLEEP APNEA (OSA).

Juli M. Bolterman, Sharon Ngan; Ambulatory Sleep Center, Kaiser Permanente, Lancaster, CA

PURPOSE: CPAP Therapy is an effective therapy for Obstructive Sleep Apnea (OSA). The purpose of this study was to determine that comprehensive patient/therapist contact time would increase patient CPAP compliance. METHODS: Retrospective chart review of patients diagnosed with OSA with the PM device ARES and treated with CPAP. CPAP compliance data tracked via data download. Patient contact time included a total of 3 sessions: Each session included one on one contact time, education on OSA and patient question and answer time. Session 1: A 60 minute review of patient completed Sleep History and Epworth Sleepiness Scale Questionnaires, proper fitting and instructions on use of the PM device. Session 2: A 60 minute review of data from PM device. Data download to computer assisted analysis software, review data with patient, properly fit appropriate CPAP interface device, place patient on AutoCPAP device for 15 minutes to desensitize, and provide a 10 minute educational video on OSA. Session 3: A 10 minute review of AutoCPAP data download, patient completed questionnaire detailing experience with use of AutoCPAP equipment. CPAP equipment ordered based on questionnaire answers. Day 30: A 30 minute CPAP Compliance Evaluation of data downloaded from patient CPAP equipment to software for compliance tracking purposes and discussed with patient. Evaluations completed with Type 4 PM device ARES and the AutoCPAP Device Remstar Auto A-Flex. CPAP Compliance were determined after 1 month of initiating CPAP Therapy. RESULTS: Study criteria included a total of 64 patients >18 yrs of age. Excluded patients: A total of 25 patients: 1 patient - CPAP Therapy Not Indicated, 4 patients did not fill Prescriptions provided, 12 patients did not show up for scheduled compliance evaluation appointments, 5 patients refused to complete the AutoCPAP titration study, 2 patients declined to use CPAP equipment and 1 patient unable to contact to confirm CPAP equipment order. A total of 39 patients met the inclusion criteria (20 Male, 19 Female), Age Range: Mean 56 years old (29 – 83), Initial AHI range Mean 44 (5-82), CPAP Therapy AHI Mean 7 (0-14). CPAP Compliance determined by days of usage in the 30 day evaluation period: Overall CPAP Compliance Rate >75%. CONCLUSIONS: It is concluded that comprehensive patient/therapist contact time of 150 minutes within 30 days of initiating CPAP therapy for the treatment of OSA is associated with increased CPAP Compliance after 1 month.

Sponsored Research - None

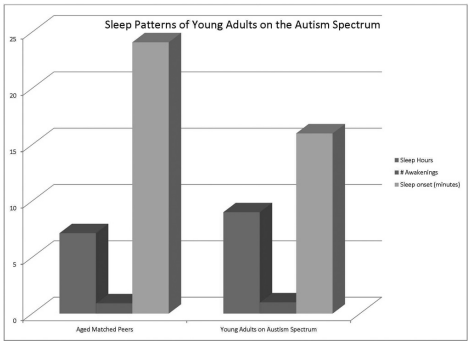
1405630

SLEEP PATTERNS OF YOUNG ADULTS ON THE AUTISM SPECTRUM.

Tamara Douglass-Burton, Lisa Crabtree; Towson University, Towson, MD

Background Young adults with an autism spectrum disorder (ASD) face many challenges with performing activities of daily living. Many of them experience problems with insomnia, difficulty falling asleep and exhibit poor sleep habits. The causes of poor sleep can be multifaceted ranging from medical problems, psychological issues and/or poor sleep hygiene. Because of inadequate amounts of sleep, some young adults with ASD have difficulties completing tasks during daytime hours, often interfering with school, work or social activities. The primary objective of this initial pilot study is to address the question: What are the sleep patterns of young adults with ASD? The literature has identified sleep disturbances in children, youth and adults with ASD, but not particular patterns of sleep. A secondary objective is to determine if the sleep patterns of young adults with ASD differ significantly when compared to age-matched peers. Methods Five young adults with ASD and 11 age-matched peers who were university students completed the National Sleep Foundation sleep diary for 14 consecutive days. Information included hours of sleep per night, number of times awakened in the night, and number of minutes for sleep onset. Sleep patterns were compared and described for each of the two groups. Results The two groups showed differences in sleep patterns. The young adults with ASD had longer sleep duration (9 hours compared with 7 hours) and shorter sleep onset (16 minutes compared with 24 minutes) than peers. Both groups averaged 1 awakening per night. Sleep patterns were more consistent in the ASD group. Conclusions Results in this pilot study suggest that sleep patterns of young adults with ASD differed from age matched peers and further analysis with a larger sample is warranted. The small sample size in this pilot study limits the ability to generalize results, although clear patterns were identified.

Sponsored Research - None



Sleep Patterns of Young Adults on Autism Spectrum

1416262

HOW DO RESPIRATORY THERAPISTS DISCUSS SMOKING CESSATION WITH THEIR PATIENTS AT THE BEDSIDE.

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Background: Respiratory Therapists (RTs) treat patients with the effects of tobacco dependence daily. They have a unique opportunity to influence patients to quit. Yet RTs have not been in the forefront of tobacco treatment and prevention with discussions at the bedside. This study was done as a master's thesis that included a review of the current problem, descriptions of evidence based practices and a review of literature describing physician, nursing and RT practices for smoking cessation. Method: This was a descriptive study consisting of surveys distributed to a convenient sample of 75 RTs. The design was appropriate to illustrate how RTs discuss smoking cessation with their patients when providing basic respiratory care. The survey consisted of eight questions in Likert five scale format adapted from a survey used by Barta and Stacy, Self-Efficacy and Behavior for Smoking Cessation Counseling Survey (Barta and Stacy, 2005). The questions regarded frequency of asking if a patient smokes;frequency of advising to quit, frequency of recommending nicotine replacement therapy; if resource materials offered; further discussions to those resistant to quitting; was time a barrier and whether RTs believe they can influence patient's smoking behaviors. An open comment section followed each question. Demographics including age, respiratory credential, smoking status, educational background and whether participant had smoking cessation training ended the survey. Prior to distribution, the survey was evaluated by the Respiratory Care Manager and director of nursing research. The survey was approved by the hospital's IRB as Study Number: 11-62. Descriptive statistics were used to analyze the results. The open comment sections were summarized for common themes. Results: 29 (39%) of the surveys were completed. 45% asked patients about smoking status 'All of the time'; 36% advised to quit 'All of the time'; 45% believed they had 'Some time' to discuss; 35% believed they could 'Definitely make a difference'; 32% received 'Very little training' on cessation. Conclusions: RTs regularly asked smoking status and advised to quit. They did not continue discussions when patients were unwilling to quit. Lack of time, resources and training were barriers consistent with literature. Future implications in practice include inservice training, staffing review, development of resource materials.

Sponsored Research - None

1417254

IMPROVING TRAUMA PATIENT OUTCOMES THROUGH ADDITIONAL PULMONARY HYGIENE INTERVENTIONS.

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Background: Trauma patients frequently display respiratory distress secondary to rib fractures, pulmonary contusions, pain and other consequences of traumatic injuries. Further respiratory complications can occur due to immobility, lack of deep breathing and poor pulmonary toilet. We hypothesize that not all trauma patients at risk for respiratory complications consistently receive focused care to prevent these complications that may result in transfer to higher intensity care settings. Increased attention to aggressive pulmonary preventive care may prevent respiratory complications, ultimately preventing unnecessary increases in length of stay and hospital incurred costs. Methods: Two pulmonary toilet order sets were created to be implemented with trauma patients on a pilot step-down unit at risk for developing respiratory complications: Standard and Aggressive (Table 1). Both respiratory care and nursing were educated about implementation of these order sets as a collaborative approach to ensure the full implementation of the developed protocols. After education, the protocol was implemented on patients upon receiving orders from the trauma physician. Results: After protocol implementation, the order set was initiated for 31 trauma patients with Injury Severity Scores (ISS) ranging from 16- 59 (Mean= 22). Of the 31 patients enrolled, 0 patients had an upgrade in care or transfer to ICU because of pulmonary complications. Data was also obtained for trauma patients (N= 41) who were not located in the study unit that had required an upgrade in care. It was found that 8 patients (ISS range= 5-29; Mean= 12) were upgraded for cardiopulmonary difficulties. Retrospective data for the prior year (N= 171) on the pilot unit with patients having similar ISS scores (>16) was also obtained. This reference data indicated 7 unplanned upgrades in care (4% occurrence rate) secondary to pulmonary complications. Conclusion: The implementation of the trauma pulmonary hygiene order sets provided beginning insight into the fact that focused pulmonary toilet interventions as a collaborative effort of Respiratory Care and Nursing staff may help to prevent respiratory complications and upgrades in care among trauma patients. Further data is needed to confirm this outcome.

Sponsored Research - None

1400499

IMPROVING PATIENT SATISFACTION SCORES WITH NOTIFICATION OF STAFF HAND WASHING.

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BACKGROUND: Hand washing with soap and water, or using alcohol-based hand sanitizers, are widely accepted as the most effective ways of preventing healthcare-associated infections. Since patients visit facilities designed to diagnose sleep disorders, these sleep centers and labs must adhere to this standard of care to limit the spread of infection. We sought better hand washing scores on our patient satisfaction survey. To do this, hand washing cards, explaining that the sleep center staff will be washing their hands, were distributed to each patient. Since hand washing was brought to the patient's attention, our hypothesis was that the hand washing cards would improve our survey scores for the question, "Staff washed their hands or used hand sanitizer before caring for me". METHODS: Upon greeting, staff members told each patient that they would be washing their hands or using hand sanitizer each time they entered the patient's room. A card, explaining that the staff member would be cleaning their hands, was signed and dated by the patient and staff member. Satisfaction scores from patients completing hand washing cards were compared to scores of patients not completing hand washing cards. Significance was determined by a Mann Whitney U-test. RESULTS: In the 5 full months preceding implementation of the hand washing cards, the average patient satisfaction score for the question, "Staff washed their hands or used hand sanitizer before caring for me", was 92.56. The average score was 94.38 for the 5 full months when the hand washing cards were distributed to the patient. There was a 1.82 (1.9%) point increase in the average patient satisfaction score when the sleep center staff used the hand washing cards. A Mann Whitney U-test showed no significant difference (p=0.1583) between patients receiving hand washing cards and those that did not. CONCLUSIONS: Although the implementation of hand washing cards increased the hand cleanliness satisfaction score, it was not significant. However, implementation of a program that notifies patients of improved infection control procedures may increase patient satisfaction scores and help achieve Pay for Performance goals. Future studies, with larger sample sizes, may demonstrate improved infection control outcomes and patient satisfaction scores.

Sponsored Research - None

1411180

EFFECTS OF 4-WEEK OUTPATIENT PULMONARY REHABILITATION ON PULMONARY FUNCTION AND QUALITY OF LIFE IN PATIENTS WITH COPD.

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BACKGROUND Chronic obstructive pulmonary diseases (COPD) induced impaired pulmonary function, decreased muscle strength, and reduced quality of life for patients after hospitalization. The benefits of pulmonary rehabilitation (PR) after discharging from hospital in COPD are well recognized. However, most reports have focused on the effects of longer-lasting PR program with durations longer than 8 weeks while little is known about the effects of short-term program (<=4 weeks). The objective of the study was to evaluate a 4-week outpatient PR program on pulmonary function and quality of life in patients with COPD. METHODS This is a prospective design study which was approved by our local institutional review board. Patients with diagnosis of COPD were recruited from an outpatient department to participate a PR program 2 sessions per week for 4 weeks. The program included exercise training, breathing training, and patient education. Pulmonary function, level of dyspnea (Borg scale) and health-related quality of life (Medical Outcome Study 36-item short-form survey, SF-36) were assessed at entry and completion of the PR program. Data analysis was performed with SPSS software (version 18.0). Descriptive data was presented as means ± standard deviation. For non-parametric distributed variables, a Wilcoxon test was used for within-group comparisons. RESULTS Twelve patients with a Global Initiative for Chronic Obstructive Lung Disease (GOLD) stage of III-IV (mean (SD) age 63.6(6.3) years, mean (SD) FEV1 29.99(4.49%) of predicted) completed the PR programs. There were no statistically significant differences in FEV1% predicted, FEV1/FVC% and total SF-36 scores between pre- and post- completion of PR program. However, the post-PR domains of SF-36 subscores of Role Emotion (57.5 vs 37.5 p=.041) and Mental Health (62.5 vs 35.7, p=0.039) were significantly higher than baseline measurement. CONCLUSION A 4-week outpatient rehabilitation program did not improve pulmonary function, but lead to improvement of psychological aspects, especially in role emotion and mental health dimension of quality of life in patients with severe COPD. Whether such PR program can provide additional benefits such as reduction of re-hospitalization rates in COPD patients may require further larger scale studies.

Sponsored Research - None

Table1. The changes in the physical and mental summary scores in all subscores of the SF-36 before and after PR program.

Sf36 subscales Median (IQR)	Pre-PR	Post-PR	p value
Physical Component Scores			
Physical Functioning	35.0 (22.5-58.8)	30.0(16.3-43.8)	.47
Role Physical	0 (0-0)	0 (0-0)	.29
Pain	62.0(41.3-78.5)	62.0(41.3-100.0)	.60
General Health	35.0(22.5-58.8)	42.5(35.0-55.0)	.21
Psychological Component Scores			
Role Emotion	0 (0-0)	0 (0-33.0)	.89
Vitality	37.5(27.5-73.8)	57.5(30.0-73.8)	.04
Social Functioning	50.0(50.0-84.4)	62.5(53.1-75.0)	.72
Mental Health	37.5 (27.5-73.8)	62.5(53.1-75.0)	.039

1417833

EFFECTIVE STRATEGIES TO MONITOR AND MANAGE POST-OPERATIVE SLEEP APNEA.

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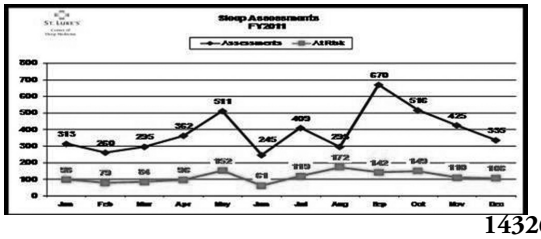
It has been estimated that 80% of the men and 93% of the women with moderate to severe Obstructive Sleep Apnea (OSA) are undiagnosed. St. Luke's Episcopal Hospital developed an intensive screening program to identify undiagnosed OSA patients. This was a pro-active approach to post operative monitoring of patients at high risk to avoid unnecessary complications. The objectives of the program were to promote quality, improve patient care, and increase outpatient sleep study referrals. Nursing and respiratory staff were trained regarding the risks of diagnosed and undiagnosed OSA related to sedation during hospitalization. A six step OSA patient management process was developed. The six steps are 1) Screening, 2) Assessment, 3) Education, 4) Monitoring 5) Intervention and 6) Follow-Up. Patients are identified through routine screening utilizing a modified STOP/BANG questionnaire. This is performed during pre-operative screening or upon admission by nursing and respiratory care. Once the patient is identified with diagnosed or high risk for undiagnosed OSA, further assessment is performed by a respiratory therapist/registered sleep technologist. At that time education regarding the OSA occurs. A determination is made to provide appropriate monitoring and intervention. After discharge patients that were determined to be at risk are contacted regarding their post hospital options associated with their OSA condition. Results: In 2011, there were 34,325 inpatient admissions and 4,636 patients were screened positive for diagnosed or undiagnosed OSA. A total of 1,368 (30%) of these patients were at risk. This determination was based on being assessed as "high risk" for OSA, non-compliant with CPAP therapy or having a previous OSA positive sleep study. Appropriate monitoring and interventions were instituted to prevent negative patient outcomes. Conclusion: A large percentage of patients with diagnosed and undiagnosed OSA are at risk during hospitalization. This population can experience respiratory arrest related to their OSA and sedation. The OSA Screening Program has contributed to safe management of this population.

Sponsored Research - None



1432637

COMPLIANCE WITH PULMONARY REHABILITATION RECOMMENDATIONS FROM THE GLOBAL INITIATIVE FOR CHRONIC OBSTRUCTIVE LUNG DISEASE (GOLD) 2011.

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Background Chronic obstructive pulmonary disease (COPD) patients are high consumers of healthcare resources and frequently readmitted. A possible strategy to mitigate readmissions is the use of pulmonary rehabilitation. The Global initiative for Chronic Obstructive Lung Disease (GOLD) consensus report updated in 2011 supports the use of pulmonary rehabilitation in a subset of patients with a classification of moderate to very severe disease know as GOLD 2 and higher. We sought to determine our compliance with GOLD recommendation for pulmonary rehabilitation in appropriate COPD patients following discharge. Methods Patients with primary diagnosis of COPD (ICD-9 CM 491.21) were identified using an administrative data set based on billing information (universal billing form). Patients were included if they were admitted between June-Dec 2011. Patients were excluded if they were discharged to nursing home/rehab, hospice, jail, left against medical advice or expired during admission. Patients were reviewed for presence of pulmonary consult, PFT within previous year and GOLD scoring was calculated on all patients. Patients were reviewed following discharge to determine presence of pulmonary rehabilitation order and completion of any pulmonary rehabilitation visits. Results 128 patients were identified as having primary diagnosis of COPD during the study period. 22 patients were excluded (12) were discharged to hospice or expired (7) discharged to nursing home, (2) discharged to jail, (1) left against medical advice. Of the remaining 106 patients only 2 received a pulmonary consult and one patient complied with rehabilitation recommendations. 70 patients did not have documented PFT within 1 year of admission. Of the 36 patients with PFT documented GOLD calculations were completed. 32 (88.9%) qualified for pulmonary rehabilitation. No patients received an order or completed rehabilitation. Conclusion Compliance with recommending pulmonary rehabilitation based on the GOLD scoring is poor. Lack of documented PFT within 1 year was high (66%). Respiratory Therapists have an opportunity to improve documentation of PFT which would allow for ability to calculate GOLD score. Based upon our findings, patients are not receiving evidenced–based practice for pulmonary rehabilitation following discharge.

Sponsored Research - None

1415691

LARGER NECK AND WAIST CIRUMFERENCE WERE CORRELATED WITH POSTEXTUBAITON RESPIRATORY FAILURE IN PATIENTS RECEIVED PROLONGED MECHANICAL VENTILATION.

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Background: Postextubation respiratory failure is a major complication in patients received prolonged mechanical ventilation (PMV) and is associated with higher complication rate, longer ventilator days, longer ICU and hospital stay, and increased hospital mortality. Previous studies showed that larger neck circumference (NC) increased the risk of upper airway obstruction. In addition, obesity and increased waist circumference (WC) were also found to be associated with respiratory failure. In this study, we investigate whether obesity, neck and waist circumference increased the risk of postextubation respiratory failure or not in patients received prolonged mechanical ventilation. Methods: Patient who were mechanically ventilated for more than 21 days were referred to regional weaning center after their clinical condition were stabilized and were ready to wean from mechanical ventilation. Among these PMV patients, those who were not tracheostomized and were extubated following a successful spontaneous trial were enrolled in this study. The gender, age, intubation date, Glasgow coma scale, APACHE II, and ICU stay were recorded. The BMI, neck circumference, waist circumference, and weaning indices were measured upon arrival to the weaning center. The cuff leak percentage was measured within 3 days before extubation. The outcome of extubation and the BMI, the neck and waist circumference were compared. Results: A total of 55 patients were enrolled in this study. Patients were categorized into 2 groups. The first group consisted of 15 patients with larger NC (^ 43 cm) and larger WC (^ 90 cm). The second group consisted of 40 patients with smaller NC (< 43 cm) and/or smaller WC (< 90 cm). There was no significant difference in gender, age, APACHE II score, coma scale, weaning indices, and cuff leak between these two groups. Patients with larger NC and larger WC had higher rate of postextubation respiratory failure (53% vs. 23%, odds ratio: 3.937), lower hospital weaning rate (40% vs. 72.5%), and higher ventilator dependent rate (33% vs. 10%). Conclusion: In this study, we found that larger NC plus larger WC were associated with increased risk of postextubation respiratory failure, lower hospital weaning rate and higher ventilator dependent rate in PMV patients. Further study is needed to reduce the risk of post-extubation respiratory failure in PMV patients with larger NC plus larger WC.

Sponsored Research - None

1417831

ESTABLISHING GOALS AND ROUTINE REPORTING FOR EXTUBATION FOLLOWING SUCCESSFUL SPONTANEOUS BREATHING TRIALS RESULTS IN INCREASED PHYSICIAN UTILIZATION OF SBT.

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Background: Our institution has been utilizing Spontaneous Breathing Trials (SBT) since 2005 to assist physicians in liberation decisions. All eligible patients (Fio2< .6, PEEP < 8 and RR < 35) receive a SBT daily and for those patients that pass a recommendation for liberation is provided to the managing physician. The results for each of the 5 ICU's for utilization of the SBT to promote liberation has been tracked and reported to the Critical Care Quality Committee. While there is no National Benchmark, each of the 5 ICUs has been encouraged to increase utilization. In 2011 the Critical Care Quality Committee established a goal of 65% of those patients that passed SBT is liberated. This goal was increased to 75% in 2012. Methods: Every eligible patient receives a SBT daily. The SBT is performed with a PEEP of 0 and with tubing compensation active. SBT duration is 30-120 minutes. Failure criteria include RSBI > 105 for more than 5 minutes, Respiratory rate increase > 35, Heart rate increase more than 10%. In 2011 to increase utilization a program was put in place to verify data integrity, increase communication with managing physicians regarding the patient's status and the program goals of the Quality Committee. SBT results were included in Progress Notes and discussed on rounds. Liberation within 4 hours of the SBT was considered a result of the SBT. The physicians decision to liberate or not was submitted to the Respiratory Information database and compliance data reported monthly by unit to the Critical Care Quality Committee. Results: Baseline results for the years 2005 to 2010 had a compliance rate of 48-55% of patients liberated following a successful SBT. The 2010 goal of 65% was exceeded at 68.6%. For the first quarter of 2012 the goal of 75% is exceeded at 78%. Re-intubation rates within 24 hours have been maintained at less than 5%. Conclusion: A standardized approach to implementing SBTs and monthly reporting with established goals has resulted in increased utilization of this technique to encourage physicians to consider liberation. Continued refinement of the process has resulted in increased physician confidence and an increased number of patients liberated while maintaining a low re-intubation rate.

Sponsored Research - None

1429430

CAN ANYONE TELL ME THE OSCILLATORY TROUGH PRESSURE(OTP)?

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Introduction: From the beginning many users of the HFOV have wondered what pressures existed within the HFOV circuit during the ventilators negative deflection (OTP). An equation has been developed to determine the OTP of the operating HFOV. The formula is a variation of the Mean Airway Pressure equation (See equation block). Purpose: Test and authenticate the accuracy of the HFOV set parameters. Use multiple parameters on the HFOV to authenticate the accuracy of the OTP equation. Testing: To determine the actual OTP and the displayed settings of the CareFusion High Frequency Oscillatory Ventilator A model a Certifier FA Plus Test System by Trust Science Innovation was utilized. The HFOV A was assembled and performance/calibration completed. The Certifier FA Plus set-up, calibrated and adapted to monitor pressures at the temperature probe port at the patient wye on the HFOV circuit. Multiple ventilator parameters were manipulated to determine the accuracy of the OTP equation and the displayed settings of the HFOV. The MAP and AMP would remain constant as several HTZ rate and Bias flow changes were made. With each change the results were recorded. (See Data Table 1) The MAP and AMP would then be altered. Again, the MAP and AMP would remain constant while several HTZ rate and Bias flow changes were made. Results: It was verified that the AMP is Delta P within +- 2 cm in 98% of the displayed HFOV AMP tested. The average measured MAP was found to be about a 1/2 cm less that displayed set with the 2 HFOV A devices used in testing. The HTZ rate on average was found to be within 15 cycles per minute of set, although with the higher HTZ the gap was larger. (See Data Table 1) The OTP equation was shown to be accurate within 93.8% of the results being captured within +or - 1.5 cm of measured OPT. (See Data Table 2) Conclusion: The OTP equation is accurate to within 1.5 cm 93.8% of the recorded values, and the displayed values on the HFOV are accurate to an acceptable range.

Sponsored Research - None

1404437

COMPARISON OF STATIC COMPLIANCE ON FOUR DIFFERENT VENTILATORS.

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Introduction: Bench studies reported as abstracts in 2006 demonstrated that not all ventilators report accurate lung compliance measurements. The purpose of this study was to compare a set compliance (Cs) on a Michigan test lung to the measured Cs on four new generation ventilators not previously studied. Method: The ventilators tested were the Drager XL, Hamilton G5, Drager Infinity V500, and the GE Engstrom Carestation. The ventilators were set to volume control mode with a tidal volume of 500 ml, respiratory rate of 12 bpm, PEEP of 0 cmH2O, and an inspiratory time of 0.9 seconds. The ventilators were individually attached to a Michigan test lung model 5601i. Compliance on the test lung was set to 100, 80, 60, 40, and 20 ml/cmH2O respectfully and verified with a Med Graphics 3 Syringe per manufacturers guidelines. Each time the compliance was changed the setting was verified per manufacture guidelines. Each ventilator was attached to the test lung at the different Cs settings and the ventilators reported Cs value were recorded. The reported values from the ventilator were then compared to the set values of the test lung. Results: The ventilators ranked in the following order from most accurate to least accurate (overall percent differences from the control value are in parenthesis): GE (8.4%) with 5.9% std, Drager V500 (15.3%) with 4.88% std, Hamilton G5 (16.33%) with a 7.1% std, Drager XL (37.3%) with 18.98 std. Conclusion: In this bench test, we found that when compared to the set compliance from the Michigan Test Lung the GE ventilator was the most accurate. All four ventilators varied with their ability to measure Cs compared to set values.

Sponsored Research - None

Reported Compliance Values

	Cs 100	Cs 80	Cs 60	Cs 40	Cs 20
GE	105	93	62	39	17
Drager V500	113	95	65	49	17.2
Hamilton	115	96	76	46	19
Drager XL	152	119	86	57	20

values in ml/cmH2O

1435697

COMPLIANCE OF PAIRED SEDATION AWAKENING TRIALS AND SPONTANEOUS BREATHING TRIALS: THE EFFECTS ON MEASURABLE OUTCOMES.

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Background: The Institute of Healthcare Improvement (IHI) ventilator bundle recognized that sedation awakening trials (SAT) paired with spontaneous breathing trials (SBT) are crucial to reduce mortality rates and improve patient outcomes. Evidence supports daily interruptions of sedation in conjunction with a SBT will decrease the length of time on the ventilator, incidence of ventilator acquired pneumonia, and the patient's overall length of stay. Methods: An interdisciplinary team was formed in partnership with coaches from IHI. The Medical Surgical Intensive Care Unit (MSICU) interdisciplinary core team committed to quality improvement developed a plan to improve transitions of care among the Respiratory Care Practitioners (RCP) and Registered Nurse (RN) at the bedside with a focus on compliance of the SBT process. Results: The Mission Hospital MSICU baseline data for March 2011 yielded a 31% adoption rate for SBT. Further investigation displayed variations in practice among the Respiratory Care Practitioners (RCP) executing the SBT and coordination with the RN's for SAT was nonexistent. The sedation holiday performed by the RN and SBT performed by the RCP were not in concert as recommended in the literature for successful liberation from the mechanical ventilator. Compliance was measured based on whether all eligible patients were identified and if the procedure was then carried out as specified in the protocol. 90 days after implementation, 100% of eligible patients were identified correctly and 100% had the SBT completed correctly. The number of ventilator days per patient was reduced from 2.79 to 2.58. Overall length of stay for ventilated patients was reduced from 5.1 to 4.33 days. VAP rates continue to remain at zero with this intervention. Conclusions: Patient outcomes have been improved and costs of care reduced through active implementation of this program. Feedback from staff suggests that communication in care improved after implementing RCP bedside rounds and providing a visual cue as a reminder to all staff of the plan to conduct the SBT that day. SBT compliance and coordination of care improved with implementation of this IHI ventilator bundle in the MSICU. The recommendation is to discuss, diffuse, and implement this model in all ICU's meanwhile sustaining gains, quality control in the MSICU.

Sponsored Research - None

1400849

EFFECT OF MECHANICAL DEADSPACE ON OXYGEN CONSUMPTION AND ENERGY EXPENDITURE WHEN USING INDIRECT CALORIMETRY.

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Background Nutrition management is one of the important factors in Intensive Care Units. We often use calculations, such as the Harris-Benedict method, for calorie counting; however, it is known that using indirect calorimetry is more accurate. Indirect calorimetry is installed on the Engstrom Carestation (GE Healthcare) and it computes oxygen consumption (VO2) and energy expenditure (EE) using the Weir calculation. It is not known whether VO2 and EE are possibly affected and not accurate in cases of increasing deadspace. Therefore, we studied whether VO2 and EE are affected in cases of increasing mechanical deadspace. Methods We measured VO2 and EE on seven healthy subjects, without additional mechanical deadspace (non-increased DS), who were ventilated noninvasively, then we added 25 mL of mechanical deadspace and measured VO2 and EE again (increased DS). Result VO2 and EE tended to decrease with increased DS. The results are VO2 272 ± 37 mL/min and EE 1824 ± 260 kcal in non-increased DS, and VO2 244 ± 38 mL/min and EE 1600 ± 261 kcal in increased DS. With increased DS, the average VO2 is 28 mL/min lower and EE is 224 kcal lower than non-increased DS. Conclusion This study demonstrates that the measured VO2 and EE using the Engstrom Carestation decrease as mechanical deadspace is added. This may be due to a change of concentration of oxygen due to the increased deadspace.

Sponsored Research - None

1414719

THE PREDICTION OF VENTILATOR WEANING OUTCOME IMPROVED BY ARTIFICIAL NEURAL NETWORK IN MEDICAL INTENSIVE CARE UNIT.

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Background: The rapid shallow breathing index (RSBI) is commonly used clinically for predicting the outcome of weaning from mechanical ventilation. However, there are existed different thresholds and sensitivities of RSBI among different populations and measurement conditions. There is no single appropriate and convenient predictor or method can be used to help the clinicians to predict the weaning outcome. The artificial neural networks (ANNs), are the machine-learning models which can change their structures and outputs based on the external or internal information during the learning phase, they had been applied in modeling the medical decision support systems. The purpose of this study was to design an ANN model for predicting the weaning outcome of mechanically ventilated patients. Method: Ninety-five ready for weaning patients living in medical intensive care unit were recruited and randomly divided into training group (n=76) and testing group (n=19). Eight features including patients' age, reasons for intubation, duration of using mechanical ventilator, APACHE II score, the mean of inspiratory time, the mean of expiratory time, the mean of respiratory rate and the mean of tidal volume in thirty minutes spontaneous breathing trail under PSV 5 cmH2O with PEEP 5 cmH2O ventilator were selected as the ANN input variables. The performance of ANN model was compared with 1-min RSBI measurement method by using confusion matrix and the receiver operating characteristic curves. Result: The area under the receiver operating characteristic curves (AUROC) of ANN model was 0.95 and that for the RSBI method was 0.51 when the threshold was set to 105 breaths/min/L. Predictions by the testing group of ANN model had a sensitivity of 91.7%, a specificity of 85.7%, and an accuracy rate of 89.5%, compared with 75%, 14.3% and 52.6%, respectively, for the RSBI method. Conclusion: In our study, the ANN model improved the accuracy for prediction of weaning outcome. By applying this ANN model clinically, the clinicians could select the appropriate weaning time as early as possible, which could decrease the chance of unnecessary prolonged ventilator support and premature weaning. Therefore, the incidence of patients' complication rate and medical cost related to ventilator support will decrease.

Sponsored Research - None

Comparison table between ANN model and 1-min RSBI measurement method

	Sensitivity	Specificity	Accuracy rate	AUROC
ANN model -testing group	91.7%	85.7%	89.5%	0.95
RSBI model -testing group	75%	14.3%	52.6%	0.51

1416225

USE OF AIRWAY PRESSURE RELEASE VENTILATION (APRV) AS A RESCUE MODE FROM HIGH FREQUENCY OSCILLATORY VENTILATION (HFOV).

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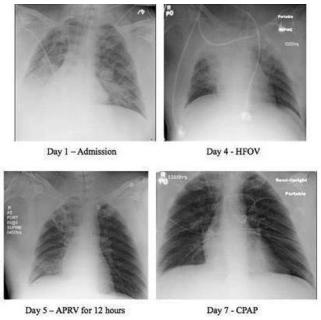
Introduction: High-frequency oscillatory ventilation (HFOV) and Airway Pressure Release Ventilation (APRV) are both strategies of mechanical ventilation based on the principle of the open-lung concept and aim to improve oxygenation by keeping the lung inflated for an extended period of time. This increased "Pressure-Time Profile" maintains alveolar stability and promotes homogeneity. Unfortunately, these modes of ventilation are typically applied as a last resort or as a 'rescue mode' when treating acute respiratory distress syndrome (ARDS). In our facility, Sinai Medical Center in Baltimore, MD, patients are transitioned to HFOV if the ARDSnet protocol fails to resolve ARDS. We hypothesized that APRV could still be used as a rescue mode even after nitric oxide therapy, prone positioning and HFOV failed to improve oxygenation, preventing a patient from requiring Extracorporeal Membrane Oxygenation (ECMO). Case Summary: A 40 year old male was admitted to the ICU after being found down and unresponsive, having vomited and aspirated. The patient was intubated upon admission rapidly requiring increased ventilatory support with the initial P/F ratio of 45 and chest x-ray (CXR) demonstrating bilateral alveolar densities which is consistent with the American-European Consensus Conference diagnosis of ARDS. The ARDSnet protocol was implemented, however, the patient remained extremely hypoxic and was then paralyzed and transitioned to HFOV. In addition, nitric oxide therapy and prone positioning was initiated with little improvements in CXR or P/F ratio. Consequently, APRV was considered as a "rescue" therapy prior to transferring the patient to another facility for ECMO. Within 15 minutes of transitioning to APRV, the SpO2 increased from 83% to 100% and immediate improvements seen in CXR, a rapid reduction in FiO2, increased P/F ratio from 83 to 334. Discussion: The application of APRV was used as a rescue mode in this case when ARDSnet protocol, HFOV and adjuncts to therapy failed. Recent data has shown that earlier application may actually prevent the development of ARDS warranting further research.

Sponsored Research - None



1434673

A CASE STUDY: APPLICATION OF HIGH FREQUENCY PERCUSSIVE VENTILATION (HFPV) DURING BI-CAVAL DUAL LUMEN VENOVENOUS EXTRACORPOREAL MEMBRANE OXYGENATION (VV-ECMO).

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Introduction: Application of HFPV for lung protective recruitment in a patient supported with VV-ECMO for severe air leak secondary to tracheal injury.**Case Summary:** A 7 y/o male presented with status epilepticus and associated vomiting and was treated with diazepam. Resulting apnea required intubation in the field. Dislodgement necessitated reintubation in the emergency room. CXR revealed severe pneumomediastinum, and extensive infiltrates. Bronchoscopy and chest CT demonstrated a 2 cm tracheal tear. Air leak worsened, with OI increasing to 50. The patient was non-operatively managed with bi-caval dual lumen VV-ECMO, and placed on rest ventilator settings. On day 6 of VV-ECMO, delivered pressures were increased over 5 days to PIP 20 and PEEP 10 without radiographic improvement or detectable exhaled tidal volume. Recruitment maneuvers, use of APRV with mean airway pressure (MAP) of 22, and bronchoscopy did not result in lung opening. Daily bronchoscopy was performed for secretion clearance and lung recruitment. The patient was then converted to HFPV with an oscillatory PEEP 8, demand PEEP 2, pulsatile flow (PIP) 30, convective rate 20, percussive rate 550, and MAP 18 to 19 on ECMO day 14. After 1 hour of HFPV, there was brisk secretion clearance and improved right lung aeration. Within 24 hours of HFPV, CXR displayed bilateral lung expansion. Decannulation occurred ECMO day 16, HFPV was continued for 4 days post-decannulation, and the patient was discharged from the ICU on day 45.**Discussion:**HFPV is a flow regulated, time-cycled pressure mode of ventilation that allows for airway clearance, while efficiently exchanging gas via high frequency, sub-tidal volume breaths at lower delivered transpulmonary pressures. In anticipation of decannulation, several methods of lung recruitment are employed in patients with ARDS on ECMO following management with rest settings: high PEEP, open lung ventilation with APRV/HFOV, and serial bronchoscopy. These strategies are used with variable success, and may expose injured lung to trauma. HFPV combines the benefits of high frequency ventilation and conventional bulk flow gas exchange, resulting in effective secretion mobilization and alveolar recruitment while limiting barotrauma. We report the successful use of HFPV as a lung-recruitment technique in a patient with resolving air leak and ARDS, managed with bi-caval dual lumen VV-ECMO.

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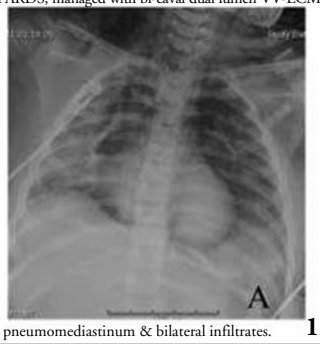

A:CXR after PICU admission shows pneumomediastinum & bilateral infiltrates.

1288780

DEVELOPMENT OF A RELIABLE VENTILATOR METHODOLOGY TO DISPLAY NEONATAL PRESSURE VOLUME LOOPS USING A SIMULATED LUNG MODEL.

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Background: There is limited data describing the reliability or methodology of how to obtaining accurate pressure-volume loops (PVL) on neonatal patients and ventilators. Objective: To describe and test a methodology to obtain accurate neonatal PVL. Methods: Neonatal lung models with different lower and upper inflection points were developed on the ASL 5000 lung simulator and verified by using external syringe volume measurements. The Servo-i neonatal mechanical ventilator was used to ventilate the ASL lung simulator and adjusted to find a reliable method to display the lung characteristics of the model using the PVL graphics. We compared the modes of PC-CMV, PC-CMV adaptive, and VC-CMV using a variety of volume, flow, and pressure strategies. Results: There are observable differences when comparing the modes of VC and PC on the generated PVL and in the reliability of determining the LIP. VC modes using flow rates of less than 1.0 Lpm with inspiratory times (Ti) of more than 1 second were required to accurately displayed the LIP. The UIP could be seen in both VC and PC modes if the delivered tidal volume (Vt) was large enough for the simulated models. There were no observable differences in the expiratory limbs of the PVL regardless of the modes or settings. Conclusion: Only a low-flow volume controlled method should be used to display PVL and to determine LIP and UIP on neonatal mechanical ventilators. The PVL may inaccurately display lung mechanics on the expiratory curve due to the effects of resistance and flow regardless of the technique used.

Sponsored Research - None

1413256

THE INDEPENDENT EFFECT OF THREE INLINE SUCTION ADAPTERS AND LUNG COMPLIANCE CHANGE ON AMPLITUDE AND DELIVERED TIDAL VOLUME DURING HIGH FREQUENCY OSCILLATORY VENTILATION IN AN ADULT PATIENT WITH ARDS: BENCH MODEL.

Shreya J. Thacker, Lynda T. Goodfellow, Robert Harwood, Ralph Zimmerman; Respiratory Therapy, Georgia State University, atlanta, GA

Introduction: The technique of instituting High Frequency Oscillatory ventilation to ventilate the lungs at volumes less than anatomical dead space to avoid high pressures is used widely. Apart from HFOV, pulmonary hygiene too forms the cornerstone in maintaining appropriate pulmonary pressures. Suctioning has been studied extensively to cause loss of tidal volume on patients receiving mechanical ventilation and adding dead space to the ventilatory circuit. Owing to this, suctioning procedures have been avoided for long periods of time to prevent derecruitment of alveoli. This leads to secretion retention and high alveolar pressures. Thus to maintain adequate tidal volumes and to prevent the suboptimal use of suctioning during HFOV, research is required to understand the mechanics between the ventilator and the ventilatory circuit. Purpose: The study answered the following research questions: 1. Effect of three inline closed suction adapters on delivered tidal volume with varying lung compliance 2. Effect of varying compliance on the amplitude delivered by HFOV 3. Effect of compliance on tidal volume delivered by HFOV. Method: An in vitro bench model using high fidelity breathing simulator (ASL 5000, IngMar Medical) simulating an adult patient with ARDS was set up with 3100B SensorMedic high frequency ventilator. The simulation included varying the compliance for each lung at 50, 40, 30 and 20cmH2O while maintaining fixed resistance of 15 cmH2O/L/sec. The ventilator was set to: power of 6, frequency of 5, inspiratory time of 33%, bias flow of 30 LPM and FiO2 of 50%. The breathing simulator was connected with the high frequency ventilator using a standard HFOV circuit. Fourteen French Kimberly Clark (T and Elbow adapters) and Air-Life suction catheters (Y adapter) were placed in-line with the circuit. Each run lasted for 1 minute after achieving stable state conditions. Results: Analysis showed that Air-Life suction catheters caused the least lost in tidal volume when placed in line with high frequency circuit. Also a direct correlation between amplitude and lung compliance was seen. Lastly, the study did not show a statistically significant change in tidal volume with changes in lung compliance. Conclusion: 1. Choice of in-line suction system to be placed in line with the ventilator is one of the many determinants of change in tidal volume during HFOV. 2. Lung compliance changes lead to associated changes in amplitude delivery by HFOV.

Sponsored Research - None

1393586

THE COMPARISON BETWEEN UNPLANNED EXTUBATION AND PLANNED EXTUBATION—THE PROGNOSIS AND THE THE PREDICTOR.

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Background: We want to investigate the prognosis and predictors of patients with endotracheal intubation experiencing unplanned extubation (UE) as compared with planned extubation (PE) in the adult intensive care units (ICUs) of a medical center in Taiwan. Methods:We retrospectively reviewed the medical records of ICU patients with UE and PE in 2010, including the demographic data, clinical variables and the latest data before extubation. Results:There were 3092 patients received ventilator support via endotracheal tube in 2010, including 58 patients with UE (1.85%) and 1736 patients with PE (56.14%). Those patients with UE had higher hospital mortality (22.4% vs.6.7%), longer ICU and hospital stays (11.4 vs.7.0 and 32.7 vs. 21.9 days, respectively) and higher hospital costs (10.8 vs. 8.5 x 1000 US Dollars). The successful rate of liberation from ventilator (not re-intubation within 48 hours) was also lower in UE group (63.1% vs. 96.1%). In multivariate analyses, the factors predicting UE (as compared with PE) were lower coma scales [odds ratio (OR), 0.932], histories of coronary arterial disease(CAD) (OR, 2.399) and cardiovascular accident (CVA) (OR, 2.983), higher respiratory rate (OR, 1.134), tidal volume (OR, 1.004) and positive end-expiratory pressure (PEEP) (OR,2.660) before extubation, higher creatinine level (OR,1.166), pre-extubation agitation (OR,6.007) and sedation use (OR,45.5). Conclusions: We found that those with UE had a poor prognosis in hospital mortality, length of stay, cost and rate of ventilator liberation. Many factors predicted UE, including lower coma scales, histories of CAD and CVA, higher respiratory rate, tidal volume and PEEP before extubation, higher creatinine level, agitation and sedation use. Physicians should provide a safety care on those patients with ventilator support, and consider the risk factors of UE and adverse events after UE.

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The outcome of the different UE groups

Items	All (n=1736)	Planned extubation(n=1678)	Unplanned extubation (n=58)	p value
Successful weaning*	1649(95.0%)	1612(96.1%)	37(63.8%)	<0.001
In-hospital mortality	125(7.2%)	112 (6.7%)	13 (22.4%)	<0.001
ICU days	7.2±7.5(1~64)	7.0 ±7.4	11.4 ± 9.2	<0.001
Hospital days	22.2±17.2 (1~191)	21.9 ± 16.9	32.7 ± 21.1	<0.001
Cost of hospitalization (x 1000 USD)	9.5±8.2 (1.0~110.4)	8.5 ± 5.8	10.8 ± 7.4	0.005

Expressed as mean ± SD (range) or n (%)

* presented as not re-intubation within 48 hours from ventilator weaning

1414711

COGNITIVE LOAD AND TIME REQUIREMENT OF INITIAL VENTILATOR SET-UP.

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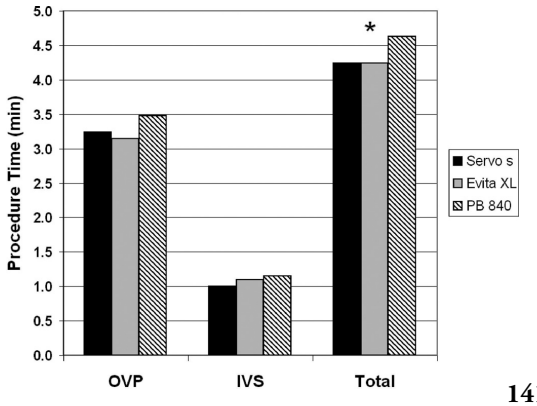
BACKGROUND ICU ventilators differ drastically in operator interface design. Different designs result in different sequences of steps required to first perform a ventilator operation verification procedure (OVP) and then to enter initial ventilator settings (IVS). The purpose of this study was to define and compare the cognitive load and time investment required for these steps. Our hypothesis was that these metrics will differ among ventilator models. **METHODS** We evaluated 3 intensive care ventilators; Puritan Bennett 840, Servo S, and Dräger Evita XL with patient circuits attached. The cognitive load was defined as the number of steps (operator actions) from power on to "ready for patient use" for each ventilator. Set-up was divided into OVP and IVS phases. Initial ventilator settings were volume control continuous mandatory ventilation; rate 16 breaths/min, tidal volume 450 mL, FiO_2 0.5, PEEP 5 cm H_2O, peak flow 60 L/min or inspiratory time 0.9 s and flow trigger 3 L/min. Alarm settings: high pressure 50 cm H_2O, low pressure 3 cm H_2O, high tidal volume 800 mL and low minute ventilation 3 L/min. Backup ventilation settings: apnea 20 seconds and other settings as above. A single experienced operator recorded (in triplicate) the total time required for each phase of ventilator set-up. Mean values were for OVP and IVS times were compared with ANOVA. Significance was assigned for P values < 0.05. **RESULTS** The cognitive load was different for each ventilator: Evita XL (33 steps) PB 840 (31 steps) and Servo S (25 steps). Results for OVP and IVS times are shown in the Figure. The Servo S had the shortest total time (OVP + IVS) and the PB 840 the longest (P = 0.004). However, the difference may not be practically important. **CONCLUSION** Cognitive load and time required for initial set-up are comparable for these ventilators.

Sponsored Research - None



1415611

A NOVEL APPROACH TO INITIATING NEONATAL HIGH FREQUENCY VENTILATION IN TRANSPORT: ESTIMATING AMPLITUDE AND INTERPRETING SETTINGS.

Robert S. Rohde; Flight For Life, Childrens Hospital Colorado, Fort Collins, CO

Background: Emergency medical transport of critically ill newborns has become increasingly complicated due to the widespread use of therapies such as high frequency ventilation (HFV). Successful transition of patients to HFV has been hindered by the inability of transport ventilators to measure amplitude. A desire to target and/or match a specific amplitude and have the ability to communicate that information to receiving physicians at Children's Hospital Colorado, led to our need for developing a method of estimating HFV settings during transport. Objective: To develop a safe and effective, universal method for estimating amplitude on high frequency transport vents. Method: Benchmark testing was performed using a modified TXP High Frequency Ventilator (TXP; Percussionaire, Corp., Sandpoint, ID). A pressure line was connected from the TXP circuit to a Sensormedics 3100a (HFOV) to provide a digital readout of TXP amplitude. Working pressure (WP), Rate (Hz), and Mean Airway Pressure were constant while two levels of amplitude were measured. The first level was measured with a test lung, representing high compliance. The second level was measured while capped, representing the lowest possible compliance (Max Amp). Both amplitude levels were measured at specified flows. This method was repeated at various WP and Hz. Result: An estimated amplitude (EA) chart was developed and implemented on transport. The two levels of amplitude provided a range for determining what flow to use on initiation. Clinical application was performed using a HFOV to measure amplitude. This allowed us to confirm accuracy of the EA chart while also providing insight into the severity of the newborn's lung disease. In most cases, the patient's measured amplitude fell between the test lung value and Max Amp value on the EA chart. It was discovered that the worse the patient's lung compliance, the closer the measured amplitude would be to the Max Amp value. Once accuracy of the EA chart was confirmed, it allowed the transport team to target amplitude without the benefit of a digital measurement. Conclusion: Creation of an EA chart proved effective for estimating amplitude on transport. EA charts are vent specific and can be replicated for most high frequency transport devices. They provide a safe and accurate tool for matching settings which lessens the inherent risk of decompensation that often occurs while transitioning critically ill newborns.

Sponsored Research - None

1418502

EFFECTS OF HAMILTON G5 FLOW SENSOR ON AEROSOL DELIVERY.

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Introduction: The Hamilton G5 ventilator flow sensor is placed between the patient and the ventilator wye. We set out to determine if the flow sensor blocks aerosol particles during treatments in-line with the ventilator. We hypothesized that the flow sensor reduces the amount of aerosol delivery to patients. Methodology: A Servoi ventilator was connected to a Michigan 5601i test lung with a Hamilton flowsensor placed at the ventilator wye. The ventilator was setup in VC mode with VT of 500 ml, RR 12, and PEEP of 5. Two Guardian disposable filters were placed between the Wye and the test lung. Prior to insertion, the filter closest to the wye was weighed to determine pretreatment weight. An Aerolife small volume nebulizer (SVN) was then placed in-line, 6 inches from the ventilator wye and filled with 5 ml of 10% hypertonic saline. The SVN was run for 5 min at 8 L/min. After the treatment, the filter was weighed to determine post treatment weight. The flow sensor was then removed and new filters were weighed and placed inline. This methodology was then repeated two times with new filters and SVNs. The weights of the filters were then compared to determine which set-up delivered the most aerosol to the filter. Results: The mean filter weight gain was 0.04g (StDev 0.00817 g) when the flow sensor was in-line and 0.097g (StDev 0.1247 g) when there was no flowsensor. The difference between mean filter gains were statistically different with a pvalue of 0.026 Conclusion: This bench study demonstrates that the flow sensor stops medication from reaching the patient. Further studies need to be performed to investigate this further and determine the clinical significance.

Sponsored Research - None

1435808

EVALUATION OF ROLE OF TUBING COMPENSATION DURING PRVC IN AN INFANT LUNG MODEL ON THE SERVO I VENTILATOR.

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Background: Tubing compensation is available on most critical care ventilators to account for compressible volume loss in ventilator circuitry during mechanical ventilation. Use of this feature generally requires that the ventilator circuit be calibrated and volume loss corrected during a circuit test. Compressible volume loss is generally a higher percentage of total delivered volume (VT) during neonatal and pediatric mechanical ventilation in comparison to adults. Leaks are also more prevalent in this population resulting in more ventilator nuisance alarms. Due to limitations in lower alarm adjustment ability, the tubing compensation occasionally gets turned off in this population. In PC ventilation, this results in unreliable display of VT. Recent increase in use of PRVC in the NICU resulted in two instances where the tubing compensation was turned off in PRVC mode due to leaks and nuisance alarms. In both instances, the RT's noticed a significant drop in Peak Inspiratory Pressure (PIP) and patient decompensation after the tubing compensation was turned off. Following these incidents, we conducted a bench test in the research lab to test the hypothesis that there was no difference in PIP and tidal volume delivered to the patient in PRVC mode with the tubing compensation turned on compared to with the tubing compensation turned off. Methods: A Servo i ventilator was calibrated according to manufacturer's recommendations using an infant Evaqua circuit and connected to the infant lung on a TTL lung model 560li (Michigan Instruments, Grand Rapids, MI). Compliance and resistance were adjusted to achieve designated set VT. A Hans Rudolph pneumotachometer (Hans Rudolph, Shawnee, KS) was calibrated and placed at the patient wye to measure delivered pressure and volume. Ventilator settings: PRVC mode, RR-30BPM, I-time-0.5seconds, PEEP-5. Three different tidal volume (VT) conditions were tested with set a set VT of 15mL, 30mL, and 100mL. All VT conditions were tested with both the tubing compensation turned on and the tubing compensation turned off. VT and PIP measurements were monitored and recorded from both the pneumotach and Servo I monitor for six consecutive breaths at each testing condition. Results: See chart below Discussion: Turning off tubing compensation in PRVC mode significantly impacts delivered pressure and volume in infants and pediatric patients with VT less than 100 mL.

Sponsored Research - None

Tidal volume and PIP

Set VT (mL)	Compensation on/measured VT (mL)	Compensation off /measured VT (mL)	Compensation on/ measured PIP (cmH20)	Compensation off/measured PIP (cmH20)
15	15	5	20	12
30	31	15	22	14
100	98	76	28	22

1435617

INITIAL FIO2 REQUIREMENTS FOR PRETERM INFANTS RECEIVING SURFACTANT IN THE DELIVERY ROOM VS. PRETERM INFANTS THAT DID NOT RECEIVE SURFACTANT IN THE DELIVERY ROOM.

Matthew Trojanowski, Shawn Hughes; The Johns Hopkins Hospital, Baltimore, MD

INTRODUCTION: Administration of exogenous surfactant is frequently included in a preterm infant's plan of care, but some debate persists regarding whether or not it should be routinely administered in the delivery room (DR). We examined initial FiO2 requirements on conventional mechanical ventilation for preterm infants that received surfactant in the DR vs. those that did not. METHODS: A database with information regarding surfactant delivery at birth (July 2009 – Oct 2010) was reviewed. Data for infants intubated at delivery with GA < /=30 weeks was examined (n = 73). 44 patients were excluded for insufficient data (n = 24), or not receiving conventional ventilation post-delivery (n = 20). Infants not excluded (n = 29) were divided into two groups: Those that received surfactant in the DR (n = 16, mean BW = 943.75 kg, mean GA = 26 1/7 weeks), and those that did not (n = 13, mean BW = 1190.5 kg, mean GA = 27 5/6 weeks). The data lacked a normal distribution, so it was analyzed using a Mann-Whitney U test. RESULTS: Infants receiving surfactant in the DR: mean FiO2 = 0.29, median FiO2 = 0.30; Infants not receiving surfactant in the DR: mean FiO2 = 0.41, median FiO2 = 0.35; p = .184. CONCLUSION: Although both mean and median initial FiO2 requirements were lower for the group that received surfactant in the DR, the difference did not reach statistical significance (p = .184). Despite this, there is still value in the finding that the group receiving surfactant in the DR had a lower initial FiO2 requirement. The results, however, need to be interpreted with some caution. A large number of patients from the initial cohort were excluded in order to limit the study population. In addition, SpO2 levels varied widely (80% - 100% SpO2) in each group and indicate that several patients probably required more or less FiO2 than what was being administered. It is important to note that this was a retrospective review of an existing database and, as such, information recorded in the database was limited and subject to documentation error. Despite the study limitations and lack of statistical significance, there was a reduction in mean and median initial FiO2 requirements for the group that received surfactant in the DR. The results of this review are encouraging, but need further validation through larger studies with more stringent control of variables.

Sponsored Research - None

1410492

DOES THE RAM CANNULA DELIVER THE SET CPAP PRESSURE WITH BUBBLE CPAP? A BENCH TEST.

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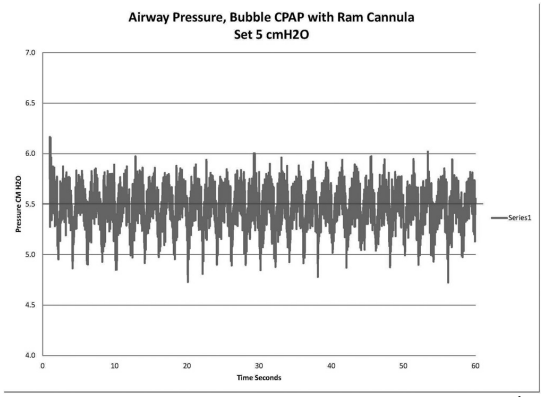
Background: The Ram Cannula (Neotech) has been marketed as an interface for noninvasive ventilation for infants. The manufacturer has provided literature form bench testing supporting its use with NIPPV but not with Bubble CPAP. We aimed to test whether the airway pressure delivered was equal to what it was set at on the bubble bottle. Methods: The ASL 500 test lung (IngMar Medical) was used in conjunction with a 3D scale model of a 28 week gestational age infant's upper airway. The breathing parameters on the ASL were configured to mimic those of a 28 week gestational age infant. The Ram Cannula was placed on the nasal model and connected to a CPAP circuit comprised of the Fisher and Paykel RT236 circuit and the Babi PAP(B&B Medical) CPAP bottle. The flow was set at 6 liters per minute. The CPAP level was set at 5 then 8 cmH2O. Measurements were recorded after one minute of stable breathing. Results: The mean airway pressure on a set CPAP of 5 cmH2O was 5.5 cmH2O with a SD 0.2. The mean airway pressure when set at 8 cmH2O was 8 cm H2O with a SD 0.2. Conclusion: The Ram Cannula is capable of delivering the pressure set on the bubble CPAP bottle within the manufacturer's specifications of +/- 1 cmH2O. This is despite the diameter of the Ram prongs and the fact that it does not completely seal the nares. One of the limitations of our test was that the nasal model did not account for any loss of gas orally, because the nasal model did not include a mouth.

Sponsored Research - None



1416532

PEDIATRIC EARLY WARNING SYSTEM AND AWARE TEAM.

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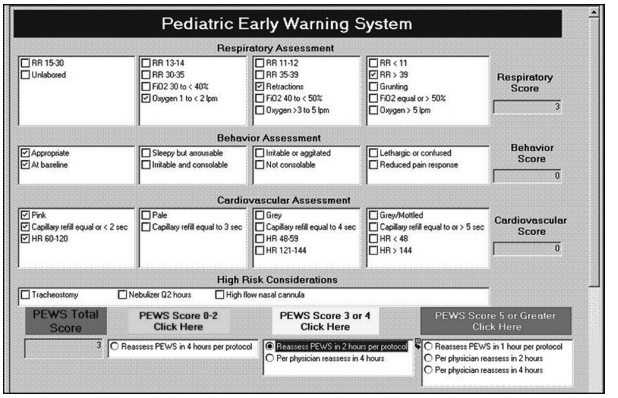
Background The goal of PEWS and AWARE was to recognize patients in the early stages of deterioration and prevent progression to respiratory or cardiac arrest.Despite implementing a Rapid Response Team in 2006, many children still required emergent interventions on general units. Through analysis, it became clear that staff were unable to identify early deterioration and language was needed to allow communication of concerns without feeling intimidated by expert level practitioners. Method PEWS was developed using an age-based scoring tool derived from clinical variables most predictive of physiologic deterioration. This technology tool was built into the electronic medrecord so that a precise score could be recorded for each patient. Data is displayed in real time, on an electronic whiteboard viewable throughout the unit. Clinicians can see at a glance which children are most at risk. The team then developed a series of algorithms with prescribed actions for nurses to follow based on the PEWS score. An AWARE (Advanced Warning and Response Event) team evaluates each child whose score indicates that the child is at higher risk of sudden deterioration. The AWARE team is comprised of the bedside RN, a pediatric critical care RN, a resident physician, a respiratory therapist and a clinical service coordinator. Each team member has a defined role in providing assessment, stabilization and interventions. Results Using the PEWs scoring system as identification, and the AWARE as a standardized approach to activate expert level assessments, HDVCH has reduced emergent events on the general units. 23 cardiopulmonary resuscitations took place in the 24 months prior to implementation of these programs, as compared to 4 in the 9 months post implementation, resulting in a 53.6% reduction. These new processes have resulted in earlier transfer to PICU when indicated and a decreased severity of illness for unplanned PICU admissions. Conclusion The PEWS and AWARE team serve as the foundation for a common understanding and language among disciplines, allowing staff to clearly communicate concerns about their patient and to seek help without fear of intimidation. Earlier identification of patients at risk, coupled by prompt interventions has increased patient safety and significantly reduced sudden, life-threatening events in children. These processes may be replicated with other populations on general medical and surgical units within other health systems.

Sponsored Research - None



1329754

DEVELOPMENT AND IMPLEMENTATION OF VENTILATOR MANAGEMENT PROTOCOLS FOR THE NEONATAL INTENSIVE CARE UNIT.

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Background: Mechanical ventilation in the neonate leads to lung injury, the tissues inside the lungs become inflamed and can break down causing scarring, leading to chronic lung disease. This quality study was developed to evaluate the implementation of ventilator management protocols in neonates' ≤ 28wks gestational age. The goal was to develop and implement ventilator management protocols to deliver consistency of care, decrease ventilator days, decrease length of stay (LOS), and increase rate of successful extubations. Methods: A multidisciplinary committee developed and implemented ventilator protocols in May 2010. Target population identified; 23-24wk and 25-28wk gestational age. Protocols were developed using evidence based methods along with review of guidelines and protocols from other facilities. The protocols allowed titration of ventilator settings based on blood gas ranges and clinical assessment. Per protocol, once a patient reached minimal settings and clinical assessment was satisfactory, the patient was extubated. Successful extubation was defined as maintaining adequate respiratory effort and not requiring re-intubation within 48 hours of initial extubation. Monitoring and data collection was implemented and entered into a database designed to track respiratory progress from birth to discharge. Results: In 2009, 91 patients ≤ 28wk gestational age required mechanical ventilation, an average 19.7 ventilator days; In 2010, 70 patients ≤ 28wk gestational age, required mechanical ventilation an average 13.1 ventilator days. In 2011, 93 patients ≤ 28wk gestational age required mechanical ventilation an average 12.2 ventilator days. In the 23-24wk age group, 70% of patients achieved successful extubation. In the 25-28wk age group, 90% of patients achieved successful extubation. In 2009, length of stay (LOS) for the ≤ 28 wk patient populations was 77 days. In 2010, LOS for the ≤ 28 wk patient populations was 72 days. In 2011, LOS for the ≤ 28 wk patient populations was 63 days. Conclusion: Implementation of ventilator management protocols resulted in a decrease in total ventilator days, decrease in LOS, and an increased rate of successful extubations. Ventilator management protocols allowed our unit to standardize care and successfully titrate our patient ventilators to help ensure successful extubation. We will continue to monitor our outcomes as we continue to address all issues in relation to mechanical ventilation.

Sponsored Research - None

1388952

SUCCESSFUL USE OF A PROLONGED INSPIRATORY TIME ON THE BUNNELL LIFE PULSE HFJV IN TREATING PNEUMONIA REFRACTORY TO CONVENTIONAL AND HFOV VENTILATION IN A NICU PATIENT.

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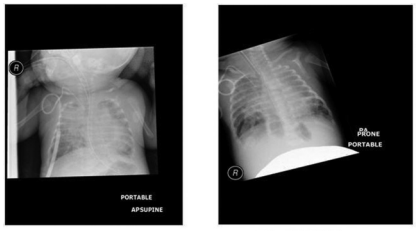
Introduction: A 28 week infant on high flow nasal cannula, who developed an acute feeding intolerance on DOL 55. Intravenous access was difficult and Broviac placement was required. She was intubated for the surgical procedure and returned to the NICU on conventional ventilatory support; PSIMV rate 40, target volume 4-6 ml/kg (inspiratory pressure 22), PEEP 6. Post-operatively, attempts to wean were unsuccessful, requiring increasing FiO2 to maintain saturations > 88%. Within 24 hours she developed a right upper lobe consolidation consistent with pneumonia and required increased ventilatory support. She was then changed to HFOV, and over the next week showed no significant improvement despite IV and inhaled antibiotic therapy,and rigorous pulmonary toilet including chest physiotherapy and frequent suctioning. Intervention: On D#68 the decision was made to change ventilation strategy, and she was changed to the Bunnell Life Pulse HFJV. Consideration was given to the difference in time constants of the consolidated region, the need to recruit this area, and a desire to not increase PAW by increasing PEEP any further. A trial of increasing the Ti to 0.03s was undertaken. Results: Improvement in CBG results were evident after 30 minutes on the HFJV, and CXR showed slightly improved aeration in the RUL after 3 hours. Settings were weaned cautiously while intentionally maintaining the amplitude (Delta P of 30) with improvement in PCO2 and decreasing FiO2 requirement. On D#75, patient demonstrated clinical improvement with decreased ventilatory support, improved CBG results, and improvement in RUL recruitment on CXR. At this time she was transitioned to CMV with FiO2 requirements consistently below 35%. Conclusions: Changing to the Bunnell Life Pulse HFJV proved to be an effective strategy for improvement in both the removal of secretions and lung recruitment. Increasing the inspiratory time to 0.03s provided the compensatory yet necessary contribution to the PAW while allowing the PEEP to be weaned from 15 to 8 over a 7 day period. This change in strategy combined with intentionally weaning PIP and PEEP together to maintain constant amplitude (Delta P = 30) in the initial phases also resulted in ventilation parameters being weaned slowly but significantly. The consolidated lung, previously refractory to interventions with convention ventilation, HFOV, and aggressive pulmonary hygiene therapies, was successfully recruited.

Sponsored Research - None



Pre HFJV Post HFJV

1401870

THE IMPLEMENTATION OF NEONATAL BUBBLE CPAP: A MODEL FOR CLINICAL CHANGE.

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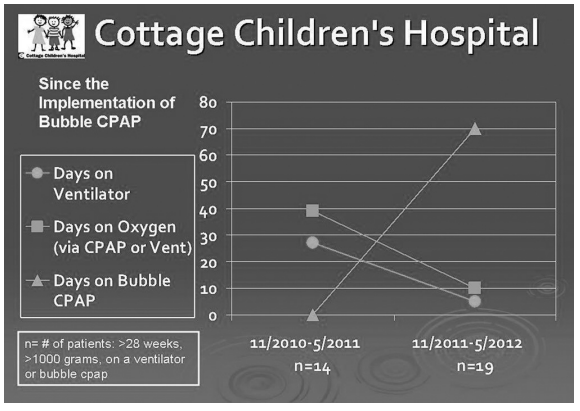
BACKGROUND: Throughout the years, bubble CPAP has proven to reduce the amount of lung tissue damage in the newborn. Benefits of bubble CPAP include: improved oxygenation and decreased work of breathing, a decreased number of days on oxygen, a decreased duration of mechanical ventilation, and a decreased incidence and morbidity of chronic lung disease. METHOD: A six month period was queried since the implementation of bubble CPAP in our NICU compared with the same six month duration the previous year. The patient population consisted of infants >28 weeks gestation and >1000 grams in weight that required respiratory intervention by invasive or non-invasive ventilation with the use of supplemental oxygen. RESULTS: The number of patient days on mechanical ventilation was reduced from 27 to 5 and the number of patient days on oxygen were reduced from 39 to 10 days. This reduction in invassive ventilation and oxygen administration were the result of an increase in bubble CPAP usage from 0 to 70 patient days. CONCLUSION: Since the implementation of Bubble CPAP at our facility there has been a marked reduction in patients requiring intubation and assisted ventilation as well as a reduction in supplemental oxygen requirements.

Sponsored Research - None



1408149

A BENCH EVALUATION OF TIDAL VOLUME DELIVERY THROUGH VARIOUS NASAL INTERFACES USING NON-INVASIVE PERCUSSIVE HIGH NASAL CPAP.

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Background: A multicenter High Frequency Nasal CPAP (HFNCPAP) human study out of the University of Utah is due to begin in the summer of 2012. In order to prepare for this study, more in depth information was needed for volume delivery thru various nasal interfaces. ***Method:*** The Percussionaire(Sandpoint, Idaho) Sinusoidal Bronchotron with Turbohub Phasitron, Hudson(Research Triangle Park, North Carolina) Nasal CPAP Prongs (sizes 0-5) and Neotech(Valencia, California) RAM Cannulas (sizes Preemie, Newborn and Infant) were attached to TSI Certifier FA Plus(Shoreveiw, Minnesota) and then to a Infant IMTMedical Smartlung(ag, Switzerland). All prongs were sealed and pressure tested prior to testing. The lung was set at compliance of 1ml/mbar and resistance at 5 mbar/L/s. TSI Certifier transducers were zeroed and Bronchotron working pressure was set at various levels to obtain MAP's of 6, 8, 10 and 12. Oscillatory CPAP & expiratory time set at maximum, and pulsatile flowrate & inspiratory time set to minimum thru out testing. Pulse frequency was set to minimum, 300 and maximum to investigate the effect on tidal volume(Vt) and minute ventilation(VE). Ventilator frequency was measured from 250bpm to 465bpm. At these various settings the Vt and VE were determined for various prong and cannula sizes. ***Results:*** We found that with increases in prong and cannula size that there was a mean increase in Vt and VE. We also found that Vt and VE increased as frequency decreased. The Vt ranges for Hudson prongs was 3 to 27ml and for RAM cannulas it was 2 to 21ml. Minute volume ranges for Hudson were 1.4 to 4.9L/m and RAM cannulas were .8 to 3.2L/m. We found that the conventional breath delivery had an inspiratory time of .08 to .12sec at a rate of 12bpm with peak pressures ranging from 22 to 52cm/H2O. ***Conclusion:*** The Hudson prongs performed well with the best overall results. The RAM cannulas performed adequately, but the results for Vt and VE were slightly lower than comparable Hudson sizes. Neotech recommends up to an 80% occlusion of the nares with the RAM cannulas and our testing was a 100% occlusive model, so results at manufacture recommendation may be less than we recorded. The Sinusoidal Bronchotron appears to be an effective device to provide support for high frequency nasal CPAP. HFNCPAP expands the capabilities of CPAP to influence ventilation by adding the ability to change Vt and VE delivered through the nasal prongs.

Sponsored Research - None

1413584

FUNCTIONAL RESIDUAL CAPACITY OF THE NEONATAL INTENSIVE CARE UNIT GRADUATES IN ONE MEDICAL CENTER AT SOUTHERN TAIWAN.

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Objective. With advances in medical technology, the survival rate of low birth weight premature infants gradually raises in recent years. However, the complications of these survived infants might increase at the same time, especially chronic lung disease (CLD). Therefore, CLD in premature infants becomes an important issue in neonatology. The goal of this study is to evaluate pulmonary function of premature infants with and without CLD who were admitted to neonatal intensive care unit of Kaohsiung Medical University Hospital in southern Taiwan with agreement of infants' parents. Patients and methods. Premature infants with a gestational age of less than 37 weeks needed respiratory support soon after birth were enrolled. The medical condition and respiratory supports were recorded during their stay of hospital. The study infants have received pulmonary function test once before discharge. Functional residual capacity (FRC) and ventilation indices were measured with a multiple-breath washin/washout technique using SF6 as a tracer gas.(Infant pulmonary function testing system, EXHALYZER® D, ECO MEDICS) Results. There were 22 premature infants performing pulmonary function test before discharge. No infant needs oxygen at discharge. The mean gestational age is 30.4 ±2.9 weeks, and the mean birth weight is 1597g± 660g. The mean age at checking lung function is 34.3 ± 33.1 days. FRC (ml) is significantly related to infants' weight and body length. When CLD is defined as a need for supplemental oxygen at the postconceptional age of 36 weeks, the FRC is not significantly different in infants without CLD (n=13) than with CLD (n=9) (FRC 22.5±10.6 ml/kg with CLD vs. 26.0±6.5 ml/kg without CLD, p=0.171). Gender, antenatal steroid, patent ductus arteriosus, diuretics or aminophylline use did not have significant effects on FRC data in ml per kg. Conclusion. Conducting infant pulmonary function test on those premature infants who prepare to discharge from hospital is practicable and it doesn't have any adverse effect. The larger sample size is needed.

Sponsored Research - None

1414988

RETROSPECTIVE REVIEW OF AIRWAY PRESSURE RELEASE VENTILATION IN NEONATES.

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RATIONALE Airway Pressure Release Ventilation (APRV) is a relatively new mode of ventilation that uses prolonged inspiratory times to achieve high mean airway pressures with lower peak pressures. Although this creates an inverse inspiratory:expiratory ratio, which historically was associated with an increased risk of pneumothorax with previous modes of neonatal ventilation, this complication is theoretically reduced in APRV by allowing exhalation during all phases of the respiratory cycle. In adult and pediatric literature APRV has been shown to improve oxygenation when conventional ventilation (pressure control and SIMV) has failed, however there is very limited evidence regarding APRV in the neonatal population. We hypothesize that APRV is a safe and effective mode of ventilation in neonates that fail conventional ventilation. METHODS This is a retrospective study of all infants that failed conventional ventilation and required rescue ventilation with either High Frequency Oscillatory Ventilation (HFOV) or APRV at our institution from January 2010 to March 2011. RESULTS Forty six infants were identified that required rescue ventilation with either HFOV (n=28), APRV (n=9) or both APRV and HFOV (n=9). The mean gestational age was 30 weeks in the HFOV group, 33 weeks in the APRV group, and 32 weeks in the infants treated with both. Survival was 50% in the HFOV group, 78% in the APRV group, and 89% in infants rescued with both APRV and HFOV. Peak inspiratory pressures significantly decreased when transitioning from conventional ventilation to APRV (25.3 vs 22.5 cm H2O, p=0.0017) with no decrease in oxygenation. Ventilation also improved when transitioning from conventional ventilation to APRV (pCO2 77 vs 61 mm Hg, p=0.01) and was similar to ventilation achieved in infants rescued with HFOV (pCO2 63 mm Hg). Although earlier modes of inverse inspiratory:expiratory ventilation were associated with increased risk of pneumothorax, the incidence of pneumothorax in our population was 11%, 14%, and 6% while on conventional, HFOV and APRV, respectively. CONCLUSIONS While larger studies are needed to determine the impact of APRV on outcome variables such as survival and chronic lung disease, our results suggest that APRV decreases peak inspiratory pressures, and improves ventilation with no increase in the incidence of pneumothorax.

Sponsored Research - None

1415668

NON-INVASIVE POSITIVE PRESSURE VENTILATION COLLABORATIVE CARE STANDARD FOR PEDIATRIC PATIENTS.

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Background: The use of non-invasive positive pressure ventilation (NIPPV) in children has rapidly increased. Occurrence of skin breakdown, an interface associated complication, is clinically significant in children using NIPPV. Accurate skin assessment, interventions, and documentation of care have the potential to decrease Incidence of avoidable injury related to NIPPV. Methods: A data collection tool was created to measure compliance with the hospital NIPPV standard of care. Over a 4 week period (November 2010) hospital –wide audits (N=91) assessed care of children (all measured in means: age=3 yrs, weight=14.2 kg, therapy days=6, hours on NIPPV=16.5) receiving NIPPV. Skin injury occurred in 14/91 (15%) of cases. A multi-disciplinary team revised the current standard of care. The new standard highlighted collaborative and more frequent skin assessments involving Nursing and Respiratory Care, skin protection with a silicone based dressing, and guidelines for alternating interfaces. Requirements for documentation, plus error reporting, were enhanced. In preparation for this practice change, Respiratory Therapists received education regarding skin assessment techniques, identification of skin injury, and interface strategies. Nurses and Respiratory Therapists were trained on the revised standard of care using collaborative return demonstration, facilitated by qualified observers, and online interactive self learning module with inclusive simulated patient care video. The revised standard of care was implemented hospital wide. Existing data collection tool was used for post-education audit to measure compliance with new revised NIPPV standard. Wilcoxon rank sum and Chi-square tests were used to compare data. Results: New hospital wide audits (November 2011, N=72) assessed care of children (all measured in means: age=2 yrs, weight= 12 kg, therapy days= 5.5, hours on NIPPV=17.5) receiving NIPPV under new revised standard. Audit data after one year revealed skin injury occurred in 4/72 (6%) of cases. Hours between interface changes and documentation of Respiratory Therapy and Nursing were also reviewed. Conclusions: Respiratory Therapist and Nurse training on consistent collaborative standard practice of improved skin assessment, interventions, and documentation can decrease occurrence of avoidable skin injury secondary to NIPPV.

Sponsored Research - None

Audit Outcomes Table

Variables	Nov. 2010	Nov. 2011	P value
Hrs btwn interface change	12 (8, 14)	7.5 (6,8)	0.0002
Hrs btwn RN doc	2 (1,4)	6 (4,12)	<0.0001
Hrs btwn RT doc	4 (4,4)	4.5 (4,12)	<0.0001
Skin Injury Yes	14 (15%)	4 (6%)	0.047
Skin Injury No	77 (85%)	68 (94%)	0.047

1415556

IMPLEMENTATION OF A NEWLY DEVELOPED CLINICAL GUIDELINE USE OF HIGH FLOW NASAL CANNULA OUTSIDE THE ICU.

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Background: High Flow Nasal Cannula (HFNC) is often utilized to decrease work of breathing in pediatric patients with primary pulmonary pathology such as bronchiolitis. Often there are patient safety concerns regarding aggressive use of high flows and FiO2 on general pediatric floors. The identification of specific flow-rate boundaries for HFNC is not well established. Utilization outside the intensive care unit where monitoring systems and staffing ratios are stretched adds to safety risks. Methods: A HFNC guideline was created employing FiO2 and flow limitations for a variety of age ranges. All staff (RT/RN/MD) who worked in designated HFNC patient care areas were educated on the guideline for standardization and safe practice. The guideline was implemented in December 2011 on general pediatric floors with high patient census of primary pulmonary pathology. Data was reviewed monthly to evaluate guideline adherence, address additional educational needs, and communicate any patient safety concerns. Results: 25 patients met clinical criteria for use of HFNC on the general pediatrics floors from December 2011 through May 2012. In 80% (20/25) of patients HFNC guidelines were followed. In 4 patients the flowrate and FiO2 were increased above recommended guidelines for clinical stabilization prior to transfer to the ICU. In 76% (19/25) of patients, at least one rapid response call was made. 4% (1/25) required a code call for acute respiratory compromise. 52% (13/25) of patients required transfer to the ICU for care. The patients had the following diagnoses: 72% (18/25) RSV/Bronchiolitis, 20% (5/25) respiratory distress, and 8% (2/25) asthma/pneumonia. Conclusion: High flow nasal cannula can be successfully implemented on general pediatric floors using clinical guideline and structured multidisciplinary education plan.

Sponsored Research - None

1418292

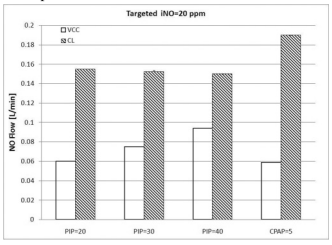
UTILIZATION OF INO WHEN USING A NOVEL VENTILATOR CIRCUIT CONNECTOR UNDER SIMULATED NEONATAL MECHANICAL VENTILATION CONDITIONS – AN IN VITRO STUDY.

Krzysztof Chmura[2], Chris Henderson[1], Timothy J. Gregory[1], Martin Keszler[3], Janusz Gadzinowski[2], Jan Mazela[1,2]; [1]Preclinical, Discovery Laboratories, Inc., Warrington, PA; [2]Department of Neonatology, Poznan University of Medical Sciences, Poznan, Poland; [3]Department of Neonatology, Brown University, Women and Infants Hospital, Providence, RI

Background: Inhaled nitric oxide (iNO) is a standard treatment for persistent pulmonary hypertension of the newborn (PPHN). The standard of care (SoC) for iNO delivery is to introduce the gas into the inspiratory limb of the ventilator circuit, leading to potential gas loss and environmental contamination. We hypothesize that the use of a novel ventilator circuit (VC) connector (Afectair®, Discovery Laboratories, Inc., Warrington, PA) will result in a substantial reduction of NO utilization during simulated neonatal ventilatory conditions. **Aim:** The aim of the study was to determine iNO utilization when targeting an iNO concentration of 20 ppm using the VC connector vs. control (SoC) under robust in vitro ventilation conditions that simulate neonatal clinical conditions. **Methods:** A neonatal system was assembled utilizing a ventilator, test lung and lung simulator. The ventilator was used in pressure control mode with a rate of 55 bpm and inspiratory pressures of 20, 30, 40 cmH_2O and CPAP of 5 cmH_2O. For SoC, using a wye connector, the iNO was delivered from the NO flow controller into the ventilator circuit. With the VC connector, iNO was administered via a non-corrugated tube attached directly to the VC connector. NO concentrations were measured with a NOxBOX®+ analyzer (Bedfont Scientific, Kent, United Kingdom) and iNO flow was titrated to achieve a concentration of 20 ppm delivered at the patient interface for both delivery systems. All measurements were done in triplicate. **Results:** NO utilization was 33%-69% lower using the VC connector compared with SoC ($p<0.05$) [Figure 1: NO flow at a targeted iNO concentration of 20 ppm under simulated neonatal ventilatory conditions]. **Conclusions:** Delivery of iNO through the VC connector allowed for less utilization of NO to achieve targeted delivery of 20 ppm. These results suggest that clinical use of this VC connector to deliver iNO may reduce NO consumption during treatment of PPHN. Further assessment of the economic impact of reduced NO consumption when using the VC connector is warranted.

Sponsored Research - Poznan University of Medical Sciences, Poznan, Poland provided financial support.

Discovery Laboratories, Inc. provided Afectair connectors.



1427625

NON-INVASIVE VENTILATON USING THE RAM NASAL CANNULA WITH THE GE ENGSTROM CARESTATION.

Kathleen Deakins, Nancy Johnson, Myers Timothy; Pediatric Respiratory Care, University Hospitals Rainbow Babies & Children's, Cleveland, OH

Background Non-invasive support via nasal cannula is used in the management of respiratory distress in the Neonatal Intensive Care Unit (NICU). Attaching, securing and managing interfaces during CPAP or non-invasive ventilation can present challenges while maintaining pressure in the presence of leaks. A new nasal cannula interface has created additional opportunities for ventilation. The purpose of this observational study was to determine the effect s of increasing leak on pressure, flow and tidal volume delivered and to determine parameters needed for optimum performance. Methods A newborn size RAM Nasal cannula (Neotech Products, Valencia CA) was attached to two pieces of pressure tubing equivalent to the length of an infant trachea and attached to a stopcock connected to an Ingmar Neonatal Demonstration Lung Model (Ingmar Medical, Pittsburgh, PA) with a set compliance of 2 mL/cmH20. The cannula's 15 mm adapter was attached to the patient wye of an Airlife neonatal ventilator circuit (Carefusion: Yorba Linda CA) on a GE Engstrom Carestation ventilator (GE, Madison WI). Following ventilator system checkout, it was placed in a non-invasive pediatric mode at the following settings: Pressure support (Psupp) = 14 cmH20, PEEP +5 cmH20, bias flow 8 lpm, rise time 100 msec, trigger 0.25 cmH20 with backup settings of: frequency = 30 bpm, inspiratory time (Ti) 0.5 sec, PEEP +5 cmH20, Psupp 15 cmH20, Time limit for pressure support (T supp) 0.8 sec and end flow 25%. Int he absence of a spontaneous breathing model, backup settings were sole source of ventilation, simulating nasal PCV. Leaks of 0%, 30%, 50%, 70% and 100% were introduced and confirmed by leak% display on ventilator. Flow, pressure and tidal volumes measurements were taken from the ventilator trend screen following 10 snapshots at each leak level. 100% leak was created by disconnecting the circuit from test lung and leaving it open to air. Results: Mean values with standard deviations for pressure, flow and tidal volume at each leak level are found in the table below: The ventilator alarmed for "no breath detected" at > 70% leak. Conclusion Pressure, flow and tidal volumes became increasingly unstable as leak increased. A minimally acceptable flow rate of 12 lpm was maintained with some degree of leak (preferred to reduce expiratory resistance). Alarms generated at high leak percentages created a safety mechanism in the face of a fixed resistance (the cannula).

Sponsored Research - None

PIP, Vt and Flow Rates at Dfferent Leak %

Leak %	PIP cm H20	Vt ml	Flow rate lpm
0%	16 + 0	4.8 + 0.5	17.4 + 0.84
30%	16 + 0	4.2 + 1.5	17 + 5.2
50%	16 + 2.2	2.4 + 0.5	15 + 0.76
70%	16 + 1.4	0.7 + 0.0	13 +3.1
100%	12.1 + 3	1.6 + 0.9	11+ 2.44

1430786

THE RAM CANNULA CAN HELP TO REDUCE FACIAL TISSUE AND NASAL SEPTAL EROSION FOR THE NEONATAL PATIENT REQUIRING NIMV AND NCPAP.

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PURPOSE: Nasal Intermittent Mandatory Ventilation (NIMV) and Nasal Continuous Positive Airway Pressure (CPAP) are ventilatory modes used quite frequently in lieu of intubation in the neonatal population. Unfortunately, the nasal interface used can be quite hazardous to the neonatal patient causing nasal septum erosion. In our neonatal unit we wanted to reduce the rate of injury and severity of facial and nasal septal erosion. Upon literature review we discovered the Ram Cannula made by Neotech Products Inc, a new nasal interface for the neonatal patient to deliver NIMV and CPAP. METHODS: In a three month period 83 RDS neonates with 93 occurrences for ventilator support were treated with the Ram Cannula. The staff tracked; gestational age, diagnosis, ventilator type, length of therapy time, any adverse effects such as increasing FIO2 requirements, inability to maintain pressures, changes in vital signs and presence of any facial tissue irritations and nasal septal breakdowns. RESULTS: The data showed that for 83 patients there were 11 cases of redness that all resolved within hours of repositioning the cannula. There were no other adverse effects. Our rate of facial tissue and nasal septal erosion was zero with Ram Cannula. We then compared this data to the previous year's data. We found that the previous year there were 4 cases of nasal septal damage (that required surgical intervention) and 10 reports of skin redness. CONCLUSIONS: With the use of the Ram Cannula we have reached our goal: zero facial tissue and nasal septal erosion. While doing this study the staff found that the Ram Cannula was very convenient to use, kangaroo care was much easier to provide, and the cost is considerably less than traditional positive pressure devices.

Sponsored Research - None

1431151

HIGH FREQUENCY OSCILLATORY VENTILATOR (HFOV) TIDAL VOLUME (VT) VARIES WITH LUNG IMPEDANCE (Z) – BUT WHERE DOES THAT VT GO?

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Background: Vt to lung from SensorMedics 3100A HFOV changes despite fixed pressure amplitude (ΔP) and frequency (F) as compliance (C), resistance (R), and/or ETT size (all components of Z) change, but the mechanism is unclear. Part ("Vo") of the piston's oscillatory volume goes out the exhalation valve. Hypothetically as lung Z changes, the piston oscillating volume remains constant and Vo changes to compensate for changes in lung Vt. This study explores that question in a bench model. Methods: A 3100A HFOV ventilated a 3 L calibration syringe used as a rigid-container test lung with C of <0.1 to 2.1 ml/cmH2O set by varying its volume, via a 4.0 mm ETT. Proximal and lung ΔP were measured with a Setra 239 pressure transducer, and lung Vt was calculated from lung ΔP. Vo was measured with a TSI model 4043 mass flowmeter in the circuit's outflow limb. A USB data acquisition device and Labview software were used. The effect of a large lung C change was studied at various F, ΔP, mean airway pressure (MAP), and bias flow, with POWER or ΔP constant for each C pair. Results: In all cases, changing from high (2.1) to very low (clamped ETT) C only modestly affected Vo. For example, at bias flow 20, MAP 12, 5 Hz, proximal ΔP of 20 at C of 2.1, Vo=9.2 ml and Vt=15.9, while with ETT clamped (zero C, no Vt) Vo rose to only 11.5 while ΔP changed to 23. In no case was the Vt drop fully diverted to add to Vo; Vt + Vo (total piston output) always fell. Changing either bias flow or MAP with the other constant, keeping proximal ΔP unchanged, significantly affected Vo but minimally changed Vt. When POWER instead of ΔP was kept constant while making these changes, there was modest effect on Vt but again large effects on Vo. . Conclusion: The hypothesis that increase in lung Z diverts Vt into Vo was disproven. This may be because altered lung Z does not change outflow valve R, so Vo only changes if ΔP does; increase in ΔP would increase Vo, whether due to increased lung Z or a control adjustment. Proximal ΔP did go up at constant POWER when the ETT was clamped, accounting for the change in Vo. Further, a change in bias flow with unchanged MAP (and vice versa) changes outflow R, and thus Vo, with either proximal ΔP or POWER constant. These findings suggest that the piston acts as a nearly "ideal pressure source", where ΔP changes are modest but Vt+Vo changes can be large with change in Z load on the ventilator due to either outflow R or lung Z changes.

Sponsored Research - None

1432240

NONINVASIVE VENTILATION IN NEONATES USING THE RAM CANNULA.

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Background: Noninvasive ventilatory support is commonly needed in neonates with respiratory distress. Both noninvasive positive pressure ventilation (NIPPV) and continuous positive airway pressure (CPAP) are common forms of noninvasive ventilation (NIV) used in the NICU. The patient interface has a major impact on success and comfort during NIV. The most commonly used interfaces are nasal prongs and masks. The Ram Cannula is a new noninvasive prong interface introduced in 2011. **Design:** Anonymous retrospective chart review analysis from November 2011-May 2012. **Methods:** Patients were managed on the Ram Cannula for increasing respiratory distress or at time of extubation. The Ram Cannula was used with bubble or ventilator based CPAP. A neonatal ventilator was used for NIPPV. Results reported as median and ranges. Analysis by chi-square, Fisher's Exact and Mann Whitney U. **Results:** There were 56 infants, 29 males and 27 females. Gestation from 31 (23-39) weeks; weight from 1850 (410 – 3716) grams; NIV start age range 2.5 (1-83) days. 42 infants were treated with NCPAP with pressure range from 7 (4-9) cmH2O. 14 infants were treated with NIPPV with a PIP of 17 (9-22) cmH2O. Median set flow for 44 patients was 10 (5-13) lpm. 47 (84%) patients remained on the RAM cannula during NIV course up to 72 hrs. 9 (16%) were change to alternative support mode; 7 (13%) required intubation. Intubation reasons included respiratory failure (4), surfactant (1), surgery (1), and apnea (1). **Conclusions:** In our experience using the Ram Cannula we found that the RAM was an effective interface in providing NIV support to neonatal patients with an 84% success rate. No statistically significant difference was noted for the measured variables between patients that failed or were successful. The patients tolerated the RAM cannula during NIV and minimal skin breakdown was noted. More studies are needed.

Sponsored Research - None

1432745

DOES ADEQUATE PRESSURE PROPAGATION OCCUR WITH NASAL CANNULA INTERMITTENT MANDATORY VENTILATION (NCIMV)?

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Background: Nasal Cannula has long been used to deliver flow based ventilation. As nasal cannula flow traditionally has derived from a wall flow source,, pressure propagation at the nasal interface is highly variable. More recently, nasal cannula delivery of intermittent mandatory ventilation (IMV) has been advocated. We asked whether a novel high flow nasal cannula with a larger diameter than conventional nasal cannula would be useful to deliver adequate pressure propagated ventilation using traditional IMV settings. Methods: We studied three cannula: the Preemie Ram Cannula, the Newborn Ram Cannula, and the Infant Ram Cannula. An Avea Ventilator (Viasys) in TCPL-SIMV mode was used to deliver pressures of 10/5, 15/5, 20/5, 25/5, and 30/5 with an It of 0.35s and flow 8 LPM. Leak and tube compensation were disabled. Measures of PIP propagation, volume delivery at PIP propagation and PEEP of 5 cm H2O, as well as mean airway pressure generation at the wye were recorded. Results: As shown in the chart. Conclusions: Little deviation in the mean airway pressure at the wye was noted. This indicates flow/pressure propagation to the nasal cannula and thus low resistance to flow at typical PEEP levels Volume delivery was adequate at the different levels of PIP using a back pressure of 5 cm H2O, indicating a limiting factor of I-time and not flow or pressure propagation. PIP pressures were limited to delivery at ranges from 15-18 cm H2O. At this level, resistive forces inherent to the cannula would prevent excess pressure generation at the nose. NC-IMV is feasible and efficacious with the RAM cannula. At higher levels of PIP, the cannula may be protective.

Sponsored Research - None

1435325

EVALUATION OF PLACEMENT OF NITRIC OXIDE SAMPLING LINE IN INFANT VENTILATOR CIRCUIT DURING SIMULTANEOUS DELIVERY WITH A CONTINUOUS NEBULIZER.

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Background: We have been using continuous inhaled Epoprostenol (Flolan®) in our NICU for several years to treat pulmonary hypertension in infants with Congenital Diaphragmatic Hernia and other conditions. Often inhaled Nitric Oxide (iNO) is also simultaneously administered to these patients. This has cause problems with medication and condensation entering the iNO sampling port resulting in clogging problems in the INOmax DSIR™ unit despite attempts to try placing filters and change the sampling line more frequently. A solution was to place sampling line prior to medication delivery to avoid nebulization into the sampling line. For our practice, this meant measuring iNO delivery prior to the aerogen solo nebulizer placed on the dry side of the heater in the inspiratory limb of the infant ventilator circuit. To validate this practice, we set up a bench study to test they hypothesis that there was no difference in iNO measurement at this site compared to the recommended placement site of the sampling line in the infant ventilator circuit Methods: A Servo i ventilator was calibrated according to manufacturer's recommendations using an infant Evaqua circuit and connected to a TTL lung model 560li (Michigan Instruments, Grand Rapids, MI). An INOmax DSIR™ unit(Ikaria, Madison, WI), was calibrated according to manufacturer's recommendations. iNO was set at 20ppm and the sampling port was placed at three different positions within the inspiratory limb of the infant ventilator circuit. Position one was located in the inspiratory limb at the patient wye. Position two was at the recommended measurement of iNO after the extension piece in the inspiratory limb. Position three was located prior to the aerogen solo nebulizer placement on the dry side of the humidifier. We allowed gas delivery to stabilize at each position for 5 minutes to record iNO readings. Results: Measurements were as follows: position one (wye) -20ppm, position two (after extension piece)- 20ppm, position three (prior to humidifier)-18ppm Discussion: There was no difference in Nitric Oxide delivery with or without the inspiratory limb extension tubing in place in the infant ventilator circuit. iNO delivery was 2ppm lower measured prior to the humidifier, but is within an acceptable range. We feel measurement at this site is superior to intermittent measurement or complications with nebulization into the sampling line and INOmax DSIR™ unit

Sponsored Research - None

1435006

VENTILATION LIBERATION IN A ONCOLOGICAL CANCER CENTER; A QUALITY IMPROVEMENT INITIATIVE.

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BACKGROUND Prolonged mechanical ventilation is a known cause of increased morbidity and mortality for patients admitted to the intensive care unit. Within our 26-bed Medical Intensive Care Unit (MICU) at The University of Texas MD Anderson Cancer Center patients spend an average of 6.62 days on the ventilator. The MICU incorporates evidence-based protocols such as a daily spontaneous breathing trial (SBT) and a daily sedation/analgesia holiday (temporary cessation of sedating infusions) to efficiently wean patients. Protocol adherence, in either of these can prolong liberation, thereby increasing the probability of infections and increasing cost. Our goal was to reduce the average ventilator days per patient by ten (10) percent in six (6) months. METHOD/INTERVENTION With Quality Institutional Review Board (QIRB) approval we organized a multidisciplinary ICU team involving intensivists, mid-level providers (MLP's), respiratory therapists (RT's), bedside nurses, clinical pharmacists, information technologists (IT), and research specialists for a weaning project. Following a Six Sigma DMAIC model we identified existing barriers that played a role in prolonging the ventilator-patient relationship. A fishbone diagram and Pareto-chart highlighted the noncompliance with sedation/analgesia holidays and spontaneous breathing trial protocols as a major focus area. Baseline data thirteen (13) consecutive months was collected. RESULTS After our intervention, our average ventilator days per MICU patient decreased by 12% following our interventions from 6.62 days to 5.84 (a decrease of 0.78 days). ICU length of stay also decreased by 13% from 9.46 days to 8.22 days per ventilated MICU patient (a decrease of 1.24 days). Nursing compliance for the analgesia holiday protocol increased from the baseline average of 30% increased to 54% four months post-intervention. Compliance for the sedation holiday protocol increased from 36% baseline to 74% post intervention. Cost reduction associated with this intervention was $398,329.62 during the period. CONCLUSION The reduction of ventilator hours and ICU days is significantly enhanced when all members of the multidisciplinary team are committed to reducing the cost of operation and applying evidence base care strategies.

Sponsored Research - None

1416683

EFFECTS OF ADDING A PEDIATRIC OMNI-FLEX CONNECTOR ON DELTA PRESSURE AND MEAN AIRWAY PRESSURE ON THE SENSORMEDICS 3100A.

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Background:The Sensormedics 3100A High Frequency Oscillatory Ventilator utilizes a low compliance circuit to effectively deliver small tidal volumes for patients < 35 kilograms. Control of oxygenation and ventilation is managed by adjusting the mean airway pressure (MAP) and delta pressure (ΔP). The 3100A circuit (Carefusion) can present challenges when trying to properly position the patient due to its rigidity. A Pediatric Omni-Flex connector (Carefusion, Yorba Linda, CA) adds additional dead space with the connector closed, opened, or bent at a 90 degree angle; but allows a degree of flexibility for circuit/patient interface. The purpose of this study was to determine if the additional dead space has an effect on the delivered MAP and ΔP. Methods:A 38 inch Flexible Patient Circuit (Carefusion:Yorba Linda, CA) was attached to a SensorMedics 3100A HFOV system calibrated and connected to an Ingmar Neonatal Demonstration Lung Model (Ingmar Medical, Pittsburgh, PA) with a compliance of 2 mL/cm H20 with the following settings: bias flow 20 lpm, power 3, Hz 12, and MAP 15 cm H2O. MAP and ΔP were measured proximal and distal to the Omni-Flex connector utilizing the airway pressure line and pressure transducer of the 3100A. MAP and ΔP data was collected under three conditions: (1) without Omniflex; (2) with Omni-flex in line, opened with a linear placement; and (3) Omni-flex opened and bent at a right angle. Paired t tests were used to compare pressure differences using no adaptor versus adding the Omniflex in two positions with a statistical significance set at $p < 0.05$. Results: There was no significant difference in proximal or distal ΔP or MAP when adding an Omni-Flex adaptor or if adaptor was opened in a linear position or at a right angle compared to a circuit without an Omni-flex adaptor. MAP and ΔP data are represented by mean values with standard deviations and displayed in the table below: Conclusions: The addition of an Omni-flex adaptor has no significant impact on measured MAP or ΔP pressure and can be utilized for optimal patient/circuit interface when necessary.

Sponsored Research - None

Mean Pressure (SD) cm H20

	Delta P Distal Pressures	Delta P Proximal Pressures	MAP Distal Pressures	MAP Proximal Pressures
No Omniflex	31.95 +/- 0.22	31 +/- 0.41	15.1 +/- 0	15.09 +/- 0.04
Omniflex open straight	31.1 +/- 0.31	32 +/- 0	14.91 +/- 0.02	14.88 +/- 0.05
Omni flex open at right angle	32.2 +/- 0.41	31 +/- 0	15.02 +/- 0.04	14.8 +/- 0

1430839

EVALUATION OF AN UNINTERRUPTABLE POWER SUPPLY SYSTEM TO IMPROVE PATIENT SAFETY DURING HIGH FREQUENCY OSCILLATORY VENTILATION.

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Background: The Sensormedics High Frequency Oscillator Ventilator (HFOV) 3100A and 3100B are frequently used in the management of critically ill neonatal and pediatric patients. Currently, these ventilators do not have a backup battery, and are at risk of terminating ventilation during power failure. There is few published literature addressing this patient safety risk. We evaluated an uninterruptable power supply (UPS) system for use with the Sensormedics 3100 A and B as a power back-up to provide uninterrupted ventilation during a power failure. Methods: To evaluate the effective operational time of the TRIPP-LITE UPS system (SMART 1200 XLHG), we tested it on a Sensormedics 3100 A and 3100 B with a standard neonatal and pediatric workload. Both ventilators were calibrated and set-up according to manufacturer specifications. A 2.5 mm I.D. endotracheal tube connected to a Maquet neonatal test lung was attached to the Sensormedics 3100A and placed on settings of: Amplitude 30 cmH20; Mean Airway Pressure of 12 cmH20; 10 Hertz; FiO2 of 0.60, I-time 33%, and Bias Flow of 20 LPM. A 5.5 mm I.D. endotracheal tube, connected to an adult Maquet test lung, was used with the Sensormedics 3100 B on settings of: Amplitude 40 cmH20; Mean Airway Pressure of 16 cmH20; 7 Hertz; 100% oxygen; I-time 33%; and Bias Flow of 30 LPM. Both ventilators were connected to two separate fully charged TRIPP-LITE UPS systems, and were then run continuously until the UPS system was completely exhausted. Results: The TRIPP-LITE UPS system supporting the Sensormedics 3100B gave its first warning alarm at 35 minutes of use. Five minutes later, it gave its second warning alarm, and completely turned off after a total of 1 hour and 10 minutes of use. The TRIPP-LITE UPS system supporting the Sensormedics 3100A gave its first warning alarm at 1 hour of use. Twelve minutes later, it gave its second warning alarm, and completely turned off after a total of 2 hours and 4 minutes of use. Conclusion: The TRIPP-LITE UPS system is able to provide effective short term back-up support for the Sensormedics 3100A and 3100B in the presence of a power failure.

Sponsored Research - None

1417441

PREDICTING EXTUBATION SUCCESS AFTER TOTAL ARTIFICIAL HEART PLACEMENT: A COMPARISON OF TWO WEANING ASSESSMENT TOOLS.

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Background: Very little is known about the pulmonary-ventilator interactions and possible weaning complications with patients who have undergone total artificial heart (TAH) placement with delayed sternal wound closure. Weaning assessments are "one size fits all" tools that try to predict extubation success in various patient populations. With so little known about this unique population, our aim was to analyze whether our six item standard weaning assessment (SWA) could accurately predict extubation failure when compared to a comprehensive assessment. We chose the Burns Weaning Assessment Protocol (BWAP) which incorporates 26 clinical assessment criteria. In a fast paced ICU, it is essential that we use the simplest and most effective method of assessment while providing safe patient care. Method: Retrospectively, 12 TAH patients were categorized as no extubation failure < 72 hr and extubation failure <72 hr. A modified BWAP score was assessed for each group. The modification to the BWAP included the removal of 2 items: physical activity and positive expiratory pressure. The score was calculated by taking the number of yes's and dividing by 24, with a score of >65% predicting success. Utilizing the SWA, the groups were scored by the same method on 6 items including blood gas analysis, NIF, vital capacity and tidal volume. The modified BWAP scores were compared to the SWA scores. Results: Comparing the two groups, extubation success to extubation failure using the modified BWAP, the mean score was 69.3% and 50% respectively (p=0.03). Comparing the same groups using the SWA, the mean score was 68.8% and 37.5% respectively (p= 0.09). This suggests that both methods of scoring may accurately be able to identify patients who would fail extubation. Conclusion: The BWAP is a predictive tool, but requires extensive assessment that may not be feasible in a busy critical care setting. The data demonstrates that utilizing a 6 item SWA may be as effective as using the comprehensive BWAP at predicting extubation success in post operative TAH patients. The p value of the SWA trended to significance and may reflect the small sample size. More research with a larger sample size will need to be done to verify these results.

Sponsored Research - None

1418317

A COMPARISON OF LEAK COMPENSATION IN ACUTE CARE VENTILATORS DURING INVASIVE VENTILATION; A LUNG MODEL STUDY.

Jun Oto, Andrew D. Marchese, Robert M. Kacmarek; Massachusetts General Hospital, Boston, MA

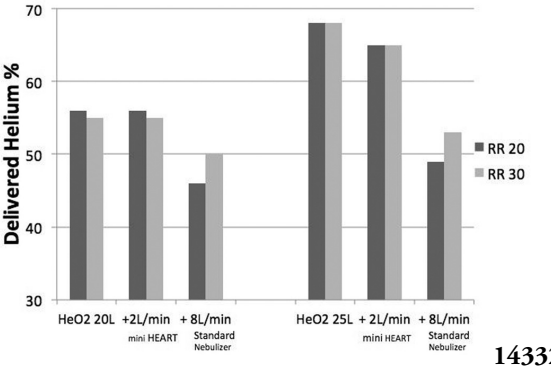
Background: Patient-ventilator synchrony is mandatory for optimal ventilator support during invasive ventilation in the presence of system leaks. We compared leak compensation in 5 new acute care ventilators. Method: Using an ASL5000 lung simulator, the Maquet Servo-i, Drager V500, Covidien PB840, Respironics V60, and Hamilton C3 were compared during increasing (n=6) and decreasing leaks (n=6). Leak levels used were: BL (baseline < 0.5 L/min), L1 (4-5L/min), L2 (9-10 L/min) and L3 (26-27 L/min). Lung model inspiratory and expiratory resistance were 10, and 20 cmH2O/L/sec with compliance 60 ml/cmH2O (Obstructive model) and inspiratory and expiratory resistance of 5, and 5 cmH2O/L/sec with compliance 20 ml/cmH2O (Restrictive model). Ventilator settings were invasive ventilation, pressure support, PEEP 5, and 10 cmH2O and pressure support level 12 cmH2O. The number of breaths to synchronization was recorded for each leak scenario. Results: Only PB840 and V60 exhibited synchronization following all increasing and decreasing leak scenarios in both obstructive and restrictive models. Servo-i did not synchronize at any leak level and the V500 and C3 could not synchronize to leak L3. Number of breaths to synchronization for increasing leaks differed from decreasing leak with median breaths (25th-75th) of 2 (1, 3) and 0 (0, 0) ($p < 0.0001$) respectively. Significant differences were observed for number of breaths to synchronization between the obstructive 2 (0, 3) and restrictive model 0 (0, 1) ($p < 0.0001$), and PEEP 5 cmH2O 0 (0, 2.25) and 10 cmH2O 1 (0, 2) ($p = 0.03$). PB840 required less breaths to synchronize to increasing and decreasing leaks in both obstructive and restrictive lung models and with PEEP 5 cmH2O and 10 cmH2O compared with V60 ($p < 0.0001$). Conclusions: PB840 and V60 were the only ventilators that adapted well to increasing or decreasing leaks. There are differences in performance between these two ventilators, although the clinical significance of these differences is unclear. In the presence of leaks over 26-27 L/min, most ICU ventilators cannot synchronize even if leak compensation is available. Grant support; COVIDIEN Inc, Boulder, CO
Sponsored Research - COVIDIEN Inc, Boulder, CO

1414451

EVALUATION OF HELIOX THERAPY DELIVERD USING THE RESPIRONICS VISION VENTILATORY SUPPORT SYSTEM.

Mark S. Siobal, Leo Bandian, Marwa El Marsafawy, Earl Mangalindan; Anesthesia, SFGH/UCSF, San Francisco, CA

Background: Non-invasive ventilation with heliox may be useful in treating patients with severe airway obstruction due to asthma. The therapeutic effects of helium have been documented at concentrations as low as 50%. We measured the fraction of delivered helium (FDHe) by adding heliox flow into the circuit of a Respironics Vision Ventilatory Support System (RespV). Method: A single chamber of a Michigan Instruments Test Lung (TTL) set to a compliance of 60 mL/cm H20 was used with a 7.5 mm endotracheal tube and a R50 resistor connected to the single limb circuit of the RespV. The RespV was set to PIP = 15 cm H2O, PEEP = 5 cm H2O, Ti = 0.8 sec, rise time = 0.1, FiO2 = 1.0, and RR of 20 and 30/min. Flow rates of 20 and 25 L/min 80/20 heliox was added to the circuit at the side port of the Plateau Exhalation Valve. The FDHe was determined by analyzing the oxygen concentration delivered to the TTL chamber where: FDHe = 1.0 – FDO2. To determine the effects of jet nebulizer treatments, separate measurements were performed during added flow of 100% oxygen at 2 and 8 L/m to the distal end of the patient circuit to mimic treatments with the mini HEART and standard small volume nebulizers. Results: FDHe concentrations of 0.55 to 0.68 were delivered at heliox flow rates of 20 and 25 L/min respectively. The addition of simulated jet nebulizers treatments at flow rates of 2 and 8 L/min decreased FDHe below 0.50 at a RR = 20. The RespV appeared to function normally during all test conditions without cycling or triggering problems on the test lung and was confirm by a volunteer breathing through the circuit. Conclusion: During this invitro bench testing, therapeutic concentrations of helium can be delivered by adding flow rates of 20 to 25 L/min into the circuit of the Respironics Vision Ventilatory Support System. Further invivo testing of this delivery system should be performed.
Sponsored Research - None

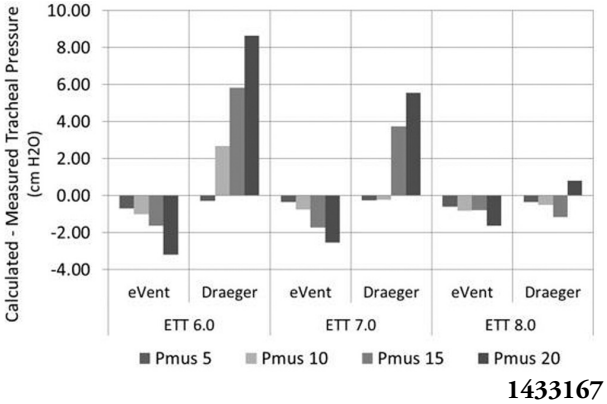


1433239

COMPARISON OF CALCULATED AND MEASURED TRACHEAL PRESSURES DURING AUTOMATIC TUBE COMPENSATION ON THE DRAEGER XL AND THE E-VENT MEDICAL INSPIRATION 7-I VENTILATORS.

Mark S. Siobal, Roberto Bautista; Anesthesia, SFGH/UCSF, San Francisco, CA

Background: Automatic Tube Compensation (ATC) is dependent on the calculation of tracheal pressure. The eVent Inspiration 7i uses the tube length in addition to the tube diameter to calculate the resistance of the endotracheal tube where as the Drager XL uses just the ETT diameter. This study compared the accuracy of the calculated tracheal pressure on the Drager XL and the Inspiration 7i during ATC with varying peak inspiratory muscle effort. The Inspiration 7i evaluated was equipped with the ATC feature not yet available in the USA. Method: An ASL 5000 Advance Breathing Simulator was set to a RR = 15, Rise Time = 10 %, Insp Hold = 20%, Release Time = 10 %, Resistance = 5 cm H2O/L/sec, and Compliance = 50 mL/cm H2O. Pmus was varied between 5, 10, 15, and 20 cm H2O using ETT sizes 6.0, 7.0, and 8.0 mm. Both ventilators were set in the Pressure Support mode, PIP = 15, PEEP = 5, Flow Trigger = 3 L/min, with the minimum Rise Time. Tests were performed at each Pmus setting with each ETT size at 100% compensation. Each test condition was recorded using a Ventrak 1550 monitor with Analysis Plus software version 5.0. A series of 3 consecutive breaths from each test condition was analyzed. The lowest tracheal pressure drop during the simulated inspiratory effort was recorded by the Ventrak at the distal end of the ETT. This was compared to the calculated tracheal pressure determined by the ventilator measurement displayed or by the scalar method from the flow waveform graphic. Results: During each test condition the Inspiration 7i under estimated tracheal pressure drop during the simulated inspiratory effort. The under estimation by the Inspiration 7i increased as Pmus increased for each ETT size tested but the magnitude of the difference deceased at ETT size increased. The Drager XL over estimated tracheal pressure in 6 of 12 test conditions. Over estimation by the Draeger XL was highest at ETT sizes of 6.0 and 7.0 mm. Conclusion: There is marked variability in the accuracy of the calculated tracheal pressure changes during ATC on the Inspiration 7i and Draeger XL ventilators. The implications of these invitro test results needs to be determined in the clinical setting.
Sponsored Research - Equipment on loan to perform bench testing.

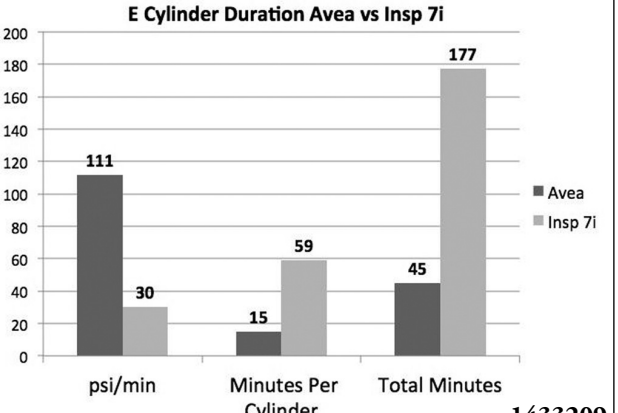


1433167

COMPARISON OF HELIOX CYLINDER DURATION BETWEEN THE E-VENT INSPIRATION 7-I VENTILATOR AND THE VIASYS AVEA VENTILATOR.

Mark S. Siobal, Leo Bandian, Marwa El Marsafawy, Earl Mangalindan; Anesthesia, SFGH/UCSF, San Francisco, CA

Background: Ventilation with Heliox is available on several ventilator platforms. The rate of heliox cylinder gas consumption is dependent on minute ventilation, the concentration of helium being delivered, and the internal function of the ventilator. We compared heliox cylinder duration using the eVent Medical Inspiration 7i Ventilator to the Viasys Avea Ventilator Method: A single chamber of a Michigan Instruments Test Lung set to a compliance of 60 mL/cm H20 was used with a 7.5 mm endotracheal tube and a R50 resistor. Ventilators were connected to the test lung and set to deliver a Vt = 600mL, RR = 10/min, PEEP = 5, inspiratory flow = 60 L/min with a square wave flow pattern, bias flow of 2.5 L/min, and a FiHe of 70%. E-cylinders of 80/20 heliox were used for the testing. Prior to each test the cylinder pressure was recorded from the digital pressure gage of the heliox cylinder regulator. Each test was timed and ended when the ventilator alarmed for low heliox cylinder pressure. Three full E-cylinders of 80/20 heliox were tested on each ventilator. Results: Cylinder pressures varied between 1500 to 2000 psi therefore the sum of the pressures from the three cylinders varied between 5300 and 5000 psi for the Inspiration 7i and Avea respectively. The sum of the run time minutes from the three test were 177 and 45 minutes, the average cylinder duration was 59 and 15 minutes, and the average cylinder pressure drop was 30 and 111 psi/min for the Inspiration 7i and Avea respectively. Conclusion: Heliox gas consumption determined by cylinder pressure drop is reduced by a factor of 3.7 and cylinder duration is increased by a factor of 3.9 using the eVent Inspiration 7i versus the Viasys Avea during invitro bench testing.
Sponsored Research - None



1433209

AN EVALUATION OF INSPIRATORY PRESSURE ATTENTENUATION IN AN ARDS LUNG MODEL WITH THREE DIFFERENT ETT SIZES USING HIGH FREQUENCY PERCUSSIVE VENTILATION.

David Grooms[1], Erin McCormick[2]; [1]Sentara Norfolk General Hospital, Norfolk, VA; [2]Tidewater Community College, Virginia Beach, VA

Background: Pressure attenuation is the diffusion of pressure, gas flow rate, and/or tidal volume during gas delivery. Using bulk flows (conventional ventilation), attenuation is higher as artificial airway size decreases. However, pressure attenuation associated with pulsatile flow delivery systems is not well understood because of the difference in breath delivery flow profiles. Method: Using a simulated ARDS test lung model (Michigan Instuments), pressure attenuation with high frequency percussive ventilation (HFPV) using the Percussionaire Volumetric Diffusive Respirator (VDR) was evaluated by using three different ETT sizes (6.0, 7.0, & 8.0). Phase 1: Pressure was measured distally (airway before ETT) and proximally (at the end of the ETT) using the Hamilton G5 (Bonaduz, Switzerland,) as a conduit for digital and graphical data capture. Phase 2: Pressure was measured distally (airway before ETT) and proximally (inside test lung) using digital and analog manometry. Pressure attenuation was measured to be the difference between distal and proximal measurements for all three airway sizes. The test lung settings remained constant at a airway resistance of 7 cm H2O/L/sec and static compliance of 17 ml/cm H2O for each airway type. VDR settings were set to target combination of analog peak inspiratory pressures (pulsatile flowrate-PIP) of 35, 45 & 55 cm H2O, with analog expiratory pressures (oscillatory CPAP/PEEP) measuring 5 & 10 cm H2O. Inspiratory and expiratory time was set to 2 seconds each, with a measured convective rate of 15bpm. Percussive rate was set at 500 bpm. Results: Phase 1: Pressure attenuation was observed with all airway sizes and did not differ significantly. Phase 2: Pressure attenuation was not observed when measuring pressure using analog manometry on the VDR (Fig 1). Conclusion: Using digital manometry, pressure attenuation was observed through all airway sizes. Using analog manometry (and validated with digital manometry), pressure attenuation was not observed. Therefore, analog measured pressure on the VDR can be assumed to reflect respiratory system pressure under these conditions in an ARDS lung model.

Sponsored Research - None

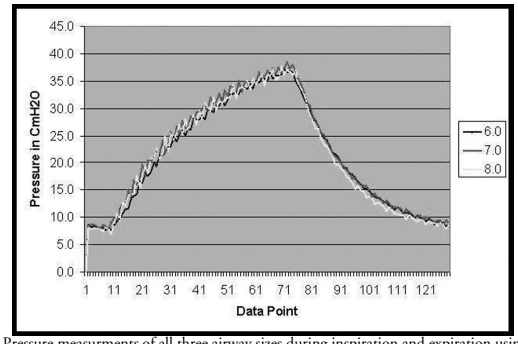


Figure 1. Pressure measurments of all three airway sizes during inspiration and expiration using pulsatile flowrate to achieve PIP of 355 cm H2O with oscillatory CPAP of 5 cm H2O.

1434659

DO CHANGES IN RESISTANCE AND COMPLIANCE EFFECT THE AMOUNT OF NITRIC OXIDE DELIVERED VIA THE VDR-4 VENTILATOR.

James Deckman, Cheryl Dominick; Children's Hospital of Philadelphia, Philadelphia, PA

James Deckman BS,RRT-NPS, Cheryl Defalco BS,RRT-NPS, Respiratory Care Department-The Children's Hospital of Philadelphia, Pa Background: The therapeutic potential of inhaled nitric oxide as a selective pulmonary vasodilator has been studied at great length for the past decade due to its pharmacologic and physiologic potential. The effective delivery of nitric oxide on the VDR-4 ventilator however has been proven challenging. Patient on this type of ventilator can benefit from nitric oxide for it pulmonary vasodilator effects however because of the bi-directional flow dynamics within the circuit delivering therapeutic dosages according to standard ways is inaccurate. Methods: We used the VDR 4 ventilator with HUB ventilation setup, Ikaria Nitric DSIR system, and Michigan Lung to simulate changes in resistance and compliance. The injector module was connected to inspiratory side of HUB. The Nitric analyzer was placed on inspiratory side of breathing circuit at patient wye. The VDR 4 ventilator causes over delivery of inhaled nitric oxide due to Bi-directional flow through the inspiratory side of the VDR ventilator (see IKARIA bulletin Ref:TB-07005). Nitric set value was set to analyze a value of 20ppm. Results: Vdr ventilator settings were PIP 30, PEEP 10, Convective Rate 20, Percussive Rate 600 and a FI02 of 65%. Results are below: Michigan Lung Resistance Michigan Lung Compliance Nitric Set/Analyzed Value 0 .001 10/20 0 .002 10/20 50 .001 10/20 200 .001 10/20 50 .002 10/20 200 .002 10/20 50 .005 10/20 200 .005 10/20 Conclusion: Changes to resistance and compliance had no effect of the amount of delivered nitric oxide. Nitric oxide can be effectively delivered to a patient on the VDR ventilator via the HUB setup. It must be delivered by setting an amount that will not be consistent with an analyzed amount. Changes in resistance and compliance had no effect on delivered amount

Sponsored Research - None

1427070

PREDICTORS OF FUNCTIONAL DECLINE IN ALS PATIENTS UNDER NIV.

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Background: The lack of more specific tools, with low costs, which may be associated with the ALSFRS score to assist in analyzing the prognosis is a constraint factor in the follow up of ALS ventilated patients. We analyzed potential predictors that can be related with rate of functional decline measured by ALSFRS in ALS patients. Methods: Prospective, comparative trial of sixty consecutive ALS patients, were assigned to two groups, G1 (n=29) included all dead patients who had been compliant to NIV, and G2 (n=31) included all compliant subjects within the same period of time that were alive at the end of the study. All patients were followed-up with ALSFRS, oximetry, respiratory function evaluation and blood gases analysis at each three months and all data were registered with respective dates to compare timings to NIV adaptation and total use. Primary outcomes included ALSFRS functional decline and disease duration; secondary outcomes included time to NIV, FVC at disease duration, oximetry data and parameters settings at NIV adaptation. A Cox regression analysis determined independent predictors of respiratory function on rate of decline of ALSFRS. Results: No clinical or laboratorial differences were observed between groups for any variable at admission. Disease duration (in days) from symptoms was higher in G2, as well as duration to NIV, but not significant. These 2 variables correlate positively with maximal inspiratory pressure (MIP; p=0.02), IPAP (P=0.041) and backup breathing rate (BR; p=0.038). Multivariate Cox regression analysis showed that ratio I:E (p=0,023), IPAP (p=0,05), EPAP (p=0,035), Inspiratory Sensitive (p= 0,002), Expiratory Sensitive (p=0,019), Rise Time (p=0,030), Maximal Expiratory Pressure (p=0,042), P.01 (p=0,012) and SatO2 (p=0,02) were associated with rate of functional decline in these patients. Conclusions: For the first time, determinants of functional decline are significantly related to parameters settings of NIV equipments as well as to compliance data suggesting that NIV may be considered a modifiable treatment disease if and when a more rigorous management of NIV is achieved.

Sponsored Research - None

1432511

VENTILATOR FUNCTION AND EFFECTIVE ALARMS DURING SPEAKING VALVE USE IN A CRITICAL CARE SETTING: A BENCH STUDY.

Kathy Grilliot, Terri Clark, Rosary Ossorio; Respiratory Therapy, Northern Virginia Community College, Springfield, VA

Background: One way speaking valves can be used during mechanical ventilation but use is limited by nuisance alarms and lack of known functional alternative alarms. Currently there are no valve use protocols available from ventilator manufacturers. This study assessed several brands of ventilators to determine how each ventilator performed with a closed position speaking valve inline, which modes were the most compatible and tested for disconnect alarms. Method: A bench study was performed using a Passy Muir® valve and the following ventilators: the Puritan Bennett 840, Philips Esprit, CareFusion Avea and Vela, Philips Trilogy 200 (active and passive circuits) and Maquet Servo-i. Each ventilator was set up with a standard circuit, closed suction catheter connected to a ventilation mannequin and a PMV 007. The ventilator modes evaluated were SIMV/PC, SIMV/VC, and/or NIV. Settings used were Vt 500 mls or pressure of 20 cmH2O, rate 12 breaths/min, FIO2 0.21, PEEP of 0 cmH2O and PS of 20 cmH2O. Ventilator alarms that activated upon disconnect were noted. Each ventilator was adjusted to a mode and alarm configuration which allowed use of the valve without nuisance alarms but offered a disconnect alarm in less than 15 seconds. Results: The AVEA, VELA, Trilogy 200 with the active circuit and Esprit ventilators each demonstrated compatibility in SIMV/VC and SIMV/PC modes with a functional disconnect alarm in less than 10 seconds. The PB840 and SERVO-i demonstrated compatibility in the NIV mode. The SERVO-i met expectations in less than 10 seconds using the high respiratory rate and high minute ventilation alarms as functional disconnect alarms. The PB840 alarmed low pressure as a yellow caution alarm at 15 seconds but did not reach a red priority alarm status. All ventilators tested met capabilities to cycle off a pressure support breath without returning volumes. Conclusion: The ventilators all functioned well with a closed position speaking valve in line with certain restrictions on the mode selected and alarm settings. A clinical study is warranted to support the results of this bench study. Sponsored Research – Some ventilators were provided by Passy Muir, Inc. and Philips Respironics

Sponsored Research - Passy Muir paid the bill to rent the ventilators that we did not own. Philips Respironics lent a ventilator to us.

1411492

THE USE OF INVASIVE CPAP FOR HYPOXEMIC RESPIRATORY FAILURE.

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Introduction: A subset of spontaneously breathing patients with adult respiratory distress syndrome (ARDS)/acute lung injury (ALI) ventilated using pressure-based modes achieve low tidal volume goals only when deltaP is titrated downward to continuous positive airway pressure (CPAP). We performed a retrospective observational study to assess the safety of CPAP alone for invasively mechanically ventilated, spontaneously breathing patients with ARDS/ALI. Methods: The records of all adult patients with respiratory failure and a PaO2/FiO2 (P/F) ratio < 300 who were invasively ventilated using CPAP at the University of Missouri Hospital between 8/1/2008 and 11/7/2009 were reviewed. Patients undergoing active weaning were excluded. Results: 23 patients were included (13 males and 10 females; age range 19 to 78 years). The mean BMI was 36 kg/m2. The median time on CPAP was 51 hours. No difference was seen in the mean respiratory rate (18.8 vs. 18.78; p = 0.99) or sedation requirements (propofol 15.0 vs. 19.5mcg/Kg/min; p= 0.48, ativan 0.02 vs. 0.07mg/hr; p= 0.54, versed 0.76 vs. 1.11mg/hr p= 0.41, fentanyl 79.4 vs. 92.1mcg/hr; p= 0.54) when using CPAP vs. conventional modes respectively. PaO2/FIO2 ratio was slightly lower (182 vs. 209; p= 0.02) and survival was 87% vs. 40-74% [historical control] in the CPAP group. Conclusions: Invasive CPAP appears safe and well tolerated in spontaneously breathing patients with ARDS/ALI. Clinical Implications: Invasive CPAP may be a useful mode in patients with ARDS/ALI.

Sponsored Research - None

	Invasive CPAP	Conventional ventilation	p Value
Respiratory Rate (b/min)	18.80	18.78	0.99
Propofol (mcg/kg/min)	15.00	19.5	0.48
Ativan (mg/hr)	0.02	0.07	0.54
Versed (mg/hr)	0.76	1.11	0.41
Fentanyl (mcg/hr)	79.4	92.10	0.54
paO2/FIO2	182.00	209.00	0.02
Survival (%)	87	40-74	N/A

1412668

ACCURACY OF HEIGHT ESTIMATION BY PRE HOSPITAL CARE PROVIDERS.

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BACKGROUND: A literature search of articles from 1999 to 2011 revealed that the accuracy of height, weight and ideal body weight (IBW) estimates by hospital clinicians are unreliable. Results also reveal that there is a tendency for clinicians to overestimate height in patients with lower body habitus and underestimate height in patients with higher body habitus. OBJECTIVE: The study aims to determine if prehospital care providers* can accurately estimate heights of supine individuals to initiate appropriate tidal volume settings for mechanical ventilation, based on standard IBW calculations. HYPOTHESIS: We hypothesize that pre hospital care providers cannot accurately estimate the height of supine individuals. METHODS: Following IRB approval the study was introduced to participants (Respiratory Therapy students) and verbal consent obtained. Subjects were prohibited from communicating with peers throughout the study. All subjects took turns laying supine on the ground while observers recorded estimated heights on a provided spreadsheet. We limited observation time to less than 30 seconds to replicate time constraints in an emergent situation. Post-observation, subjects were measured supine to establish actual height. Subjects were deidentified and a concordance correlation coefficient test was performed using the statistical program MedCalc. RESULTS: Our results reveal that the sample could not estimate height accurately with a poor concordance correlation coefficient of 0.8037. However, further data analysis revealed that derived tidal volumes from estimated heights fell within 4-8ml/kg/IBW with 83% of calculations <6ml/kg/IBW. CONCLUSION: We conclude that pre hospital care providers cannot accurately estimate the height of supine individuals. However, there appears to be a general ability to mechanically ventilate a patient within established safe limits. Our study was limited to a small sample and requires larger studies to validate our results. *Prehospital care providers refers to individuals who administer care prior to hospital admission e.g. military medics, EMT etc.

Sponsored Research - None

1418264

THE EFFECT OF PAUSE TIME ON DOUBLE-TRIGGERING IN A SIMULATED ASYNCHRONOUS LUNG MODEL DURING LUNG PROTECTIVE VENTILATION.

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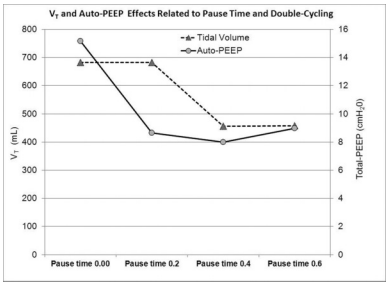
Introduction: Patients with Acute Respiratory Distress Syndrome or Acute Lung Injury are typically managed with a tidal volume of 6mL/kg of PBW. This has been associated with increased work of breathing, double-triggering, and Auto-PEEP. Double-triggering can be refractory to adjusting inspiratory flow rates to meet demand. We have anecdotal experience that adding pause time during volume control ventilation can mitigate double-triggering. We conducted a bench test to determine if increasing pause time could reduce double-triggering in a simulated asynchronous lung model. Methods: An asynchronous patient on lung protective ventilation was simulated by connecting an Avea Ventilator to an Ingmar ASL 5000 test lung. The ventilator was set to Assist-Control, VT 480 mL, frequency 20, PEEP +5 cmH2O, FiO2 1.0, demand flow off, and square flow wave pattern. The test lung was set to 32 breaths/min, compliance 20 mL/cmH2O, airway resistance 5cmH2O/L/sec, and a negative transpulmonary pressure of -30 cmH2O to simulate an aggressive respiratory effort. A laptop was connected to the Avea for video capture and VT and total PEEP measurements were obtained through the Ingmar test lung. Measurements were collected for two minutes during each of the following pause times: 0.0s, 0.2s, 0.4s, and 0.6s. X2 test was used to determine differences in double-triggering between different pause times. Total-PEEP and VT are presented as mean ± standard for all breaths runs. Results: There were differences in the number of observed double-triggering events that were related to the preset inspiratory pause times (p< 0.000). There were 21 double-trigger events for pause times of 0.0s and 0.2s.There were no observed double—triggered breaths when the pause times were set at 0.4s and 0.6s. A nearly two-fold reduction in VT and Total PEEP was observed when the Pause Time was increased from 0.0s to 0.4s (figure). Conclusions: Based on these findings, double-cycling may result in excessive lung overdistension during lung protective ventilation. Increasing the inspiratory pause to 0.4s or 0.6s eliminates double-triggering in a simulated asynchronous patient. Further clinical investigation is needed.

Sponsored Research - None



1427215

EFFICACY OF INTRAPULMONARY PERCUSSIVE VENTILATION (IPV) ON TRAUMATIC BRAIN INJURY PATIENTS.

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Introduction: IPV has been used as a method to deliver bronchodilators, enhance secretion clearance and to decrease atelectasis. Patients with traumatic brain injury (TBI) often require pulmonary toilet to mobilize secretions and chest physical therapy (CPT) is preferred method to do so. However, often TBI patients can't tolerate laying flat due to increased intracranial pressures (ICPs) and pulmonary toilet becomes difficult to execute. We hypothesized that using the IPV could be a more effective method of secretion clearance without increasing ICPs. Case Summary: A 63 year old male was involved in a motor vehicle crash (MVC) suffering multiple right rib fractures and a brain hemorrhage in left basal ganglia extending into frontal and temporal lobes. The patient underwent a craniotomy for control of ICP and an intraventricular catheter (IVC) was placed. The patient's ICPs increased when supine and he could not tolerate CPT as a method to mobilize pulmonary secretions. The CXR showed increasing bilateral atelectasis. An alternative means for secretion clearance was needed and IPV was initiated. IPV treatments were performed thru the ventilator and included albuterol and normal saline. During treatments the IVC was clamped. The IPV was performed Q4 and copious secretions were successfully removed without increased ICP. Within 3 days there were improvements in both CXR and ABG and ventilator support was weaned. Results: During the 3 days of IPV treatments the patient experienced marked improvement in CXR. Mechanical ventilation was successfully weaned to spontaneous pressure mode. During this period, respiratory therapists consistently charted notable increases in secretion volume removed during and after IPV treatments. Radiographic and Physiological improvements, as shown below, were directly associated to the secretions cleared with IPV treatments. Conclusion: The IPV alleviated ICP safety concerns raised by conventional CPT. Further research is needed to see the effect of IPV with TBI.

Sponsored Research - None

DAY	VENTILATOR SETTINGS	ABG	P/F RATIO
Admission Date	SIMV/PRVC/PS RR 18, tidal volume 600ml, PS10, PEEP 12, 50%	7.46/38/86/27/3.3 96%	176
1	Decrease to 40% FIO2	7.47/35/112/25/2.1/97%	280
2	RR decrease to 16	7.46/38/91/27/2.9/96%	288
3	SIMV/PRVC/PS RR 16, tidal volume 500ml, PS10, PEEP 10, 40%	7.44/42/96/28/4.1/96%	240
4	PS 10, PEEP 10, 40%	7.44/44/138/30/5.6/96%	345

1427049

USING HIGH FLOW NASAL CANNULA IN CONJUCTION WITH THE PASSY MUIR VALVE TO WEAN FROM VENTILATOR.

Tera Martin, Maria Madden, Matthew Davis, Peter Saunders, Venessa Peregrim, James Huff, Angela Toney, Kate Dolly, Christoper Kircher, Deborah Stein MD; Respiratory Care,, University of Maryland Medical Center/R Adams Cowley Shock Trauma Center, Baltimore, MD

Introduction: Complete cervical spinal cord injury (C-SCI) patients can require mechanical ventilation for weeks prior to being weaned. A study by Dr. Como in 2005 stated that 100% of C5 and above C-SCI patients will require tracheostomy and 71% of all C5 SCI patients required mechanical ventilation at discharge. We hypothesize that using a high flow nasal cannula (HFNC) in conjunction with a speaking valve, could provide a bridge to aerosol trach collar. Though HFNC, in theory, is a low pressure interface with the patient, we further theorize that the actual pressure being delivered to patients with a tracheostomy tube and speaking valve may be higher than normal. To help quantify the amount of pressure, we simulated the scenario by placing a pressure manometer inline on the tracheostomy tube and speaking valve with a HFNC device at forty liters per minute. The pressure was measured between 2-4 cm H2O. Case Summary: A 69-year-old male that suffered a complete spinal cord injury at C5 resulting from a fall, was transferred to our facility after failure to wean at another medical center. It had been reported that when the patient was ready to be weaned from the mechanical ventilator to aerosol trach collar, the patient did not tolerate independent breathing for more than five minutes each time. The decision was made to try our lab-tested theory on this patient by setting up a HFNC in conjunction with a speaking valve. Subsequently, we were able to see the patient tolerate longer and longer trach collar trials, eventually being ventilator-free for longer than 24 hours. Conclusion: The use of both a speaking valve and HFNC helped liberate our patient from the mechanical ventilator. While this is only a single patient, the outcome was promising. The authors agree that further research is needed.

Sponsored Research - None

1427062

CHANGING TRACHEOSTOMY TUBE MATERIAL AND UTILIZING SILICONE DRESSINGS HEALED THIS STOMA - A CASE STUDY.

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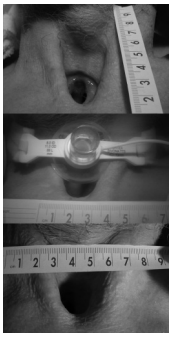
Introduction: Tracheostomy tubes are made of a variety of materials: plastic, silicone, stainless steel. Chronic wound infections and misshapen stomas are a complication of prolonged tracheostomy. Our goal was to see if a change in tracheostomy tube material in conjunction with stabilizing the tube could improve the condition of this stoma. History: 52 year old male with diagnosis of MS decompensated requiring tracheostomy and prolonged mechanical ventilation. A number 6 Shiley™ tracheostomy tube was inserted. Over time, the stoma enlarged and the site was a constant source of infection; red, irritated skin at the stoma site, copious foul smelling secretions, and bad breath. Routine 30 day tube change showed a black moldy substance on the shaft of the tube. The weight and constant movement of the ventilator circuit caused the stoma to become enlarged and misshapen; the cuff could be seen. The decision was made to place a 6 Shiley XLT tube with increased distal length to better seal the airway for mechanical ventilation. This patient weaned from the ventilator, but remained tracheostomized secondary to his weakened neuromuscular state. The stoma site continued to be a challenging wound, so the decision was made to change tube material and stabilize the tube. Objective: Our goal was to see if a change in tracheostomy tube material in conjunction with stabilizing the tube could improve the condition of this stoma. Methods: #8 Bivona® TTS silicone tube was inserted and stabilized with a Sil.Flex® TC Pad. This silicone pad was applied under the flange. Nothing else was changed in regards to his routine trach care or oral care. Results: Within 3 days the foul smell was gone, secretions had cleared, and the mucosa became a normal pink color. There was evidence of new healthy skin growth around the stoma. The patient noted less movement of the tube immediately and greater comfort. Other benefits noted were: increased SaO2, skin tone/color and LOC. After one month routine tube change revealed a remarkably clean shaft of the tube; inside and out. Conclusion: This single patient case study demonstrated significant improvement in the tracheostomy stoma site when the tube material was changed to silicone and stabilized with the Sil.Flex TC Pad.

Sponsored Research - None



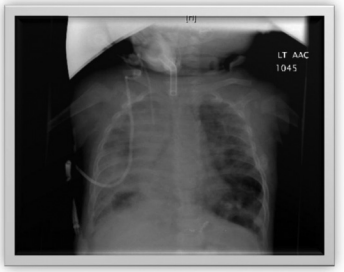
1414483

USE OF AIRWAY CLEARANCE TO TREAT CHRONIC ATELECTASIS IN A VENTILATOR DEPENDENT INFANT WITH CHRONIC LUNG DISEASE: A CASE REPORT.

Stephanie A. Bailes[1], T. Jeffery Bulter[2], Teresa A. Volsko[1]; [1]Respiratory Care, Akron Childrens Hospital, Akron, OH; [2]Neonatalogy, Akron Childrens Hospital, Akron, OH

BACKGROUND: Bronchopulmonary dysplasia (BPD) is chronic lung disease associated with chronic airways inflammation, reduced number of alveoli, impaired secretion mobilization and chronic atelectasis. Although airway clearance (ACT), is a commonly prescribed for this population, modalities are limited. CASE REPORT: An eight month- old medically complex female with BPD received albuterol MDI, 2 puffs with postural drainage and clapping (PD &C) every 3 hours in addition to ventilatory support for 30 days. Ventilator settings were PRVC/SIMV, tidal volume (VT) 45 mL, mandatory rate 30, PEEP 14 cm H2O, pressure support 17 H2O, inspiratory time 0.5 seconds, FIO2 .28. The patient was alert and oriented, with warm, pink and well perfused skin. An acute change in respiratory status occurred. Coarse crackles and decreased aeration bilaterally were noted. An increase in FIO2 to 67% was needed to maintain a SpO2 > 92%. Peak inspiratory pressures rose from 21-33 cm H2O to 45-59 cm H2O. Respirations ranged from 50-80 breaths per minute. Slight improvement in aeration was noted after 2 puffs of albuterol by MDI. A chest radiograph was ordered which revealed the distal end of the tracheostomy tube just below the clavicles and worsening atelectasis, Figure 1. Blood, urine and sputum cultures were obtained. The VT was increased to 50 mL, a longer custom tracheostomy tube was ordered and empiric antibiotics administered. Airway clearance therapy changed from PD&C to the Frequencer V2X every three hours. White Blood Count was 27.7 cells/μL/cu mm. Sputum cultures revealed moderate growth of pseudommas aeruginosa and stenotrophomonas (Xanthomanas) maltophilia. FIO2 and VT returned to baseline and tachypnea resolved within 48 hours of initiating the care plan change. Within seven days a custom tracheostomy tube was inserted and repeat chest radiograph obtained which revealed the distal end of the tracheostomy tube at T3-T4 and marked improvement in atelectasis. Radiographic findings remained unchanged for the next 6 weeks with the new ACT regimen. DISCUSSION: Patients with BPD may benefit from ACT and an evaluation of the ACT required when assessing the plan of care. The Frequencer V2X may offer a viable alternative to PD&C for medically fragile infants with BPD.

Sponsored Research - None



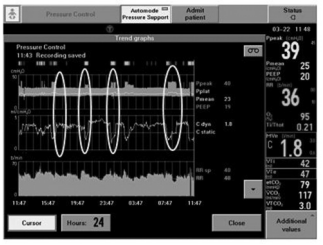
1416605

USE OF NAVA TO RELIEVE ASYNCHRONY ASSOCIATED WITH SEVERE TRACHEOBRONCHOMALACIA A CASE REPORT.

Kristen Hood[1], Maria T. Zuluaga[1,2]; [1]Children's Medical Center Dallas, Dallas, TX; [2]Division of Critical Care Medicine, University of Texas Southwestern, Dallas, TX

Introduction: Tracheobronchomalacia (TBM) is a condition characterized by weakness of the cartilage within the trachea and one or both mainstem bronchi. Patients with severe TBM have significant airway collapse during expiration leading to hyperinflation and inadequate ventilation and often require long term mechanical ventilation. When patients with TBM spontaneously breathe; airways collapse without transmitting changes in flow to the ventilator. This makes synchronization with the ventilator difficult. Use of airway stents has shown increased mortality and morbidity. Leaving positive pressure, control of ventilation and artificial airway insertion the only viable treatments. Case: A 3 month old male infant was admitted to our facility for surgical repair of double outlet right ventricle. Post-operative course was remarkable for multiple failed attempts to wean from non-invasive ventilation and recurrent need for intubation. Bronchoscopy revealed severe tracheomalacia and left mainstem bronchomalacia with 40% obstruction. Patient underwent tracheostomy to bypass tracheomalacia. Post operatively a large amount of intrinsic PEEP with abrupt expiratory flow termination was noted on the ventilator indicating continued airway collapse. Different sizes of tracheostomy tubes and multiple modes of ventilation were attempted without success. Only keeping PEEP at 20 cmH_2O, stabilized malacia and improved ventilation, yet any attempt made by the patient to spontaneously breath or bare down resulted in recurrent severe episodes of hypoxia and hypercarbia requiring manual adjustment in PS and PEEP for recovery. Edi catheter placement revealed trigger, volume, and termination asynchrony. Patient was subsequently switched to NAVA mode with vast improvement in events and ultimate weaning of PEEP. Patient was able to receive additional support immediately without manual ventilator adjustment. Monitoring of Edi signal during PSCPAP assisted in determining level of patient work as well as adequate PEEP and PS settings. Patient was successfully transitioned to the Trilogy ventilator with sprints monitored by Edi values. Discussion: NAVA has been shown to reduce trigger delay and improve ventilator response time in several pediatric and neonatal studies. However in this case NAVA relieved asynchrony and provided appropriate support by adjusting off of the electrical activity of the diaphragm. NAVA is not limited by clinician derived flow, volume, or pressure settings.

Sponsored Research - None



Patient trend data illustrating multiple collapse events characterized by decreased pulmonary compliance necessitating increased PIP

1418233

INDEPENDENT LUNG VENTILATION USING MID-FREQUENCY VENTILATION IN SINGLE LUNG PULMONARY HEMMORHAGE OF UNKNOWN ORIGIN.

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INTRODUCTION: Independent lung ventilation (ILV) has been described for use in patients with non-homogenous lung injury. The theory behind ILV is to protect a non-injured lung from excessive strain while also maintaining ventilation. Mid-Frequency ventilation (MFV) has been described as a means to provide potential lung protective benefits similar to high frequency ventilation using a conventional ventilator (Respir Care 2008;53(12):1669-1677). We describe a case of acute lung injury leading to pulmonary hemmorhage treated with ILV and MFV. CASE SUMMARY: A 69 year old man was admitted for liver transplant. During sugery, the patient developed hemoptysis and right pnuemothorax. A right tube thoracostomy was performed and the right lung was isolated with a double lumen endotracheal tube. An emergent bronchoscopy was performed on the right lung but we were unable to identify a source of bleeding. Blood gases on arrival to the ICU was pH = 7.18 PCO_2 = 74 mmHg PO_2 = 82 mmHg. ILV was started and the left lung was maintained on conventional ventilatory settings (PC-CMV rate 24 breaths/min, T_I 1.25s, V_T ~400 mL, PEEP 8 cm H_2O, F_iO_2 100%). The right lung was set up with MFV (PC-IMV rate 80 breaths/min, T_I 0.43s, V_T approximately 80 mL, PEEP +15, F_iO_2 100%). The resulting blood gas showed: pH = 7.39, PCO_2 = 46 mmHg, PO_2 = 105 mmHg. The right lung hemoptysis stopped, allowing interventional radiology opportunity to identify a source of bleeding. No pulmonary source was identified. The next day, we were able to wean the patient to conventional ventilation on both lungs and he remained on conventional ventilation throughout the rest of his admission.. The patient had a long complicated post-operative course and eventually succumbed to renal and hepatic failure. DISCUSSION: This patient's complicated coagulopathy likely contributed to the hemoptysis. On arrival to the ICU, our goal was to keep the right lung isolated while still maintaining ventilation and oxygenation. The first thought was for high-frequency ventilation on the right lung for lung protection, however the equipment was not immediately available. Stabilizing an injury by reducing the change in ventilatory pressures was our primary goal. We targeted a mean airway pressure, much like high frequency ventilation. Ultimately, the patient was safely ventilated using ILV and MFV.

Sponsored Research - None

1411204

THE USE OF VARIABLE TRIGGER SENSITIVITY ON A NON-INVASIVE VENTILATED PEDIATRIC PATIENT: A CASE REPORT.

Mike Robertson; Respiratory Care, Nationwide Childrens Hospital, Columbus, OH

Introduction The use of non-invasive ventilation (NIV) to treat acute respiratory failure has increased dramatically in recent years has been successful in the pediatric population. However, with many pediatric patients, the inability to trigger the device can lead to; ineffective triggering, auto triggering, increased work of breathing, longer duration on the device, and potential invasive ventilation. The Philips Respironics V60 is equipped with Auto-Trak + software which allow clinicians to assist pediatric patients with their trigger and cycling needs. The application of Auto-Trak + in an acute respiratory failure pediatric patient is reported. Case Summary An 8 month, 5.2 kg patient was receiving mechanical ventilation for respiratory failure secondary to a large patent ductus arteriosus. The patient had previously failed multiple extubation attempts due to inability to appropriately trigger a non-invasive support device resulting in re-intubation. The last time the patient was extubated he was placed on a Respironics V60 with settings: IPAP 14, EPAP 8, I-Time 0.5 sec, rate 35 and monitored for effectiveness. The Auto-Trak+ trigger sensitivity was initiated and titrated until asynchrony index was < 10%. Asynchrony was detected by visual inspection and the asynchrony index (AI) was calculated. Ineffective triggering was defined as an airway pressure drop (≥ 0.5 cmH2O) simultaneous to a flow decrease and not followed by an assisted breath. Prior to auto-trak + initiation, the patient's AI was 17%, RR 80, HR 161, Sp02 80% with noticeable work of breathing. Figure one clearly shows the patient's inability to appropriately trigger the machine. After the increase in trigger sensitivity, the patient's AI reduced to 1%, RR 44, HR 120, Sp02 98% and a decrease in work of breathing. With the help of variable trigger sensitivity, the patient was able to avoid re-intubation and transitioned off of non-invasive ventilation. Discussion The ability to accurately control trigger sensitivity can assist selected pediatric patients with their trigger and cycling needs while auto-adjusting during changing leaks. AutoTrak+ may help in making noninvasive therapy more comfortable for the patient and more versatile for the clinician. Whether adjustable trigger sensitivity allows the V60 to reduce asynchrony on all pediatric patients cannot be determined from this single case study and should be the subject of future investigations.

Sponsored Research - None

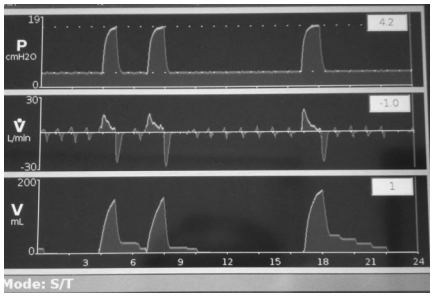

Figure 1

1417461

UTILIZING MODERN TECHNOLOGY TO LOCATE AN ASPIRATED FOREIGN OBJECT.

Janice Ellis, Joel M. Brown, Gerald M. O'Brien; Christiana Care Health System, Newark, DE

Introduction: The incidence of foreign body (FB) aspiration in the adult population is difficult to ascertain, often because they are spontaneously cleared, and therefore not reported. However, patients who are unable to spontaneously clear foreign objects have significant morbidity and mortality. Retrieving a FB in patients can be challenging if granulation has already occurred. Electromagnetic Navigational Bronchoscopy (ENB) has been utilized to locate lung masses in airways previously inaccessible by conventional bronchoscopy. Case Summary: In this case, a woman presented to her primary care physician with a persistent cough, CXR and CT scan revealed a thin metallic object in the LLL. The patient was referred to the Interventional Pulmonologist (IP) who was presented with the challenge of finding and retrieving the object. Upon review, it was decided to utilize the ENB software to identify the exact location of the FB. A special CT scan rendered a 3D image of the airways, allowing the IP to know the exact location of the FB. Knowledge of the FB's location provided an opportunity to gather the necessary equipment to retrieve the object from the small airways. This plan of action proved to be extremely effective, as the object was located in the anterior segment medially of the LLL. A rigid bronchoscope was utilized for airway control, and a pediatric bronchoscope was necessary to access the small airways. In an eight year review of over 7,000 bronchoscopies performed in this particular facility, removal of a foreign body was the primary reason in 0.53%, and FB retrievals requiring rigid bronchoscopy occurred in 6% of those cases. In FB retrieval cases, a large channel bronchoscope is normally utilized. However, due to the depth of this object; a true "needle in a haystack" scenario, a pediatric bronchoscope was required. Knowing the exact location of the object, by way of the ENB software, allowed the team to locate and retrieve the pin safely and quickly, and the patient to be discharged on the same day. Discussion: The retrieval of a FB that has been aspirated is a challenging prospect, and most often is not an elective procedure. In this case, the patient was not in distress, but the removal of the foreign object was justifiable. Utilizing the ENB software, the team was able to determine the exact location of the object; therefore decreasing the procedure time and having the proper equipment prepared for the smaller airways.

Sponsored Research - None

The ball pin after it was removed from the patient's left lower lobe.

1418136

THE EFFECT OF APRV VENTILATION ON INTRACEREBRAL PRESSURE AND CEREBRAL HEMODYNAMICS : A CASE REPORT.

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Introduction: Airway pressure release ventilation (APRV) is a ventilation strategy incorporating the "open lung" concept, which is often associated with a higher mean airway pressure (MAP) than conventional low tidal volume ventilation. Classic teaching suggests that elevated MAP impedes venous return which may increase intracerebral pressure (ICP). Several studies have determined an association between PEEP and ICP and have concluded that influences to ICP and cerebral blood flow are a function of lung compliance and distention. In this case, we present a patient who suffered a sub-arachnoid hemorrhage (SAH) with a ventriculostomy in place, who was transitioned from pressure-controlled mandatory ventilation (P-CMV) to APRV due to progressive hypoxemia. Case Summary: A 68 year-old female with hypertension, and coronary artery disease, presented with sudden onset of headache, nausea and vomiting, and a syncopal episode. A non-contrast CT and CT-angiography of the head and neck revealed a ruptured large basilar arterial terminus, multiple intact small intracranial aneurysms, and significant intraventricular hemorrhage with enlarged ventricles. The patient underwent a ventriculostomy and coil embolization within eight hours of presentation and was admitted to the neurological ICU for post-intervention management. Post-operatively the patient was initially asymptomatic; however, within 72 hours developed altered mental status and respiratory distress requiring intubation and mechanical venitlation. She required increased ventilator support with the following ventilator settings: P-CMV with PC of 20 cm H2O, PEEP of 8 cm H2O (MAP of 10 cm H2O), set respiratory rate of 12 bpm and FIO2of 1.0. Due to refractory hypoxemia and atelectasis, the mode of ventilation was changed to APRV with the following settings: PHigh 26 cm H2O, FIO2 titrated to 70% based on the SPO2, THigh 5 sec, TLow 0.8 sec (termination of expiratory flow of 50%), with a MAP of 22 cmH2O. Extensive cerobro-hemodynamics monitoring was obtained before and after the change in mode of ventilation. Discussion: In this case, we demonstrate that the use of APRV, in a patient with close to normal static lung compliance (50mls/cm H2O), was effective in improving oxygenation without significantly elevating ICP. This patient ultimately survived and was liberated from mechanical ventilation.

Sponsored Research - None

	ICP mmHg	CVP mmHg	Mean Arterial Pressure mmHg	Carotid Blood Flow ml/min	Mean Airway Pressure cmH2O	PaO2/FIO2	Static Lung Compliance ml/cmH2O
P-CMV	2	13	76	450	10	87	50
APRV	3	15	73	530	22	204	50

1434620

DETERMINING SUPPLEMENTAL OXYGEN REQUIREMENTS FOR ACTIVITIES OF DAILY LIVING IN AN ADOLESCENT PATIENT.

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Introduction: The 6-Minute Walk Test (6MWT) is a reliable and reproducible study for suboptimal exercise in pulmonary patients with moderate to severe impairment. This report relates our experience with a severely impaired adolescent in assessing supplemental O_2 needs for activities of daily living (ADL). **Case Summary:** A 15 y/o female presented with a complaint of severe dyspnea on exertion which progressively worsened over the last three years. She had been diagnosed with nasopharyngeal rhabdomyosarcoma at age 8. She was treated with radiation and chemotherapy and was in remission since age 9. The patient was admitted for evaluation of dyspnea. Possible differential diagnoses included restrictive lung disease, V/Q mismatch, pulmonary hypertension, and silent aspiration. Previous spirometry showed severe restrictive lung disease (FVC=36%, FEV_1=37%, FEV_1/FVC=91%). Serial chest CTs had been performed and the most recent showed progressive, extensive cystic bronchiectatic changes. A swallow study showed mild dysphagia. The echocardiogram was consistent with pulmonary hypertension. V/Q scan showed right upper lobe was non-functioning. Her SpO_2 at rest was 99 -100%. The patient performed 3 different 6MWT. The initial study (day 2, without supplemental O_2) showed desaturation with lowest SpO_2 of 83%. A treadmill study (day 7) was performed for titration of supplemental O_2 and revealed a 2 L/min O_2 requirement. A repeat 6MWT (day 9, on 2 L/min O_2), performed while pulling a portable O_2 concentrator (POC) (wt. = 4.5 kg) showed desaturation with lowest SpO_2 of 82%. A lighter portable liquid O_2 system (wt. = 2.7 kg) was substituted and the 6MWT was repeated revealing a 2.5 L/min requirement. She was discharged the next day with supplemental O_2 at 2.5 L/min for normal ADL. **Discussion:** This study illustrates three important points. First, O_2 titration needs to be done under real life conditions. We found that the weight of the POC increased her workload, thus increasing her O_2 requirement. Second, this study relied heavily on collecting oximetry data during all phases of the study and quantified physiologic needs. Although ATS guidelines state that pulse oximetry is optional and that SpO_2 should not be used for constant monitoring during exercise, it was very informative in this case. Third, this case underscores the importance of evaluating for desaturation during exercise in patients presenting with dyspnea.

Sponsored Research - None

1415517

AGGRESSIVE MANAGEMENT OF H1N1 IN A PREGNANT PATIENT.

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Introduction: A 29 year old female presented to an outlying hospital with shortness of breath, cough and tachycardia. Upon exam patient had decreased oxygen saturations and was transported to our facility for management of suspected H1N1 pneumonia. At admission patient was 26 0/7 weeks pregnant with a history of hypertension, GERD, asthma. Case Summary: After an initial BiPAP trial, the patient was intubated and mechanically ventilated due to hypoxia, tachypnea, and increased work of breathing. Within 18 hours, the patient was transitioned to high frequency oscillatory ventilation (HFOV) secondary to increasing plateau pressures and worsening respiratory acidosis. The patient's acidosis resolved after two hours of HFOV though the PaO2/FiO2 (PF) ratio remained low. After four days of HFOV, with limited success weaning FiO2 and maintaining PaO2, veno-venous (VV) double lumen extracorporeal membrane oxygenation (ECMO) was initiated. ECMO was utilized for a total of eight days prior to decannulation. Five days post ECMO, while still mechanically ventilated and sedated, the patient experienced preterm premature rupture of membranes. Labor was induced due to fetal heart rate decelerations. The infant was delivered vaginally at 28 5/7 weeks. The infant had an uncomplicated neonatal course requiring short term CPAP. Discussion: The patient's high cardiac output resulted in an intrapulmonary shunt creating a challenge to adequately oxygenate both the patient and fetus. Lung protective strategy was utilized early in this patient in order to minimize volutrauma. Initial tidal volume (VT) was 6.7 mL/kg predicted body weight (PBW) with a plateau pressure of 25 cmH2O. Tidal volumes were progressively decreased due to elevated plateau pressures. Prior to initiation of HFOV VT was 4.8 mL/kg PBW with a plateau pressure of 32 cmH2O. Although the patient initially improved with HFOV, continued low PF ratios and a persistent FiO2 requirement of 1.0 led to the initiation of ECMO. Transition to conventional ventilation from HFOV occurred six days into the ECMO course; with a total course of HFOV of ten days. The ECMO course was complicated by the migration of the VV cannula into the right atrium, causing ectopy. This required emergent adjustment by the surgeon at the bedside. The patient weaned successfully from HFOV, ECMO and mechanical ventilation. The total course of mechanical ventilation was 29 days; and the patient was discharged to home after 34 days.

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1401750

THE USE OF NEURALLY ADJUSTED VENTILATORY ASSIST (NAVA), HELIOX AND CONTINOUS ALBUTEROL IN SEVERE BRONCHOSPASM DUE TO COPD EXACERBATION: A CASE REPORT.

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Introduction: Dynamic hyperinflation caused by COPD exacerbation often causes dys-synchrony between the patient and the mechanical ventilator, making it difficult for the patient to trigger and cycle each breath. Common strategies used to compensate for these problems include continuous bronchodilator therapy, administration of helium-oxygen mixtures (Heliox), and chemical paralysis of the patient. Neurally Adjusted Ventilatory Assist (NAVA) may be used in conjunction with continuous bronchodilator therapy and Heliox, without the need for chemical paralysis, eliminating the associated morbidity. Case Summary: A 58 year old female patient was admitted from an outside hospital, intubated and chemically paralyzed with cisatracurium due to a severe COPD exacerbation associated with pneumonia. The initial ventilator settings were SIMV (vol)/PS, VT 500ml x 10 bpm PS 10 cm H2O PEEP 5 cm H2O FIO2 0.5. The cisatracurium was held, but the patient decompensated demonstrating a prolonged forced expiratory phase with audible wheeze and increased ventilating pressures (PIP > 60 cm H2O, Plateau 39 cm H2O, Total PEEP 23 cm H2O). Cisatracurium was resumed; the PEEP was decreased to 0, with no improvement to PEEPAuto. Continuous Albuterol nebulizer (20 mg/hr) and Heliox was initiated with minimal improvement in bronchospasm and ventilation. Multiple attempts were made to discontinue the paralytic agent. Many empirical changes were made to ventilator settings to minimize hyperinflation. All failed until the patient was placed in NAVA. At that point, the breathing pattern had changed to a respiratory rate of 1-4 bpm, VT 800 - 1400 ml with an extremely prolonged expiratory phase. Five days after extubation, patient did well with short periods of BiPAP at night. The patient was discharged to an outside hospital for rehabilitation. Discussion: With the use of NAVA, the patient was able to control her breathing pattern and respiratory rate spontaneously, regardless of the flow she could generate. Triggering the ventilator with the electrical activity of the diaphragm made it possible to dramatically reduce air trapping and improve ventilator synchrony, eliminating the need for chemical paralysis. This allowed the patient to breath at a comfortable low rate with a very long expiratory phase while maintaining reasonable blood gas values. This eventually lead to successful extubation without the morbidity associated with the prolonged use of muscle relaxants.

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1417305

PERFORATION OF THE RIGHT TYMPANIC MEMBRANE SEEN IN A PATIENT WITH DUCHENNE MUSCULAR DYSTROPHY USING A MECHANICAL ASSIST COUGH DEVICE AND NON-INVASIVE VENTILATION.

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Introduction: Patients with Duchenne muscular dystrophy (DMD) frequently utilize positive pressure devices to maintain adequate bronchial hygiene and ventilation due to the progressive muscle weakness they experience. While these devices can greatly improve their quality of life, they can also present some unexpected challenges. This case illustrates the course of a 19 year old male with DMD who presented with a perforated right tympanic membrane (TM) following the use of these devices. **Case Summary:** During a clinic visit, the patient reported while using a mechanical assist cough (MAC) device at 35 cmH_2O, he experienced a loud pop in his right ear. He also reported when using non-invasive ventilation (NIV) at night, he experienced a dull pain in his right ear, and noise that kept him awake. He was placed on NIV for assessment, and it was noted that air was flowing through his right ear, creating a whistling sound and causing the TM to flutter. Pressure Control (PC) on NIV was lowered from 20 to 16 cmH_2O until he became asymptomatic of ear problems. MAC pressures were also lowered to a maximal setting of 30 cmH_2O. The patient had a pressure equalization (PE) tube present which should have served as a pressure relief device to prevent TM perforation, which did not occur. He was referred to ENT and the PE tube was removed to allow the TM to heal. Even with the reduction of pressures with NIV and MAC, the TM did not heal. Approximately 13 months after the initial report of TM perforation, ENT confirmed it had finally healed and the patient should be able to tolerate higher pressures. During this time, the patient had been mostly non-compliant with therapy, and experienced an increase in pCO_2 levels from 48 to 65 mmHg. One month later, the patient collapsed, was non-responsive, and had no pulse or respirations. He was successfully resuscitated. As a result of this experience, the patient's compliance with NIV and MAC improved. Pressures were increased on both devices in an attempt to improve his ventilatory status by normalizing his pCO_2 levels. **Discussion:** Perforation of the TM while utilizing positive pressure devices is a rarely reported event. To validate the patient's complaint, placing him on NIV during a clinic visit and observing the air leak was extremely important in taking measures to minimize the problem. The challenge in this case was balancing the reduction of pressures while maintaining adequate ventilation, and allowing the TM to heal.

Sponsored Research - None

143006

SYMPTOMATIC CONGENITAL PULMONARY AIRWAY MALFORMATION: A CASE STUDY.

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Introduction: We describe the rare presentation of a previously healthy 5 month old infant who developed respiratory distress secondary to a spontaneous tension pneumothorax (PTX) which was caused by a rare congenital lung malformation. **Case Summary:** The patient presented to an outside hospital with increased work of breathing (WOB), tachypnea and low grade fever. She was diagnosed with acute otitis media and sent home with oral antibiotics. She continued to have increased WOB and was taken back to the hospital where a chest x-ray (CXR) was done revealing an acute right-sided tension PTX and significant mediastinal shift to the left. Needle aspiration was done without resolution. She was transferred to our facility and a chest tube was placed which resolved the distress but a residual air pocket/cyst was noted on repeat CXR. She was placed on 2 LPM O_2 to improve WOB. The chest tube came out on day 3 and she developed the tension PTX again. The chest tube was replaced and a CT was done due to lack of improvement of the air pocket. CT revealed a cystic lesion in the right upper lobe consistent with Congenital Pulmonary Airway Malformation (CPAM). An echocardiogram (ECHO) was done to rule out cardiac malformation and revealed a small shunt through the foramen ovale, and a left to right interatrial shunt. She was taken to surgery on hospital day 4 for right upper lobe lobectomy. The pathology report confirmed the diagnosis of CPAM Type 1. She tolerated surgery well and was taken off O_2. The chest tube was removed on day 6 without complications and she was discharged the same day. **Discussion:** CPAM is a rare abnormality of lung development that occurs from abnormal embryogenesis, results in cystic lung changes, and may cause a reduction in alveolar growth. The prevalence is estimated at ~ 1:25,000 to 1:35,000. The mortality rate is estimated at 25-35% of all children who present in the newborn period. There are 5 classifications of CPAM primarily based on cyst size. This case illustrates three important points. First, due to its rarity, CPAM should be considered when an infant presents with a spontaneous tension PTX. Second, an ECHO should be done to rule out coexisting cardiac lesions as they are frequently associated with CPAM. Third, resection of CPAM has two benefits: 1) removes risk of complications such as recurrent infection, PTX, and possibility of malignant transformation; 2) if done in the first 1-2 years of life, allows for compensatory lung growth.

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1404272

PLASTIC BRONCHITIS IN A PEDIATRIC PATIENT SECONDARY TO FONTAN PALLIATION.

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Introduction: Plastic Bronchitis (PB) is a condition where large casts or plugs are formed throughout the tracheobronchial tree causing obstruction of the airways which can lead to respiratory failure and possible cardiac arrest. This case describes the course of a 3 year old male who developed PB after undergoing a Fontan procedure. **Case Summary:** The patient underwent a fenestrated Fontan procedure and had to be taken back to surgery to address mediastinal bleeding. He was placed on VA ECMO post-operatively. After five days, he was weaned from VA ECMO support. He developed profound hypoxemia and was placed on VA ECMO a second time. A snare was placed on the fenestration between the right atrium and vena cava to control the blood flow through the pulmonary arteries. Pulmonary services performed a bronchoscopy and found a large cast, which extended throughout his entire tracheobronchial tree. It was later removed with a rigid bronchoscopy. Aggressive pulmonary toilet was started including acetylcysteine, dornase alfa, and Tissue Plasminogen Activator via nebulization, along with scheduled bronchoscopies. After 2 days, the patient was weaned from ECMO, but was unable to be weaned from positive pressure ventilation and underwent a tracheotomy. He seemed to improve when he developed another occlusive cast that resulted in cardiac arrest with asystole. A large tracheal cast was dislodged during chest compressions. The patient returned to his baseline level of consciousness. Due to the recurring tracheal casts, he was transferred to our institution where he received an orthotopic heart transplant and did not have any more occurrences of casts. **Discussion:** PB is also known as Fibrinous Bronchitis or Pseudo-Membranous Bronchitis and is an extremely rare and potentially fatal complication after Fontan procedure. It is characterized by expectoration of long, branching bronchial casts which can manifest in recurrent life threatening airway obstruction. The exact cause of the condition is unknown. Seear et al classifies this as type 2 (acellular) PB, consisting of casts composed of mucin with little or no cellular infiltrate and occurring only in children with congenital heart disease (CHD). The most common procedure associated with PB is the Fontan. This case demonstrates the severity of PB associated with CHD. It also illustrates that an orthotopic heart transplant along with aggressive pulmonary toilet can lead to the survival of patients with reoccurring PB.

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1403485

CONTINUOUS HIGH FREQUENCY OSCILLATION IN THE PRESENCE OF A LARGE AIR LEAK AND AIRWAY CLOT.

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Introduction: High-frequency oscillation (HFO) has been used in a variety of forms for secretion mobilization. We report a case of continuous HFO (CHFO) using the Metaneb® System (Advanced Respiratory Inc., St. Paul, MN) in a patient with severe ARDS complicated by continuous pulmonary air leak and pulmonary hemorrhage. Case: A 31yo, 68kg man suffered pulmonary hemorrhage and fulminate pulmonary edema following an elective aortic homograft replacement. He was unable to wean from cardiopulmonary bypass and was transferred to our facility for transition to V-A ECMO. Despite ongoing bleeding, further complicated by heparin induced thrombocytopenia and renal failure, cardiac function improved and the patient transitioned to V-V ECMO at hour 301. Pulmonary function made little recovery in the first two weeks despite maintenance on HFOV with mean airway pressures of 40-45 cm H_2O on days 9-14. Upon transition to back CMV, the chest x-ray revealed bilateral white-out and dynamic compliance (C_{dyn}) was 5.66 mL/cm H_2O on PC-SIMV PIP/PEEP 26/14 cm H_2O. At ECMO hour 635, a bedside tracheotomy was performed. Over the next 72hrs, daily bronchoscopies failed to mobilize several large, fibrinous clots obstructing the major bronchi and branching airways. CHFO with nebulized n-acytelcysteine, was used in-line with mechanical ventilation in an attempt to mobilize the clot burden. Following the first treatment, several large clots were suctioned from the airway. As a result, on PC-SIMV PIP/PEEP 30/10 cm H_2O, the patient's tidal volume increased from 3 mL/kg to 6 mL/kg. Five additional treatments were conducted over the next 24 hours with continued removal of large clots. The continuous air leak in the right lung remained stable throughout CHFO treatment, despite improved C_{dyn} from 10 to 20 mL/cm H_2O. At ECMO hour 703, a flexible bronchoscopy revealed widely patent and clear proximal airways. The patient's gas exchange continued to improve and he was decannulated at ECMO hour 756. Discussion: Two relative contraindications to the Metaneb® System, pulmonary air leak and pulmonary hemorrhage, were present in this patient and were carefully considered. The transthoracic pressures transmitted during CHFO are not completely understood, however, our case suggests they may not contribute substantially to shear stress which may aggravate an existing pulmonary air leak. Further research is needed to assess pressure attenuation across various ETTs during treatment with CHFO.

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1431902

TREATMENT OF SEVERE OBSTRUCTIVE APNEA AND MICROGNATHIA WITH PLACEMENT OF AN INTERNAL JAW IN A NEWBORN.

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Introduction: infants with severe apnea as a result of micrognathia were traditionally treated with a tracheostomy and a wait-and-grow plan of care. Technology dependent patients have their own sets of challenges and place significant financial and time burdens on the family. Select children's hospitals now offer an alternative to a tracheostomy in mandibular distraction osteogenesis. Case Summary: The patient is a term infant with a fetal diagnosis of micrognathia/retrognathia. At birth, the condition was found to be complicated by a cleft palate. The infant was born at an outlying hospital and transferred to CHOP for evaluation of increased respiratory distress with stridor and retractions when supine. The infant was kept in the prone position until workup was complete and plan of care decided. A 16-channel sleep study was performed and showed severe obstructive apnea with a hypopnea index in the 120's; patient was placed on CPAP of 5 and ultimately NIMV via RAM cannula through the Evita XL ventilator to control the apnea. A microlaryngoscopy and bronchoscopy was performed prior to surgery which revealed severe tongue-based upper airway obstruction with no lower anomalies. Internal mandibular distracters were surgically placed. The distracters were turned 3 times daily by nursing staff to allow separation of the jaw and osteogenesis for formation of a traditional size mandible. The infant remained intubated for 1 week after surgery and was extubated to room air without any complications. Discussion: This infant's case was complicated by the mother's ability to care for the child after discharge. At the time of treatment mom was homeless and living in a shelter. The internal jaw was determined the best treatment option for long term care in the unknown home environment. The internal jaw is less visible but does have the limitations of only being able to move the jaw in one direction and for a definitive additional length (under 25 mm) and can require more significant surgery for removal. This infant's obstructive apnea was clinically resolved after 1 week and now requires no pulmonary support. This patient is being followed by the neonatal multidisciplinary critical airway team to optimize care and outcomes.

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1431009

HIGH FLOW OXYGEN THERAPY IN EARLY PALLIATIVE CARE.

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Background High Flow Oxygen Therapy (HFO) is a very new process for acute respiratory failure's treatment (ARF). HFO can bring up to patients 20 to 70 liters per minute with a adjustable fraction of delivered oxygen from 21 to 100%. This therapeutic is also attractive for its comfort (1). Approximately, 70% of patients afect by a cancer will present ARF (2). This patients, whose prognosis is less than 6 months, are not eligible in Intensive Care Unit (ICU). In the other hand, in France, they often require a conventional high concentration oxygen therapy by mask (HOM) with more frequent monitoring in a dedicated unit. We thought that these patients will take several benefit from this new process, particularly in term of comfort, communication and dyspnea. In this study, we compere HFO with conventional HOM in cancer patients whose present ARF. Method This is a pilot, prospective and cross over observational study. It was made in the Sainte Anne Military Hospital from Toulon, France. Patients with cancer, whose have early write a approach of non-ICU admission, and whose present an ARF, are screened. After consent, we assess some objective criteria (pulse oxymetry : SpO2 and respiratory rate : RR) and some subjective criteria (visual analog scale of dyspnea and communication, the palliative Edmonton Symptom Assessment System : ESAS), under convontional HOM and after 30 minutes of HFO using. For each patient, assessment was made by patient and/or family, by doctor and nurse. Results From June to December 2011, 10 patients were included in this study. SpO2 increase with the use of HFO (99.8% with HFO vs 93.6% with HOM, $p<0.0001$). RR (breath/minute) decrease with the use of HFO (22.2 with HFO vs 27.8 with HOM, $p<0.001$). For patients and/or families, the subjective assessment shows a significant improvement in 4 variables analyzed with the use of HFO. It was Dyspnea (5.1/10 with HFO vs 9/10 with HOM, $p<0.0001$), Exchange and Communication (2.2/10 with HFO vs 7.2/10 with HOM, $p<0.0001$), Well be (6.1/10 with HFO vs 8.2/10 with HOM, $p<0.0002$) and Anxiety (4.5/10 with HFO vs 6.7/10 with HOM, $p=0.0003$). For Doctors and Nurses, the subjective assessment shows a significant improvement in the same 4 variables. Conclusion This study (10 patients) is completely innovanted. No work on HFO in palliative care is reported to date. (1,3). HFO improves the comfort of cancer patients whose present ARF and it mainly allows decrease valuable admission in care unit.

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1417428

EFFECT OF POP-OFF VALVE ON FLOW AND PRESSURE IN HEATED HIGH FLOW NASAL CANNULA DELIVERY IN PEDIATRICS.

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Background: Heated high flow nasal cannulas (HHFNC) have become an integral part of pediatric respiratory care. The set-up used at our institution does not include a pop-off valve (POV). The impact that POVs could have on flows and pressures during HHFNC has not been widely investigated. **Objective:** Evaluate the effect of an in line POV on flow and pressure. **Methods:** A bench study was conducted comparing maximal flows and pressures in a HHFNC system with and without a POV in line. Flow rates for cannula sizes were set as follows: 6 LPM in premature infant cannulas (PMIC), 7 LPM in infant cannulas (IC), 8 LPM in pediatric cannulas (PC), and 60 LPM in small adult cannulas (SAC). Five cannulas and POVs were used for each test. Data were collected at 32° and 37°C. F_iO_2 was 1.0. Measurements of flow and pressure were acquired using the Biopac MP-100 System. For the PMIC, IC, and PC, one 0-35 LPM pneumotachograph (PNT) was placed where the large bore tubing connects to the nasal cannula and one 0-35 LPM PNT was connected directly to the portion of the cannula that would be inserted in the nares. The SAC was configured the same way, but two 0-160 LPM PNTs were used. Pressure was calibrated with SJ-16 vertical manometer. All output signals were routed via an analog channel box into the Biopac MP-100 data acquisition unit converting them into digital signals that can be processed with a computer. Signals were obtained at a rate of 1000 samples per second. **Results:** The pressure differences with the POV in line were significantly lower with both temperature settings in the PMIC. The mean flow differences with the POV in line were significantly lower with both temperature settings in the PMIC and IC. This was also noted in the PC at the higher temperature setting. The pressure within the circuit averaged 29.98 cmH_2O when using the POV, although the POV limit is stated as 40 cmH_2O. The pressure generated at the patient interface was < 0.41 cmH_2O in all cases with the exception of the SAC which generated a maximum pressure of 2.06 cmH_2O at the patient interface. **Conclusion:** The current practice for not utilizing the POV in-line was validated in this study. The circuit pressures were not extreme, and would not be translated to the patient based on these results. With the POV in line, the flows were reduced which could impact the patient's course of treatment.

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1398139

EDUCATION AND TRAINING IMPROVE PHYSICIAN COMPLIANCE IN THE ORDERING OF OXYGEN.

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Introduction: Physician orders are mandatory for a patient to receive oxygen. A valid order includes the delivery device, liter flow, frequency and special instructions such as desired saturation. In 2011 one area our institution experienced an increase in patients without a valid Physician order. Hypothesis: Interdisciplinary education and training can reduce the incidence of patients receiving oxygen without valid orders. Methods: A quality and education project was developed utilizing Performance Improvement methodology. An analysis was completed that indicated several reasons for the lack of valid orders. Interviews with nursing uncovered an "urban myth" that patients on low level oxygen for shortness of breath or chest pain did not require orders. Additionally patients admitted from the Emergency Department and direct admits from physician's offices had a high incidence of no orders. An education program was developed that included meetings with multiple physician groups, multiple nursing meetings, creation of signage, and revision of the order location in the CPOE (computerized physician order entry) order set. A daily audit process was introduced with monitoring of all patients on the affected unit. An immediate follow-up with physicians identified by the audits was initiated. Audit results also indicated the placement of the oxygen order in the admission order set was problematic. An update and relocation of the oxygen order in the CPOE admission order set was completed. Results: Initial baseline audits for quarter 3 of 2011 indicated 114/1667 (6.84%) patients did not have required orders. 4th quarter 2011 showed improvement with 59/1639 (3.6%) without orders. Through continued implementation and follow-up the 1st quarter 2012 showed a decrease to less than 1%. Discussion: Multiple issues were identified as barriers to completion of the required oxygen order. A systematic quality improvement process with daily audits has reduced the incidence of oxygen being administered without a valid order at our institution. A multidisciplinary approach in a large tertiary hospital can be utilized to identify barriers and change practices to achieve desired outcomes. We have expanded this program to the entire campus.

Sponsored Research - None

1429423

COMPARATIVE STUDY OF CIRCUIT PRESSURES AND CPAP EFFECT FOR TWO HIGH FLOW NASAL CANNULA DEVICES.

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Background: High pressures can be generated within the circuit of heated high flow nasal cannula (HHFNC) systems. A comparative study was undertaken to determine the pressures generated within the circuit and the patient interface of two manufacturers HHFNC devices. **Objective:** Evaluate the pressures generated within the circuit and at the patient interface. **Methods:** A bench study was conducted comparing maximal flows and pressures in a HHFNC system with two manufacturers' nasal cannula devices [Fisher/Paykel (F/P) and Neotech Ram (RA)]. Flow rates for cannula sizes were set as follows: 6 LPM in F/P premature infant cannulas (F/P1) and RA preemie infant cannulas (RA1), 7 LPM in F/P infant cannulas (F/P2) and RA newborn cannulas (RA2), and 8 LPM in F/P pediatric cannula (F/P3) and RA infant cannulas (RA3). Five cannulas were used for each test. Data were collected at 32° and 37°C. F_iO_2 was 1.0. The external diameters and lengths of all cannulas were measured with calipers. Measurements of flow and pressure were acquired using the Biopac MP-100 System. For all cannulas, one 0-35 LPM pneumotachograph (PNT) was placed where the large bore tubing connects to the nasal cannula and one 0-35 LPM PNT was connected directly to the portion of the cannula that would be inserted in the nares. Pressure was calibrated with an SJ-16 vertical manometer. All output signals were routed via an analog channel box into the Biopac MP-100 data acquisition unit converting them into digital signals that can be processed with a computer. Signals were obtained at a rate of 1000 samples per second. **Results:** The circuit pressures noted in F/P cannulas were significantly higher (60% – 70%, $p < 0.001$) than in the RA cannulas. However, there was < 10% difference in pressures generated at the patient interface between manufacturers. Measured pressure at the patient interface was less than 0.50 cmH_2O for both manufacturers (F/P 0.29-0.42; RA 0.27-0.42 cmH_20). Temperature settings did not appear to have an effect on pressures generated in either case. The diameters of the F/P cannulas were smaller than the equivalent size of RA cannulas. **Conclusion:** Based on these results, F/P cannulas showed significantly higher circuit pressures than RA cannulas. Additionally, the diameters of the F/P cannulas may be responsible for the degree of back pressures generated in the circuit. Minimal pressures were generated at the patient interface in both manufacturers' cannulas.

Sponsored Research - None

1416275

FRACTION OF INSPIRED OXYGEN DURING INADVERTANT LOW FLOW BAG MASK VENTILATION.

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Background: During bag mask ventilation (BMV) there is no standardized recommendation for liter flow delivery. Current ACLS guidelines simply advise supplemental oxygen delivery of 100%. Clinical conditions vary greatly with the possibility of inadvertent low flow meter settings to manufacture recommendations of 15 L/m and an arbitrary "flush" setting. The purpose of this study is to determine delivered FiO2 during low flow BMV with the variables of liter flow (L/m), delivered tidal volume (Vt) and ventilation rate (BPM). Method: Data was obtained using three different adult manual resuscitators (BMV #1 with reservoir tubing, BMV #2 with a reservoir bag and BMV #3 with a variable volume reservoir tubing) while measuring delivered FiO2 using an oxygen analyzer. Analysis was done at flow meter settings of 2 L/m and 4 L/m. At each flow rate three ventilation rates were assessed (6 BPM-consistent with a 30:2 ventilation to compression ratio, 10 BPM and 20 BPM), and finally, three different tidal volumes were assessed at each ventilation rate (500mL, 800mL, and 1000mL). All testing was done for 2 minutes and 30 second intervals to obtain a steady state FiO2 and tidal volumes were applied using a hinged arm and three level stop block device. Results: At a flow rate of 2 L/m all devices demonstrated thier highest FiO2 at 6 BPM and a Vt of 500 mL (58.4%, 60.8% and 56.7% respectivley), while all had progressive drops in FiO2 as ventilation rate and Vt increased, demonstrating thier lowest FiO2 of 30.6%, 29.8% and 28.1% respectively at a ventilation rate of 20 BPM and a Vt of 1000 mL. At a flow of 4 L/m BMV #1 showed a highest FiO2 at 10 BPM and a Vt of 500 mL (75.7%), while BMV #2 and BMV #3 showed a highest FiO2 at 6 BPM and a Vt of 500 mL (71.4% and 69.3% respectivley). Dispite these variations at the 4 LPM level there was also a progressive drop in FiO2 as ventilation rate and Vt increased, demonstrating thier lowest levels of 40.6%, 35.7% and 36.4% respectively at a ventilation rate of 20 BPM and a Vt of 1000 mL (Table 1). Conclusion: All three adult manual resuscitators demonstrated that at an inadvertent low flow rate of 2 L/m or 4 L/m there is superior FiO2 delivery at lower ventilation rates and lower tidal volumes. The results of this study support current recommendations of ventilating with lower tidal volumes and avoidance of hyperventilation during resuscitation.

Sponsored Research - None

1418763

PERFORMANCE COMPARISON OF TWO PORTABLE OXYGEN CONCENTRATORS.

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INTRODUCTION New portable oxygen concentrators (POCs) have recently become available but there is little information regarding their comparability. The purpose of this study was to evaluate the performance characteristics of 2 commercially available, light weight, POCs); LifeChoice (Inovo Labs) and XPO_2 (Invacare). **METHODS** Oxygen purity and pulse characteristics were measured with the Oxygen Conserver Test System (Hans Rudolph Inc.). Oxygen delivery was evaluated with an ASL 5000 Lung Simulator (IngMar Medical Inc.). Breathing frequency was 15-35 breaths/min with tidal volume of 500 mL. The POC was connected to a fixture representing the nose with a standard adult nasal cannula. Mean values were calculated for 5 breaths after a stabilization period of 25-50 breaths. **RESULTS** The XPO_2 delivered oxygen concentrations to the simulated lung in the range from approximately 22% to 30%. The LifeChoice delivered oxygen in the range of approximately 23% to 26% (see Figure). For both POCs, oxygen delivery decreased as frequency increased. For the XPO_2, oxygen concentration increased as the device setting increased at all frequencies. For the LifeChoice, oxygen delivery increased as the device setting increased at a frequency of 15 breaths/minute. However, at 20 and 25 breaths/minute, oxygen delivery remained constant as the device setting increased from 2 to 3. The XPO_2 had pulse flows that were 2 to 4 times higher than the LifeChoice. Furthermore, the XPO_2 was able to increase pulse volume as the device setting increased by increasing both pulse flow and pulse duration. In contrast, the LifeChoice only increased pulse duration as the OCD setting increased. **CONCLUSIONS** There were important performance differences between these 2 POCS. The more stable and consistent oxygen delivery of the XPO_2 can be explained by the higher oxygen purity and the pulse delivery profiles. The XPO_2 delivers more oxygen than the LifeChoice at the most common breathing frequencies found with ambulatory patients in the home care environment. At any frequency, increasing the XPO_2 setting increased the oxygen delivered. The LifeChoice does not trigger reliably above 25 breaths/min because it was not designed to do so. Furthermore, at frequencies above 15/min, increasing its setting from 2 to 3 did not increase oxygen delivery. The XPO_2 delivers more oxygen at a larger range of patient breathing rates and therefore may prove more clinically versatile.

Sponsored Research - The study was funded by Invacare.

1416361

A COMPARISON OF OXYGEN MASK FIO2 CONCENTRATIONS USING A RANGE OF TIDAL VOLUMES AND INSPIRATORY FLOWRATES.

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Rationale: Oxygen administration is a ubiquitous therapy in nearly every hospital setting. A multitude of delivery modalities can collectively meet the needs of every patient in every situation. Although medical equipment must undergo standards and testing requirements, we question the ability of some devices to meet the needs of a patient in certain distress situations. The purpose of this research was to measure the delivered oxygen concentration from multiple oxygen modalities while using different ventilator patterns. The research determined the oxygen masks ability to maintain accurate oxygen concentrations Methodology: The researchers utilized the ASL 5000 breathing simulator, a manikin head and five oxygen delivery modalities, e.g. simple mask, non-rebreather mask, 50% venturi mask, Oxymask™, and Misty-Ox™. The ASL 5000 breathing simulator created the following ventilator parameters: respiratory rates (12, 24, 36), tidal volumes (200, 600, and 800 mLs) and inspiratory flow rates (60, 80, 100 lpm). Oxygen concentration was measured downstream at the manikin's carina. Results: All devices were able to meet advertised oxygen concentrations when the ventilator pattern simulated "normal" breathing, i.e. f = 12, Vi = 60lpm, Vt = 200mLs. As the ventilator parameters increased, i.e. f = 24/36, Vi = 80/100lpm, Vt = 600/800 mLs, the ability of delivery device to meet the advertised oxygen concentrations decreased substantially. Devices that utilized a venturi system appeared to perform better than those devices using the oxygen flow meter as the only supply source. Conclusion: Our results demonstrate the limitations for each device based on varying respiratory conditions. Although most of the devices we tested adequately provided sufficient oxygenation during a "normal" breathing scenario, the ability to deliver an advertised oxygen level decreased with the implementation of a respiratory distress or high minute volume scenario. Careful selection and matching of the oxygen modality with the patient's needs is warranted. Depending on the level of respiratory distress experienced by the patient the selection and implementation of an oxygen modality could have less than optimal outcomes. These results have direct impact to healthcare providers utilizing oxygenation therapy for acute and emergent needs.

Sponsored Research - None

1407907

BACTERIAL GROWTH ON SIZE E OXYGEN CYLINDERS IN THREE AREAS OF A HEALTHCARE FACILITY.

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BACKGROUND: Size "E" oxygen cylinders are used frequently in health care facilities. The E-cylinders are often placed on the patient's bed during a transport or placed on the floor during a diagnostic procedure. As a result, pathogenic organisms may be transferred to the patient. The purpose of this study was to investigate bacterial growth on the surface of E-cylinders. METHODS: The IRB approval for this study was not needed because the study did not involve human subjects. Twenty E-cylinders were randomly selected from three areas of a hospital. The areas were ICU, ER, and storage room. One control group was set up with 2 cylinders from the ICU, 2 from the ER, and 1 from the storage room. The control cylinders were wiped with germicidal disposable wipes. Each of the control and experimental cylinders was labeled and cultured. For experimental cylinders, each was cultured along the top, middle, and bottom of the cylinder's surface by using sterile swabs and normal saline drops covering a 2" x 2" area. The sample was then inoculated onto the blood agar plates. All samples were incubated for 48 hours in a carbon dioxide rich environment created by using candles. At the end of incubation period, gross bacterial colony count and gross morphology were recorded. The results of the study were analyzed using t-test and MANOVA. RESULTS: The total bacterial colony counts were as follows (Figure 1): control (0), storage (135), ER (427), and ICU (432). The area with the highest number of colonies was the bottom surface area of the E-cylinders: ER (375), ICU (208), and storage (59). The area with the second highest colony count was the top area of the E-cylinder: ICU cylinders (151), storage (71), and ER (24). The area with the fewest colonies was on the middle area of the E-cylinder: ICU (73), ER (28), and storage (5). The control group cleaned with germicidal disposable wipes had no growth for a total count of zero colonies. The t-test results showed significant difference at the p<0.05 level. The MANOVA test results were inconclusive due to small sample size. CONCLUSIONS: The results showed significant bacterial growth on all experimental E-cylinders. Germicidal disposable wipes completely eliminated bacterial growth on E-cylinders. Implementing a cleaning protocol of cylinders with germicidal wipes may benefit patients by reducing or eliminating bacterial contamination.

Sponsored Research - None

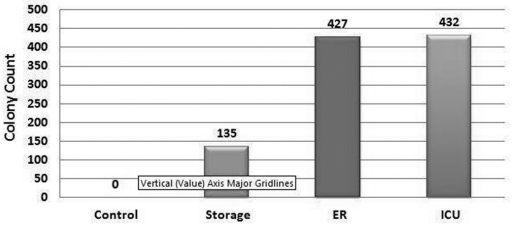

Figure 1. Total bacterial colonies on control and experimental cylinders

1406142

THE EFFECTIVENESS OF THE MISTY OX® HIGH FIO2-HIGH FLOW NEBULIZER.

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INTRODUCTION: the MISTY OX® high FIO2-high flow nebulizer (Cardinal Health, Dublin OH) was developed to overcome shortcomings of conventional air-entrainment devices. The MISTY OX® is designed to deliver FIO2's from 0.60 to 0.96 with total gas flows from 42 to 80 L/min. We sought to determine the actual delivered FIO2 when using the MISTY OX® via aerosol mask in normal subjects. METHOD: Following informed consent, 10 healthy volunteers had an 8 French catheter inserted with the tip positioned immediately behind the uvula and secured to the nare by tape. Subjects were placed on a MISTY OX® High FIO2-High Flow Nebulizer connected to large bore tubing and an aerosol mask. Oxygen therapy was set at an FIO2 of 0.60, 0.75 and 0.96 with the flow meter set at 40 L/min for a period of 5 minutes at each setting. With the subjects breathing normally, gas samples were analyzed from three sites: the MISTY OX® nebulizer outlet, subject's lip and from the subject's pharynx using a calibrated oxygen analyzer. The mean and standard deviations were calculated from all samples. RESULTS: Gas samples from the 0.60 and 0.96 were lower in the pharynx then what was set on the MISTY OX® but was equal from 0.75. Samples from the nebulizer output and mask were lower from 0.60 and 0.96, however were higher in 0.75. CONCLUSION: Actual delivered FIO2 when using the MISTY OX® nebulizer can vary considerably from the set value. Care should be taken when interpreting patient response to oxygen therapy when using this device as actual FIO2 may be less than set FIO2.

Sponsored Research - None

Table 1: Delivered Oxygen Concentration via the Misty-Ox High FIO_2-High Flow Nebulizer via Aerosol Mask with Flowmeter setting of 40 L/min

Misty-Ox High FIO_2 – High Flow Nebulizer via Aerosol Mask at 40 L/min									
	Location of Gas analysis								
	Nebulizer Outlet			Subjects Lip			Oropharynx		
Set FiO2	.60	.75	.96	.60	.75	.96	.60	.75	.96
Analyzed FIO_2 (SD)	54.06 (1.2)	80.28 (2.89)	91.26 (4.14)	55.11 (2.7)	79.75 (3.0)	90.74 (4.11)	54.65 (3.07)	75.55 (4.36)	85.42 (4.11)
Range	52-56	76.8-86.0	83.8-98	51.1-61.0	76.1-85.5	85-97.1	48.5-57.7	66.8-80.1	77-90.6

* mean (SD) of all subjects

1417972

EVALUATION OF FIVE CHEMICAL OXYGEN GENERATORS.

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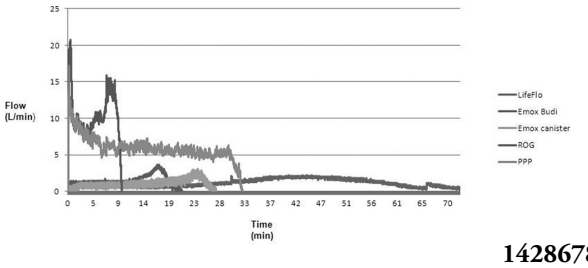
Background: Oxygen delivery at the point of injury may be lifesaving but presents a number of logistic issues. High pressure cylinders represent an explosion and projectile risk. Liquid systems consume oxygen even when not in use and have the risk of spills and burns. Chemical oxygen generation is used in commercial air flight and can be used in an austere environment. The main risk of chemical oxygen generation is high temperatures created during the exothermic reaction. We evaluated five chemical oxygen generators designed for emergency care in austere environments. Methods: Devices were operated to the exact instructions provided by the manufacturers. Oxygen flow was measured using a respiratory monitor (IMT, Switzerland) incorporating an infrared oxygen analyzer and a screen pneumotachograph until oxygen generation ceased. Output of the analyzers was sent to a software program (FlowLab, IMT, Switzerland) for storage and later analysis. External temperature of devices was measured using a thermal imaging camera to evaluate the changes in external temperature, recording a thermograph every minute of operation. A minimum of three of each device were tested. Data was stored on a PC for later analysis. Results: This study demonstrated significant differences in the flow output and duration of oxygen generation between the devices. The emOx canister and the emOx Budi Bag produced little oxygen (mean 1.2 lpm ± 1.2 and 1.3 lpm ± 0.9 respectively). The canister produced a higher peak flow (9.9 lpm vs 5.3 lpm) but had a shorter duration than the Budi Bag (17 vs 21 min). The PPP device had a consistent 6 lpm ± 2.8 flow rate, but also had the highest external temperature of any of the devices (188°C at the metal tip), and could easily cause burns if placed too close to a casualty. The LifeFlo device produced up to 2 lpm of oxygen but had the lowest mean flow (0.8 lpm ± 0.5) and the longest duration (70 min ± 2.8). The ROG had the highest mean flow rate (11.6 ± 3.9 lpm) but had the shortest duration (9 min ± 1.0). The range of duration of oxygen flow among the devices was 9 – 70 minutes. The figure below shows representative flow measurements for a single run with each device. Conclusions: The oxygen flow and duration of oxygen generation was significantly different between devices. The external temperature of the devices can represent a burn hazard. Operators should know the performance characteristics and limitations of these devices.

Sponsored Research - None



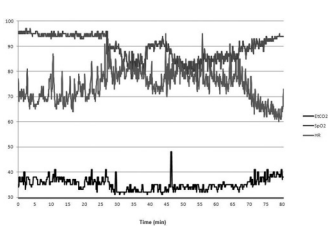
1428678

COMPARISON OF OXYGEN DELIVERY DEVICES FOR REVERSAL OF ALTITUDE INDUCED HYPOXIA IN NORMAL SUBJECTS.

Thomas Blakeman[1], Dario Rodriquez[2], Richard Branson[1]; [1]Department of Surgery, University of Cincinnati, Cincinnati, OH; [2]Center for Sustainment of Trauma and Readiness Skills (CSTARS), United States Air Force, Cincinnati, OH

Background: Hypoxemia secondary to reduced barometric pressure is a complication of ascent to altitude. Current medical operations in support of warfighters in Afghanistan often require ascent to 14,000 feet or more in unpressurized aircraft during evacuation of casualties. Aboard aircraft, oxygen can be delivered using a continuous flow of oxygen from liquid or compressed gas sources or via an oxygen concentrator. We designed a study to compare the reversal of hypobaric hypoxemia at 14,000 feet with continuous flow oxygen from a cylinder and pulsed dose oxygen from a portable concentrator. Methods: Thirty healthy volunteers were randomized to one of three study arms, placed in an altitude chamber and ascended to 14,000 feet (PB 428 mm Hg). Subjects breathed room air for 10 minutes to induce hypoxemia. If the oxygen saturation fell below 82% or at the 10 minute time point oxygen was delivered via a nasal cannula from a cylinder at 1, 2, or 3 lpm of continuous flow for 10 minutes. Then the subjects again breathed room air at altitude for 10 minutes. The equivalent dose of pulsed oxygen from the concentrator (16, 32, or 48 mL) was placed on the subjects for 10 minutes. If needed in order to match the SpO2 while on continuous flow, the pulse dose was increased in steps. Subjects were then returned to sea level. Measurements of SpO2, EtCO2, RR, HR, Hgb, and tissue oxygenation (StO2) were continuously recorded throughout each "flight". Results: SpO2 varied both between and within study arms. The 1 lpm/16 mL arm had the widest SpO2 range: 89% - 99% (mean 93.4 % ± 3.1) and 87% - 97% (mean 91.5% ± 3.4) respectively and was not able to correct hypoxemia (SpO2 ≥ 90%) in every subject. The 2 lpm/32 mL arm range was 95% - 98% (mean 69.8% ± 0.9) and 88% - 96% (mean 92.0 % ± 2.5) respectively. The 3 lpm/48/mL arm was able to correct hypoxemia in each subject (mean 97.7% ± 1.3 and 94.1% ± 2.9) respectively. Figure below shows recorded data from a sample flight. Conclusions: At 14,000 feet, 1 – 3 lpm continuous flow oxygen corrected hypoxemia in all but one subject (SpO2 89%). Although using the concentrator in the 16 mL and 32 mL arms had more subjects with SpO2 < 90%, the increased pulse dose required to obtain SpO2 equivalent to continuous flow was well within the device's capability. Oxygen concentrators may be an alternative to liquid oxygen or cylinders for use by during aeromedical evacuation. Key words: oxygen, hypobaric, concentrator, hypoxemia, aeromedical.

Sponsored Research - None



1432508

AUGMENTED VENTILATION TO IMPROVE ACTIVITIES OF DAILY LIVING-A CASE STUDY.

Kimberly S. Wiles[1], Robert McCoy[3], Toni Brennan[1], Brian Carlin[2]; [1]Klingensmith HealthCare, Ford City, PA; [2]Drexel University, Pittsburgh, PA; [3]Valley Inspired Products, Apple Valley, MN

Introduction: Respiratory insufficiency is a limiting factor for patients with chronic lung disease when performing activities of daily living (ADL). Contributing factors include hypoventilation, perfusion and poor conditioning, thus preventing patients from exercising or performing ADLs. It has been showed that supplying non-invasive ventilation and oxygen during walking could offset some of the functional impairment associated with advanced COPD. A new non-invasive open ventilation system (NIOV™, Breathe Technologies, Irvine, CA), is a 1lb device that can be easily carried and provides both oxygen therapy and ventilation. As part of a pilot study, we evaluated a 79 year old male with Stage IV COPD while performing ADL activities and exercise using his oxygen system followed by the same activities using the NIOV™ system. The severity of his disease has limited the patient's ability to go outside of his home without severe dyspnea, fatigue and fear. The patient was evaluated at home and asked to establish a motivational goal. Baseline information was collected on the patient's status using his current oxygen as well as the NIOV™ system. SpO2, HR, and RR were collected along with Borg, Comfort rating system (CRS) and Fatigue rating systems (FRS) at the beginning, middle and end of the ADL exercise. The same information and activities were recorded after using the NIOV™device for 46 days. After 46 days, ADL activity and exercise remained limited on the patient's oxygen system, but showed improvement on the NIOV™. While using the NIOV™ and performing ADLs and exercise the SpO2 was 3% higher with lower respiratory rates, Borg, CRS and FRS scores. His exercise on the treadmill increased from 8 minutes to 16 minutes. The patient's daily routine now includes a minimum of 15 minutes of exercise with either a stationary bicycle or treadmill. Prior to using the NIOV™, he was unable to exercise and never left his home. Since using the NIOV™, he has been able to resume an active lifestyle and achieve his goal of driving his car and taking walks. Conclusion: Ambulatory augmented ventilation in the home enabled this patient to go from a sedentary lifestyle to an active one. Clinical implications for the therapy are to enable participation in pulmonary rehabilitation as well as resuming ADLs. With the overall improvement in conditioning, SpO2/RR and dyspnea the patient's risk of complications should be diminished.

Sponsored Research - None

Baseline	Unloading Groceries	Walk 4 Points of the Home	Treadmill	Sp02	RR	Borg	CRS	FRS
Oxygen	5 mins	5 mins	none	93-94%	25-26	4	9	7
NIOV	4 mins	13 mins	8 mins	94-97%	26-32	1	1	0
After 46 days	Unloading Groceries	Walk 4 Points of the Home	Treadmill	SpO2	RR	Borg	CRS	FRS
Oxygen	3 mins	7 mins	None	94-95%	28-32	3	3	1
NIOV	4 mins	6 mins	16 mins	95-98%	24-30	1	0	1

1418231

DYSPNEA SCORES AND ACTIVITIES OF DAILY LIVING CAPABILITY AS PREDICTORS OF REHOSPITALIZATION RATES IN A 30 DAY HOME RESPIRATORY CARE PROGRAM.

Brian W. Carlin[1], Dan Easley[2], Kim Wiles[2]; [1]Sleep Medicine and Lung Health Consultants, Ingomar, PA; [2]Klingensmith HealthCare, Ford City, USA Minor Outlying Islands

Abstract Background: The overall 30 day readmission rate for patients who have been hospitalized following hospitalization for a COPD exacerbation approaches twenty five percent in Western Pennsylvania. Predictors for rehospitalization are necessary to help target those patients who are at an increased risk for rehospitalization. Objective: To measures level of dyspnea as related to ADL capability and its impact on rehospitalization rates for COPD exacerbations. Methods: The Discharge, Assessment, and Summary @ Home (D.A.S.H., Klingensmith HealthCare, Ford City, PA) program was implemented for home oxygen dependent patients throughout Western Pennsylvania. The program uses face-to-face visits with a respiratory therapist at days 2, and 30 following hospital discharge. Additionally an enhanced DASH is available for patients who qualify for home health services which incorporates Nursing and OT/PT/RT services over 60 days. Weekly care coordinator phone interviews supplement the respiratory therapy visits during that same time period. The program uses educational, behavioral modification, skills training, oxygen titration during activities of daily life, clinical assessment, and adherence data collection. The 30 day readmission rate for all patients was assessed. Four patient selected activities of daily living were measured at each of the visits. Dyspnea, as measured by Borg scores, was measured post performance of a self selected ADL at the 2 day visit. Assessment of 30 day rehospitalization rate was measured. Results: 192 patients with COPD completed the program over a twenty four month period (January 1, 2010 through December 30, 2011). Overall, 17 (8.8%) patients were readmitted within a 30 day period. 102 of 192 (53%) patients had a Borg score of 3 or greater. Of these 102, 10 (10%) required readmission. The readmission rates for patients who could perform (at the time of the 2 day visit) 4 of 4 ADLs was 6.9%, 3 of 4 ADLs was 12.2%, 2 of 4 ADLs was 4%, 1 of 4 ADLs was 16.7%, and 0 of 4 ADLs was 20%. Combining ADLs and level of dyspnea did not improve prediction of rehospitalization. Conclusions: Performance of only 0 or 1 of 4 ADLs is predictive of a higher risk of rehospitalizaton. Level of dyspnea and ADL performance appear to be independent predictors of risk of rehospitalization

Sponsored Research - Study is part of a program conducted by Klingensmith HealthCare.

1434791

PATIENT-PHYSICIAN APPOINTMENTS FOLLOWING HOSPITALIZATION FOR PATIENTS REQUIRING SUPPLEMENTAL OXYGEN THERAPY: EFFECT ON 30 DAY REHOSPITALIZATION RATES.

Brian W. Carlin[1], Dan Easley[2], Kim Wiles[2]; [1]Sleep Medicine and Lung Health Consultants, Ingomar, PA; [2]Klingensmith HealthCare, Ford City, PA

Abstract Background: The overall 30 day readmission rate for patients who have been hospitalized following hospitalization for a COPD exacerbation approaches twenty five percent in Western Pennsylvania. A patient's appointment with the primary care provider soon after the hospital discharge has been suggested as a means to help to reduce the 30 day readmission rates. Objective: To measure the effect of a patient-physician visit following discharge for patients requiring supplemental oxygen therapy on 30 day rehospitalization rates. Methods: Patients with a COPD exacerbation who required supplement oxygen therapy on hospital discharge were entered into a post-hospitalization transition of care program (Discharge, Assessment, and Summary @ Home,DASH, Klingensmith HealthCare, Ford City, PA). The program consists of face to face visits by a respiratory therapist with the patient in the patient's home on days 2, 7, and 30 following hospital discharge. The visits are supplemented by a series of care coordinator phone interviews. Education, behavior modification, skills training, oxygen titration during performance of activities of daily living, clinical assessment, and adherence data collection are components of the program. The status of a scheduled patient-physician visit within the 30 day period was assessed. Each patient was asked at the day 2 visit about whether a visit was scheduled with the physician within the next month. The 30 day readmission rate for all patients was assessed. Results: 256 patients who required supplemental oxygen therapy completed the program over a twenty four month period (January 1, 2010 through December 30, 2011)(192 with COPD, 24 with CHF, 9 with pneumonia, and 15 with hypoxemia). 109/256 (41%) did not have a physician office visit scheduled within the month. Overall, 17/256 (6.6%) patients were readmitted within a 30 day period. 70 of 192 (36%) patients with a diagnosis of COPD did not have a visit scheduled. Of these, 9 (4.6%) were readmitted within 30 days. For those patients who were readmitted (n=17), 9 (52%) did not have an office visit scheduled. Conclusions: The DASH program resulted in a low number of rehospitalizations for patients with hypoxemia. A significant number of patients who ultimately required rehospitalization did not have a physician office visit scheduled for the first month following hospitalization.

Sponsored Research - Study was conducted by Klingensmith HealthCare

1434830

INTEGRAL ROLE OF HOSPITAL BASED RESPIRATORY THERAPISTS IN THE EDUCATION OF INPATIENTS WITH A COPD DIAGNOSIS.

Amy Wise, Lillian O'Neill; Respiratory Care, BryanLGH Medical Center, Lincoln, NE

Background: COPD has become the 3rd leading cause of death in the United States and the 4th leading cause of 30 day readmissions among Medicare beneficiaries. While focusing on the current readmissions for pneumonia at BryanLGH, it was noted that over 80% of these patients also had a secondary diagnosis of COPD. At BryanLGH Medical Center, the goal: To increase the involvement of the Respiratory Therapists in the education of inpatients with a diagnosis of COPD. Predicted outcome: To decrease readmission rates while also increasing patient satisfaction quality measures. Method: All Respiratory Therapists attended classes with instruction on: 1.) the rationale behind the process, 2.) how to utilize an education standard using the teach back method, and 3.) tools and resources. Established resources consist of care management, pulmonary rehab, palliative care and physician support. Results: Obtaining three outcomes by implementing this process. First, achieve patient satisfaction at the 80th percentile based on the Avatar question, "The respiratory therapist gave me good explanation of my therapy". January 2011 – May 2011, results were 67.12%, January 2012-May 2012, results were 81.44%. Second, decrease the 30 day readmission rate of pneumonia from a FY rate from 20.29% to 15.21%, June 2011 thru January 2012 readmission rate, 17.39%. Finally, to prepare for the reduction in reimbursement based on the 30 day readmission rate of the COPD patients in 2015. Conclusion: In implementing the process of educating the COPD patient, the respiratory therapy staff has felt they made a greater difference in the lives of their patients. Efforts to collaborate with current resources to improve patient's quality of life continue to grow creating a continuum care and reducing readmission.

Sponsored Research - None

1417428

VITAMIN D3 AND THE SEVERITY OF INFLAMMATION DUE TO ASTHMA.

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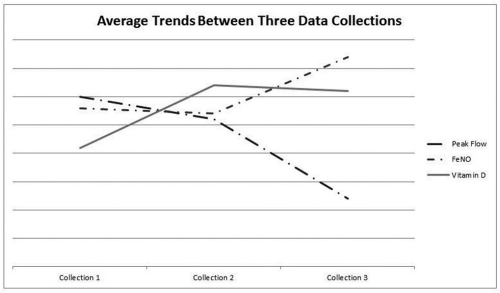
BACKGROUND: Midtown Community Health Center in Ogden, Utah provides healthcare to the underprivileged residents of Northern Utah. Within that population, over 800 patients have a diagnosis of asthma. The purpose of this study is to evaluate the correlation between levels of serum vitamin D3 and the severity of inflammation due to asthma. Previous research shows a correlation between vitamin D3 and decrease sputum eosinophil levels. This study utilizes the technology produced by Aerocrine to measure fraction of exhaled nitric oxide (FeNO). When activated the non-adrenergic noncholinergic system causes a production of nitric oxide (NO) in the airways. Nitric oxide is selectively produced by airway inflammation but is unaffected by bronchoconstriction. METHODS: Midtown Community Health Center assisted in the recruitment of 20 patients between the ages of 8 and 69 with an asthma diagnosis who were also deficient in serum vitamin D3. Over the period of one year, participants supplemented with a standardized amount of vitamin D3 to obtain a target serum level of 50-80 ng/ml. Upon enrollment, participants completed an asthma questionnaire and underwent three tests: fraction of exhaled nitric oxide (FeNO), peak expiratory flow (PEF) and serum vitamin D3. Each of these was then repeated at six-month intervals. The asthma questionnaire was used to assess management of the patient's asthma. Nitric oxide was measured using Aerocrine's NIOX MINO. An average PEF measurement was recorded after three consecutive attempts. Blood samples were taken to Ogden Clinic to be tested for 25-hydroxyvitamin D3 (25-OHVitD) as measured by chemiluminescense. Statistical analysis was performed using T-tests (p=0.01). RESULTS: T-tests concluded that participants showed a statistically significant increase in serum vitamin D3 levels between the initial and final sample collections (T value: 3.113, critical value: 2.878). T-tests for FeNO (T value: 1.356) and peak expiratory flow (T value: 0.020) values did not prove to have a statistically significant change. CONCLUSIONS: There is a lack of statistical evidence suggesting the null hypothesis be accepted. There are multiple limitations to the results of this study. One limitation to the results is previous research suggests that vitamin D does not show physiological effects until blood levels are above 50 ng/ml. Only three of the participants reached that level.

Sponsored Research - Aerocrine allowed us to use a demo unit (NIOX MINO) without charge for our study. We purchased the necessary mouthpiece/filters for the machine. Our study was conducted in full using grant money from two sources—Hall Endowment for Community Outreach and Office of Undergraduate Research (both acquired through Weber State University affiliation).



1429423

USE OF ASTHMA MEDICATIONS AND PEAK FLOW METERS PRIOR TO EMERGENCY DEPARTMENT VISITS, 2009 - 2011.

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BACKGROUND: Uncontrolled asthma results in frequent visits to the Emergency Department (ED) exposing the asthma patient to increased risk and the health care system to increased cost. OBJECTIVE: To survey patients and identify opportunities for improvement of patient self-management education. METHOD: A convenience sample of all patients with asthma diagnosis during the years 2009-2011 were given a questionnaire to collect information on type of drugs taken prior to arriving to the ED, types of drugs being prescribed, if the patient has a peak flow meter (PFM), the number of visits to the ED in the past year for asthma and the severity of their symptoms. Questionnaires were analyzed to determine the following: prior to arrival at the ED which asthma patients took short-acting beta2 agonists (SABA) medications, those who did not take any medication, and those who took their inhaled corticosteroids (ICS) medications. We also looked at the number of visits to the ED and possession of a PFM. RESULTS: Of 386 patients from 2009-2011 for whom we had medication data, 76% took SABA prior to the ED visit compared to 24% who did not take any medications. Less than 1% were taking their ICS. Of 393 patients for whom we had PFM data, those with multiple ED visits were nearly three times more likely to have a PFM than those with no prior visits. (13% vs. 5%). Overall, only 18% of our ED asthma patients own a PFM. CONCLUSION: According to the NHLBI/NAEPP guidelines we have a great opportunity to improve effective, asthma self-management education by improving the consistent and appropriate use of SABA, ICS and PFM. Since we provide asthma education to all ED asthma patients, it is encouraging that those with multiple visits are much more likely to have a PFM.

Sponsored Research - None

Meds Taken Prior to Admission					
	2009	2010	2011	Totals	%Total
No Meds	21	37	33	91	24%
SABA	44	147	101	292	76%
ICS	0	1	2	3	<1%
			Total	386	
Possession of Peak Flow Meter					
	2009	2010	2011	Totals	%Total
Multiple visits with peak flow meter	8	21	21	50	13%
Multiple visits w/o peak flow meter	31	79	62	172	44%
No prior visits with peak flow meter	3	14	4	21	5%
No prior visits w/o peak flow meter	3	75	72	150	38%
			Total	393	

1398139

PROMOTING PHYSICAL ACTIVITY FOR CHILDREN WITH MODERATE PERSISTENT ASTHMA CAN REDUCE ASTHMATIC SYMPTOMS AND OBESITY.

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Abstract: Children with moderate persistent asthma are often reluctant to engage in physical activity and as a result are more prone to obesity and increased incidence of asthma related problems later in life. The purpose of this study was to develop and evaluate a program to enhance physical activity among elementary aged children with moderate persistent asthma. The hypothesis was that with increased physical activity, asthma related symptoms such as wheezing, coughing, and shortness of breath would decline while decreasing the risk of obesity later in life. A quantitative, non-experimental, non-randomized longitudinal design was used to evaluate a pilot program that emphasized physical activity accompanied by asthma management skills. A six week program consisting of two hour sessions per week was implemented. This pilot asthma program was evaluated by comparing asthma symptoms and physical activities partook pre- and post-program in conjunction with quantitative measurements of forced vital capacity (FVC) volume completed on the first and last day of the program. This program that emphasized physical activity significantly improved asthma control among all participants, increased physical activities partaken, and increased the average FVC volume from 1.93 ± 0.30 liters to 2.74 ± 0.37 liters, indicating improved lung conditions. In addition, the participants became more willing to partake in future physical activities, which indicate a significant positive change in their perspectives toward physical exercise. This study shows that enhanced physical activity for children with moderate persistent asthma can reduce asthmatic symptoms and risk for obesity later in life.

Sponsored Research - None

Pre- and Post-Program Asthma Symptoms

	Pre-program frequencies	Post-program frequencies	Significance p < 0.01
Asthma incidences per month			
0-1	2	7	
2-3	5	3	yes*
4-5	2	0	
>6	1	0	
Asthma incidences per week			
0-1	4	8	
2-3	4	2	yes
4-5	1	0	
>6	1	0	
Asthma incidences per night			
0-1	7	9	
2-3	3	1	No
4-5	0	0	
>6	0	0	
Emergency room visits last 3 months			
0-1	8	10	
2-3	2	0	No
4-5	0	0	
>6	0	0	

* p-value < 0.001

1416275

INDIVIDUALIZED SELF-MANAGEMENT ACTION PLAN USING A STEPWISE APPROACH TO AIRWAY CLEARANCE TECHNIQUES AND HOME SPIROMETRY MONITORING IN CYSTIC FIBROSIS. STEP-UP TO BETTER BREATHING (SUBB).

Michael Cantine[1], Paula Lomas[2], Elissa Cohen-Engel[2], Carol Cahill[2], Rebecca Griffith[2], Stanley Fiel[2], Arthur Atlas[3], Rami Bustami[4]; [1]Respiratory Care, Morristown Medical Centner, Morristown, NJ; [2]Department of Medicine, Morristown Medical Center, Morristown, NJ; [3]Goryeb Children's Hospital, Morristown Medical Center, Morristown, NJ; [4]Department of Grants and Research, Atlantic Health, Morristown, NJ

Background: Some chronic disease states use monitoring devices to help manage the disease process: one example would be a glucometer for daily glucose measurement. In cystic fibrosis (CF), the forced expiratory volume in the first second (FEV1) is an important value in the management of CF. Treatment and disease management decisions are made as a result of these values. Individuals with CF do not know their FEV1 value between center visits or how it is impacted by exacerbation or airway clearance (ACT) activities. Objective: This study will provide FEV1 and exacerbation data to the individual on a daily basis. This information provides a foundation to make daily, self-management decisions on how to plan the course of the day in terms of stepping-up ACT and treatment needs. Method: This is an observational study performed over a 2 to 3 month time period between center visits. 44 patients were given a PIKO 6 spirometer as well as exacerbation score (based on the Akron Children's Hospital exacerbation score). The patients were instructed to perform and measure FEV1 daily as well as a self-assessment of exacerbation. These values were documented on their daily log. As a result, if the patient noted a decline in FEV1 or a rise in their exacerbation score, they would step-up their ACT activities. If their exacerbation score reached 3 on a 10 point scale, for more than 3 days or reached 5 on the 10 point scale, they were instructed to call the center and report their data. Results: Pre and post Cystic Fibrosis Quality of Life revised (CFQ-R) scores, exacerbation scores and FEV1 were measured. A post-study questionnaire was performed. The pre and post CFQ-R overall was: 73.34 pre study, 72.01 post study which does not demonstrate a significant reduction in CFQ-R. The mean FEV1 pre study was 2.39 L and post was 2.44 L. No significant change was noted. The mean exacerbation score pre study was 2.66 and post study was 1.87 on a 10 point scale. This represents a 30% reduction in exacerbation score post study. When asked, "I understand and I am able to identify CF pulmonary exacerbation better since I participated in the SUBB study" 19 of the 38 respondents "agreed" and 14 "strongly agreed". Conclusion: Using home spirometry may help to identify early exacerbation in CF. While the results were positive overall, further studies such as a blinded, multi-center study could be accomplished to further investigate results.

Sponsored Research - None

1387579

AN EVALUATION OF THE PEAK PERFORMANCE USA ASTHMA EDUCATION PROGRAM.

Kitty Hernlen, Susan Johnson, Randall Baker; georgia health sciences university, Augusta, GA

Introduction: A 2009 study indicated a need for asthma education for teachers and school staff in the East Central Health District of Georgia. Peak Performance USA (PPUSA), developed by the American Association for Respiratory Care (AARC), is a one hour program designed to educate school personnel about asthma. PPUSA was provided to faculty and staff at two schools in the ECHD. This purpose of this study was to evaluate asthma knowledge of school personnel before and after PPUSA. Methods: Permission was obtained from the AARC to use PPUSA in this study. PPUSA training was provided for teachers by the same instructor at two schools in the fall of 2011. 75 teachers and staff attended the PPUSA education and 37 participated in the study. A True/False 10 item questionnaire based on the contents of the PPUSA program was developed to assess asthma management. The questionnaire was administered before and immediately after the PPUSA presentation. Individual and group results for the schools were compared to determine changes in asthma knowledge. Results: A paired t-test was used to examine whether the total number correct responses on the questionnaire changed after the PPUSA presentation. The paired t-tests indicated that the educational program did improve the overall total number correct on the questionnaire from pre- to post-test by one correct item ($p<0.0001$). To examine change in correct responses in each individual questionnaire item, McNemar's test was used. There was a significant change from pre- to- post test in items 5 (Coughing is a symptom of asthma) and 8 (A peak flow meter is a device that measures how well air moves out of the lungs). Individuals who answered incorrectly at pre-test more likely to answer correctly at post-test. Conclusion: While scores from faculty and staff improved in both schools, our sample size was too small to be conclusive. We propose to expand enrollment of both urban and rural schools to further evaluate PPUSA and assess rural and urban differences and asthma management awareness.

Sponsored Research - W.G. Raoul Foundation

Table 1: Descriptive statistics on adult questionnaire data

Variable	Pre-test	Post-test
Question 1 (n, %)	34, 92%	37, 100%
Question 2 (n, %)	35, 95%	37, 100%
Question 3 (n, %)	37, 100%	37, 100%
Question 4 (n, %)	35, 95%	36, 97%
Question 5 (n, %)	24, 65%	35, 95%
Question 6 (n, %)	29, 78%	34, 92%
Question 7 (n, %)	35, 95%	35, 95%
Question 8 (n, %)	32, 86%	36, 97%
Question 9 (n, %)	37, 100%	37, 100%
Question 10 (n, %)	28, 76%	37, 100%
Total Number Correct (mean, SD)	8.8, 1.2	9.8, 0.5

1417465

ASTHMA MANAGEMENT IN MILLENIAL COLLEGE STUDENTS: ATTITUDES AND PERCEPTIONS OF RESOURCES.

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BACKGROUND: College students are a unique population with specific needs in regards to asthma self-management. During this transition period, adolescents face many challenges that can interfere with their ability to manage their asthma effectively. The purpose of this study was to describe Millennial college students' level of asthma control and their attitudes and perceptions of how well their asthma is managed. METHODS: The study utilized mixed methods of data collection. A survey research methodology was utilized to describe students' perceived level of asthma control and their actual level of control. An email invitation with a link to the electronic survey was sent to all first year students. Students were asked to complete the survey if they were able to self-report a diagnosis of asthma. In addition, those that completed the survey were asked to indicate interest in participating in a focus group designed to describe resources utilized for disease management and additional resources or adaptations necessary to better meet students' needs. RESULTS: 106 students completed the survey. The age range was 18 – 20 years, and 92% lived in on-campus University housing. 63% had well-controlled asthma and 69% of those perceived that their asthma was well-controlled. However, 46% of those that perceived their asthma as well-controlled actually had poorly controlled asthma. This compliments the first focus group finding. Many of the 10 focus group participants revealed that while they perceived their asthma as well-controlled, through the discussion they discovered that they do not have an accurate understanding of asthma control. In addition, access to care and pharmacies covered by insurance was identified as a barrier, as was dealing with environmental changes due to climate, allergen and irritant exposures. CONCLUSIONS: Many college students have well-controlled asthma. However, there are opportunities to better inform students of resources available to them on and around campus for routine and emergency asthma care, and current students have a definite preference for interactive, convenient and accessible information.

Sponsored Research - None

1417339

MAST CELL STABILIZING ACTIVITY OF ETHANOLIC EXTRACT OF PIPER LONGUM LINN.

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Background: The use of herbal medicines is based on traditional healing, and is also influenced by culture. In India, the use of medicinal plants and herbal therapy has been practiced long before recorded history.However, scientific knowledge concerning the uses of medicinal plants in asthmatic disease is very limited. It is likely that some of the plants used have no significant effect on respiratory disorders. In this study, I investigated piper longum, which is traditionally used in India for asthma therapy, and focused our attention on their inhibitory action against histamine release from mast cell. Methodology: The mast cell has long been associated with asthma, since it releases a variety of preformed and newly synthesized mediators that could account for several features of asthma. Among the mediators released from mast cells, histamine is a well characterized and the most potent vasoactive mediator in acute bronchoconstriction. In the present study the ethanolic extract of fruits of piper longum was screened for mast cell degranulation properties. Albino rats were sensitized by horse serum along with triple antigen containing Bordetella pertussis organism. Treatment of drug extract and standard given for 14 days, on the 14th day 3h after the last dose treatment rats were sacrificed and intestinal mesentery was taken for study of mast cell. Histopathology of intestinal mesenteric tissue were also done for the confirmation of mast cell stabilizing activity. Results: In the unsensitized rats, 12.55±1.8% of the mast cells were found to be in the process of degranulation. In the sensitized untreated rats, 80.90±4.65% of the mast cells were degranulating when challenged with the antigen. At the doses used, prednisolone as reference standard were found to inhibit degranulation of mast cells to an extent of 72.25±3.91%, respectively. The ethanolic extract at 200 and 400 mg/kg body weight was found to inhibit degranulation of mast cells to an extent of 57.25±2.96 and 68.34±3.50%, respectively. All the values obtained were highly significant ($P<0.001$,Table 1). Conclusions:The effect of ethanolic extract at two different dose level (200mg/kg and 400mg/kg), markedly protected the rats against antigen induced challenge of mast cell. Preliminary phytochemical analysis showed positive response for flavonoids. Flavonoids are reported as mast cell stabilizer active principle of plant origin.

Sponsored Research - None

Table 1-Mast cell stabilizing activity of ethanolic extract of fruits of Piper longum.

Group	Treatment	Dose(mg/kg body weight	Route of administration	Granulated mast cells(%)(mean Â±S.E.)	Degranulated mast cells(%)(mean Â±S.E.)
I	Control(Tween 80,1%)*	-	Oral	87.44±4.62	12.55±1.80
II	Control(Tween 80,1%)	-	Oral	21.32±1.78	80.90±4.65
III	Prednisolone	10	Oral	72.25±3.91*	28.14±1.34*
VI	Ethanolic extract	200	Oral	57.25±2.96*	40.32±2.70*
V	Ethanolic extract	400	Oral	68.34±3.50*	32.68±2.11*

*Not treated with horse serum and triple antigen.
Values are mean ± S.E.
n=6
*P<0.001(Students t-test)

1392095

METHODS FOR EVALUATING THE PULMONARY EFFECTS OF SWIMMING IN CHLORINATED WATER.

Michael Pajewski[1], Scott T. Dwyer[1], John F. Hunt[1], Alison Montpetit[2], Thomas N. Pajewski[3], Michael D. Davis[2,1]; [1]Division of Pediatric Respiratory Medicine, University of Virginia, Charlottesville, VA; [2]Adult Health and Nursing Systems, Virginia Commonwealth University, Richmond, VA; [3]Anesthiology, University of Virginia, Charlottesville, VA

Background: Chlorine-releasing compounds are the most common sanitizing agents used in swimming pools to help prevent the transmission of infectious diseases by destroying a wide range of potentially dangerous bacteria and viruses. The chlorine that is dissolved in pool water releases gas into the atmosphere. The chlorine gas is concentrated just above the surface of a chlorinated pool and is especially so in indoor pools. Inhaled chlorine gas goes into solution in the airway lining fluid to form hypochlorous and hydrochloric acids. These together cause acidic and oxidative injuries to the cells and proteins of the airway, which can cause pulmonary dysfunction. Objective: We hypothesized that lung function would be adversely affected by swimming because of the inhalation of chlorine and resulting changes in airway chemistry. Methods: After obtaining baseline exhaled breath condensate (EBC) and spirometry, subjects swam for 2.25 hours (6,250 – 7,300 yards). Immediately following the swimming session, EBC and spirometry were re-obtained. Nitrite (NO2-), nitrate (NO3-), and gas-standardized pH levels were measured in EBC. Results were analyzed using paired t-test. Results: All subjects (5 male, 1 female, age 15-17 years) have tolerated the study without adverse events of any kind. pH, NO2-, and NO3- were measurable in EBC of all subjects. No statistically significant changes occurred in spirometry, EBC pH, or EBC NO3-. EBC NO2- increased by a median of 0.441 μM and approached statistical significance (p = 0.057). Conclusion: Preliminary data suggests a possible increase in EBC NO2- after exercising in chlorinated water. Our ongoing subject enrollment will further define this issue, which may result in a better understanding of the impact of chlorinated water on lung function.

Sponsored Research - None

Mean EBC and Spirometric Values Pre/Post Swimming

	Mean Pre-Exposure	Mean Post-Exposure	p
EBC pH	6.70	6.88	0.831
EBC NO2- (μM)	0.44	0.854	0.057
EBC NO3- (μM)	0.614	0.334	0.404
FEV1 (L)	4.47	4.31	0.218
FVC (L)	5.656	5.523	0.851
FEV1/FVC	0.798	0.797	0.957

1432199

IMBALANCE OF TH17/TREG CELLS IN MICE WITH CHRONIC CIGARETTE SMOKE EXPOSURE.

Huaying Wang[1], Weidong Peng[1], Yuesong Weng[2], Huajuan Ying[1], Hequan Li[3], Dajing Xia[4], Wanjun Yu[1]; [1]Department of Respiratory Diseases,,Affiliated Yinzhou Hospital,College of Medicine, Ningbo University, Ningbo, China; [2]Clinical Laboratory, No. 1 Hospital, Ningbo, China; [3]Department of Respiratory Diseases, First Affiliated Hospital, College of Medicine, Zhejiang University, Hangzhou, China; [4]Institute of Immunology, School of Medicine, Zhejiang University, Hangzhou, China

Background: Recent studies have revealed that autoimmune responses mediated by CD4+ T cells may contribute to the development of chronic obstructive pulmonary disease (COPD). Meanwhile, imbalance of Th17/Treg has been reported to play a key role in the pathogenesis of autoimmune diseases. However, information on Th17/Treg balance in COPD is quite limited. Method: We established a mouse model of COPD induced by chronic cigarette smoke (CS) exposure. Th17 and Treg in lung tissue and peripheral blood were quantified by flow cytometry. The level of the specific transcription factors of both T cell subsets in lung tissue were determined by real-time PCR. The expressions of Th17- and Treg-related cytokines in serum and bronchoalveolar lavage fluid (BALF) were measured by enzyme-linked immunosorbent assay (ELISA). Results: We found that mice with chronic CS exposure showed significant increase in lung Th17 prevalence, retinoic acid orphan receptor (ROR)-γt mRNA and Th17-related cytokines (IL-17A, IL-6 and IL-23). Meanwhile, there was obvious decrease in Treg cells prevalence, Forkhead box (Fox) p3 mRNA and Treg-related cytokine IL-10, as compared to mice underwent sub-acute CS exposure and air-exposure. Similar tendency was also found for the Th17/Treg ratio in peripheral blood. Conclusions: Our study thus reveals that the Th17/Treg imbalance exists in mice with chronic CS exposure, suggesting its potential role in the breakdown of immune self-tolerance in COPD. Further research on regulation of Th17/Treg balance may provide insights into the development of new therapeutic targets for this disease.

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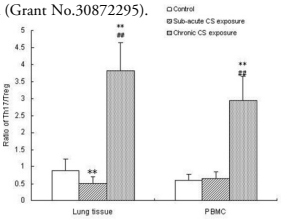

The ratio of Th17/Treg in lung tissue and peripheral blood. There was a significant increase in the ratio of Th17/Treg in lung tissue and peripheral blood in mice with chronic CS exposure compared with control and sub-acute CS exposure mice. Values were shown as mean ±SEM of twenty mice per group. * p < 0.05 and ** p < 0.01 versus control group; # p < 0.05 and ## p < 0.01 versus sub-acute CS exposure group.

1416767

ASTHMA CLASS INTERVENTION FOR FAMILIES OF CHILDREN HOSPITALIZED WITH ASTHMA.

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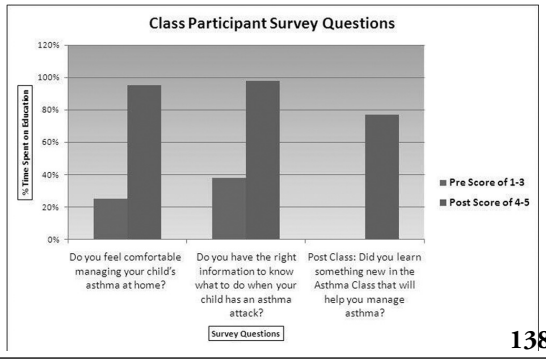
Background: The asthma educational process typically provides education at the bedside by the Respiratory Therapist (RT). This approach leads to variable content and can consume considerable RT time. To improve consistency, an Asthma Class was provided prior to hospital discharge. We hypothesize that an Asthma Class will improve patients/caregivers' comfort and preparedness in managing asthma at home, while reducing time spent by the RT with caregivers; thereby, leading to cost savings. Methods: The Asthma Class was given by the Asthma Coordinator every other week day. The RT reviewed only the individualized Asthma Action Plan prior to discharge. Structured surveys were given to all attendees before the class (pre) and directly after the class (post). RT time spent on education with participants/nonparticipants was documented to permit comparisons of time-savings and crude estimates of cost-savings. Difference in proportion, Wilcoxon tests, and Mann-Whitney estimates of effect size (ES) were computed using Stata 11.2. Results: Between 02/2011-02/2012, 320 caregivers and/or parents responded to the survey. Caregivers taking the class reported: Greater comfort managing asthma at home (p<0.0001; ES=0.42); believed they know what to do during an asthma attack (p<0.0001; ES=0.53); believed that they learned something new about asthma management (p<0.0001; ES=0.98). Documented time spent by the RT with caregivers and patients decreased by an average of ~3 minutes (p<0.0001; ES=0.41). RT consults after the classes were on average $1.24 per patient less than those of patients/caregivers that did not attend a class. Conclusion: The Asthma Class has proven to be successful in reducing RT time and effectively delivering asthma education to patients/families. Additional study is needed to measure the full benefits of classes to include improved patient outcomes, improved patient quality of life, and other potential benefits

Sponsored Research - None



1384160

IMPROVED CLINICAL, HEALTH, AND FINANCIAL OUTCOMES FROM A REGIONAL ASTHMA DISEASE MANAGEMENT PROGRAM.

Melinda S. Shuler[1,2], Susan Sutherland[2], Amy S. Trees[2,1], Terrence F. Smith[2,1], Daniel J. Grady[2,1], Donald W. Russell[1]; [1]Regional Asthma Disease Management Program, Mission Hospital's, Asheville, NC; [2]Respiratory Care Services, Mission Hospital's, Asheville, NC

Background: A Regional Asthma Disease Management Program (RADMP) was implemented for rural Western North Carolina (WNC) to address the needs of minority children. The program provided services to Native American, African American, and Hispanic children with suboptimal access to care. A multi-faceted approach was used helping families build skills to connect them with community resources for asthma education. Children and families were given care and education in homes, childcare centers, and schools. Collaborators included the NC Asthma Program, Asthma Alliance of NC, WNC School Systems/Child Care Centers, NC Department of Health and Human Services, NC Department of Environmental and Natural Resources, WNC Primary Care Providers, Cherokee Indian Hospital Authority, Faith-Based Organizations, Satellite Clinics, Sub-specialists, and school nurses. **Methods**: RADMP provided clinical assessment, spirometry, exhaled NO, PFM monitoring, and a symptom diary. Patient ed consisted of the pathophysiology of asthma, identification of triggers, avoidance measures, identification of early/ late warning signs of an asthma exacerbation, and patient empowerment to self-manage. Medication review, assessments, and recommendations were made based on the EPR-3 NHLBI guidelines. An individualized Asthma Action Plan was implemented. Environmental assessments of the patients' home and school/childcare setting were completed. Communication of pertinent information to physicians, families, school nurses, and others was completed. Program outcomes were determined over a two year period by comparing costs and clinical outcomes before/after program intervention. The program was structured with a staggered enrollment of fifty patients (n=50). **Results**: The program resulted in decreased ED visits by 94%, and ED visit cost avoidance of $ 142,006. Hospitalizations decreased by 95%, with a charge avoidance of $687,477. PFT results improved by 21%. Eosinophilic inflammation decreased by 3.4%. Average missed school days decreased by 47%, **Conclusions**: A regional, pediatric, asthma disease management program resulted in decreased ED costs, hospitalizations, school absences, eosinophilic inflammation, and improved lung function measures. This program improved access to asthma disease management services for minority pediatric patients in WNC. This program won first place in the EPA 2012 National Environmental Leadership Award for Asthma Management, Health Care Provider.

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1399140

THERAPIST DRIVEN PROTCOLS IMPROVE PATIENT OUTCOMES.

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Background: Therapist driven protocols (TDPs) have been demonstrated to reduce misallocation of respiratory therapy and cost of care. In limited patient populations, TDPs have proven to reduce hospital length of stay and ICU length of stay. We implemented airway clearance (AWC), lung volume expansion (LVE), and bronchodilator (BD) protocols in 2008 and monitored the effect on various patient outcomes through December 2011. Methods: The protocols were approved by our institution for use on all adult inpatients, except those diagnosed with Cystic Fibrosis (CF) or those who were post lung transplant. For the first 24 hours after a provider's order, therapy was administered based on the original provider's order unless an "assess and treat" order was input by the provider. After the first 24 hours of therapy or within 4 hours of receipt of an assess and treat order, a specially trained therapist performed a protocol assessment. The protocol assessment and algorithms were programmed into branching logic software which drives protocol decisions. Several new therapy procedures were offered in the post protocol phase including high frequency chest wall compression, mechanical insufflation-exsufflation, CPAP Hyperinflation therapy, and use of a breath actuated nebulizer. Results: Pre and post protocol outcome measurements included hospital length of stay (LOS), ICU LOS, Ventilator Days, and average number of treatments received per patient. Pre-protocol patients (n = 1051) included any non-CF or non-lung transplant patients who received short acting bronchodilator, airway clearance, or lung volume expansion therapy during the two years prior to protocol implementation. Post protocol (n = 3,452) patients demonstrated a significant reduction in LOS (21.3 +/- 20.4 vs 16.4 +/- 16.2 days, P < 0.0001), ICU LOS (12.4 +/- 15.5 vs 9.4 +/- 12.8 days, P < 0.0001), and ventilator days (10.1 +/- 11.0 vs 8.3 +/- 10.3 days, P < 0.0001) while the average number of treatments per patient was unchanged for both AWC/LVE (24.2 +/- 26.3 vs 24.6 +/- 31.5 therapies, P 0.74) and BD protocols (37.4 +/- 49.5 vs 37.6 +/- 56.0 therapies, P 0.92). Conclusion: Therapist driven protocols at our institution directed via branching logic software produced a significant improvement in patient outcomes while providing a similar number of treatments per patient when compared with physician directed care.

Sponsored Research - None

1432757

THE EFFECT OF COMPLETION OF AN OUTPATIENT PULMONARY REHABILITATION PROGRAM UPON THE RATE OF HOSPITAL READMISSION.

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BACKGROUND Chronic Obstructive Pulmonary Disease (COPD) is the fourth leading cause of death in the USA and Europe. COPD readmissions to hospitals have historically caused economic burden, which is increasing. It has been reported that patients who complete pulmonary rehab programs may experience a decrease in hospital readmissions due to education received regarding the COPD disease process, exercise during program sessions, and proper training regarding energy use while performing activities of daily living. The purpose of this study was to determine if a pulmonary rehabilitation program is associated with changes in hospital readmissions for these patients. The specific hypothesis was that patients discharged from the hospital with a diagnosis of COPD who complete an outpatient pulmonary rehab program will have fewer hospital readmissions than those who do not complete the program. METHODS Data were obtained using a retrospective chart analysis of patients with a primary diagnosis of COPD from Hillcrest, Euclid, and South Pointe hospitals between January 2010 and December 2011. Inclusion criteria were all patients discharged with a primary diagnosis of COPD. Rehabilitation program completion was defined as attending all of the sessions approved by physician prescription or limited by insurance payment. Partial completion was defined as attendance to some but not all of the sessions approved by physician prescription or limited by insurance payment. Program non-participation is defined as those patients who did not participate in the program. Patients were divided into two groups: Group 1 as completers and Group 2 as partial completers/non-participants. Readmission rates for the two groups were compared with a Chi-square test, with P < 0.05 indicating significance. RESULTS Records of 192 patients were reviewed using the ICD-9 codes relating to COPD. Of the 192 patients, 75 participated in and completed pulmonary rehab, 37 started but did not complete the program, and 80 did not participate in the program. The readmission rate was significantly less for those patients who completed the program (0/75 vs. 15/117, P = 006). CONCLUSIONS Hospital readmission rates were significantly less for those who participated in and completed a Pulmonary Rehab program when compared to partial completers/non-completers. Referral to a Pulmonary Rehabilitation program for patients diagnosed with COPD is recommended. Further studies are suggested to confirm results.

Sponsored Research - None

1448298

USE OF ROUTINE SCREENING TOOLS FOR EARLY IDENTIFICATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE IN PRIMARY CARE PRACTICES: A RANDOMIZED CLUSTER DESIGN CLINICAL TRIAL.

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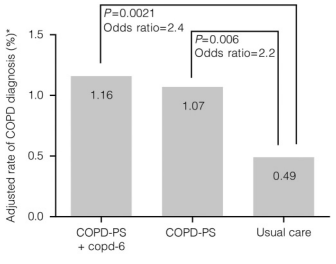
Background: COPD is the third cause of death in the US. COPD prevalence is largely underestimated, as many individuals only seek medical help at the latter stages of disease, when symptoms are intolerable. Although primary care physicians are in a key position to identify symptoms early, make a diagnosis, and instigate treatment, it is estimated that 56–85% of subjects are undiagnosed. The COPD-Population screener (COPD-PS), a validated five-item screening tool, identifies at-risk subjects. Also, use of hand-held spirometric devices, such as the copd-6, is advocated for case-finding in subjects with airway obstruction. The SEARCH trial was designed to determine if routine screening could bridge the gap between diagnosed and undiagnosed COPD cases in real-life primary care settings. Method: This prospective, cluster-randomized, controlled trial included 168 primary care sites in nine US regions. Sites were randomized to three arms that evaluated the effectiveness of the COPD-PS alone (Arm 2) or in combination with the copd-6 (Arm 1) vs usual care (Arm 3). Sites were blinded to the other arms and did not receive extra training on COPD diagnosis. Subjects, aged ≥40 years, attending a scheduled visit were consecutively recruited. Subjects completed the COPD-PS (Arms 1 and 2 only) and those with scores ≥5 performed the copd-6 (Arm 1 only). The screening results were given to the primary care physicians. The primary endpoint was a new diagnosis of COPD by the primary care physicians within 8 weeks of the initial visit, as documented in the subject's medical records. Results: 8770 subjects with no prior diagnosis of COPD: 2871 (Arm 1); 2999 (Arm 2); and 2900 (Arm 3) were included in the study. 119 subjects had a new COPD diagnosis within 8 weeks of initial visit: 52 (Arm 1); 45 (Arm 2); and 22 (Arm 3). Comorbidities were more frequent in subjects with vs without a prior COPD diagnosis. Rates of new COPD diagnosis within 8 weeks of initial visit were statistically significantly higher in both Arms 1 and 2 vs Arm 3 (Figure). Combined use of the COPD-PS and copd-6 resulted in the highest rates of new COPD diagnoses vs usual care. Conclusions: This is the first prospective study demonstrating the effectiveness of screening tools that increased COPD diagnosis in a real-life setting using a randomized control approach. The two intervention arms were effective in increasing the rate of diagnosed COPD cases compared with usual care, which may aid earlier diagnosis.

Sponsored Research - Boehringer Ingelheim Pharmaceuticals, Inc.

Pfizer Inc

Figure. Comparison of intervention arm effects on new diagnosis of COPD



*Adjusted for regional effects and any primary care site clustering effect as a result of the trial design

1434134

FLEXIBLE FIBEROPTIC BRONCHOSCOPY: VENTILATION MONITORING USING INTEGRATED PULMONARY INDEX VERSUS STANDARD MONITORING PROCEDURES.

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Background: Conscious or moderate sedation is common practice during invasive procedures. The best approach to monitor ventilation is end-tidal carbon dioxide (EtCO2). EtCO2 provides a noninvasive, "real-time" measurement of a patient's ventilation. The purpose of this study is to investigate if the IPI decreases during bronchoscopy before physician or staff directed intervention, and to determine if EtCO2 remains unaltered from a baseline before the procedure to when the bronchoscope is at the level of the vocal cords. Methods: This was an observational study with no blinding and was conducted at Rush University Medical Center, Chicago. Subjects provided written consent before their procedure to be enrolled in the study. Eight patients were enrolled in the study but complete data was collected only during 6 bronchoscopies. Microstream bite blocks were used to monitor subjects and deliver oxygen. The alarms were silenced on the Microstream 20 monitoring device so physicians would not be alerted. Results: The mean age of the participants was 53.8 years-old, with the youngest 29 years-old and the oldest 83 years-old. Four subjects had a minimum IPI below 3 and there was no need for intervention. The lowest recorded EtCO2 value throughout both pre-procedure and procedure period was 0mmHg. The greatest decrease in EtCO2 from pre-procedure to during procedure was from 45mmHg to 25mmHg. EtCO2 decreased during two procedures after the scope was inserted and increased during four. A complete list of observed vital signs and alarm activation can be found in the attached table. Conclusion: Practitioner intervention occurred twice during all 6 procedures combined. These interventions were not preceded by a low IPI reading. Practitioner interventions included increasing oxygen flow to the subject, terminating the procedure to place the subject on a non-rebreather mask, and delivering a dose of versed in response to agitation and increased pulse rate. EtCO2 values did fluctuate from before insertion of the bronchoscope to after.

Sponsored Research - None

Silenced Urgent Alarm Activation During Procedure

	Alarm set values	Subject 3	Subject 4	Subject 5	Subject 6	Subject 7	Subject 8	Total
Length of Procedure (min)		6	38	13	11	9	19	96
EtCO2 HIGH	60 mm Hg	0	0	0	0	0	0	0
EtCO2 LOW	25 mm Hg	4	49	19	2	6	32	112
RR HIGH	30 breaths/min	4	0	0	0	0	0	4
RR LOW	6 breaths/min	0	1	0	0	0	5	6
NO BREATH	20 sec lapse	0	21	0	0	0	19	40
SpO2 HIGH	100%	0	0	0	0	0	0	0
SpO2 LOW	90%	1	0	0	0	0	0	1
PR HIGH	120 beats/min	5	0	0	0	1	0	6
PR LOW	50 beats/min	0	0	0	0	0	0	0
IPI LOW	3	0	0	0	0	0	0	0
CO2 NOT AVAILABLE		0	1	0	0	0	0	1
SpO2 NOT AVAILABLE		7	1	0	0	2	0	10

1414125

COMPARATIVE RESPIROMETER STUDY FOR VOLUMETRIC ACCURACY ACROSS A PHYSIOLOGIC RANGE OF FLOW RATES.

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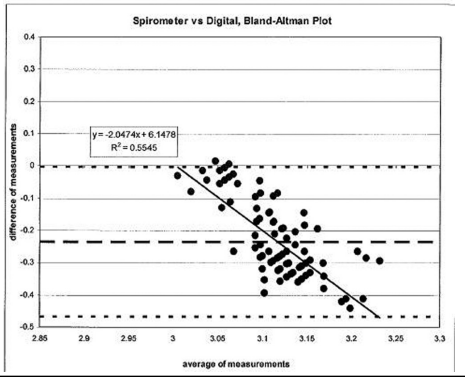
Background: The frequent need to assess exhaled volume for non-ventilated patients is conveniently met with volumetric devices called respirometers, which have been in use for decades. Having now both mechanical and electronic variants of these devices, it was desired to validate their accuracy and to understand their limitations to best apply them in the clinical context of non-invasive ventilatory assessment. Method: The study was conducted with an experimental apparatus consisting of three in-line volumetric devices: the Wright Respirometer (Wright Model 4,Nspire,Inc), a Digital Respirometer (Anesthesia Associates, Inc. Model 00-295), and a calibrated spirometer. Ninety-nine serial three- liter syringe volumes where delivered through the devices at a variety of flow rates in representative physiologic ranges, and the volume from each device, as well as a mid-expiration flow measurement (FEF25-75), serving as proxy for the mean flow rate, were recorded. Mean error and standard deviation was assessed for the instruments in their overall response, and also separately in low-flow and high-flow ranges. Results: Both devices suffer from a drop off in sensitivity at low flow rates, especially under 1.2 LPS. Although the Wright displays a mean error of about 0%, the large 8.1% confidence interval (95% CI) allows for large deviations around that mean, while the digital device, with a smaller 6% CI, demonstrates a much larger fixed bias (mean error) of 5%. In the higher flows, there is a much more linear response, with the Wright displaying a high precision of volumetric determination (1.6%CI), with a fixed bias (mean error) of about 5%. In the same range the digital device disappointingly demonstrates a fixed bias of almost 10%, with imprecision almost twice as large (3.4%CI) as the Wright. Conclusion: Successful application of these respirometers in the clinical context may be achieved only by application of a fixed correction factor, of about 5% for the Wright, and about 10% for the Digital, with the assumption that the measured flowrates over the expiratory phase typically exceed 1.2-1.5 LPS.

Sponsored Research - None



1395094

SHELF LIFE AND GAS CONCENTRATION STABILITY OF SUPERSATURATED DISSOLVED OXYGEN SOLUTIONS AT REDUCED TEMPERATURE.

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Background: Although dissolved oxygen has been considered insignificant when compared to hemoglobin during blood oxygen transport, hyperbaric medicine studies have shown that dissolved oxygen alone may sustain life in the absence of hemoglobin when hyperbaric levels of dissolved oxygen exist in plasma [1]. Supersaturation and hyperbaric levels of dissolved oxygen in fluid may be achieved by (1) increasing the partial pressure of gas exposed to the fluid, (2) increasing the solubility of the fluid for gas solvation by decreasing fluid temperature, and (3) varying combinations of increased pressure and decreased fluid temperature. The objective of this study was to determine the length of time that hyperbaric tensions of dissolved oxygen are maintained in fluid following supersaturation. **Methods**: A supersaturated dissolved oxygen solution was prepared by bubbling 100% gaseous oxygen at 3 L/min through 2.5 liters of sterile water for 20 minutes at a temperature of 43 degrees F = 6 C. Ambient oxygen percentage was controlled by means of a gas blender/ flowmeter. After 20 minutes of bubbling oxygen gas in the liquid, the oxygen flowmeter was turned off. The temperature of the sterile water solution remained constant at 43 degrees F and was regulated by circulation of ice water refrigerant via coiled tubing within the experimental solution using a novel hyperbaric tonometer. Solution temperature and the dissolved oxygen concentration (mg/L) were measured at 15 minute intervals. A total of 22 measurements were made. Dissolved O2 concentration in solution (mg/L) was measured by a Hanna Instruments HI 98186 dissolved oxygen analyzer. Measurements were made under conditions of ATPS. **Results**: Following supersaturation of the liquid at 55 degrees F, the dissolved oxygen concentration remained stabel at 50 mg/L (the upper limit of the analyzer) for more than 4 hours as shown in the graph. **Conclusions**: This study demonstrates that a supersaturated dissolved oxygen solution, contains greater than atmospheric partial pressures of dissolved oxygen, remains stable, and retains high dissolved oxygen concentrations for extended time periods. Although gaseous oxygen bubbled through water appears to the naked eye to bubble out of solution, liquid water retains extremely high dissolved oxygen partial pressures in a stable solution, when the temperature of the solution is decreased and maintained as a cold solution.

Sponsored Research - None

1. Bassett BE and Bennett PB. **Introduction to the Physical and Physiological Bases of Hyperbaric Therapy**. Hyperbaric Oxygen Therapy. Undersea and Hyperbaric Medical Society, Bethesda, MD1988, p. 15.

1408631

MEASUREMENT OF BLOOD GAS CHANGES AND ARTERIOVENOUS OXYGEN CONTENT DIFFERENCE FOLLOWING INJECTION OF COLD SUPERSATURATED DISSOLVED OXYGEN SOLUTION IN VITRO.

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Background: Mixing supersaturated dissolved oxygen solution, (which contains dissolved partial pressures of oxygen greater than 900 mm. Hg) with arterial blood, will increase blood oxygenation *in vivo* [1]. The objective of this study was to evaluate blood gas changes and the arteriovenous oxygen content differences following injection of equal volumes of cold supersaturated dissolved oxygen solution into arterial and venous blood samples in a swine model. **Methods**: The supersaturated dissolved oxygen solution was prepared by bubbling gaseous oxygen at 3 L/min through 1.0 liter of Lactated Ringers solution, at a temperature of 49 degrees F = 9.4 C for 20 min using a novel hyperbaric tonometer. The dissolved O_2 of the supersaturated solution was 42 mg/L, as measured by a Hanna Instruments HI 98186 Dissolved Oxygen analyzer; which converts to 1050 mm Hg. The supersaturated dissolved oxygen solution (2.5 ml) was mixed with 2.5 ml. arterial and venous blood samples; and both of the mixed samples were re-analyzed using an IL Gem Premier analyzer. An arterial and venous blood sample were obtained from a single swine following line placement and stabilization on mechanical ventilation. **Results**: The injection of 2.5 ml of cold (49 F = 9.4 C) supersaturated solution into 2.5 ml arterial and venous blood samples produced the following results: **Changes in arterial blood**: 1. $PaCO_2$ decreased by 29 mm. Hg. = 59%. 2. PaO_2 increased by 437 mm. Hg. = 455% 3. SaO_2 increased by 2.0%. 4. CaO_2 increased by 1.58 vol%= 18%. **Changes in venous blood**: 1. $PvCO_2$ decreased by 33 mm Hg = 60% 2. PvO_2 increased by 185 mm Hg = 462%. 3. SvO_2 increased by 26% = 35% 4. CvO_2 increased by 2.7 vol% = 43%. **Changes In the C(a-v)O2 difference**; 1. There was a decrease of 1.41 vol% in the $C(a\text{-}v)O_2$ difference, which equals a decrease of 44%, when $C(a\text{-}v)O_2$ baseline is compared to $C(a\text{-}v)O_2$ difference following injection of supersaturated dissolved oxygen solution. **Conclusions**: When arterial and venous blood samples are mixed with equal volumes of supersaturated dissolved oxygen solution, substantial increases occur in PaO_2, SaO_2, and Oxygen Content in both arterial and venous blood samples. Further, the arterio-venous oxygen content difference decreased by approximately 44%. Additional research is necessary to determine blood gas changes following (1) a bolus injection and (2) continuous IV infusion of supersaturated dissolved oxygen solution.

Sponsored Research - The study was supported by a partial grant from Outcome Solutions, LLC.

1. Stone et al. Effect of Supersaturated Oxygen Delivery on Infarct Size After Percutaneous Coronary Intervention in Acute Myocardial Infarction. **Circulation, American Heart Association, October 2009,** pp 366-374.

1403772

NITRIC OXIDE DELIVERY IN MRI USING AN ADAPTED INOMAX®DSIR SYSTEM.

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Background: Inhaled Nitric Oxide (iNO) is a potent pulmonary vasodilator FDA approved for use in term or near term neonates with hypoxemic respiratory failure. It is also widely used for various off label applications. The INOmax®DSIR (Ikaria) is the standard device for iNO delivery and has not been cleared for use in MRI. MRI utilizes a strong magnetic field which poses a safety risk as metal objects are attracted to the magnet and may be pulled into the scanner at high rates of speed. MRI may interfere with function of medical equipment and electronic equipment may create artifact affecting the quality of images.Method: The complete INOmaxDSIR system was scanned for ferrous metal content which was found in components of the stand as well as the INOmax® cylinder cap. Both the INOmaxDSIR & INOblender® were removed from the stand and secured on a MRI safe stand. The cylinder cap with ring was removed from the cylinder and the regulator attached outside the MRI suite. Following preuse check, the system was rescanned for ferrous metal content before being moved into the MRI room and placed behind the guass line. The Injector module and sample line were placed in line with the SERVO-I MRI safe ventilator (Marguet) utilizing standard ventilator circuits. A test lung was attached to the wye. The DSIR contains a 6 hour battery so was not connected to AC power to prevent artifact in MRI images. Standard brain MRIs were run on a Siemens Avanto 1.5 Tesla scanner. Ventilator parameters and imaging was varied to mimic neonatal, pediatric, & adult patients. NO dose was adjusted to 5, 10, 20, & 40ppm. All alarms were set at standard levels. The INOmax DSIR system and SERVO-i were monitored for delivery accuracy, along with function of alarms, monitors, and infrared device. MRI images were monitored for artifact. The INOblender was also tested at doses of 5, 10, 15, 20, 30, & 40ppm.Results: Artifact was not noted on the MRI images. The INOmaxDSIR & INOblender functioned within specifications (no variability) at all NO doses and ventilator settings. No variances in alarm function, monitoring, or infrared system were noted on the INOmaxDSIR.Conclusions: The INOmaxDSIR & INOblender were deemed MRI conditional at our institution when placed on a MRI safe stand with removal of ferrous metal components. This system has been used successfully on patients undergoing cardiac, brain, & neck MRIs without issues. Additional testing is required for use with systems >1.5 Tesla.

Sponsored Research - None

1417427

COMPARISON OF GAS CONSUMPTION OF THE ISPIRA EMERGENCY RESUSCITATION DEVICE VERSUS THE SELF INFLATING BAG DURING RESUSCITATION.

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Background: Changes in resuscitation guidelines strongly recommend breath consistency to prevent hyperventilation. Self inflating bags have been the standard device typically used in non-infant resuscitations. Portable manual resuscitators can be used to provide consistent pressure while frequency is guided by cues from a timing device. Both types of resuscitation devices utilize an external gas source to provide supplemental oxygen. The purpose of this study was to compare the gas consumption of a new manual resuscitator versus the "gold standard" self inflating bag in pediatric and adult simulated patients. Methods: A new manual resuscitator prototype: the Ispira Emergency Pulmonary Resuscitation Device (Neoforce, Ivyland, PA) is a manual ventilation system that incorporates a switch within the resuscitation mask that can be manually triggered to deliver pressure control ventilation to either pediatric or adult patients at suggested set flow rates. The Ispira high-pressure hose was attached to an E-cylinder of oxygen containing 2200 PSI. A proprietary breathing circuit was attached to the Ispira resuscitator with a size 5 valved mask that was clamped to another size 5 resuscitation mask (Medline Industries, Mundelein, IL) that connected to the BC Biomedical Infant Smart Lung with compliance at 5 ml/mbar and a resistance 5 L/sec. The system was tested for leaks. The "CPR Nome" was set for 10 breaths per minute (BPM) and the resuscitator flow was set to 36 lpm to achieve a set pressure of 30 cm H20 per manufacturer's recommendations. The "CPR Nome" timer was set at the beginning of the study. The study was conducted using three E cylinders: manual breaths were delivered until the tank was depleted and the preset pressure was no longer reached. The average tank duration for a self inflating bag was also calculated in separate testing based on a standard 8 liter per minute flow rate. Mean PSIG used per hour, number of cylinders used per hour and cylinder ratio were compared in both devices. Results: Average PSIG used per hour, number of cylinders used per hour and cylinder ratio comparing both devices are displayed in the table below: Conclusion: Despite requiring a set flow that was 3.5 times higher, the Ispira Emergency Pulmonary Resuscitation Device conserves gas and only consumed 33% more oxygen per cylinder than the standard self inflating bag.

Sponsored Research - None

Delivery Device	Flow Rate	PSIG / hour	Cylinders/ hour
Ispira	36 lpm	2357	1.07
	36 lpm	2163	1.02
	36 lpm	2200	1.0
Self Inflating bag	8 lpm	1714	0.78

1418167

EVALUATION OF MANUAL VENTILATION USING THE ISPIRA PEDIATRIC AND ADULT PULMONARY RESUSCITATION DEVICE.

Kathleen Deakins, Nancy Johnson, Timothy Myers; Pediatric Respiratory Care, University Hospitals Rainbow Babies & Children's, Cleveland, OH

Background During adult resuscitation, frequencies and tidal volumes typically exceed those recommended by the AHA. Excessive ventilation is associated with poor clinical outcomes after cardiopulmonary arrest. Manual ventilation devices may provide constant ventilation pressures and reduce over ventilation. The purpose of this study was to evaluate precision and accuracy of pressure delivery during manual ventilation using a resuscitation device. Methods The Ispira Emergency Pulmonary Resuscitation Device (Neoforce, Ivyland, PA) is a prototype device that incorporates a manual trigger switch on a mask that when depressed, initiates a manual breath at a target PIP. Size, 2, 3, 4 and 5 masks (#1) were individually connected to the valved end of a proprietary breathing circuit with the cushion side opposing the cushion of a matching size resuscitation mask (#2)(Medline Industries, Mundelein, IL). Masks were clamped together to simulate a mask/airway interface. The second Medline mask connector was attached to an Infant Smart Lung (BC Biomedical, St. Louis MO) with compliance at 5 ml/mbar and a resistance 5 L/sec. As adaptortor with two pressure ports connected the Medline resuscitation mask (#2) and the test lung. Pressure ltubing was connected to the Breath Tracker (Sechrist Industries, Anaheim, CA) to observe the PIP readings with each manually delivered breath. A second line was attached to the BioMed M-10 monitor (Biomed, Guilford, CT) for digital recording of PIP. A CPR Nome timer on the Inspira was set to 10 bpm to audibly cue the caregiver to trigger manual ventilation. Inspiratory time was observed at 1.0 sec on the Breath Tracker. The Inspira was preset to flow rates and PIP for each size mask and circuit. The resuscitator was cycled 50 times per circuit/mask. PIP was recorded in cmH20 from the monitor. Accuracy in achieving targeted PIP was evaluated as mean standard error (error=mean measured value / target value). Mean values for standard error were compared using a paired t - test for each mask: statistical significance set at $p < 0.05$.Results There was a significant difference in PIP compared to target in all but one mask. The data below summarizes measured mean PIP values with standard deviations, error in the table below: Conclusion: PIP delivered with the Ispira Resuscitator was accurate but not precise except for the Size 4 mask. While differences in PIP occurred in all but one mask, it is within a clinically acceptable range.

Sponsored Research - None

Mask size	Flow rate liters/minute	Targeted pressures cmH20	Measured pressures cmH20	Mean Standard Error	p value
Size 2	4	18	19.7 + 1.0	1.7 +0.9	0.0001
Size3	6	18	19.1 + 1.1	1.1 + 1	0.0001
Size4	20	18	18.3 +1.3	0.3 + 1.3	0.0882
Size 5	36	30	34.3 + 0.5	4.4 + .5	0.0001

1431065

EVALUATION OF THREE EDI CATHETER SIZES AND TIME TO INSERTION IN ADULT MECHANICALLY VENTILATED PATIENTS.

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BACKGROUND: Respiratory physiologic monitoring and neurally adjusted ventilatory assist (NAVA) are possible during mechanical ventilation with insertion of an electrical activity of the diaphragm (Edi) catheter (Maquet, Sölna, Sweden). Subjective clinician opinions suggest that there is a difference in catheter insertion time based on catheter size (Fr). As part of an ongoing assessment of NAVA, we tested the hypothesis that there is no difference between Edi catheter size and insertion time. METHODS: 50 adult patients between the ages of 31 and 88 (Mean = 60.1 ± 12.1) were conveniently sampled prospectively for catheter insertion based upon need for NAVA. Catheter sizes included 8 Fr/125 cm, 12 Fr/125 cm, and 16 Fr/125 cm. Catheters were inserted by senior level RRTs. Insertion time started when the catheter was inserted into the patient's nare. Time was stopped when an Edi signal was visualized on the ventilator's (Servo I; Maquet, Sölna, Sweden) catheter positioning screen. SPSS version 20 (Chicago, IL) was used to apply a Kruskal-Wallis Test to determine if there was a statistically significant difference between catheter size and insertion time. Alpha level was set at .05. Informed consent was waived by the IRB. RESULTS: 50 catheter insertions were attempted. 68% of catheters were 16 Fr/ 125 cm (n = 34), 26% were 12 Fr/125 cm (n = 13), and 6% were 8 Fr/125 cm (n = 3). The 16 Fr/125 cm catheter mean rank = 24.49; 12 Fr/125 cm catheter mean rank = 28.58; 8 Fr/125 cm mean rank = 23.67; $\chi 2 = .84$; $P = .66$. CONCLUSION: There is no statistically significant difference between catheter size and insertion time. Larger studies should evaluate if there is a difference between insertion time and the number of attempted insertions with the addition of a catheter stylet.

Sponsored Research - None

1382395

EFFECT OF FOUR DIFFERENT T LOW SETTINGS ON FOUR DIFFERENT ETCO2 MONITORS.

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John Newhart, Elsie Collado Koman, Richard M Ford, UC San Diego Medical Center San Diego CA. Background: At our institution Bi-level or APRV are used as a lung protective strategy. Staff has noticed that when incorporating very short expiratory phases, the ETCO2 readings in many cases would decrease. While some changes may be attributed to the impact of respiratory physiology, we sought to examine breath mechanics as reasons for the decrease. We devised a bench top study to examine the impact of decreasing e-time on ETCO2 readings, while CO2 production was held constant. Methods: Test were performed using 4 different ETCO2 monitors: Phillips NICO, Oridion Microcap, Phillips Intelivue with an Oridion module, and a GE Datex S5 with gas module. We assembled a two chambered TTL with lift bar. One chamber was ventilated (master chamber) with 0% CO2 and the other (slave chamber) was being moved by the lift bar. CO2 production and ETCO2 was modeled by filling the slave chamber with a constant concentration of CO2 from a mechanical blender. The result being the different sampling lines and sensors were exposed to zero percent CO2 on inspiration and a fixed concentration of CO2 on expiration thus simulating a patient being mechanically ventilated. A Puritan Bennet 840 ventilator was set to drive the master chamber using Bi-level at pressure at a P-Low of 0 and a P-High of 15, at a RR of 14. The Expiratory Time or Time-Low was set at each of the following 2.16, 1, 0.5, and 0.25 seconds. Measures of ETCO2 were recorded on each setting. Results: The capnograms displayed on each device resembled that of typical respired CO2 pattern and ETCO2 readings displayed. As indicated in the table, all four monitors displayed a decrease in ETCO2 as Time Low was sequentially decreased, ranging from an average of 36 mmHg to that of 13 mmHg at the lowest expiratory time. Conclusion: In our bench model, very short expiratory (T low) times corresponded to decreased displayed ETCO2 readings in all devices. It does appear that shortened expiratory times in using Bi-Level breath patterns may either limit alveolar emptying or that there is some other property related to device sampling/response that limits CO2 readings. Further evaluation is necessary; however clinicians should be aware of this issue when evaluating ETCO2.

Sponsored Research - None

ETCO2

T low	2.16	1	0.5	0.25
Oridian	34	29	21	11
Phillips	37	31	26	12
Datex	39	33	26	14
NICO	32	27	24	14
Avg.	35.5	30	24.5	12.75

1429727

A CASE OF DERECRUITMENT AND RECRUITMENT OBSERVED WITH ELECTRICAL IMPEDANCE TOMOGRAPHY.

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INTRODUCTION: Electrical impedance tomography (EIT) monitors regional lung ventilation via an electrode chest belt measuring impedance. EIT displays a functional tomograph image similar to a CT-scan slice of the chest which is viewed as a live video usually at 20 frames per second. We conducted an IRB approved blinded study of EIT on ALI/ARDS patients (EIT Evaluation Kit 2, Draeger Medical, Luebeck Germany). The following case was a patient in our observational study. CASE SUMMARY: A 78 year old male presented as a result of a motor vehicle crash. Patient had B/L pnuemothorax, aortic & chest contusion and pelvic fractures. Patient required a splenectomy and developed ARDS by day 3 of admission. EIT monitoring was performed on day 7 of admission after informed consent. On day 7 of admission, patient had been weaned to PSV 8 cmH2O, PEEP +5 cmH2O and FiO2=35%. Patient RR was < 20. Patient was placed on routine spontaneous breathing trial (SBT) by protocol, PSV 5 cmH2O with PEEP+5 cmH2O. After 30 minutes on the SBT, patient was noted to have RR > 30, increasing dyspnea and desaturation to 84%. Patient was increased to PSV 12 cmH2O, PEEP+12 and FiO2 50% over about 15 minutes of observation. Patient RR decreased below 20, dyspnea was relieved and SpO2 increased > 95%. The EIT device was monitoring the patient during this time, although caregivers were blinded. Observation of the EIT data by investigators revealed the derecruitment of the left posterior quadrant of the patient's lung while on the SBT and recruitment of that quadrant after settings were increased (see the figure). SBT attempts were made on subsequent days and the patient continued to have desaturation events.A tracheostomy was placed on day 17 of admission and tracheostomy trials were initiated. The ventilator was discontinued on day 34 and patient was discharged home on day 40. DISCUSSION: This case demonstrates a patient recovering from ARDS who derecruited a large portion of posterior lung area while receiving an routine SBT. Once the caregivers noticed signs of decompensation (increasing RR & dyspnea with desaturation), support was increased (PSV and PEEP). EIT demonstrated the recruitment of the posterior lung area that had derecruited on the SBT. EIT could play a future role in monitoring recruitment and derecruitment in patients at risk for derecruitment and atelectasis.

Sponsored Research - None

1429372

COMPARISON OF PREDICTED AND MEASURED CARBON DIOXIDE PRODUCTION FOR MONITORING DEAD SPACE FRACTION DURING MECHANICAL VENTILATION.

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BACKGROUND The assessment of pulmonary dead space to tidal volume fraction (Vd/Vt) has been used as a predictor of extubation success. It is a useful tool in titrating PEEP during mechanical ventilation and has been used as a predictor of mortality in acute lung injury (ALI) patients. Siddiki et el (Critical Care 2010;14(4):R141) have modified the Harris Benedict equation to estimate CO_2 production as a basis for calculation of Vd/Vt. These authors noted that there has been no comparison of estimated with measured CO_2 production ($V'eCO_2$). The purpose of this pilot study was to compare Vd/Vt values calculated from estimated and measured values for $V'eCO_2$. **METHODS** After obtaining informed consent, the following data were collected at the bedside; age (years), height (cm) weight (kg) sex, diagnosis, and body temperature (degrees C). A NICO monitor (Philips Healthcare) was used to measure $V'eCO_2$ and calculate Vd/Vt. Minute ventilation (V'e) was obtained from the ventilator (PB 840, Covidien) as an average of 10 breaths. An Arterial Blood Gas was drawn at the same time and results entered into NICO. The following equations were used for manual calculation: $Vd/Vt = 1-[(0.86 \times estV'eCO_2)/(V'e \times PaCO_2)]$ where V'e is the expired minute ventilation (from the ventilator) $estV'eCO_2$ is the estimated CO_2 production est $V'eCO_2$ = (predHB x hf x 0.8)/6.8644 where predHB is the predicted resting energy expenditure (Harris Benedict): predHB females = 655.1 + (6.56 x weight) + height – (4.56 x age) predHB males = 66.45 + (13.75 x weight) + (5 x height) – (6.76 x age), hf is a metabolic correction factor; 1.13 per degree C over 37 degrees, 1.2 for minor surgery, 1.35 for major trauma and 1.6 for severe infection. **RESULTS** Data for Vd/Vt values are illustrated in the figure (shows inter-quartile range and median). There was no significant difference between Vd/Vt values calculated from measured and estimated values for $V'eCO_2$ (0.44 vs 0.52; P = 0.327). However, the small sample size resulted in a low power (0.054). **CONCLUSIONS** Based on these preliminary data, a larger sample size might reveal a significant and clinically important difference in calculated Vd/Vt values. Furthermore, estimating $V'eCO_2$ based on relatively constant parameters (eg, weight and height) may not be appropriate when using Vd/Vt for dynamic medical decisions like ventilator management. Further research is warranted.

Sponsored Research - None

1416282

EVALUATION OF TWO COMMERCIALLY-AVAILABLE HEATED HUMIDIFIERS FOR T-PIECE RESUSCITATION IN THE DELIVERY ROOM.

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BACKGROUND: Newborns have difficulty regulating their core body temperature immediately after birth. Radiant warmers are used to aide in the stabilization of an infant's core body temperature in the delivery room. Unheated inspired gas (25 sC) from a compressed gas outlet used to power T-piece resuscitators in the delivery room may contribute to the challenges of maintaining consistent core body temperature in the desired range. The purpose of this study was to determine if heated inspired gas delivered by a t-piece resuscitator could be rapidly achieved using two commercially-available humidification systems. METHODS: An Ohmeda 3300 Infant Warmer System (Ohmeda Medical, Wauwatosa, WI) was preheated at 100% power setting to obtain a measured temperature at 33sC. The heated wire 900RD110 Humidified Resuscitation System (Fisher /Paykel, Auckland, NZ) was attached to the MR850 Humidifier and the NeoPIP manual resuscitator (Neoforce Inc. Ivyland, PA). A MediChoice digital thermometer was placed at the t-piece of the circuit to measure the temperature delivered to the simulated patient. The NeoPod T humidification system (Westmed, Tuscon AZ) was filled with 20cc of sterile water was placed on the radiant warmer and attached to the manual resuscitator circuit. A NeoPIP circuit was attached to the NeoPod T and the NeoPIP. The MR850 was set in the invasive mode while the NeoPod T was set to 36°C. The time to reach measured distal temperatures of 34°C and 36°C at the patient wye were evaluated in triplicate for each setting using a stop watch. Mean time to reach temperature for the two systems was compared using an unpaired t-test. RESULTS: Mean values, standard deviations and p values for both humidifiers are displayed in the table below: CONCLUSION: The heated wire 900RD110 Humidified Resuscitation System achieved desired temperatures significantly faster than the NeoPod T. The NeoPod T warm-up time to reach a stabilized targeted temperature is not sufficient for heating inspired gas under a radiant warmer in a delivery room situation.

Sponsored Research - None

Commercial Heater	MR900RD110 Humidified Resuscitation System (minutes: seconds)	NeoPod-T (minutes: seconds)	P value
34°C	2:30 +/- 0:20	4:23 +/- 0:30	p<0.0001
36°C	16:09 +/- 5:40	24:06 +/- 7:00	p<0.0001

1431182

EDUCATIONAL INVENTIONS TO IMPROVE CLINICIAN DOCUMENTATION.

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Intoduction: Timely and accurate documentation is extremely important to enhance shift communications and review sequencing of clinical events. Accurate documentation is the cornerstone of being able to evaluate the patient's progress and assess the patient's response to clinical interventions. Another importance of proper and timely documentation is the legal ramification. To meet the above objectives, our department require that two SBAR (Situation, Background, Assessment, Recommendation) notes. One note is to be documented at the start of each shift and one at the end of the shift. Documentation can occur between notes if warranted. Methods: To examine our practice of documentation, we collected fifty random pre/post assessment notes. We reviewed the notes to assess if they contained the elements of SBAR as required. Post assessment, we provided SBAR format reviewed during our mandatory educational days, the completion of an on-line learning module, and attendance at a documentation presentation provided by our Legal/Risk Management Team. Results: Post education the improvement in SBAR documentation increased from seventy to ninety percent. Individualized and content focus education was conducted and currently our documentation scores are being maintained above ninety percent on a monthly basis. (Table 1) Conclusion: The importance of content education and vigilant monitoring insures precise and appropriate staff documentation. Precise documentation helps to provide clear clinical goals and helps optimize patient outcomes.

Sponsored Research - None

SBAR Note Results

	#Notes	S	B	A	R	%Correct
Pre-Ed	50	37	35	35	33	70%
Post-Ed	50	47	48	45	50	90%

1351626

IMPLEMENTATION AND EVALUATION OF A VOLUMETRIC DIFFUSIVE RESPIRATOR EDUCATION PROGRAM.

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Background: The Volumetric Diffusive Respirator (VDR) is a precise, synchronized, high and low frequency time cycled ventilator. A change in one ventilator setting affects other settings simultaneously. Use of this ventilator requires increased knowledge, skill, and training. A decision was made to initiate a small VDR user team to maintain consistent language and standard practice, and to observe patient safety goals. 14 staff members were selected as VDR user team. 7 staff members traveled to Sandpoint, Idaho for additional training at Forrest Bird compound. Traditional and kinesthetic learning methods were chosen to instruct user team. Method: From materials received at training, power point presentations covering topics of VDR setup, ventilator overview, and management strategies, were created for hands on workshops. A VDR simulation program was developed to assess use of consistent language and standard practice. The scenario, based on an actual patient requiring VDR for secretion removal after failing oscillator with nitric oxide, included arterial blood gas results requiring interventions and setting changes. One qualified observer utilized a 35 item checklist, including technical and non-technical skills, to evaluate participant performance. A 17 question evaluation survey was distributed via Zoomerang online software to all who attended the simulation. Survey sample contained 10 VDR user team members. Results: All 10 VDR user team members completed the survey. 70% (30% strongly agree, 40% agree) of respondents felt more prepared to set up the VDR in clinical after simulation. 77% (33% strongly agree, 44% agree) felt clinical performance skills with the VDR improved. 70% (30% strongly agree, 40% agree) were more confident suggesting the VDR in clinical after simulation. 66% (33% strongly agree, 33% agree) were more confident choosing/changing VDR settings. 77% (33% strongly agree, 44% agree) found critical thinking skills associated with VDR strategies improved. 80% (30% strongly agree, 50% agree) thought the VDR simulation was appropriately challenging. 90% (30% strongly agree, 60% agree) considered the VDR simulation a positive learning experience. Conclusions: Simulation training is a challenging, positive, and effective learning method to increase knowledge and skills for the VDR.

Sponsored Research - None

1417289

A SURVEY OF RESEARCH ROLES AMONG RESPIRATORY THERAPISTS.

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Background While research is critical to respiratory therapy, little attention has been given to the role of respiratory therapists (RTs) in conducting research. To better understand the prevalence and spectrum of roles of RTs in research, a survey of RTs has been designed and administered. Methods The study was deemed exempt from consent by the Cleveland Clinic Institutional Review Board. An invitation to participate in the study was sent electronically to members of the American Association for Respiratory Care (AARC) via AARConnect (the AARC's social and professional networking site) on May 21, 2012. Subscribers to the AARConnect Help Line (N = 50,018), Management Specialty Section (N=1,847) and Research Roundtable (N=78) were invited to complete the brief survey (14 questions) regarding whether they have participated in a research role and if so, what role and to what extent. The survey was administered between May 21 and June 1, 2012. Results A preliminary analysis of responses (between May 21 and May 25, 2012) revealed 70 respondents, of whom 39 (56%) completed the entire survey. Respondents practiced respiratory therapy in 23 unique states. Of the 69 active RT respondents, 26 (38%) reported being currently involved in research activity, 24 (35%) had been involved in research in the past but not currently, and 19 (28%) reported never being involved in any research activity. Thirty one (79%) played a role in research as an RT, 25 (64%) as a co-investigator, 17 (44%) as a principal investigator, and 15 (38%) as a research coordinator. Thirty three (85%) conducted research in a hospital inpatient setting and 7 (18%) conducted outpatient research. Of the 39 who fully completed the survey, 18 (46%) dedicated less than 10% of their time to a research activity in a typical month. Conclusions To our knowledge, these represent the first and broadest survey of RTs to ascertain research roles. The results suggest that a large minority (38%) of RTs do have a research role. Limitations of this study include possible biases related to small sample size, self-selection of respondents, and self-reported data. To expand the sample and complement the AARConnect population, an additional emailing of the survey to all RTs included in the Ohio Respiratory Care Board list is planned.

Sponsored Research - None

1415569

RESPIRATORY PROGRAM DIRECTOR LEADERSHIP IS IMPERATIVE FOR SUCCESSFUL PROGRAM OUTCOMES. OR IS IT?

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Background: All organizations require leadership in order to be successful. In respiratory education, the program director as the leader is responsible for overseeing program curriculum development, organization, administration, review, and accountability of program outcomes as established by CoARC. Purpose: The purpose of this study was to discern the relationship between the directors' leadership style and program outcomes. Method: Program directors leadership styles were measured by the Multifactor Leadership Questionnaire (MLQ). Program director, faculty and program demographics were compiled with a researcher-designed questionnaire. CoARC accredited program directors (n=321) and their full and part-time faculty (n=172) received an e-mail requesting participation in the study with a web link to obtain demographic information. Faculty members received an e-mail from Mind Garden, Inc. with a web link to complete the MLQ. Results: This study found that none of the predictor's transformational, transactional, and passive/avoidant leadership styles were significant predictors of program outcomes ($p > .0125$). Furthermore, this study found no moderation effects of program director years in current position on the relationship between program director's leadership style, program completion rate and RRT exam pass rate ($p > .05$). Conclusion: There are many factors that influence program outcomes (i.e. teaching style, quality of student, admission criteria, faculty effectiveness, program funding, and other resources). Program director leadership behavior is only one of those many factors. Regardless of this study's findings, the ultimate responsibility for accountability of the program rests on the director.

Sponsored Research - None

1401347

IMPROVING THE ONLINE ORIENTATION DOCUMENTATION PROCESS.

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INTRODUCTION: One of the roles of RT clinical preceptors is to evaluate the competency of new hire orientees. At UC San Diego the preceptor evaluates and documents progress through completion of a set of forms that reside on the medical center I-Share network. This process allows all preceptor to access information related to orientee progress and areas in need of improvement. Although well intended, we observed preceptors compliance with documentation using I-Share was in need of improvement. Reasons included the process of multiple logins and difficulty in navigating the site and forms libraries. We elected to select a new on-line tool and measure the impact on documentation compliance. METHOD: We change the evaluation forms from being available on a password protected word document based form available on SharePoint to designing a web based set of entry forms that can be accessed by clicking a link. This eliminated the need for multiple logins required by the preceptors in order to process the forms. The web based program consists of a formstool database where the data is collected and allows for ease of review for preceptors, clinical specialist, and education coordinator. We also conducted meetings instructing preceptors on the new forms available. We collected data from original on-line Share Point orientation documentation site and cross reference it with new on-line web based evaluation forms and database. The number of online evaluations completed during one month period was recorded prior to making the on-line web based form available. The number of responses was recorded again after the new on-line forms were made available. RESULTS: DISCUSSION: The data reflects an 18% increase in online orientation documentation compliance since the new web-based forms were implemented. CONCLUSION: The data reflects an improvement in online orientation documentation in response to various actions taken in order to facilitate the availability of electronic forms. Easy access to evaluation forms in conjunction with increase awareness and instruction added to the preceptors increase in compliance. This demonstrates the importance of continuous evaluation and the refinement of processes associated with charting, documentation, and staff/preceptors communication.

Sponsored Research - None

Online Orientation Documentation Compliance

Pre-Implementation	64%
Post Implementation	82%

1417640

EDUCATIONAL INTEVENTION TO IMPROVE MDI AND DPI PROFICIENCY AMONG RESPIRATORY THERAPISTS.

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BACKGROUND: At a rural hospital, I noticed frequent readmissions, improper frequency of medication and duplication of medication. At the bedside there was improper inhaler technique. This observation led me to believe there is a need for education of proper inhaler technique. OBJECTIVE: To evaluate the overall knowledge of MDI and DPI techniques among respiratory therapists in a rural community hospital using a single, on-line, self-directed educational session. METHODS: A heterogonous group of twelve credentialed practitioners were given a pre-test and post-test related to MDI and DPI techniques. Each participant was given a unique identifier for anonymous data analysis, with each practitioner servicing as his/her own control. After taking a pre-test with open-ended questions, each practitioner was directed to review a brief, on-line, multi-media educational presentation. After two weeks, the participants were re-tested with the same open-ended questions to analyze their retention of knowledge. There was 100% participation in the pre- and post-test process. The data was collected and analyzed using McNemar and Chi-Square tests with an Alpha of 0.05. RESULTS: The comparison of scores on the paired samples statistics indicates significant improvement in mean scores: MDI (23%) and DPI (43%). All practitioners showed improvement in retention on post-test scores. The three key steps for MDI technique that demonstrated the greatest improvement were: mouth seal, breath hold and wait between actuations. The four key steps for DPI technique that demonstrated the greatest improvement were: exhale away from the mouthpiece, hear capsule vibrate, breath hold and exhale away from the mouthpiece. CONCLUSIONS: The data analysis suggests credentialed respiratory therapists in a rural community hospital lack proper MDI and DPI techniques. A single, on-line, self-directed educational session demonstrating proper MDI and DPI technique is useful in improving MDI and DPI post-test scores. Annual proficiency testing using the on-line tool could be beneficial in retention of knowledge of proper MDI and DPI techniques and positively affect patient outcomes.

Sponsored Research - None

1417665

ASSESSING COMFORT LEVELS IN PRECEPTING NEW HIRES.

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INTRODUCTION: As experienced clinicians preceptors serve as role model during and after the new hire orientation process and are of critical importance in the education and socialization process. With the knowledge acquired during orientation the new hire becomes empowered to make decisions and take action to benefit patient care. In our institutions new preceptors are required to attend initial training where they are introduced to the various roles and responsibilities. We were interested in finding if our preceptor training program was of value in preparing clinicians for this role. METHOD: We conducted a survey at two San Diego hospitals. A total of 128 individuals were asked to indicate their level of comfort in six areas using a rating scale of; 1 Not Comfortable, 2 Comfortable, and 3 Very Comfortable. Percentages of responses in level were compared. RESULTS: DISCUSSION: The data reflects a variation in preceptors comfort level with their various roles and responsibilities. Regarding communications, evaluation, facilitating, and critical thinking less than 20% indicated they were not comfortable. Lesson mapping appears to be the area with the greatest opportunity for improvement where 42% of preceptors do not feel comfortable. CONCLUSION: This information provides good guidance in deciding where to focus education and training. Future training programs will provide additional focus on both conflict resolution and lesson mapping. Although a similar survey was not conducted prior to preceptor training, we can assess that the majority of preceptor feel capable regarding these key skills that are part of training curriculum. We will continue to use surveys as a tool to refine and improve preceptor comfort with this important role.

Sponsored Research - None

PRECEPTORS COMFORT LEVEL

	Not Comfortable	Comfortable	Very Comfortable
Lesson Mapping	42%	38%	20%
Conflict Resolution Skills	23%	51%	26%
Communication Skills Skills	13%	36%	51%
Evaluation Skills	16%	51%	32%
Facilitating Skills	19%	51%	30%
Critical Thinking Skills	14%	36%	50%

1417606

WHAT'S IN YOUR EDUCATIONAL PORTFOLIO? AN IMPLEMENTATION OF CONTINUING PROFESSIONAL DEVELOPMENT MODEL.

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Staff development and ongoing continuing education are an important aspects for all medical professionals. Professional development through ongoing education, provides both enhancement in clinical services and promotes staff satisfaction and retention. Historically, Respiratory Care departments have struggled to develop programs that are both time and cost efficient while being flexible to accommodate individual learning styles. To better meet the continuing education needs of our staff, we developed a multifaceted Continuous Professional Development (CPD) program which supports educational development through individualized learning modules. Methods: Respiratory Care educational leadership at the University of Michigan Medical Center developed a multifaceted, modular program approach to ongoing staff educational competencies. That original program was modified to meet the needs of the Pediatric Respiratory Care department at C.S. Mott Children's Hospital (UMHS). Staff implementation took place in the fall of 2010. Results: Survey of staff satisfaction was conducted after 8 months of operation (Year 1) and again 12 months later (Year 2) to determine ongoing satisfaction. The comparative results for staff survey responses (Year 1 compared to Year 2) are presented in Figure 1. Conclusions: Survey results demonstrate a substantial reduction in staff satisfaction with this educational model between Year 1 and Year 2. Several factors have been identified which may have contributed to the decrease in staff satisfaction. Most significant of those factors may have been related to the following: 1) Opening of new Children's hospital 2) Hiring of 45 new staff over past 12 months

Sponsored Research - None

Category	Survey Questions	Year 1	Year 2
1	Rate the ease of use of the CPD modular (portfolio) program	7.3	7.4
2	How well does the CPD program allow you to tailor your educational pursuits to those topics in which you are interested?	8.15	6.4
3	How well do the different categories in the CPD program allow you to learn in a method that suites you best?	7.45	6.2
4	Do you feel that your knowledge base has improved since the implementation of the CPD program?	7.2	4.5
5	If the CPD program was not in place, how active would you be in attempting to expand your knowledge base?	7.6	5.5
6	Overall, how satisfied are you with our new CPD program?	7.6	6.4

Scoring in each category is based on a linear scale ranging from 1 (low) to 10 (high). Values for Year 1 and Year 2 represent median responses per category.

1417784

TEACHING HEALTH CARE PROFESSION STUDENTS WITH INTERACTIVE VIRTUAL MEDICAL LABORATORIES IN SECOND LIFE.

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BACKGROUND: We used a 3D 0n-line virtual animation platform "Second Life" to develop a simulated blood gas laboratory. This open source technology supports creation of virtual classrooms and real-world simulations that are accessible via the internet. The purpose of this project was to teach students how to assess sample acceptability and to run simulated blood gas evaluation and interpretation. METHODS: The Second life project was devolved in several stages: Stage 1(Design Phase): Define learning objectives /determine learning hierarchy, develop instructional & presentation strategies. Stage 2 (Development Phase): program the virtual simulation and perform prototype/usability testing. Stage 3 (Formative Evaluation): Collect additional data for assessing usability Stage 4 (Implementation Phase): Pilot test design with student users to determine areas that need revision. Stage 5 (Evaluation Phase): Pre and post tests are analyzed to evaluate student learning success; in addition student's reflections on the project are evaluated. We utilized the 2nd Life platform to teach our students how to correctly receive the sample using personal protective equipment, verify two forms of sample identity, accept or reject the blood sample, perform the blood gas test, and evaluate/interpret the results. For the software evaluation process we divided the class into subgroups of 3 students each. Students took turns performing pre-analysis, analysis, and post analysis. The virtual laboratory utilizes several techniques including: visual simulation, student and instructor live chat stream, an interactive selection menu that incorporates supplies selection and a decision tool, and an email system for student communication with instructors. Post simulation surveys indicated that students liked the teaching platform and found the teaching tool very interesting. CONCLUSIONS: Virtual online training allows students from all healthcare disciplines to practice laboratory blood gas skills to gain efficiency and competency prior to entering the clinical setting. This training tool helps to decrease the amount of training time required by students in the teaching lab and the amount of time spent in the hospital clinical setting. In adding the simulation setting lowers the cost of supplies and personnel time.

Sponsored Research - None

1418531

ESTABLISHING THE EFFECTIVENESS OF TEACHING BMV TO ENTRY LEVEL RT STUDENTS: A COMPARISON OF TRADITIONAL AND SIMULATION ENHANCED TRAINING METHODOLOGY.

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Background: Managing the airway by bag mask ventilation (BMV) is one of the basic skill requirements for a respiratory therapist as put forth by the American association of respiratory care. [1] There is a paucity of research that reports the effects of simulation enhanced training for respiratory therapists. The purpose of this quantitative and qualitative study was to determine if a simulation enhanced education activity is more effective for training techniques of BMV than traditional lecture in a population of entry level respiratory therapy students. Methods: IRB approval was secured for this study. A prospective randomized waitlist controlled study design was used. After baseline assessment was complete the study volunteers were randomly selected into the intervention and control arm. The intervention consisted of PowerPoint lecture supported with video followed by demonstration with part task trainers. Time was built in for the learners to engage in focused repetitive practice supported by timely feedback. Following the intervention a post assessment was conducted. Assessment data was collected via a cognitive test, an affective survey and psychomotor skills check list conducted in a high fidelity simulation center. After the study was complete the control group was offered the intervention. Results: There was no difference between Group A and B pre/post cognitive scores. There was no difference between the groups affective self reported assessment pre/post. The psychomotor skills test results for Group A pre assessment had a mean of 16% (0-62%) and a post mean of 79% (61-92%) showing a 64% improvement in proficiency compared to group B pre mean of 40% (1-92%) and post 49% (15-77%) showing a 10% improvement. Conclusion: Learners that participated in a simulation enhanced training activity performed better than learners who received traditional didactic lecture alone on the psychomotor skills assessment.

Sponsored Research - None

1416534

ASTHMA EDUCATION FOR CHILDREN IN A RURAL SETTING: GARNERING SUPPORT AND PARTICIPATION FROM AREA SCHOOLS.

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BACKGROUND: Cox Monett Hospital, Monett Missouri received a five year grant from the Missouri Foundation for Health in August 2009 to provide Asthma Education to school age children in the rural Missouri counties of Barry and Lawrence. The grant had not sufficiently met objectives with regard to the expected number of participants during the first two years of its life. Objective 2 of the Grant agreement states: "By the end of the project, at least 2000 students will receive education and awareness of asthma within the school system and the community." For the purpose of this comparison we looked at ways of improving participation of the number of schools and the number of children in order to increase active enrollment in Asthma Education classes and meet our objective. METHODS: Direct comparisons were made between the first year, (August 2009-July 2010), second year, (August 2010-July 2011), and third year to date, (August 2011-March 2012). Analysis of the following parameters were completed: (1) number of schools participating; (2) number of screening questionnaires completed; (3) number of students receiving education and awareness of asthma; (4) number of students actively enrolled in Asthma Education classes. During the third year an incentive "Lunch and Learn" program was initiated to enhance greater participation in completing screening questionnaires from students, teachers and schools. RESULTS: Comparisons were made between years one, two and three resulting in the following outcomes for each of the years respectively. Table I shows Parameter (1): 3, 6, and 15 schools. Parameter (2): 139, 361, 788 completed questionnaires. Parameter (3): 0, 0, 1181 students. Parameter (4): 22, 7, 102 active enrollees. CONCLUSIONS: These findings document the need for finding a niche and filling a need by working closely with support staff in the schools to develop relationships necessary to allow the program to thrive.

Sponsored Research - None

Objective 2 of the Grant states: "By the end of the project, at least 2000 students will receive education and awareness of asthma within the school system and community".

1384585

THE USE OF A VIDEO LEARNING MODULE FOR OXYGEN THERAPY INSTRUCTION.

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BACKGROUND: Although oxygen therapy is a fundamental modality routinely performed by respiratory care practitioners, many situations arise in which oxygen administration is provided by other health care professionals. Research suggests that routine education needs to be provided to those health professionals to ensure proper administration of oxygen therapy. The aim of our work was to evaluate the use of a video learning module about oxygen therapy that was developed by a senior respiratory care student for the purpose of educating health professionals. The indications for oxygen administration; signs and symptoms of hypoxia and proper delivery of oxygen by five of the most common oxygen devices were presented in this video presentation. We hypothesized that participants completion of this video learning module about oxygen therapy, would show a significant improvement in their knowledge about oxygen therapy. METHODS: A video learning module was presented to a class of twenty-five medical terminology students. An 18 question pre-test was completed prior to the video presentation and then the same questions were asked after viewing the video learning module. Pretest scores were compared to post test scores. RESULTS: A paired-sample t test was used to compare the differences between the mean pretest and post test scores. The mean pretest was 44.8% (SD=0.14), and the mean on the post test was 62.1% (SD=0.15). The mean gain from pretest to post test was 17% (SD=0.15). The increase in participants' scores was statistically significant ($t(24) = -5.705$, $p<.05$). CONCLUSIONS: The results of this study suggest that a video learning module can improve the participants' knowledge related to oxygen therapy. Further research is needed to determine if this video learning module for oxygen therapy could be translated into other languages for use in other countries.

Sponsored Research - None

1418400

RESPIRATORY ARREST RELATED DEATHS HAVE DECREASED DRASTICALLY SINCE THE IMPLEMENTATION OF THE ADVANCED RESUSCITATION TRAINING (ART) PROGRAM.

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Background: In 2007 the Advanced Resuscitation Training (ART) program was implemented in our hospital. The ART program encompasses the implementation of the Rapid Response Team (RRT), Code Blue committee, seated resuscitation, the apnea program and a unique and specialized CPR training that advocates a continuous chest compression (CCC) approach to CPR. The CCC approach to CPR decreases the amount of pauses which decrease coronary perfusion pressure along with interposed ventilations performed at a 10:1 ratio. Ventilations are initiated with the onset of compression recoil for both unprotected and protected airways explore the impact of the ART program on outcome from inpatients with suspected respiratory arrest. Methods: This study was conducted in two urban university hospitals from 2006-2012. The ART program was implemented in 2007. Data for all Cardiopulmonary arrests (CPA) are entered into a resuscitation database. CPA events are categorized based on suspected etiology. Survival-to-discharge rates before and after implementation of the ART program were evaluated using chi-square analysis including test for trend. Results: Respiratory survival has increased from baseline 24.5% in 2006-2007 to 55.6% in 2011-2012. The incidence of respiratory arrest has decreased from 34% of the total arrests in 2006-2007 to 22% in 2011-2012. Together, these results have taken respiratory arrest-related deaths from 34% of the total arrest-related deaths in 2006-2007 to only 16% in 2011-2012. Since the implementation of the ART program we have witnessed a decrease in arrest-related deaths with respiratory arrest in 2006-2007 being the dominant cause to in 2011-2012 it being number five out of six on the list of arrest-related deaths. Conclusion: All components of the ART program have assisted in drastically decreasing the incidence of respiratory arrest-related deaths in the in hospital setting. Between early intervention with programs like the apnea program, mid-line intervention with programs like the RRT and seated resuscitation to a novel way of doing CCC to breaths at 10:1, it has been proven that we can improve patient outcomes in the face of respiratory arrest.

Sponsored Research - None

1432322

A CAREER ADVANCEMENT PROGRAM CAN INCREASE PROFESSIONAL GROWTH AND DEVELOPMENT IN RCP'S.

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Background: A literature search conducted in 2007 addressing the use of career ladders for respiratory care professionals revealed only two articles published. Therefore, Children's Healthcare of Atlanta created a career ladder for respiratory care professionals (RCP) called the Career Advancement for Respiratory (CAR) based on a contributions system along with certain acceptable behaviors in order to advance. Since the program was to encompass three separate campuses with different attitudes and mindsets into one working career ladder, this model allows the therapist to customize their professional growth. Method: In 2011, an 18 question survey was developed by the CAR committee to assess the RCP's understanding of the program along with level of satisfaction. Other goals of the survey included the perceived usefulness of the program for professional advancement and to measure changes in professional development such as obtaining advanced degrees and council involvement. The survey was electronically sent via an online survey tool to all 269 RCP's within the three hospital systems. Additionally, Human Resources was contacted to find out if recruitment and retention has been affected by the CAR program. Results: The findings of our survey showed an increase in professional development and career advancement. Conversely, the survey did not show a perceived improvement in professional satisfaction or recruitment and retention. Conclusion: A career ladder can be instrumental in improving and engaging staff by increasing professional development and growth. Although the survey and feedback from the staff has shown an overall dissatisfaction with the career advancement program, the survey did show increased involvement and staff have remained engaged in ways that they have not previously been before. Despite the dissatisfaction of the program, our Human Resources Department reports it has not affected recruitment and retention of staff based on exit interviews. Ongoing development and changes to the program in 2012 will be based upon the needs identified in the survey.

Sponsored Research - None

1396289

ADVANCED RESPIRATORY CARE PRACTITIONER INITIATIVE.

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Background: The concept of a Master's prepared Respiratory Care Practitioner with an advanced scope of clinical practice and prescriptive rights was discussed at the Stony Brook University Respiratory Care Program Advisory Committee meeting in November 2009. Several members from this advisory committee attended the New York State Society Respiratory Care (NYSSRC) Board of Directors meeting in June 2010 to share and discuss this idea. The board supported the initiative by creating a NYSSRC Ad Hoc Master's Committee. This committee was charged with the following: 1. Promote the concept by communicating with members of the NYSSRC, the Respiratory Care profession, and other interested healthcare practitioners; 2. Survey members of our profession using resources available through the American Association for Respiratory Care (AARC); 3. Obtain legislative sponsorship and support when needed. Method: An e-mail was sent to New York State AARC members requesting participation in a thirteen question survey posted on SurveyMonkeyTM from November 10, 2010 to December 10, 2010, requesting feedback regarding the creation of a Master's prepared advanced Respiratory Care Practitioner with prescriptive rights. Results: The thirteen question survey was e-mailed to 2496 AARC members in New York State with 355 responses.The survey results indicated: 54.1% respondents had greater than 20 years experience, 49% worked at medical centers, 49.9% worked as staff therapists, 84.5% identified critical care as an area of expertise, 85.4% were licensed respiratory therapists, 71.5% felt they were limited in advancement opportunities in our profession, 54.2% have considered changing professions and 66.9% felt a Master's prepared Respiratory Care Practitioner with prescriptive rights would be beneficial for the practice of Respiratory Care in New York State. Conclusion: The survey results indicate that New York State AARC members support the creation of a Master's prepared Respiratory Care Practitioner with prescriptive rights. These results provide initial needs analysis data for program development, stakeholder support and legislative sponsorship. It is hoped that the results of this survey will stimulate discussion within the profession and with other interested parties so that a model for a national curriculum can be created.

Sponsored Research - None

1434023

ADVANCED CARDIAC LIFE SUPPORT: 12 YEARS OF OUTCOMES ASSOCIATED WITH A 3 CREDIT HOUR COURSE IN A RESPIRATORY CARE EDUCATIONAL CURRICULUM.

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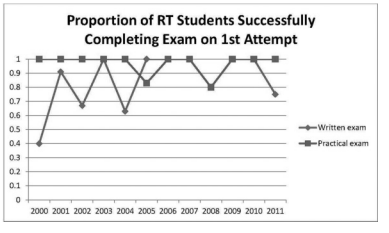
INTRODUCTION: The American Heart Association ACLS course is designed for healthcare providers who participate in cardiopulmonary resuscitation. Course elements include objectives related to the identification and treatment of life-threatening cardiac and respiratory events. Results from 12 years of integration of ACLS objectives in the curriculum of a baccalaureate degree-granting RC educational program are presented. CASE SUMMARY: In 2000, a CoARC accredited, baccalaureate degree-granting RC educational program in the Midwest transitioned from a 3 credit hour unidisciplinary EKG analysis lecture course to a 3 credit hour multidisciplinary course including AHA ACLS requirements. The primary goal of the new course was to facilitate understanding of EKG assessment and administration of evidence-based emergency cardiopulmonary therapeutic intervention for students enrolled in the university's Nuclear Medicine, Radiologic Technology, and Respiratory Therapy programs. A typical RT student enrolls in the course after having completed two semesters of RT didactic and clinical coursework. The course lecturer was the same Registered Respiratory Therapist throughout the entire 12 year period. The first 1/3 of the course includes lecture and interactive learning experiences to facilitate understanding of cardiac dysrhythmias and evidence-based pharmacologic and electrical interventions. The remainder of the course provides traditional practice and testing stations similar to a standard ACLS provider course. DISCUSSION: During the 12 year period, 103 students majoring in Respiratory Therapy enrolled in the course. With the exception of the first year, the majority of RT students successfully completed both the written and practical ACLS examinations on the first attempt each year. Atypical written examination outcomes in 2000 may be associated with instructor inexperience and poor course design. The proportion of RT students successfully completing the written and practical examinations is the same for five of the most recent six years, possibly indicating that instructor experience and effective course design expose the fact that the written and practical examinations evaluate understanding of similar concepts. Results from this case analysis suggest that students who have completed two semesters of didactic and clinical coursework in a baccalaureate degree-granting RC education program can successfully complete AHA ACLS written and practical examinations.

Sponsored Research - None



1406321

WORKLOAD PROJECTION TOOL; MATCHING STAFFING TO WORKLOAD FOR SMART PRODUCTIVITY.

Christopher Kircher, Ford Jeffrey, Martin Marlin, Smith Robin, Saunders Peter, Madden Maria, Reza Hamid, Davis Matthew; Respiratory Care Services, University of Maryland Medical Center, Baltimore, MD

BACKGROUND The management of appropriate staffing levels is a multifactored process that requires knowledge of seasonal workload, facility geography, budget and productivity. Unfortunately, departments often lack a shift by shift process for consistent flexing of staff against workload. To determine correct staffing levels for Respiratory Care Services at the University of Maryland Medical Center (UMMC), a computer based workload projection tool was developed that allows staff entry of key work indicators and calculates staffing required in each clinical area. METHOD In the late 1990s, an extensive internal time study was performed for the most common tasks performed by a respiratory therapist. After validating results against AARC time standards, appropriate values were used for the primary work drivers per area and mathematically determined each shift's staff level through the use of an Excel® spreadsheet. These work value units (WVUs) are multiplied by the total numbers of each work driver to obtain total WVUs per area. The design of the original model evolved as work requirements, budgetary constraints, and facility geography has changed. As hospitals are adapting to widespread changes with in healthcare, there exists an ever increasing need to financially adjust and manage staffing in leaner and more cost efficient ways. UMMC has helped provide counsel to department managers who have been tasked to reevaluate their staffing roster and offer up potential increases in efficiency. In all cases, these managers lacked a formal tool to match staffing to workload, and could not justify the importance of specific staffing levels. All have since adopted a version of the UMMC staffing tool. RESULTS The workload projection tool has provided a reliable, data driven method to flex staffing levels for each shift, enabling consistent decisions to activate or cancel staff. The reflection against productivity and utilization reports has validated the tool and is shared with the staff to show how the management team balances financial constraints against increased clinical demands. CONCLUSION Smart management requires constant reflection on many factors to maintain fiscal responsibility and optimal customer service. Appropriate staffing tools are essential, but should not be too cumbersome to use. The computerized model at UMMC easily adapts with facility growth, can be utilized by lead therapists and supervisors, and assures safe and efficient staffing.

Sponsored Research - None

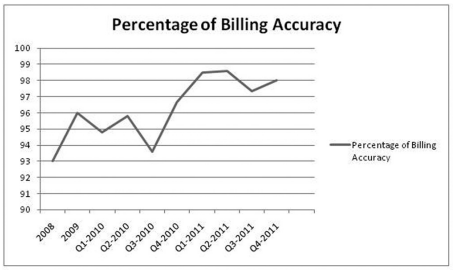
1433927

IMPROVING BILLING PRACTICES THROUGH A DEPARTMENT WIDE GOAL INITIATIVE.

Joyce Baker; Children's Hospital Colorado, Aurora, CO

Background: In 2008 it was identified a significant amount of salary expense, a total of 120 hours a month, was being paid for several staff therapists to recover an average of 8.12% in missed billable procedures and equipment. These hours and salary expense were equivalent to a .45 FTE dedicated exclusively for revenue recovery. Methods: Starting in January 2009 a department financial goal to decrease lost revenue by 3% was set and cascaded to all staff, with the end target for December 2009. This would be achieved through identifying barriers to billing consistency, ongoing education, timely follow up around inappropriate billing and staff empowerment. An average of 167 various treatments were audited each month to track progress, identify inconsistencies, and measure trends. From the audits one on one education was done with employees who had consistent discrepancies in billing; solicited feedback from staff around regular barriers to billing were identified; and changes in processes were implemented in the electronic medical record (EMR). An employee database was built to provide each employee the opportunity to track their variances in billing practices, empowering them to seek out information, and have ownership on impacting the overall department financial goal. Results: From 2008 to 2009 there was a 3% improvement in billing practices, resulting in the department meeting the financial goal for 2009. Ongoing tracking of billing accuracy beyond 2009 has resulted in further noted trends directly related to hiring of new staff, increase inpatient volumes, and ability to implement additional EMR changes to minimize human error. Conclusion: By implementing a department wide goal where every member is held accountable; providing prompt follow up around variances in billing; identifying barriers specific to billing; and minimizing the barriers within the EMR we have been able to improve billing practices by 6% over a three year period. As a result of these billing improvements we were able to decrease hours paid to recover revenue from 120 hours a month to 48 hours a month, a 50% reduction in hours or decrease in paying a .28 FTE specifically to revenue recovery.

Sponsored Research - None



1399617

SUCCESSFUL RESPIRATORY INTUBATION PROGRAM FOR COMMUNITY HOSPITALS.

Travis Collins, Patricia Miles; Respiratory Care, St. Elizabeth Healthcare, Ft. Thomas, KY

Background: Community hospitals often lack the available resources compared to larger tertiary medical centers. Two hospitals in Northern Kentucky already absent of residents, fellows, and now a reduction in anesthesia coverage were in need of additional staff that could support the on-call house physician in artificial airway intubation. A decision was made by administration in 2009 and with the support of anesthesia, all 20 licensed Respiratory Therapists were trained to intubate at both Hospitals. Method: The therapists were required to complete the initial intubation program and maintain annual competency in an on-going basis as a condition of employment. The initial training included policy/procedure review, required completion of a 20 question written exam, manikin practice, and a 3 day OR rotation. After the initial training all staffs are required to complete a minimum of 5 intubations annually, which may be a combination of manikin and/or patient. Tracking sheets are distributed at the beginning of each year and turned in prior to their annual performance appraisal is completed. Failure of completion requires follow-up training in the OR. Each therapist is expected to increase the number of patient intubations incrementally each year. Results: In the first 2 years of the program the therapist have intubated 135 patients (94 during the initial training in 2010 & 41 during the 2011 skills retention year. No complications due to intubation by Respiratory have been reported for 2 years. Rate for successful intubation on initial attempt by RT is 85%. Conclusion: All 4 Pulmonologist were surveyed after 2 years of the program's inception and all answered "yes" that having Respiratory trained to intubate improves safety and is a valuable program to maintain.

Sponsored Research - None

Average Exam Score	# Patients	Initial Attempt Success
95%	135	85%

1435107

WHY THERAPISTS DO NOT PRECEPT.

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Background: Preceptors are experienced clinicians who are competent staff members who serve as clinical role models and resources for newly hired staff or students. Previous research shows therapists who precept, feel a personal sense of accomplishment and value for their profession which increases their job satisfaction. Knowing why therapists' precept we decided to look at why therapists do not precept. Method: We developed a survey that queried acute care therapists about precepting from across the state of California. Participants' were asked if they precepted and if they answered no they were asked to circle reasons that would indicate why they were not preceptors. This survey was conducted by a combination of electronic e mail and hand distribution for a total of 242 surveys. Reasons identified for not precepting and the associated results are reported. A total of 142 surveys were completed by RCPs for a response rate of 59%. Ninty-one of those queried or 40% answered no to serving as preceptors RESULTS QUESTION RESPONSE PERCENTAGE No Interest 13% No Time 18% Not Supported By Management 11% Never Asked 30% No Benefit 7% Not Comfortable Precepting Outside My Area Of The Hospital 5% Other 8.7% Discussion: A positive observation of the survey was that nearly 60% of RCPs precept. For those that don't, the results clearly indicate that simply by asking there is significant potential to recruit new preceptors. Support by managers with the provision of adequate time are also important factors. As a result of the survey additional focus is being placed on demonstrating the benefit and creating incentives for perception. We will continue to use similar surveys to identify opportunities for improvement and preceptor program refinements.

Sponsored Research - None

RESULTS

QUESTION	RESPONSE PERCENTAGE
No Interest	13%
No Time	18%
Not Supported By Management	11%
Never Asked	30%
No Benefit	7%
Not Comfortable Precepting Outside My Area Of The Hospital	5%
Other	8.7%

1416511

TITLE: HOW INCREASING THE NUMBER OF PROCEDURE CAPTURE PER PATIENT CAN HELP DETERMINE SHIFT STAFFING LEVELS.

Ernest Jones, Jenifer Graves, Herbert French, Fernando Gonzalez, Gina Giles-Oas, Richard M. Ford; Respiratory Care, UCSD Medical Center, San Diego, CA

Background: An ongoing issue for Respiratory care departments is the capture of therapist activity to justify staffing. These activities are specified in the American Association for Respiratory Care Uniform Reporting Manual. As a result of benchmarking it became apparent that we were not capturing all tasks. Through focus groups we determined that we could simplify the charge capture steps in our management information system (Clinivision) and better educate practitioners on the importance and process of documenting their workday activities. Methods: The medical center charge description master for Respiratory Care was refined to expand the number of non-chargeable activities included. These activities were then configured in Clinivision in a way to simplify data entry in which charges are captured through clinical documentation. The shift supervisors informed staff of the new procedures and emphasized the importance of documentation and the potential impact on staffing. The shift supervisors also audited records and followed up with the RT's who missed charting opportunities. The impact of these efforts was measured by comparing the charge per patient ratios for a two year period prior and a 6 month period after the initiative. Results: Baseline data collected over the prior two years indicated activities per patient average during of 23.4. After the initiative activities per patient where 25.4 resulting in an 8.75% increase. Conclusions: We observed an increase rate of activity capture with these initiatives. Considering that determination of staffing levels as well as comparing performance through benchmarking are largely dependent on counts of workday activity, it remains important to develop systems and programs that insure such activity is captured.

Sponsored Research - None

1417626

THE DEVELOPMENT OF A RESPIRATORY SUPPLIES INDEXING SYSTEM TO IMPROVE RETRIEVAL TIME.

Kenneth Miller, David Blalock, Heather Skilies, Raymond Smith; Lehigh Valley Health Network, Bath, PA

Background: In large respiratory care departments locating a specific equipment item can sometimes be overwhelming. Often equipment is located by trial and error. Also equipment inventory continues to change as newer products are added and current items are replaced. This can cause critical delays in the delivery of care and can compromise patient outcomes in emergent situations. This also can lead to staff frustration and dissatisfaction. The necessity for an inventory location indexing system has become a critical need for any rapidly expanding respiratory department with an abundance of equipment and supplies. Method: An analysis of 395 respiratory supplies was conducted. 54 items (14%) had been discontinued, 311 items were stocked in our main storage room, and 30 items were special order items. Out of the 341 respiratory supplies, an average of 20 items (6%) is stocked on the general med/surg floors and an average of 60 items (18%) is stocked in the ICUs. Respiratory therapists and equipment technicians were questioned on the location of random items stocked in various units and the main equipment storage room. Although common items could be promptly located, sporadically used items proved difficult to find in a timely manner. Based on this response time to locate critical supplies, we identified the need for a system to rapidly identify the storage locations of any and all respiratory items. Results: The creation of a searchable on-line inventory document that includes photos and item locations, has significantly improved the response time for deliveries of all respiratory items . Before the creation of the indexing system, finding certain items could take up to a minimun of 10-20 minutes or even longer for seldom used items. Since the implementation of the indexing system, there have been no questions from therapists or newly hired equipment technicians regarding the location of any respiratory supplies. All staff can now locate any respiratory item within one minute. Equipment delays have be erracated and staff satisfication has been enhanced. Conclusion: The development of an on-line searchable equipment inventory system has increased response times for deliveries and has reduced therapist frustration. This system also limits the confusion of locating an item for therapists who need equipment urgently. In addition, the indexing system has proved beneficial in the training of newly hired staff.

Sponsored Research - None

1393139

THE EFFECT OF A TREATMENT FREQUENCY PROTOCOL ON APPROPRIATE UTILIZATION OF AEROSOL THERAPY.

Rebecca Vidrine, Jules Poirier, Teri Keller, William Borron; Respiratory Care, West Jefferson Medical Center, Marrero

Background: The Hospital's conversion to a computerized provider order entry (CPOE) with an electronic medical record eliminated the hard copy of the patient's medical record. Prior to this, alerts to physician by the respiratory therapists were placed on the medical record communicating any change in a patient's pulmonary status and suggested treatment frequency. Without this avenue, an alternate plan was developed. And the treatment frequency protocol was initiated. Method: The treatment frequency protocol was developed using the Cleveland Clinic's Respiratory Therapy Consult service as an evidence-based guideline. This protocol included bedside patient assessment, review of test results, and use of a scoring matrix to determine recommended treatment frequency. A convenience sample of inpatients ordered on aerosol therapy to deliver inhaled medications was assessed within 24 hours of the initial physician order using the protocol by designated assessment therapists, who evaluated patients 7 days/week. Results: Over an 8-month period, 1,282 patients were assessed using the treatment frequency protocol. Our results showed that 7% of ordered aerosol treatments were not indicated and thus discontinued. Also, seen was 43% of the ordered treatments indicated a decrease in frequency within 24 hrs of admit using the protocol. 3% of the ordered treatments were increased within 24 hrs of admit. Following protocol implementation, an average drop of 25% in aerosol treatment volume resulted each month as compared to the same timeframe in 2010. With this protocol in place, there was a staff reduction of 3.7 FTEs, primarily from the 11 pm - 7 am shift staff as well as a patient cost savings with the appropriate utilization of treatment frequency totaling $942,123 during the 8-month period. Conclusion: The Treatment Frequency Protocol resolved the lack of an avenue for respiratory therapists to communicate changes in patient's respiratory status to physicians and thus changes in treatment plan. Subsequently, the protocol has had a significant impact with eliminating inappropriate treatments resulting in decreased staff levels and has cost savings for the patient and the hospital.

Sponsored Research - None

1416564

RISK ASSESSMENT OF NON-ICU PATIENTS RECEIVING NONINVASIVE VENTILATION, CPAP, OR WITH UNASSISTED TRACHEOSTOMY BREATHING.

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BACKGROUND: In 2004, the Institute for Healthcare Improvement (IHI) recommended the hospital implementation of Rapid Response Teams (RRT) as part of their 100,000 lives campaign. The use of RRT programs conceivably could reduce non ICU cardiac arrests and decrease emergency ICU transfers. Patients in non-ICU settings receiving respiratory support with non-invasive ventilation (NIV), continuous positive airway pressure (CPAP), or with unassisted tracheostomy breathing (trach) would appear to be at "high risk" for untoward events requiring RRTs. To assess this, we performed a retrospective review of RRT and "Code Blue" events in these patients. . METHOD: IRB approval was obtained to review RRT and Code Blue activations for patients receiving noninvasive ventilation (NIV), CPAP, or with tracheostomy management for 2011 in the non-icu arena in a 1000+ bed academic medical center. This was compared to the overall rate of RRT activations or Code Blue events in our hospital (1.6% and 0.5% of all admissions respectively). RESULTS: See Table CONCLUSION: Non-ICU patients requiring CPAP have RRT needs and Code Blue events at rates comparable to the overall hospitalized population. The need for NIV or the presence of a tracheostomy identifies a population several times more likely to require an RRT or Code Blue.

Sponsored Research - None

Results

	TOTAL PTS	% PTS with RRT	% PTS with CODE BLUE
CPAP	1701	1.4%	0.5%
NIV	768	7.9%	1.6%
TRACH	490	10.8%	4.9%

1417356

"PROCESS IMPROVEMENT INITIATIVE HAS SIGNIFICANT IMPACT ON REDUCING THE NUMBER OF UNRECONCILED RESPIRATORY THERAPY MEDICATIONS IN THE ICU"

Laura G. Withers, Quan Nguyen, Clarence Finch, Kristen Price; Respiratory Care, The University of Texas MD Anderson Cancer Center, Houston, TX

BACKGROUND: Medication reconciliation has been an initiative for Joint Commission (JCAHO) and the Institute for Healthcare Improvement (IHI) for years. JCAHO defines medication reconciliation as the process of comparing a patient's medication orders to all of the medications that the patient has been taking. This is done to avoid medication errors such as omissions. The ICU has approximately five (5) unreconciled respiratory therapy medications per day. As a quality improvement project we instituted an initiative to improve the reconciliation process. METHOD: Each unreconciled medication is considered a medication error that warrants a time consuming corrective action process to be carried out by the ICU Clinical Specialist (CS) for Respiratory Care on a daily basis. The process requires the CS to print out the "Overdue Respiratory Therapy Medication" report each morning, perform multiple chart audits for documentation review within two different systems, and electronically reconcile each medication left by the Respiratory Therapists (RT) for the past 24 hours. The CS reviewed the unresolved data with the therapist as an in-service initiative instituting an accountability process. Placing the responsibility of each to print out the overdue medication report before the end of their shift to ensure all medications have been reconciled to eliminate medication errors. To monitor the compliance of the new process the CS will print out the daily report ensuring all medications are reconciled appropriately. Evaluating the process effectiveness the CS randomly selected 100 daily medication reconciliation reports over an 11-month period pre and post implementation. We calculated the number of medications left unreconciled per day on each of the electronically generated reports. RESULTS: Old process: Average of 4.62 medications per day left unreconciled (462 meds/100 reports) New process: Average of 0.99 medications per day left unreconciled (99 meds/100 reports) Improvement: Reduced the number of unreconciled medications by 78.6% CONCLUSION: The new process improved accountability and significantly reduced the number of respiratory medication errors in the ICU by 80%.

Sponsored Research - None

1417440

THE VENTILATOR MANAGEMENT INITIATIVE: REDUCING COSTS AND LENGTH OF STAY IN MECHANICAL VENTILATOR PATIENTS.

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Background and Method: The mechanically ventilated patient population is the most critical and requires extensive resources to treat. Since 1997, our facility has instituted ventilator management initiatives divided into distinct phases in a relentless pursuit of improvement of outcomes related to this population. During each phase, program objectives were developed and staff training for all caregivers was implemented. Results of the program were shared with all caregivers. The major objective of the program was to reduce Ventilator Associated Pneumonia (VAP). Results: Significant reductions in both ventilator associated pneumonia and ventilator length of stay were seen consistently over time. At the beginning of our project in 1997, 149 patients had VAP for a rate of 8.97 (rate per 1000 ventilator days). At that time we initiated a pneumonia protocol and by 2000, the VAP rate dropped to 3.8. In 2005, after initiation of the ventilator bundle the rate dropped again to 1.2. Slight increases in the VAP rate from 1.2 in 2005 to 1.5 in 2008, led to initiation of a ventilator management initiative with focused concentration by all disciplines caring for this population. In 2011, only 13 patients had VAP for a rate of .81. Year to date in 2012, only 1 patient has had VAP for a rate of .37. The estimated cost of VAP in 1997 exceeded $4.2 million dollars compared to $199,000 in 2010 & $365,000 in 2011. During the 2011 phase, the Ventilator Management through Informatics phase coupled the use of Bridge-Tech Medical Technology application and Mediserve Respiratory Information Management documentation system "branching logic." This contributed in decreasing the length of ventilation (LOV) from 5.6 days in 2010 to 4.6 days in 2011 or 17.8%. Conclusion: Over the years, an organized approach to reduce ventilator associated pneumonia had a profound effect on decreasing ventilator length of stay. This use of technology coupled with staff acceptance and education, performance goal setting and an integrated caregiver approach has allowed us to achieve success in both important metrics.

Sponsored Research - None

1432549

TOTAL PATIENT CARE: RE-ENGINEERING FOR QUALITY PHASE I.

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Background: As part of an enterprise-wide Staffing to Workload initiative, Respiratory Services at Mayo Clinic in Florida restructured and redefined the role of the respiratory therapist. Our mission, to achieve clinical excellence by streamlining and utilizing our skills to improve patient safety, patient and staff satisfaction, and continuity of care; to increase productivity; and to be better aligned with other Mayo Clinic practices, provided us with the impetus to embark on a journey that would transform the way we practiced. Method: Using Six Sigma and DMAIC methodologies, a team of managers and staff met over the course of seven months to develop and implement the Total Patient Care (TPC) model. Two early-on small tests of change quickly resulted in the decreasing of the number of per shift-required patient-ventilator assessments and eliminating the redundancy of checking continuous pulse oximeters on a certain patient population. Mandatory classroom and online education provided opportunities for all therapists to become trained and proficient in performing patient driven protocol assessments. Surveying the therapists, patients, and providers/nurses before the project provided important feedback used to increase customer satisfaction. Post project surveys were used to validate our successes. Results: Through implementation of the TPC model, we were able to improve staffing ratios by decreasing redundancy of tasks performed and streamlining our staffing model; improve customer satisfaction by decreasing the number of patient interruptions and better identification of the assigned therapist; increase job satisfaction through better utilization of skills; improve capture of charges by decreasing redundancies and potentially missed charges; and implement a system that better aligns staffing ratios by using nationally recognized time-standard allotments. Conclusion: The TPC initiative has allowed us to remove non-value added procedures from our daily task lists. Additional time gained in the work day now allows our therapists opportunities to spend more time with our patients, thus improving patient safety and providing more efficient and better quality care. The team will now regroup and focus on implementing Phase II of the project, which will provide our therapists with opportunities to perform more critical tasks, such as arterial line placements, intubations, and extracorporeal membrane oxygenation (ECMO) responsibilities.

Sponsored Research - None

1426866

INTERRUPTION DURING SHIFT REPORT: IMPACT ON PATIENT CARE.

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BACKGROUND: The Joint Commission and the Department of Veterans Affairs National Center for Patient Safety in America reported communication failure is the primary cause of patient safety events or near miss incidents. The study objective was to determine the effects interruptions during shift report had on patient safety. We hypothesize that interruptions occurring during shift report will contribute to safety events which reach the patient or result in a near miss event. METHODS: A nine question survey collected data on the incidence and type of interruptions occurring during morning and evening shift report. Information regarding patient acuity, staffing levels, near miss incidents and safety events which reached the patient was ascertained. The anonymous and confidential questionnaire was distributed to respiratory therapists assigned to the neonatal and pediatric intensive care units at a tertiary care Children's Hospital. Each completed survey was placed in a sealed letter size envelope prior to hand delivery to the principle investigator. The envelopes containing the returned surveys were not opened until the close of the 4 week study period. RESULTS: Fifty three surveys were completed yielding a 40% response rate. Interruptions occurred more frequently in the morning (72.22%), compared to evening (47.62%) shift. Shift report was interrupted more often in the NICU (71%) than the PICU (29%). In all cases, a therapist participating in report was called to the bedside to reposition an endotracheal tube (19%), adjust ventilator settings (35%), set-up and troubleshoot equipment (12%), administer medication (4%), assess patient or participate in other forms of care at the bedside (30%). Staffing was at threshold 67% of the time and one below threshold 33% of the time. Interruptions occurring when staffing was below threshold resulted in a termination of report. Workload data are found in Table 1. Eleven errors occurred during the study period. Four errors reached the patient and resulted in a missed therapy, five documentation errors occurred and wrong information was provided on two patients during report that resulted in near miss safety events. CONCLUSIONS: Frequent interruptions during shift report led to miscommunication and contributed to safety events which reached the patient.

Sponsored Research - None

The type and frequency of interruptions that occurred during shift report.

Acuity	ALL	NICU	PICU
Tracheostomy	386	255	131
Servo-I Ventilator	388	284	104
Home Ventilator	43	1	42
HFOV	17	17	0
Nitric Oxide	4	4	0
Sub-Ambient	0	0	0
Family Teaching	22	21	1
Heliox	0	0	0
Vapotherm	190	159	31
Bipap	6	0	6
Albuterol	2	0	2
NAV,NIV-NAVA	130	128	2
Extubations	15	10	5
Codes/MRT	1	0	1
Intubations	12	8	4
Tracheostomy Tube Changes	7	5	2

1415815

MORAL DISTRESS IN RESPIRATORY THERAPISTS AND THE RELATIONSHIP BETWEEN JOB SATISFACTION AND JOB ATTRITION.

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BACKGROUND: Respiratory therapists (RTs) are often faced with many challenges that bring elements of moral distress. Moral distress may be caused by situations that place RTs in conflict with fulfilling their moral obligation to their patients, which may include end-of-life care, policy constraints, and organizational ethics. The purpose of this research was to examine the factors associated with moral distress among RTs and if a relationship existed between factors of moral distress and job dissatisfaction and job attrition. METHODS: Moral distress among RTs was assessed using a moral distress survey instrument consisting of 28 items on a 5-point rating scale (1 = never to 5 = always). Additional items were included to obtain information regarding participant demographics, job dissatisfaction, and job attrition. The survey instrument was administered through a web-based survey tool to RTs with an available email address currently working in a healthcare setting. Participation in the study was voluntary. Data were analyzed using descriptive and multivariate statistical methods. RESULTS: A total of 504 RTs participated in the study. An exploratory factor analysis was conducted on 200 randomly selected cases from the total number of participants. The results revealed a four factor theoretical model: "Individual Responsibility," Not in Patient's Best Interest," "Deception," and "Work Environment." The table below illustrates the means, standard deviations, and internal consistency for the four factors. Regression analysis revealed that work environment (inadequate staffing and staff development) was a significant predictor in job dissatisfaction, $R^2 = .22$, adjusted $R^2 = .18$, $F(10,188) = 5.20$, $p < .001$. Further analysis revealed that work environment was a significant predictor of job attrition related to dissatisfaction, χ^2 (10, N = 199) = 19.58, p = .03, while deception and age groups 20-29 and 30-39 were significant predictors of job attrition related to stress, χ^2 (10, N = 199) = 27.55, p = 002. CONCLUSION: Respiratory therapists in this study reported experiencing varying degrees of moral distress, which may be associated with job dissatisfaction and an increased likelihood of leaving their jobs due factors associated with moral distress.

Sponsored Research - None

Means, Standard Deviations, and Internal Consistency for Moral Distress Four Factors (N=199)

Factors	M	SD	Cronbach's α
Individual Responsibility	1.94	0.58	0.76
Work Environment	2.78	0.81	0.75
Deception	2.80	1.11	0.82
Not in Patient's Best Interest	3.53	0.68	0.66

1416493

A STATE-WIDE SURVEY OF PATIENT SAFETY ISSUES AND STAFFING LEVELS IN HOSPITAL-BASED RESPIRATORY CARE DEPARTMENTS.

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Background: Previous studies have identified an inverse correlation between staffing levels and patient mortality in Nursing units1. The North Carolina Respiratory Care Board (NCRCB) followed up on patient safety issues brought before the Board; where (1) licensed therapists had reported that mathematically impossible workloads resulted in patient care issues; and (2) managers expressed concerns regarding inaccurate comparative data from external consulting companies used to determine staffing levels. These issues were investigated by means of a state-wide survey of Directors/ Managers of Respiratory Care Departments. **Methods**: A voluntary, anonymous survey was developed and sent to all Directors/Managers of Hospital-based Respiratory Care departments throughout North Carolina. The survey focused on the metrics in use to determine staffing levels, presence or absence of adequate staffing, perceived causes of chronic understaffing, and management reports of patient safety issues resulting from understaffing in the acute care hospital setting within the past year. **Results**: A total of 35 (n=35) licensed Directors/Managers of Respiratory Care departments completed the survey, for a state-wide 26 % response rate. Reported patient safety issues are summarized in the table below, which follows this abstract. Key findings included 30% of departments reported being chronically understaffed, 75 % of hospitals were using metrics provided by external consultants which the AARC specifically recommends to not use, and more than 50% of the Directors/Managers rated the quality of comparative data provided by proprietary hospital consultants as "poor". **Conclusions**: This survey has identified serious, reported patient safety issues associated with the metrics, productivity targets, and proprietary comparative data used to determine Respiratory Care department staffing levels. These safety issues are significant and indicate anecdotal reports of possible patient harm. As a result of the magnitude of these findings, the NCRCB has developed a position statement which states that the determination of safe staffing levels is within the scope of practice of licensed Directors/ Managers of Respiratory Care services. Further, it is recommended that this survey be expanded nation-wide, and that national standards are developed to ensure that patient safety is ensured by safe staffing levels.

Sponsored Research - None

References: Needleman J. et. al. **Nurse Staffing and Inpatient Hospital Mortality**. N Engl J Med 2011; 364: 1037-1045, March 17, 2011.

1403686

VALIDITY OF COMPARATIVE DATA FOR RESPIRATORY CARE SERVICES PROVIDED BY A PROPRIETARY CONSULTING COMPANY.

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Background: Benchmarking has been defined as "the continual and collaborative discipline of measuring and comparing the results of key work processes with those of the best performers in evaluating organizational performance" [1]. Some proprietary consulting groups in the healthcare industry have deviated from this open, collaborative benchmarking process and use comparative data to determine staffing targets, productivity levels, and to manage expenses without regard to practice models and matching services. **Methods**: The validity of comparative data from a proprietary consulting company was evaluated by phone survey to 12 hospitals in the consulting company database. A total of 18 items related to service delivery were surveyed in12 hospitals for 216 (n = 216) measures. The match of services between the surveying hospital and the others in the database was determined. The percentage match between the surveying hospital and the others in the database was assigned a letter grade based upon a traditional academic grade scale. For example, if 95% of the comparative group provided the same service as the surveying hospital, a grade of "A" was assigned for that item. A "report card" was generated to indicate the validity of service match by item for the comparative group. **Results**: Validity data are shown in the table below. For the 18 items compared to the surveying hospital RC department, the report card showed a total of 2 grades of "A", 1 grade of "D", and 12 grades of " F" . **Conclusions**: The quality of comparative data provided by the proprietary consulting company matched very poorly with the surveying hospital RC services. We conclude that the data provided by the propietary consulting company was not valid. Because of the magnitude of crucial decisions in cost-containment, and the need for valid benchmarking to improve operational performance, this study has identified the need for national / state standards for quality assurance for comparative data provided by proprietary consulting companies.

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Sponsored Research - None

1408767

INFLUENCE OF BREATHING PATTERNS, FLOW RATE AND FACE MASK ON AEROSOL DELIVERY TO SIMULATED SPONTANEOUSLY BREATHING INFANTS AND PEDIATRICS.

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Background: Aerosol face masks have been used extensively for aerosol drug delivery to treat infants and pediatrics with airway diseases. However, aerosol delivery may be affected by various factors such as the rate of gas flow and shape of aerosol face mask . Objective: The purpose of this in vitro study was to determine the influence of breathing pattern, flow rate and face mask on aerosol drug delivery in simulated spontaneously breathing infants and pediatrics. Methods: A spontaneous lung model (ALS5000, IngMar Medical) simulating infant breathing pattern (tidal volume 100 mL, inspiratory time 0.7 second, and respiratory rate 30 breath/min) and pediatric breathing pattern (tidal volume 250 mL, inspiratory time 1.0 second, and respiratory rate 20 breath/min) was attached to collecting filter for inhaled mass collection. Two types of pediatric face mask, the OxyKid (Southmedic Inc) and the Dragon (Cardinal Health Corp.) were chosen to deliver aerosols through connected by a 22 mm ID aerosol tubing to the outlet of a high flow humidification system (OptiFlow™, Fisher & Paykel) at 3, 6, and 12 L/min. A unit-dose of 5.0 mg/2.5 mL salbutamol (GSK Corp.) was nebulized by a vibrating mesh nebulizer (Aeroneb, Aerogen Inc) at the inlet of humidifier (n = 3). Drug collected in the filter was eluted from the filter and analyzed with a spectrophotometer (Thermo Fisher Scientific) at 276 nm. Independent t- test and one-way analysis of variance with Bonferroni test were used for statistical analysis ($p< 0.05$) . Results: Table shows mean percent of dose inhaled ± SD. Drug delivery was influenced by breathing patterns ($p = 0.004$) and flow rates used in this study. The inhaled mass was significantly lower at 12 L/min than at 3 and 6 L/min ($p < 0.001$). No statistical difference was found between the types of face masks ($p = 0.123$). Conclusion: The flow rates of gas entering the mask and breathing patterns influence aerosol delivery, independent of the face mask used.

Sponsored Research - None

Inhaled mass %±SD among settings

Mask	OxyKid			Dragon		
Flow (L/min)	3	6	12*	3	6	12*
Infant	6.4±1.2	4.2±0.7	2.8±0.2	4.7±0.8	6.2±1.4	3.2±0.4
Pediatric#	7.3±0.9	5.8±0.6	3.4±0.4	8.0±1.1	8.1±1.1	5.7±0.2

*significantly lower at 12 L/min than at 3 and 6 L/min ($p < 0.001$)
#Significant in pediatric

1416869

PERFORMANCE OF REUSED-PASTEURIZED DISPOSABLE NEBULIZER.

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Background: Aerosolized medication via small volume nebulizer (SVN) is most common used for treating respiratory symptoms in Taiwan. Due to the cost of these disposable SVNs, hospitals often reuse the SVN after pasteurization procedure for infection control between patients. Objective: The purpose of this study was to demonstrate the influence of reused-pasteurization procedure to the performance of SVNs. Methods: Twenty new SVNs (Galemed Cop) were test for comparison, and 18 pasteurized nebulizers were chosen randomly form respiratory care departments in Chang Gung Memorial Hospital. A spontaneous lung model (ALS5000, IngMar Medical) with tidal volume 600 mL, inspiratory time 1.0 second, and respiratory rate 12 breath/min was attached to collecting filter for inhaled mass collection. Particle size distribution were tested through an Anderson cascade impacter (Thermo Scientific). A unit-dose of 5.0 mg salbutamol (GSK Corp.) was nebulized with 8 L/m of gas at 50-pisg. Drug from the filter and collecting plates of the impactor was eluted and analyzed with a spectrophotometer (Thermo Fisher Scientific) at 276 nm. Independent t- test was used for statistical analysis, and $p< 0.05$ was used for statistical significance. Results: The table shows the mean inhaled drug (expressed as % of an unit-dose±SD), mass median aerodynamic diameter (MMAD), geometric standard deviation (GSD), and nebulization time. No statistical difference was found between new and pasteurized nebulizers. Conclusion: The performance of reused nebulizer under various times of pasteurization were similar. Further study needs be done to exam the limit for times of pasteurization procedure for nebulizer disinfection.

Sponsored Research - None

Comparison of nebulizers' performance

	Inhaled Mass%	MMAD ±GSD (um)	Nebulization time (min)
New	4.24±1.0	2.86±2.05	3.49±1.4
Pasteurized	4.22±0.8	3.22±2.09	2.83±0.9

1416964

TIME AND EFFICIENCY OF AEROSOL DELIVERY WITH CONTINUOUS VS INTERMITTENT INSPIRATORY AND EXPIRATORY PNEUMATIC MODES DURING CMV.

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Background: Aerosol delivery through mechanical ventilation is influenced by aerosol generation pattern. Purpose: The purpose of this in vitro study was to compare the efficiency of three modes of pneumatic nebulization provided by a new ventilator. Method: Three modes of pneumatic nebulization: inspiratory intermittent, continuous, and expiratory intermittent were compared, using ventilator (Galileo Gold; Hamilton Medical Inc) set to deliver a tidal volume 600 mL, reparatory rate 16 b/min, inspiratory time 1.0 second, and PEEP 5 cmH2O, via endotracheal tube and collecting filter to a single test lung (TTL, Michigan Instrument Inc). A unit dose of salbutamol (5 mg/2.5 mL, GlaxoSmithKline) diluted to 4 mL with distilled water was added to a small volume nebulizer (Galemed Corp). The nebulizer was placed in the inspiratory limb of the ventilator circuit and connected to the ventilator nebulization outlet via an oxygen tube and powered by the the flow provided by the ventilator with each of the 3 modes (n = 5). Time for nebulization recorded in minutes. Drug collected in the filter, nebulizer, T-piece and tubing was eluted and analyzed with a spectrophotometer (Thermo Fisher Scientific) at wavelength 276 nm. Analysis of variance with Bonferroni test and Kruskal-Wallis test were used for statistical analysis, and $p< 0.05$ was used for statistical significance. Result: Table shows drug as % of total dose (mean ± SD). Drug in T-tube was greater with intermittent inspiration higher than continuous ($p = 0.002$) and intermittent expiration ($p = 0.001$). Drug deposited in the corrugated tube with intermittent inspiration was significantly higher than it with continuous ($p = 0.016$) and intermittent expiration ($p = 0.005$). Nebulization times (median and range) intermittent inspiration continuous and intermittent expiration were 38.89 (34.92-42.25), 14.28 (12.22-14.55), and 17.65 (16.53-17.77) minutes respectively ($p = 0.003$). Conclusion: Aerosol delivery was similar in all modes; however the nebulization time with intermittent inspiration was >2 fold more than the other two modes.

Sponsored Research - None

Drug depositions among three modes (mean ± SD as % of total dose)

	Intermittent Inspiration	Continuous	Intermittent Expiration
Inhaled mass	8.80±4.45	6.95±2.77	7.67±1.60
Nebulizer	42.61±1.63	41.95±1.61	43.32±3.35
T-tube	3.63±0.54	2.26±0.31	2.07±0.52
Corrugated tube	6.98±0.91	4.60±0.85	4.16±1.43

1416995

RANDOMIZED DOUBLE-BLIND MONOCENTRIC TRIAL ON TOLERABILITY, ACCEPTABILITY AND EFFICACY OF TWO FORMULATIONS OF INHALED 7% HYPERTONIC SALINE WITH AND WITHOUT HYALURONIC ACID IN REDUCING AIRWAYS INFLAMMATION IN PATIENTS WITH CYSTIC FIBROSIS PRELIMINARY RESULTS.

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Background. In Cystic Fibrosis disturbances in pulmonary epithelial ion transport bring both to a depletion of airway surface liquid (ASL) volume and reduced mucociliary clearance. Nebulized 7% hypertonic saline has been proposed to hydrate airways and restore ASL by inducing osmotic flow of water along lung epithelium and hence improving mucociliary escalator. The aim of the study is to evaluate tolerability and efficacy of one month-inhaled 7% hypertonic saline with and without 0.1% sodium hyaluronate in patients with CF for four weeks treatment. Methods. 26 patients (12men) in clinical stable condition have been enrolled in two groups (7% hypertonic saline vs. 7% hypertonic saline + 0.1% sodium hyaluronate - Hyaneb®). Mean age was 15.7 yrs (range 8 -35, sd 6.8) and FEV1 89.5% pred. (range 46.9 - 117.4 sd 19.7). All patients have been randomized to two different treatment groups. Results. All patients showed a positive response to bronchodilation with short-acting β2-agonist administered by spacer: FEV1 increased meanly of 5.54% and MMEF25-75 of 6.2%. A mean increase in FEV1 of 3.2% was reported after four weeks treatment but difference between two groups was not statistically significative ($p=0.06$). FVC did show the same increase of 3.2% without significance ($p=0.092$). Total pulmonary resistances decreased of 16.9% ($p=0.46$) and RV decreased of 22.55% ($p<0.05$). TLC showed a statistically significative increased of 4.2% ($p<0.02$). The impairment of baseline lung function expressed as FEV1 seems to correlate with a fall in residual volume ($r=0.4$). The VAS indicated and average degree of satisfaction of 5.73 after the first administration. The treatment was completed in 44% of patients; The adherence questionnaire showed that main reasons for not taking prescribed aerosol were lack of time in the morning (36%), fatigue in the evening (28%) and/or duration of aerosol administration (20%). Conclusions. Preliminary data show a positive trend in improved mucociliary clearance and reduced total airways resistances and RV by administration of inhaled 7% hypertonic saline with or without hyaluronic acid. The hypertonic solution shows a good efficacy in reducing airway obstruction and in increasing pulmonary functions parameters in the short-term period, Discomforts from inhalation of hypertonic solutions tend to decrease after four weeks.

Sponsored Research - None

1432140

THE EFFECT OF NEBULIZER TYPE AND MASK DESIGN ON AEROSOL DELIVERY DURING NONINVASIVE POSITIVE PRESSURE VENTILATION OF AN ADULT LUNG MODEL.

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BACKGROUND: Patients with acute exacerbations of airway obstruction are commonly managed with aerosol therapy and noninvasive positive pressure ventilation (NIPPV); however, the efficiency of different NIPPV masks on aerosol deposition during NIPPV is not well understood. The purpose of this study was: To determine the efficiency of three different NIPPV masks in conjunction with two different VMNs during NIPPV. METHODS: An in-vitro lung model consisted of the upper airway of an adult teaching manikin with a collecting filter at the level of the bronchi attached to a passive test lung. Three masks were used: (1) Full Face mask (Performax mask) (2) Oro-nasal mask (AF531) and (3) Performa track mask. NIPPV was administered via each mask with PIP/PEEP of 20/5 cmH2O. Albuterol sulfate (2.5 mg/ 3ml) was nebulized with two vibrating mesh nebulizers: (1) Aeroneb Solo (Aerogen) and (2) NIVO (Respironics). Each nebulizer was placed between the leak and the mask. Filters were eluted with 0.1 HCl and analyzed by spectrophotometer at 276 nm. Descriptive statistics, ANOVA and dependent t-test were used for data analysis ($p<0.05$). RESULTS: The mean (± SD) values for inhaled mass and percentage of nominal dose are shown in the table below. With both Solo and NIVO aerosol generators the oro-nasal mask is more efficient than the full face mask ($p=0.012$ and $p=0.037$, respectively). Aerosol delivery with both aerosol generators are similar with full mask ($p=0.284$). CONCLUSION: Delivery efficiencies of mesh nebulizers during NIPPV vary with both neb and mask designs.

Sponsored Research - None

Nebulizers	NIVO		Aeroneb Solo		
Masks	Full Face Mask	Oro-nasal Mask	Full Face Mask	Oro-nasal Mask	Track Mask
Mass (mg)	0.49 ± .02	0.58±.02	0.53±.04	0.72±.05	0.46±.06
Dose (%)	19.59 ± 1.05	23.07±.70	21.02±1.93	28.83±1.93	18.51±2.47

1394318

THE EFFECT OF SOURCE GAS FLOW ON TREATMENT TIMES FOR SMALL VOLUME NEBULIZERS.

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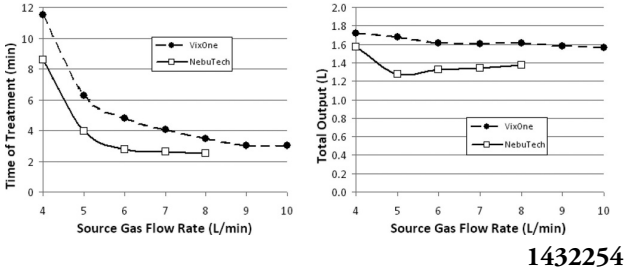
BACKGROUND There are many different designs of small volume nebulizers (SVN) and they all perform differently. One performance metric in particular, treatment time, is a function of both residual volume and source gas flow. Manufacturers recommend source gas flows of between 4 and 10 L/m. Therefore, the workload associated with aerosol treatments is dependent on both the brand of nebulizer and how it is used. The purpose of this study was to compare the treatment times of two SVNs used at our institution as a function of source gas flow. We hypothesized a difference in minimum treatment times between nebulizers. **METHODS** We evaluated the VixOne (Westmed) and the NebuTech (Salter Labs) nebulizers charged with 3 mL of normal saline. Three nebulizers of each brand were tested in duplicate. Source oxygen flow was varied from 4-10 L/min for the VixOne and 4-8 L/min for the NebuTech (per manufacturer's recommendations). Treatment time was defined as the time to sputter (first break in the plume of aerosol). Output aerosol was calculated as the change in mass of the nebulizer during the treatment time (assuming 1 g = 1 mL). Mean values were compared with 2-way ANOVA or t-test, with $P < 0.05$ indicating significance. **RESULTS** Raw data are shown in the graphs. Treatment time decreased as flow increased up to 6 L/min for the NebuTech and up to 9 L/min for the VixOne. The NebuTech had shorter treatment times than the VixOne ($P = 0.002$) across all flows. However, the NebuTech had a lower total output (1.4 mL vs 1.6 mL, $P < 0.001$). The shortest treatment times were not different (3.8 ± 1.3 s for NebuTech vs 3.0 ± 0.3 s for VixOne, $P = 0.169$). **CONCLUSIONS** Because treatment times were similar for the NebuTech at 6 L/min and the VixOne at 9 L/min, aerosol workload may be minimized using either nebulizer if source flow is standardized. Although the VixOne had a higher nebulizer efficiency (1.6/3.0 = 0.53) than the NebuTech (1.4/3.0 = 0.47), the NebuTech has a built in conserver reservoir. Therefore, further research is required to determine delivery efficiencies by measuring inhaled aerosol (Respir Care 2007;52(8):1037-1050).

Sponsored Research - None



1432254

ILOPROST DRUG DELIVERY DURING INFANT MECHANICAL VENTILATION: INFLUENCE OF NEBULIZER POSITION DURING CONVENTIONAL AND HIGH FREQUENCY VENTILATION.

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INTRODUCTION: Iloprost Inhalation Solution is a selective pulmonary vasodilator that has been used in critically ill neonates with hypoxic lung disease and pulmonary hypertension. There are currently no recommendations for selecting aerosol delivery devices or how those devices should be configured to efficiently deliver Iloprost during mechanical ventilation. Moreover, many clinicians are hesitant to deliver aerosolized drugs during high frequency oscillatory ventilation (HFOV) because it is believed that medication delivery is negligible due to the small volumes, short inspiratory times and high gas flows used with this form of ventilation. We designed studies in vitro to test the hypothesis that there were no differences in drug delivery between conventional and HFOV, testing two different nebulizer locations with each ventilator. METHODS: A neonatal test lung model (ASL 5000, Ingmar Medical) was configured with compliance 1.0 mL/cmH2O and resistance: 50 cmH2O/L/s. The lung model was ventilated with a conventional ventilator and HFOV with standard settings and heated-humidification (39°C) connected to a 3.5 Fr ET- tube. The Aeroneb Pro® (Aerogen, Galeway, Ireland) was tested in two different locations: 1) between the patient wye and the ET-tube (Proximal) and 2) between the ventilator and humidifier (Distal). Iloprost (30 mcg) was nebulized in three trials with three new nebulizers in each of the circuit locations. A filter was placed at the distal end of the ET- tube for each trial. Iloprost was recovered by eluting the filter with ethanol and quantified using high pressure liquid chromatography. Differences between mean drug mass were compared at each condition using ANOVA with Tukey post-hoc tests. Significance was determined as $p<0.05$. RESULTS: During conventional and HFOV, drug delivery was greater with the nebulizer placed in the proximal position compared to the distal position ($p<0.05$). There was nearly a 3-fold greater increase in drug delivery during HFOV than conventional ventilation (Figure). DISCUSSION/CONCLUSIONS: Iloprost drug delivery is best achieved when the nebulizer is placed between the ET tube and patient-wye during neonatal mechanical ventilation. Future investigations will be needed to better understand why drug delivery appears to be more efficient during HFOV than conventional ventilation.

Sponsored Research - Actelion provide Iloprost drug for this study.

1429723

COMPARISON OF AEROSL DELIVERY USING THE AEROGEN MICROPUMP AND JET NEBULIZER IN A CLOSED-SYSTEM VENTILATOR CIRCUIT.

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Background There has been discussion on the efficacy of aerosolized medication devices given through closed-system ventilator circuits. The jet nebulizer and the micro pump aerosol generator have been an acceptable method of aerosolized medication delivery systems in the hospital setting. However, little is known about how much aerosolized medication is actually delivered to the patient when using the jet nebulizer and the micro pump in-line through a closed-system ventilator circuit. Methods Testing was performed through an Airlife Care fusion Infant Respiratory (RT4851-12) closed-system circuit connected to an Avea Ventilator utilizing a Biomed™ device test lung. Each test disbursed a 3 ml of TC 99mTC DTDA as our aerosol. The Aerogen micro pump and Misty-Neb™ jet nebulizer were placed in line at the temperature probe on the inspiratory limb of the ciricuit approximately 18 inches from the patient wye and patient effort was simulated at a 0.45 minute volume. The built in nebulizer function of the Avea ventilator was used to drive the Misty-Neb™ jet nebulizer. All nebulizer sessions were performed over the duration of medication. All circuits were then placed under a GE Infinia Hawkeye Gamma Camera. Results Data was analyzed from 15 sessions. The average medication delivery toward the patient with the micro pump was 3.45% ±2.13 (n=9). The average medication delivery toward the patient with the jet nebulizer was 0.78% ±0.53 (n=6). Single factor analysis of variation (ANOVA) yielded a P= 0.008 between the micro pump and the jet nebulizer. Conclusion With the intubated patient there was a statistically significant difference in delivery of the aerosolized medication toward the patient using the Aerogen Micropump at the temperature probe compared to the Misty-Net™.

Sponsored Research - None

1432828

POOLED DATA ANALYSIS OF THE IMPACT OF TIOTROPIUM HANDIHALER ON THE MORTALITY OF PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE.

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Objectives: Medical therapy of Chronic Obstructive Pulmonary Disease (COPD) currently aims to reduce the exacerbation rates and to improve the quality of life. Only longterm oxygen administration has been proved to prolong the survival of COPD. The purpose of this meta-analysis was to synthesize current evidence regarding the impact of tiotropium handihaler on the survival rate of these patients, which is still controversial. Methods: A systematic search in the electronic databases of the Cochrane Library, Medline and Scopus was conducted by two independent authors (May 2012). Randomised Controlled Trials (RCTs) and Cohort studies comparing inhaled tiotropium versus control (placebo or open control) or prescriptions with versus without inhaled tiotropium in the treatment of patients with stable COPD were included. Data on total mortality were extracted and missing data were obtained from authors. Relative risk (RR) for total mortality was calculated for each study and pooled. Data were non-heterogeneous, so fixed effects model analysis were used. Results: 27 Randomised Controlled Trials and two cohorts, evaluating 36754 patients, met the inclusion criteria. Inhaled tiotropium, when added to the prescriptions of COPD patients was associated with a decreased risk of all-cause mortality (relative risk 0.782, 95% confidence interval 0.715 to 0.854). The number needed to treat to prevent one fatality was estimated to be 65.53 (95% CI 51.44-120.94). Conclusion: Statistically significant reduction of the mortality rate was found in patients who were prescribed tiotropium in the maintenance treatment of COPD. Further studies are needed to determine the impact of tiotropium on different stages of COPD and on the cause-specific mortality.

Sponsored Research - None

1432920

IN-VITRO COMPARISON OF AEROSOL DRUG DELIVERY IN PEDIATRICS USING PRESSURIZED METERED DOSE INHALER, JET NEBULIZER, AND VIBRATING MESH NEBULIZER WITH AMBU BAG.

Huriah A. Al Sultan, James B. Fink, Robert Harwood, Meryl Sheard, Lawrence Bryant, Arzu Ari; Respiratory Therapy, Georgia State University, Atlanta, GA

Background: While some studies compare jet nebulizer (JN), vibrating mesh nebulizer (VMN) and pMDI, there is no study comparing these three devices in young children with self-inflating resuscitator. The aim of this study was to quantify aerosol in a simulated pediatric with active and passive breathing patterns. Methods: Albuterol was administered with JN (Misty-neb) and VMN (Aeroneb Solo) with 2.5 mg in 3 mL NS, and via pMDI (ProAir HFA) 108 µg per puff and total of 4 puffs with valved holding chamber (AeroChamber). Each aerosol generator was placed between self-inflating bag (Ambu Inc) and infant facemask (Mercury Medical), held firmly against the face of a SAINT infant upper airway model. Active and passive breathing parameters (Vt of 100 mL, RR of 30 breaths/min, and I:E ratio of 1:1.4). Active breathing was simulated using a ventilator (Esprit, Respironics/Philips Healthcare) connected to a dual chamber test lung (Michigan Instruments), attached to an absolute filter (Respirgard II), connected to the SAINT model. Ambu bag was run at 10 L/min of oxygen and attached to aerosol generator with facemask. Passive breathing consisted of manual ventilation of the SAINT to a passive test lung. Each aerosol device was tested three times (n=3) with each breathing pattern. Drug was eluted from the filter and quantified using spectrophotometry (276 nm). One-way analysis of variance (one-way ANOVA) and independent t-test were performed ($p < 0.05$). Results: Table shows tracheal deposition of albuterol mass and % of dose (mean ±SD). Deposition with the JN was similar with active and passive, while pMDI and VMN were more efficient in active breathing. pMDI/VHC had greater deposition % ($p=0.013$) while VMN delivered greater drug mass . Conclusion: Aerosol treatment may be administered to young children using JN, VMN, or pMDI/VHC combined with ambu bag. Active breathing is more efficient with VMN and pMDI/VHC.

Sponsored Research - None

Tracheal deposition of albuterol mass and % of dose (mean ±SD)

	Passive Breathing			Active Breathing		
Aerosol Device	JN	VMN	pMDI	JN	VMN	pMDI
Inhaled Mass (µg)	64.3 ± 8.6	149.6 ± 32.0	84.4 ± 6.9	61.2 ± 11.6	190.5 ± 25.1	120.2 ± 10.9
Inhaled Dose%	2.57 ± 0.34	6.0 ± 1.3	19.6 ± 1.6	2.5 ± 0.5	7.6 ± 1.0	27.8 ± 2.5

1433147

LUNG DEPOSITION OF ^{99M}TC-SALBUTAMOL FROM A PRESSURISED METERED DOSE INHALER AND VALVED HOLDING CHAMBER, USED WITH FACEMASK OR MOUTHPIECE IN CHILDREN WITH STABLE ASTHMA - A PILOT STUDY.

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Pressurised metered dose inhalers (pMDIs) are an effective and convenient method of delivery of inhaled medication to patients with asthma. Valved holding chambers (VHCs) can improve the delivered dose to the lungs while minimising adverse effects from oropharyngeal deposition. The use of VHCs with facemasks is required in young children until they can use a mouthpiece. Early research showed that oral inhalation via a mouthpiece was more efficient than the combination of oral and nasal inhalation which occurs when using a facemask. Recent improvements in facemask design and materials have highlighted the need for new comparative studies between VHC facemasks and mouthpieces. **Research Questions:** 1. How does lung deposition from a pMDI-VHC with a newly designed, well-fitting facemask compare with a mouthpiece? 2. At what age can children be trained to use a mouthpiece effectively? **Methods:** Four children (3 male) with stable asthma aged 4-5 years were included. One child (male, 5 years) was screened but not included due to non-compliance with both facemask and mouthpiece use. A transmission scan of each patient was initially taken, using a flood source containing 37MBq ^{99m}Tc. In total 180 µg of ^{99m}Tc-labelled salbutamol (ProAir, TEVA) was administered to each patient through an antistatic VHC (OptiChamber Diamond, Philips Respironics) with either a dedicated facemask (LiteTouch, Philips Respironics) or a mouthpiece interface, on separate occasions in random order. Simultaneous anterior and posterior planar scintigraphic scans (120 sec acquisition time) were taken immediately after salbutamol inhalation. Student's t-test for paired data was used to test for significant differences ($p<0.05$) between the two study arms (facemask and mouthpiece). **Results:** Mean (SD) lung deposition (% label dose) was 17.0 (2.9)% for the facemask and 19.1 (10.2)% for the mouthpiece when corrected for tissue attenuation ($p>0.05$). Lung deposition in the peripheral compared with central regions (P:C ratio) was 1.5 (0.5) for the facemask and 1.1 (0.5) for the mouthpiece ($p<0.001$). There was no difference ($p>0.05$) in oropharyngeal and gastrointestinal deposition with the two interfaces (21.7 (7.7) and 20.2 (1.4) for the facemask and mouthpiece respectively. **Conclusions:** Contrary to previous studies, there was no difference in lung deposition with the use of the facemask compared with a mouthpiece. Peripheral lung deposition was significantly higher with the use of the facemask.

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1433375

PULMONARY RADIOAEROSOL DEPOSITION USING MESH AND JET NEBULIZERS IN HEALTHY NORMALS DURING NONINVASIVE VENTILATION.

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Introduction: In vitro studies of aerosol delivery during noninvasive ventilation report > two fold differences in inhaled dose using jet and mesh nebulizers. Limited data is available to establish in vitro/in vivo correlations for aerosol delivery. Objectives: To analyze the distribution of aerosol into the lungs during administration using Mesh and Jet nebulizers during NIV in healthy subjects. Methods: Four healthy volunteers (2 female) with mean age of 26.5±3.1 years, weight 78.0± 12.35 kg, height 1.69±0.07 m, and BMI 26.52 ± 3.77 were administered aerosol containing DTPA-Tc99m with radioactivity of 25 miC in a total volume of 3 mL and 1 mL during bilevel positive pressure ventilation of 12 cmH2O / 5 cmH2O with a BIPAP device (Synchrony, Respironics, Murrysville, Pennsylvania, USA) via face mask (Respironics, Murrysville, Pennsylvania, USA) Radioactivity counts were performed using a gamma camera (STARCAM 3200 GE, California, USA). To quantify radiation counts in the lungs, upper airway, stomach, as well as nebulizer, circuit, inspiratory and expiratory filters, with activity in each compartment expressed as a percent of total radiation. filters, with activity in each compartment expressed as a percent of total radiation. Statistical analysis was performed using Friedman test, considering significant $p <0.05$. Results: Table shows lung deposition reported as mean ± SD % of total radiation. Lung deposition with the Mesh was > 3 fold greater than JN, independent of dose volume used with the MESH. Conclusions: Administration of aerosol via Mesh nebulizer during NIV provided a higher radioaerosol deposition than jet nebulizer, supporting in vitro studies reporting > 2 fold difference in inhaled dose. These results have important implications in clinical practice when supporting patients with asthma or COPD to ensure effective pulmonary deposition of aerosol during NIV.

Sponsored Research - None

Neb/Dose	JN 3 mL	MESH 3 mL	MESH 1 mL
Total Lungs	1.41 ± 0.83%	5.90 ± 1.08 %*	4.41 ± 1.18 %**

*$p<0.0001$(MESH 3 mL vs JN 3 mL) and **$p<0.007$ (MESH 1 mL vs JN 3 mL).

1434604

A COMPARISON OF AEROSOL DRUG DELIVERY AND PLACEMENT WITH AND WITHOUT THE NEOFLOW™ SENSOR.

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Background: Delivery of bronchodilators via Aeroneb is common in neonatal mechanically ventilated patients. Using a Dräger ventilator, Neoflow™ sensor placement at the airway is preferred, but impact on aerosol delivery with the sensor in-line has not been reported. Removal of the Neoflow™ sensor to deliver Albuterol to this patient population may lead to increased risk of Ventilator Associated Pneumonia and safety risks related to ventilator setting augmentations. Method: Dräger Evita XL set in PC 20/5 x 30 x 21%, 2.5 mg of albuterol was delivered via Aeroneb Solo placed distal (pre-humidifer) delivered through the inspiratory limb of a neonatal heated wire circuit (37 ± 1° C) with and without the Neoflow™ sensor. Drug was collected on a nonconductive respiratory filter distal to a 3.5 mm ETT, and attached to a passive test lung. The same circuit was used for all trials (n=3); they were performed in the order listed. Samples were eluted from the filters using an ethanol/water mixture. Absorbance at 276 nm was used to estimate the amount of albuterol in the eluent. Results: Table belowshows results of each run with ug of albuterol also expressed as mean ± SD. Conclusion: Despite a trend toward higher drug delivery with Neoflow removed, T test showed no statistical difference in the deposition with the Neoflow™ sensor present or absent from the circuit. Further studies are needed to standardize delivery method and quantify dose delivered with and without Neoflow.™

Sponsored Research - None

Comparison of Drug Delivery With and Without Neoflow™

Neoflow	Spacer Location	µg Albuterol on Filter	Mean	SD
Present	Distal	2.47		
Present	Distal	5.25	4.63	1.93
Present	Distal	6.17		
Absent	Distal	19.44		
Absent	Distal	6.48	10.19	8.07
Absent	Distal	4.63		

1435062

GROWTH OF NASAL-LARYNGEAL AIRWAYS IN CHILDREN AND THEIR IMPLICATIONS IN BREATHING AND INHALED AEROSOL DYNAMICS.

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Background: Infants and children are more vulnerable to respiratory disorders than adults. Evaluating the health effects of environmental exposure in children requires a thorough understanding of transport and deposition of inhaled agents in their respiratory airways. As a human grows from birth to adulthood, both airway anatomy and breathing conditions vary, altering the aerodynamics and behaviors of inhaled aerosols. Method: In this study, we developed anatomical accurate computer models of the nasal-to-laryngeal airway based on CT/MRI scans of pediatric subjects at different ages, i.e., a 10-day-old newborn, a 7-month-old infant, a 3-year-old girl, and a 5-year-old boy. Dramatic growth was observed with age in both airway morphology and dimension. The airway dimension was further quantitatively compared based on different parameters (i.e., volume, cross-section area, and hydraulic diameter) and different sub-regions (i.e., nose, pharynx, and larynx). To investigate the breathing in children, a high-fidelity fluid-particle transport model was employed to simulate the multi-regime airflows and particle transport/deposition. Results and conclusions: For a same flow rate, breathing resistance persistently decreases with rising age. Specifically, ultrafine particles were evaluated under breathing conditions from sedentary to heavy activities. Results of this study indicate that the nasal airways at different ages, albeit differ significantly in morphology and dimension, do not significantly affect the total depositions for ultrafine aerosols. However, the deposition partitioning in the sub-regions (i.e., turbinate, nasopharynx, pharynx, and larynx) was quite different among the four subjects considered.

Sponsored Research - None

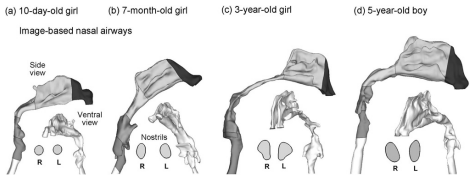

Image-based nasal airway model of (a) 10-day-old girl (neonate), (b) a 7-month-old girl (infant), (c) a 3-year-old girl, and (d) a five-year-old boy (child).

1413330

BRONCHODILATOR DELIVERY DURING SIMULATED NONINVASIVE VENTILATION OF A PEDIATRIC ASTHMATIC.

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Introduction: Noninvasive respiratory support is commonly used as an alternative to invasive ventilation in pediatric patients with severe respiratory distress due to asthma. Bi-Level Positive Airway Pressure (Bi-PAP) devices use a single circuit for breath delivery with an integrated leak valve to purge the circuit of carbon dioxide. Effective bronchodilator delivery is an important intervention for these patients. There have been no forthcoming studies in the literature describing the optimal nebulizer position, with respect to the leak valve, during pediatric noninvasive ventilation. We hypothesized that there are no differences in albuterol delivery with a vibrating mesh nebulizer between 3 different positions/exhalation leak valve combinations within the patient circuit during simulated pediatric noninvasive ventilation. Methods: A face/airway model was attached to a simulated spontaneously breathing pediatric asthmatic lung model (ASL 5000, Ingmar). A V60 Bi-PAP Ventilator (Phillips Respironics, Carlsbad, CA), equipped with heated wire circuit and, Fisher and Paykel 850 heater was attached to the simulated patient via a oronasal mask. Albuterol (5 mg) was delivered with 3 vibrating mesh nebulizers and at 3 different circuit position/leak condition combinations, including: 1) prior to the humidifier and leak valve; 2) between the humidifier and leak valve; and 3) within the mask and after the leak. The Aerogen Solo nebulizer was used for medication delivery in the first two positions and a new lightweight nebulizer that can be integrated into the patient mask (Aerogen NIVO) was used in for the third. Albuterol was recovered from a filter at each position and quantified using high-pressure liquid chromatography. Results: There was greater Albuterol delivered to the lung model with the NIVO nebulizer placed following the exhalation valve than any other testing condition ($p<0.01$). In the conditions where the nebulizer was placed prior to the exhalation leak valve, greater drug delivery was observed when the nebulizer was placed proximal to the mask than when placed prior to the humidifier ($p<0.01$). Conclusion: Albuterol delivery during simulated pediatric non-invasive ventilation is affected by the position of the nebulizer in relation to the expiratory leak valve. The Aerogen NIVO nebulizer may provide a better alternative for medication delivery than those previously used during noninvasive ventilation of pediatric patients with asthma.

Sponsored Research - NO funding— Only 3 NIVO nebulizers contributed by Trianim

1405642

EFFECTS OF MILD-MODERATE CHRONIC OBSTRUCTIVE PULMONARY DISEASE AND THE IMPACT OF TREATMENT WITH TIOTROPIUM BROMIDE.

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Background: Optimal clinical management of mild-moderate COPD is yet to be routinely established, as physical limitations are often unrecognized at this stage. This study aimed to characterize exercise limitation mechanisms, describe daily physical activity in GOLD I/II COPD patients vs age-/sex-matched controls, and evaluate the impact of treatment with a maintenance bronchodilator. Method: Symptomatic COPD patients (n=126) and controls (n=104) were enrolled at 15 sites (US and Canada). Subjects were m/f, ≥40 yr. COPD patients had dyspnea index focal score ≤9 and/or daily cough with sputum for 3 mo/yr in ≥2 consecutive years, post-bronchodilator FEV1/FVC <70% and FEV1 ≥50%, and ≥100 mL decrease in inspiratory capacity (IC) during exercise. Controls were nonsmokers with no significant diseases. Visit 1: incremental treadmill exercise test. Visit 2: constant work rate (CWR) treadmill exercise test at 80% peak work rate from Visit 1. Visit 3: CWR test; COPD patients were randomized to daily tiotropium (Tio) or placebo. Between Visits 1–2 and 2–3: 1-wk activity monitoring. Visits 4–6 (COPD patients): spirometry and CWR tests; crossover treatment was separated by 4-wk washout (Visits 4–5). Dynamic hyperinflation was assessed using IC (baseline at rest vs peak exercise). Results: COPD patients and controls were demographically well matched; clinical characteristics were markedly different (Table). GOLD I and II groups had significant lung hyperinflation at rest, decreased activities of daily living, increased dyspnea scores and impact on work productivity vs controls. Peak exercise capacity was significantly decreased in GOLD I and II groups vs controls, with no significant difference between GOLD I and II. COPD patients had a decrease in IC with exercise, higher dyspnea scores and increased ventilatory demand on exertion during exercise vs controls. Tio improved FEV1 and reduced dynamic hyperinflation in COPD patients. It significantly improved exercise duration (change in CWR duration 57.9±24.0 *s*; $P<0.05$) in GOLD II, but not in combined GOLD I/II or GOLD I. Conclusions: Symptomatic COPD patients showed distinct physiological impairments at rest and during exercise, as well as impacts on self-reported outcomes and daily activity; these abnormalities were largely similar in GOLD I and II. COPD patients benefited from Tio treatment, with decreased static and dynamic hyperinflation and improved lung function. Tio increased exercise duration in GOLD II patients.

Sponsored Research - Boehringer Ingelheim Pharmaceuticals, Inc.

1433805

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For additional information related to relationships between authors and industry, refer to: Fontanarosa PB, Flanagin A, DeAngelis CD. Reporting conflicts of interest, financial aspects of research, and role of sponsors in funded studies. JAMA 2005;294(1):110-111 (doi:10.1001/jama.294.1.110).

TRIAGE PRIORITY AFFECTS TIME TO INITIAL TREATMENT FOR PEDIATRIC ASTHMA PATIENTS RECEIVING CONTINUOUS ALBUTEROL IN AN ACADEMIC ED.

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Background: Patients with severe asthma attacks often initiate the emergency medical services (EMS) system for transport to the emergency department (ED). The use of continuous albuterol has been shown to be a safe and effective treatment for severe asthma exacerbations.1 After arrival in the ED each patient is seen by a nurse and given a triage priority of 1 to 5 with 1 being the highest priority. The purpose of this review was to determine if EMS-transported pediatric asthma patients who subsequently received continuous albuterol in the ED were treated faster, had higher triage priorities or were more likely to require admission to PICU or stepdown. Methods: Records of pediatric patients placed on continuous albuterol in the Duke ED from 2/21/2009 to 4/31/2011 were retrospectively reviewed through an IRB approved protocol. Data tracked consisted of transport via EMS, triage priority, patient diagnosis, time to from triage and registration to initial bronchodilator treatment, number of treatments prior to initiation of continuous albuterol, and disposition from the ED. The need for continuous albuterol and disposition was determined by ED physician in consultation with the respiratory therapist. Results: 148 pediatric patients (age 7.5±5 years) who received continuous albuterol therapy in the ED were included. 71 (48.0%) patients (age 7.7±5.2 years) arrived via EMS transport while 77 (52.0%) patients (age 7.4±4.9 years) arrived via personal transport. The most common dose was 20 mg/hr for both EMS and non-EMS patients. The use of concomitant medications was done through standard ED guidelines and was similar in both groups. Results are displayed in the table below. In our population patients who arrived via EMS received a higher triage priority and as a result were more likely to: be admitted, treated faster with bronchodilators/steroids, require admission to PICU or stepdown and be placed immediately on continuous albuterol. Overall admission rate was high in both groups. Conclusion: Timely and effective triage of pediatric asthma is essential to provide appropriate treatment. Triage priority appears to have a significant effect on time to initial bronchodilator treatment. Development of a simple, easy to use asthma scoring system may help to further optimize appropriate triage priority. References 1. Peters, SG. Continuous Bronchodilator Therapy. Chest 2007;131(1):286-289.
Sponsored Research - None

Triage Priority for All Patients		
	Priority 1-2 n=85	Priority 3-4 n=63
EMS	47 (55.3%)	24 (38.1%)
Admission Rate	78 (91.8%)	53 (84.1%)
PICU/Stepdown	52 (61.2%)	25 (39.7%)
Bronchodilator <=0:30 from triage	62 (72.9%)	31 (49.2%)
Corticosteroid <=0:60 from triage	63 (74.1%)	36 (57.1%)
Immediate placement on continuous albuterol	40 (47.1%)	21 (33.3%)

1435398

PERIOPERATIVE TRANSPORT AND MONITORING OF THE PATIENT ON INHALED NITRIC OXIDE.

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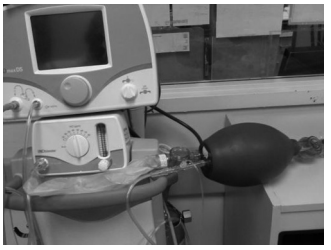
BACKGROUND: Inhaled nitric oxide (iNO) has been used for complex cardiac surgery. Studies have indicated that iNO may attenuate intraoperative right heart dysfunction. Post operatively, patients should be transported to intensive care unit (ICU) on iNO, but there has been limited studies proving that the level of iNO delivered and monitored via resuscitation bag during transport is comparable to that provided by commercial ventilator with DS delivery system (CVDS). METHODS: A Mercury®, (Clearwater, Florida) disposable manual resuscitator bag (MB), with a positive end expiratory pressure valve, INOmax DS® (Ikara, Clinton, NJ) (DS) was connected to a test iNO gas cylinder of 800 parts per million (ppm) and attached to a test lung (TL). Two 7' sections of oxygen (O2) tubing was connected to a gas "E" cylinder containing 100% O2. Two methods for delivery and monitoring of iNO were evaluated. Delivery setup; the O2 tubing was connected to the internal blender (IB) or to the injector module (IM) and gas inlet of the MB. The MB was connected to the TL, the DS was set for 20 ppm and O2 gas flow initiated, allowing comparison of hand ventilation, checking for variation between set and measured iNO. In addition, DS alarms response was evaluated, lines disconnected to test alarm response. The following schematic reflected the experimental monitored method on MB; T1. IB; monitoring via sample tee (Ikara, Clinton, NJ) on gas inlet T2. IM; monitoring via sample tee to gas inlet T3. IB; monitoring sample line to pressure monitor port (PMP) T4. IM; monitoring sample line to PMP, on the top of MB RESULTS: At set flowrate of 10 L/min on the O2 tank, the IB and IM delivery systems performed up to expectations with respect to set iNO to monitored levels iNO, NO2, and FIO2, The results of T1 to T4; iNO-20 ppm, NO2-0.3 ppm and FIO2- 0.99. All alarms responded appropriately for breach of alarm limits. CONCLUSION: We have demonstrated that both iNO delivery and monitoring in a simulation transport system is comparable to that achieved with the CVDS. Gas sampling of iNO and FIO2 is important for detecting alarm conditions. Between May 2006 and May 2012, more than 150 adult patients have been safely transported between operating room and ICU at The University of Chicago Medical Center with the DS and MB. Our results are limited to the MB, additional study is needed to validate other manual resuscitators performance for transport with the DS.

Sponsored Research - None



MB with sample tee

1410789

ULTRASOUND GUIDED ARTERIAL CANNULATION IN CONTINUOUS FLOW VENTRICULAR ASSIST DEVICES.

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Background: 5 million Americans experience heart failure which affects 10 in every 1000 people over 65 years old. Continuous flow left ventricular assist devices (cfVAD) are increasingly used for cardiac support with more than 4300 patients supported as of June 2011. These patients require close monitoring of blood pressure, are at increased risk of infection and bleeding, and typically require more arterial catheter days than other patient populations. These 2nd generation devices create limited pulse pressure making non invasive blood pressure monitoring challenging. Invasive monitoring is a challenge for the same reason and the use of ultrasound (US) guidance for arterial cannulation may improve the rate of successful arterial cannulation. Method: We conducted a retrospective review of US guided arterial cannulation by a dedicated team of critical care therapists on a cardiac surgical ICU with cfVAD patients from Jan 2011 to May 2012. Success rates and complication rates were abstracted. Cannulation technique is described. Results: 21 unique patients reviewed received 24 successful US guided arterial lines with an average of 5 catheter days. The average pulse pressure on insertion was 17mmHG with 15 patients having a pulse pressure of less than 15mmHG. 1 patient required alternate sites, femoral and pedal, due to unsuccessful radial cannulation. No major complications were noted. The radial artery is selected as the first choice for cannulation, brachial may be used if necessary. If more than two attempts are required, a second skilled therapist or physician may attempt an alternate site. Femoral or pedal sites are utilized by a physician if upper extremity flow is not present on US or access is unsuccessful. The iLook ™ or SICU™ (Sonosite, Bothell, WA) is used to identify the artery with the transducer in the transverse plane. Compressibility, pulsatility and blood flow directionality with 2D imaging and color flow Doppler are used to differentiate venous and arterial vessels. Real time visualization was used during arterial catheter insertion with the Seldinger technique. Conclusion: The use of US guided arterial line placement by a dedicated team of critical care therapists may reduce the number of attempts and the number of sites required for cannulation while minimizing the risk of complications in this unique population.

Sponsored Research - None

1408798

CORRELATIONS BETWEEN CHANGES IN AMBIENT OXYGEN PERCENTAGE AND DISSOLVED OXYGEN CONCENTRATION DURING SOLVATION AND SOLUTION SUPERSATURATION USING A NOVEL HYPERBARIC TONOMETER .

Daniel J. Grady[1], Michael A. Gentile[2], John H. Riggs[3], Terrence F. Smith[1], Todd McCarl[1], Ira M. Cheifetz[2], Gregg Stashenko[1]; [1]Respiratory Care, Mission Health System, Asheville, NC; [2]Pediatric Critical Care Medicine, Duke University Health System, Durham, NC; [3]Clinical Research, VentLab, Inc, Mocksville, NC

Background: Previous research has demonstrated that supersaturated dissolved oxygen solutions (which contain dissolved partial pressures of oxygen greater than 760 mm Hg) may be achieved outside of a hyperbaric chamber [1]. The purpose of this study was to evaluate effects of various ambient oxygen concentrations on dissolved oxygen tensions in solution using 2 different solution temperatures in a novel hyperbaric tonometer. . **Methods**: Supersaturated dissolved oxygen solutions were prepared by bubbling gaseous oxygen at 3 L/min through 2.5 liters of sterile water for 20 minutes. Ambient oxygen percentage was selected and controlled by means of a gas blender. A total of 10 measurements of dissolved oxygen were made at 8 ambient oxygen percentages, for a total of 80 measurements per solution. The dissolved oxygen measurements were made using 2 different solution temperatures; 70 F = 22 C and; 55 F = 13 C for an overall total of 160 measurements. Dissolved O_2 in solution was measured under conditions of ATPS by a Hanna Instruments HI 98186 dissolved oxygen analyzer in units of mg/L. Descriptive statistics (alpha = 0.05) and Pearson's correlation coefficient (R^2) were calculated for each of the above experimental groups. **Results**: At both solution temperatures of 70 F and 55 F, strong correlations exist between changes in ambient oxygen percentage and subsequent dissolved oxygen concentrations in solution, with R^2 = 0.995 and R^2 = 0.9896; respectively. In addition, when the two solution were compared for dissolved oxygen following exposure to 100 % oxygen, statistically significant differences in concentrations of dissolved oxygen were achieved at the colder solution temperature of 55 F, $p < 0.001$. **Conclusions**: This study has demonstrated strong correlations between ambient oxygen percentages and the resulting concentration of dissolved oxygen in sterile water solutions when gas solvation occurs at different temperatures using a novel hyperbaric tonometer. Additional research is necessary to determine correlations between ambient oxygen percentage and dissolved oxygen content in electrolyte and colloidal solutions.

Sponsored Research - None

1. Grady D, Smith T, and Gentile M. Measurement of Dissolved Oxygen Tension in Fluid Following Supersaturation with Oxygen Gas Using a Novel Hyperbaric Tonometer. Respir Care, Oct 2011, 56;10, pp. 1661.

1408449

STRATIFICATION OF SUPERSATURATED DISSOLVED OXYGEN SOLUTIONS WITH DEPTH AND TEMPERATURE USING A NOVEL HYPERBARIC TONOMETER.

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Background: Supersaturated dissolved oxygen solutions may exhibit stratification due to variables such as solvent polarity, molecular mobility, spin exchange between oxygen molecules, container shape, solution temperature, and container depth[1]. The purpose of this study was to evaluate supersaturated dissolved oxygen concentrations at various solution temperatures and depth levels using a novel hyperbaric tonometer. **Methods**: The supersaturated dissolved oxygen solution was prepared by bubbling gaseous oxygen at 3 L/min through 2.5 liters of sterile water for 20 minutes. Dissolved oxygen measurements were made at the container bottom, 1, 2, and 3 inches above bottom; and at the solution surface. The dissolved oxygen measurements were made using 3 different groups of solution temperatures (62, 57 and 52 degrees F, which equals 17, 14, and 11 degrees C; respectively) for a total of 15 (n = 15) measurements. Dissolved O_2 of the supersaturated solution was measured by a Hanna Instruments HI 98186 Dissolved Oxygen analyzer in units of mg/L under conditions of ATPS. Student's t-test (alpha = 0.05) determined statistical significance. **Results**: Slight changes in dissolved oxygen concentration at different depths within the tonometer are shown in the figure below. A statistically significant difference ($p = 0.0004$) was seen between the supersaturated dissolved oxygen solutions at 11 C (52 degrees F) compared to 14 C (57 degrees F). Also, there was a statistically significant differences ($p = 0.0004$), between the dissolved oxygen solutions at 14 C (57 degrees F), compared to 17 C (67 degrees F). **Conclusions**: This study has demonstrated significant differences in dissolved oxygen in sterile water solutions when solvation occurs at different temperatures. Also, slight stratification of supersaturated dissolved oxygen solutions in sterile water was observed due to changes in depth within the tonometer. With warmer solution temperatures, the highest dissolved oxygen measurements occurred 1 inch above the bottom of the container. At the coldest solution temperature, the highest dissolved oxygen content was observed near the surface. Additional research is needed to determine the efficacy of systems to homogenously mix the supersaturated dissolved oxygen solutions.

Sponsored Research - None

1 Moscatelli et al. Oximetry of Oxygen Supersaturated Solutions Using Nitroxides as EPR Probes. J. Phys. Chem. B, 2006, 110, 7574-7578

1407793

PERFORMANCE OF HEAT AND MOISTURE EXCHANGERS AND OTHER HUMIDIFYING DEVICES FOR TRACHEOSTOMIZED PATIENTS WITH SPONTANEOUS BREATHING: A BENCH STUDY.

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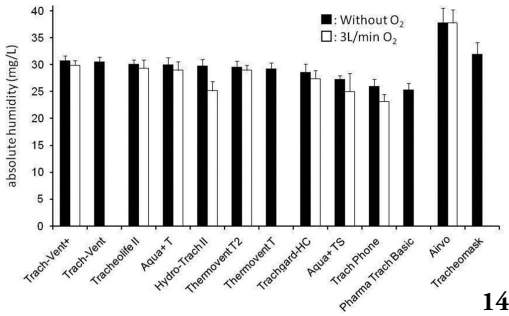
Background: Heat and moisture exchanger (HME) is popular as a humidifying device for mechanically ventilated patients. It is also applied for tracheostomized patients with spontaneous breathing (SB), however its performance remains to be clarified. The aims of this bench study were to investigate effects of SB parameters and supplemental oxygen on performance of the HMEs and to compare them with other humidifying devices. ***Method:*** We assessed humidification performance of 11 HMEs. In addition, an oxygen mask with nebulizer heater and high flow continuous positive airway pressure (CPAP) system for tracheostomized patients. SB was simulated with a mechanical ventilator (Puritan-Bennett 840, Covidien, Carlsbad, CA), a model lung (TTL model 1601, Michigan Instruments, Grand Rapids, MI) and a servo-controlled heated humidifier (MR730, Fisher&Paykel, Auckland, NZ). Tidal volume (V_T) were 300, 500 and 700 mL and respiratory rate of 10 and 20 breaths/min. High flow CPAP system was set at 15, 30 and 45 L/min. Eight of HMEs and high flow CPAP system had a port to deliver oxygen, and measurements were repeated with 3 L/min of dry oxygen. We measured absolute humidity (AH) of the inspired gas by using a hygrometer after stabilization of at least one hour. ***Results:*** A figure shows AH values among the devices and effects of supplemental oxygen. AH varied among the tested HMEs, and 4 of 11 HMEs maintained AH higher than 30 mg/L. AH with the high flow CPAP system and oxygen mask with nebulizer heater was 37.7±2.8 mg/L and, 31.9±2.2 mg/L, respectively. Supplemental oxygen of 3 L/min decreased AH, and AH was not maintained above 30 mg/L with any HMEs. As V_T increased, AH decreased in all devices. ***Conclusions:*** There were significant differences in humidification performance among HMEs for tracheostomized patients with SB. With supplemental oxygen, AH decreased below the level of AARC guideline values. Caution is advised, when supplemental oxygen is applyed to HMEs in tracheostomized patients with SB.

Sponsored Research - None



1429187

THE EFFECTS OF STETHOSCOPE PRICE AND CHEST PIECE TYPE ON SOUND TRANSMISSION.

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Background: Several types of stethoscopes were selected for testing to determine how much sound intensity is lost due to factors such as configuration, materials, and chest piece type. The purpose was to provide an objective basis for comparing stethoscope performance and determine if a relationship between price and performance existed, and the difference between bell and diaphragm chest piece transmission. The hypothesis more expensive stethoscopes would have less sound loss was tested. **Methods**: Twelve models of stethoscopes (3 of each model, 12 with diaphragm and 9 with bell chest pieces) were tested using audio capture equipment (UA-1G interface with Cakewalk software by Roland Corp., Los Angeles, CA). A speaker (sonitor) designed for interfacing with a stethoscope chest piece was used to send a sinusoidal sound sweep 40-4000 Hz through each stethoscope. The earpiece was connected to a microphone mounted in an anatomically correct ear canal model and the apparatus was placed within an anechoic chamber for measurement in a room with low background noise. The difference between sound input/output equaled the amount of sound lost for each stethoscope (greater average area under the curve (AUC) value means less sound loss). **Results**: Several bell chest piece models were different from each other (p=0.009) as measured by One-Way ANOVA between Means and the Prestige Medical (PM) model S125 was different than all of the other models by having the least sound loss by Tukey-Kramer Multiple-Comparison test. The same analyses also showed a difference in the diaphragm chest piece models (p=0.002) with the PM model S107 having least sound loss value (different from 8 other models). The average AUC for all bell chest piece models was greater than that of the diaphragm models (p<0.001) for both full frequency range tested and upper range (1500-4000 Hz) using the Pooled t-test. Correlation and linear regression showed no significant relationship between price and sound loss (r = -0.406 for bell and r = 0.246 for diaphragm). **Conclusions**: The findings from this small sample indicate some models perform better than others based on this type of controlled measurement but a higher price does not insure better performance. Additional analyses may identify certain models as better for specific frequency sub-ranges and specific applications.

Sponsored Research - This student research project was partially supported by Prestige Medical, manufacturer of several of the models tested in the study. Partial funding was in the form of supplying product for testing and purchase of some recording software and supplies.

1435766

RELIABILITY OF NASAL CANULA SAMPLING TO DETECT ETCO2 IN THE PRESENCE OF CPAP.

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Background: EtCO2 monitoring has become an essential tool in monitoring post-operative patients at risk of developing respiratory depression due to over sedation. Many of these patients have been diagnosed with obstructive sleep apnea pre-operatively and are placed on CPAP using a nasal or face mask after surgery. Our study investigated the reliability of respired CO2 via a sampling cannula in an environment of continuous flow and leaks. Method: Testing was done on healthy subjects. The Carefusion EtCO2 nasal cannula was tested on eight males and eleven females ages 23-53. A 3 minute baseline EtCO2 was determined for each participant. Each participant placed a nasal CPAP mask over the EtCO2 nasal cannula and readings observed on a CPAP of 5 cm H20 for 3 minutes following another 3 minutes trial on a CPAP of 10 cm H20. Subjects were instructed to breathe through their nose. During each three minute trial we documented an average of the lowest and highest EtCO2 readings on each pressure. We then followed the same method using a full-face mask CPAP documenting the average EtCO2 both at 5cm H20 and 10cm H20. Results: Nasal masks on 10 cmH2O had the highest variability (10%) from baseline, followed by full face masks at 10 cmH2O (7%) then nasal masks at 5 cmH2O (5%) and full face masks at 5 cmH2O (4%). Discussion: Based on our testing we feel EtCO2 measurement via a sampling cannula is a valid means of monitoring patients receiving CPAP via nasal or full face mask. The baseline variability may be affected by wash out of respired CO2 at the cannula sampling port and the physiologic impact of CPAP levels. However our intent was to determine if CO2 could be detected for the purpose of monitoring respiratory rate and detection of apnea. Our preliminary results indicate such capabilities are possible. Further testing will be done to compare side stream and mainstream types of monitor, higher pressures, controlled leaks, longer periods of time and comparison of mouth breathers and nose breathers.

Sponsored Research - None

1434867

A COMPARISON OF ORAL VS BITE BLOCK INSPIRED OXYGEN CONCENTRATION DURING FLEXIBLE BRONCHOSCOPY IN A SPONTANEOUS BREATHING LUNG MODEL.

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BACKGROUND: Fiberoptic bronchoscopy (FOB) is an invasive procedure that allows clinicians to directly observe the tracheobronchial tree. One of the most common complications of FOB is hypoxia, which is corrected by supplemental oxygen. This study compared the inspired FIO2 when using the nasal cannula (NC) in the mouth and the bite block during FOB. Method: The Laerdal AirMan (Laedral, Wappingers Fall, New York) was attached to a Michigan Test Lung TTL (Michigan Instruments Inc.). This lung was driven by PB 7200 (Covidien, Boulder, CO) to simulate spontaneous breathing. The compliance of the test lung was set to 40 cm H2O/L with a fixed airway resistance of 5 cm/H20/L/sec. The Storz 14-33 Rigid Bronchoscope was advanced pasted the manikin's carina into the right mainstem. FiO2, flow, and pressure measurements were made in-line between the right main stem and test lung. The volume delivered to the lung was exhaled through a one-way valve to prevent contamination with previously inspired gas. Pressure, flow and volume measurements were made using a NICO cardiopulmonary monitor (Philips Electronics, Andover, MA). FIO2 was analyzed using an oxygen analyzer (maxo2me, maxtec, Salt Lake City, UT). The driver was set on CMV, rate of 10, 18 and 25, sine flow waveform, VT of 400, 600, 800 mL, and peak flows of 40, 60, 80 and 120 LPM. Oxygen flow of 2, 4, 6, 8 and 10 L/m were provided to the manikin via the NC in the mouth and the bite block (Smart OmniBloc, Oridion, Needham, MA). RESULTS:: See table 1. a. Significantly greater than 2L/min by mouth or bite block (p <0.05) b. significantly greater than 4L/min by mouth or bite block (p <0.05) c. significantly greater than 6L/min by mouth (p <0.05) CONCLUSIONS: There were no significant differences between the inspired oxygen concentration between the NC in the mouth and bite block at the same liter flow. Inspired oxygen increased significantly with increases in liter flow from 2 to 8 L/min with both methods of delivery. Both devices may provide similar inspired oxygen concentrations during FOB. Sponsored Research - None

Sponsored Research - None

Means (SD) of the measures on both methods of oxygen delivery.

O2 Flow and Device	VT L (Exhaled)	PIF (L/min)	Ve (L/min)	FiO2(%)
2 (NC mouth)	0.393 (0.124)	39 (10.4)	7 (3.3)	0.34 (0.07)
4 (NC mouth)	0.398 (0.124)	39 (10.3)	7 (3.3)	0.46 (0.09) a
6 (NC mouth)	0.399 (0.125)	39 (10.3)	7 (3.4)	0.51 (0.08) a,b
8 (NC mouth)	0.391 (0.125)	42 (10.6)	7 (3.3)	0.55 (0.06) a,b
10 (NC mouth)	0.392 (0.123)	42 (10.5)	7 (3.3)	0.56 (0.05) a,b,c
2 (NC/Bite Block)	0.388 (0.122)	42 (10.6)	7 (3.2)	0.36 (0.09)
4(NC/Bite Block)	0.391 (0.122)	42 (10.7)	7 (3.3)	0.46 (0.11) a
6 (NC/Bite Block)	0.392 (0.123)	42 (10.6)	7 (3.3)	0.52 (0.10) a,b
8 (NC/Bite Block)	0.393 (0.124)	42 (10.5)	7 (3.3)	0.56 (0.09) a,b,c
10(NC/Bite Block)	0.395 (0.124)	42 (10.6)	7 (3.3)	0.57 (0.07) a,b,c

1418235

ELECTRICAL IMPEDANCE TOMOGRAPHY USED TO MONITOR REGIONAL VENTILATION DIFFERENCES OF MECHANICAL AND SPONTANEOUS BREATHS IN AN ARDS CASE.

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INTRODUCTION: Electrical impedance tomography (EIT) monitors regional lung ventilation via an electrode chest belt measuring impedance. EIT software can compare four Regions of Interest (ROI). We conducted an IRB approved blinded study of EIT on ALI/ARDS patients (EIT Evaluation Kit 2, Draeger Medical, Luebeck Germany). CASE SUMMARY: A 32 year old female in a motor vehicle crash presented with multiple fractures and a severe chest contusion which developed into ARDS. EIT monitoring was performed on day 10 of admission after informed consent. Data on the day of EIT monitoring: APRV mode, Pressure High=24cmH2O, Pressure Low=0 cmH2O, Time High=14 seconds, Time Low=1.0 seconds, FiO2=50%. MAP=23cmH2O, Ve=9.5 LPM, RR=24. PaO2/FiO2 ratio=140. Her chest x-ray and CT scan both were consistent with ARDS. The patient was spontaneously breathing on APRV. EIT data was analyzed in 4 ROI slices of the lung (see the figure). % ventilation for the ROI slices were averaged for 20 spontaneous breaths versus 20 mechanical breaths. % ventilation of ROI slices 1 through 4 were as follows: Mechanical breaths = 19.5+1.7%, 44.5+1.5%, 26.3+2.7% and 9.1+0.5% Spontaneous breath = 8.8+1.5%, 33.0+2.6%, 43.9+3.4% and 11.8+0.8% Mechanical breaths ventilated the anterior regions (ROI 1 and 2) with 64% of the ventilation while spontaneous breaths ventilated the anterior regions with 41.8%. Mechanical breaths ventilated the posterior regions (ROI 3 and 4) with 35.3% of the ventilation while spontaneous breaths ventilated the posterior regions with 55.7%. The blinded EIT monitoring had no direct effect on this patient's care. The patient progressed in recovery and was discharged to a short term rehabilitation facility on day 39 of admission. DISCUSSION: In this case of ARDS during APRV with spontaneous breathing, EIT demonstrated differences in regional lung ventilation between mechanical and spontaneous breaths. In this case on APRV, mechanical breaths ventilated a larger portion of anterior lung and spontaneous breaths ventilated a larger portion of posterior lung. Also, spontaneous breaths exhibited better balance of ventilation in anterior versus posterior regions than the mechanical breaths. Balancing ventilation in different regions of the lung could play a role in lung protection and EIT could be a valuable device to monitor regional lung ventilation in the future.

Sponsored Research - None

1429122

EVALUATION OF THE EFFECTS OF IN-LINE INTRAPULMONARY PERCUSSIVE VENTILATION ON DELIVERED INHALED NITRIC OXIDE DURING MECHANICAL VENTILATION.

Nancy Johnson, Kathleen Deakins, Timothy Myers; Pediatric Respiratory Care, UHHS RBC Case, Cleveland, OH

Introduction: Intrapulmonary Percussive Ventilation (IPV) (Percussionaire, Sandpoint ID) is often utilized for airway clearance or hyperinflation for atelectasis on intubated mechanically ventilated patients. At Rainbow Babies & Children's, IPV is typically delivered in-line when the need for inhaled Nitric Oxide (iNO) or substantial ventilator support is required. The purpose of this study was to determine if in-line IPV treatment has an undesired effect on delivered iNO concentrations. Methods: A Draeger XL ventilator (Draeger Medical, Telford, PA) equipped with an Airlife Pediatric circuit (Carefusion, Yorba Linda CA) on the following simulated settings: pediatric mode at PCV +, PIP 30, PEEP +10, rate 30, Pressure support 5, FIO2 30% was attached to a BC Biomedical Infant Smart Lung (BC Biomed, St. Louis MO) set with compliance at 5 ml/mbar and a resistance 5 L/sec. An IPV breathing circuit assembly was connected to the inspiratory limb of the ventilator circuit with a T adapter. The iNOmax DS ir (Ikaria: Hampton NJ) flow injector was placed in-line the ventilator circuit and set at NO levels: (10, 20, 40 and 80 ppm) As iNO levels stabilized, measured values were recorded from the sample line five inches from the patient wye on the inspiratory limb. IPV was then introduced and cycled at the following settings; pressure 20 cm H20, frequency 220/bpm for a period of one minute. iNO concentration measurement was repeated after introducing IPV. The difference in measured iNO values were compared with and without IPV running in line with the ventilator. Results: The analyzed results from the iNOmaxDS ir are listed below: Conclusion: For mechanically ventilated patients that require iNO, when introducing IPV for clinical conditions, clinicians need to be aware that iNO concentration delivered is 10 % of the desired level.

Sponsored Research - None

Analyzed NO Results pre/post IPV

	Measured ppm			Measured ppm			Measured ppm			Measured ppm	
SET	PRE	POST	SET	PRE	POST	SET	PRE	POST	SET	PRE	POST
10	10	1.4	20	19	2.1	40	39	4.6	80	80	9.1
	9.5	1.4		19	2.0		40	4.8		80	10.1
	9.8	1.4		19	1.9		39	4.8		81	11.0
	10	1.5		20	3.0		38	5.0		81	8.9
	9.9	1.4		20	2.9		39	4.9		80	9.2
	9.8	1.6		20	2.8		39	5.3		80	9.4
	9.8	1.6		20	2.7		39	4.8		81	8.7
	9.8	1.5		20	2.7		39	4.6		80	9.8
	9.7	1.4		20	2.5		39	4.3		80	8.9
	9.7	1.2		20	2.7		39	4.9		80	8.7
	MEAN	1.3		MEAN	2.3		MEAN	4.3		MEAN	8.5

1418300

BREATH-BY-BREATH UPDATE OF PULMONARY DEAD SPACE FRACTION MEASUREMENT DURING ACUTE LUNG INJURY.

Lara Brewer, Kyle M. Burk, Simon A. Rodriguez, Joseph A. Orr; University of Utah Health Sciences Center, Salt Lake City, UT

Background: The ratio of physiologic dead space (Vd) to tidal volume (Vt), also called dead space fraction (Vd/Vt) is calculated using the Bohr-Enghoff equation: $Vd/Vt = (PaCO_2\text{-}PeCO_2)/PaCO_2$, where $PaCO_2$ is arterial partial pressure of CO_2 and $PeCO_2$ is mixed expired CO_2. Since high Vd/Vt has been identified as a pulmonary-specific predictor of mortality for patients with early ARDS, it would be valuable to know whether Vd/Vt has changed without requiring a new arterial blood gas (ABG) measurement for every Vd/Vt estimation. In prior work, we found evidence that in healthy lungs, the Vd/Vt can be updated based on breath-by-breath tidal volume (Vt) and airway deadspace (Vdaw) measurements for up to an hour. The aim of this study was to evaluate whether Vd/Vt can also be updated without new ABG information during an acute lung injury which models ARDS. **Methods:** Five male swine (27-30 kg) were ventilated with FiO2 of > 0.4, Vt of 12 mL/kg, and I:E time ratio of 1:2; RR was adjusted to maintain etCO2 of 35-40 mmHg. An arterial cannula provided continuous BP and periodic ABG samples. The NM3 volumetric capnometry monitor (Philips Respironics, Wallingford, CT) recorded $PeCO_2$, Vdalv, Vtalv, and Vd/Vt. An acute lung injury was induced by intravenous injection of 0.8 mL/kg oleic acid. Two Vt and two RR settings were used to create four ventilation levels during which ABG was sampled. ABG was sampled at 5, 15, and 30 minutes after each ventilator settings change. Breath-by-breath updates to Vd/Vt were calculated as: Vd/Vt = (Vdalv_old + Vdaw)/ Vt, where Vdalv_old = (Vdalv/Vtalv)old * Vtalv_current. The (Vdalv/Vtalv)old was calculated using the old $PaCO_2$. Vd/Vt updated from old ABG information was compared to Vd/Vt from current ABGs. **Results:** During lung injury Vd/Vt calculated using old ABG information and current ventilation parameters was accurate compared to Vd/Vt calculated from current ABG. Linear regression analysis of the Vd/Vts gave r^2 of 0.84. The difference between the two measurements was -0.02 ± 0.03 (-3.7% ± 4.8%). For both healthy and injured lungs, the difference between the two measurements was -0.007 ± 0.03 (-1.1% ± 5.3%). **Conclusion:** This study provides additional evidence that updating the displayed Vd/Vt based on old ABG and current Vt and Vdaw may be preferable to fixing the value until the next ABG sample, even during lung injury. We plan future evaluation of breath-by-breath updates to Vd/Vt for longer periods.

Sponsored Research - Philips Medical

1434611

ALVEOLAR DEAD SPACE RATIO PREDICTS END-TIDAL ARTERIAL CO_2 GRADIENT.

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Introduction: One cause of the observed difference between arterial and end-tidal CO_2 is dilution of the end-tidal gas by gas from the alveolar dead space. Alveolar dead space ratio (VD_{alv}/VT_{alv}) is the fraction of the alveolar tidal volume (total volume minus airway dead space) that ventilates non-perfused alveoli. High dead space ratio (Vd/Vt) has been identified as a pulmonary-specific predictor of mortality for patients with early ARDS. As the percentage of unperfused alveoli increases, the magnitude of the $PetCO_2$-$PaCO_2$ gradient is expected to increase since the inspired air remains in the dead space without equilibrating with the blood. In an animal study, we evaluated the linearity and strength of the relationship between alveolar dead space ratio and $PetCO_2$-$PaCO_2$ gradient. **Methods:** Five male swine (27-30 kg) were ventilated with FiO2 of > 0.4, Vt of 12 mL/kg, and I:E time ratio of 1:2; An arterial cannula provided continuous BP and periodic ABG samples. The NM3 volumetric capnometry monitor (Philips Respironics, Wallingford, CT) recorded $PetCO_2$, Vdalv and Vtalv. An acute lung injury was induced by intravenous injection of 0.8 mL/kg oleic acid. Two Vt and two RR settings were used to create four ventilation levels during which ABG was sampled. ABG was sampled at 5, 15, and 30 minutes after each ventilator settings change. At the time of each ABG measurement, the corresponding $PetCO_2$ was recorded. The $PaCO_2$ values, along with the corresponding volumetric capnography data were used to calculate the alveolar dead space ratio. We plotted the $PetCO_2$-$PaCO_2$ gradient versus the alveolar dead space ratio. **Results:** Figure 1 shows the mean and standard deviation of the $PetCO_2$-$PaCO_2$ gradient for each range of alveolar dead space ratio. The figure also shows the individual arterial and end-tidal P_{CO2} measurements from which the gradients were calculated. Linear regression analysis of the data shows a linear relationship between alveolar dead space ratio and arterial end-tidal gradient (r^2 = 0.925). The gradient increases by approximately 6.8 mm Hg for each 0.1 increase in the alveolar dead space ratio (VD_{alv}/VT_{alv}). **Conclusion:** The relationship between alveolar dead space ratio and $PetCO_2$-$PaCO_2$ gradient is linear and strong based on our data. Since airway dead space has little effect on $PetCO_2$ measurement, we expect the relationship is less direct for the total dead space ratio (Vd/Vt) than it is for the alveolar dead space ratio (VD_{alv}/VT_{alv}).

Sponsored Research - Philips Medical

1435371

EVALUATION OF AIRWAY PRESSURE AND TOLERANCE OF THE PASSY MUIR VALVE IN PEDIATRIC PATIENTS WITH TRACHEOSTOMY.

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Background: For pediatric patients with a tracheostomy, utilizing a Passy Muir Valve (PMV) may facilitate phonation, smell, taste, swallowing, secretion management, and improve cough. Two previous reports in the literature recommend monitoring airway pressure during use of a PMV to ensure an intact upper airway and prevent complications from high airway pressures(1,2). A pressure of <10 cmH20 is recommended, but this may substantially limit the number of pediatric patients who are able to tolerate the PMV. In order to offer the benefits of using a PMV to more patients, we adopted an institutionally approved modification procedure to provide pressure relief by drilling up to two holes in the PMV for patients with pressures >10 cmH20. The objective of this retrospective study is to identify how many of our pediatric patients were able to safely wear a PMV with and without the modification procedure. Methods: A retrospective chart review was performed for patients fitted with a PMV from November 2011 to May 2012 to assess airway pressure. Baseline pressure was recorded for all patients. If the modification was ordered, the pre and post pressures were recorded along with trach/type, size, airway diagnosis, age, number of holes drilled, and PMV tolerance. Data was recorded in an excel spreadsheet and is reported as mean and SD. Results: 25 patients were included in the study from our transitional care center, complex airway floor, and pulmonary clinic. Age range- 6 m to 27y/o, mean 5.46 (+/-5.8). Mean baseline pressure 19.2 (+/-13.6). 60% of the patients required a PMV modification. 24% required only one hole with mean pressure change 15.22 (+/-8.07). 36% required 2 holes with mean pressure change 9.2 (+/-33). Mean total pressure 7.9 (+/-2.07). One patient did not tolerate the PMV with 2 holes, but was able to tolerate with 2 holes after downsizing trach. Discussion: Implementation of a Procedural Guideline for monitoring and modification of PMV valves has standardized practice, increased patient safety by preventing high airway pressures, and allowed more patients to benefit from wearing a PMV. References: 1. Gereau SA, Navarrob GC, Cluterio B, Bassila M, Ruben RJ. Selection of pediatric patients for use of the Passy-Muir valve for speech production.1996;35:0-6. 2. Brigger MT, Hartnick CJ. Drilling speaking valves: a modification to improve vocalization in tracheostomy dependent children.The Laryngoscope 2009;119(1):176-179.

Sponsored Research - None

Modified PMV with 2 Holes

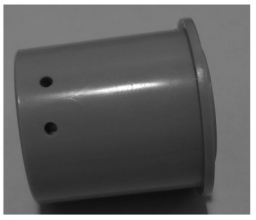

Figure 1

1416485

STANDARDIZED OXYGEN WEANING CHALLENGE IN NEONATAL INTENSIVE CARE UNIT.

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Background: Several advances in technology have aided babies who require oxygen (O2) support in neonatal intensive care units (NICUs). However, timing and weaning off oxygen varies across sites. There is a paucity of evidence to standardize O2 weaning for NICU patients on nasal cannula (NC O2). This quality assurance (QA) initiative is aimed at using a standardized Oxygen Weaning Challenge (OWC) for eligible infants who remain on conventional NC O2 <30% and with O2 saturations >90% at 28 days of life (DOL) or 36 weeks gestational age (GA). The OWC offers a step-wise structured method to assess vital signs, respiratory effort, and O2 saturation to better document and define each patient's tolerance and their outcome (Pass or Fail). Methods: This QA project included a multi-disciplinary team that proposed to translate research into clinical practice. This observational study examined a hospital based cohort starting with a needs assessment describing the complexity and respiratory needs of infants admitted between January 2011 and January 2012 (n= 599). The OWC was utilized to assess readiness to wean O2. Staff education on OWC was provided via committee meetings, emails and huddles. A convenience sample of staff (n=60) was surveyed regarding awareness and benefits of OWC, the importance of O2 weaning and comfort levels of communicating O2 needs to RTs. Analyses included descriptive statistics and cross tabulations. Results: We identified 69 infants (12%) on O2 DOL 28 or 36 weeks GA. The majority were male (73%), >32 weeks GA at birth (57%), > 1.5 kg birth weight (65%), on O2 at delivery (70%) and received antenatal steroids (50%). Most were on ventilator support > 4 days (75%) and hospitalized in NICU > 60 days (75%). Many had congenital birth defects requiring either heart surgery (24%) and/or GI surgery (24%). Ten were OWC tested with a 60% pass rate. Of the 55 clinicians who returned the survey (91%), the majority (85%) reported the OWC was very beneficial to care for eligible stable infants. Most (80%) reported being very comfortable regarding OWC communication with RTs and 86% reported a structured O2 wean was very important. However, only 22% were very familiar with the OWC. Conclusions: These findings suggest we need ongoing promotion and evaluation of the utility of the OWC as a NICU standard of practice within our vulnerable infant population.

Sponsored Research - None

1415806

REDUCING UNPLANNED EXTUBATIONS WITH CONSISTENCY AND COLLABORATION.

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Background: Unplanned extubations plague the ventilated infant for many inherent reasons and create a patient safety concern. Lack of dentition, poor skin integrity, and uncuffed endotracheal tubes create problems not observed in adult mechanical ventilation. In the calendar year of 2011, it was perceived and noted that the NICU of The Reading Hospital and Medical Center had a spike in unplanned extubations. Method: A multidisciplinary approach was used to create an action plan which included representation from respiratory therapy, nursing, and neonatology. In September of 2011, historical data was collected specifically looking at reason for reintubation being unplanned extubations to quantify the perception. With a marked increase proven, the team created the action plan with special attention in maintaining skin integrity. The action plan was two parted: consistent ETT securing using the STABLE technique with a hydrocolloid barrier and waterproof, occlusive tape; and two clinicians at the bedside when moving and positioning the infant. Education to the entire NICU staff on the new policy was performed in December, 2011. Data was continually collected after the new process was in place. The goal of the intervention was to decrease unplanned extubations to 2 per 100 ventilator days. Results: Data displayed an average unplanned extubation rate of 5.36/100 ventilator days, with a monthly high of 14/100 from April to September, 2011. When data collection began, a marked decrease was noted. This appears to be the effect of clinician's awareness of leadership focus on the solution. After education was performed and consistency established, unplanned extubations were maintained below the benchmark goal (actual 0.67/100). No skin breakdown was attributed to the securing technique. Conclusion: This quality improvement project was proven successful using the mentioned taping technique along with Respiratory Therapy and Nursing collaboration. Specific taping techniques were not evaluated in this study but the consistency of the procedure allowed for proper evaluation. We speculate that reducing unplanned extubations leads to improved ventilator outcomes and patient safety. Sponsorship: None

Sponsored Research - None

1415883

DURATION OF MECHANICAL VENTILATION AND DEADSPACE FRACTION IN INFANTS WITH CONGENITAL DIAPHRAGMATIC HERNIA FOLLOWING ECMO.

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BACKGROUD: Children with congenital diaphragmatic hernia (CDH) are known to have complicated hospital stays and often experience prolonged mechanical ventilation and sometimes require the use of extracorporeal membrane oxygenation (ECMO). The purpose of this investigation was to determine the relationship between physiologic deadspace fraction (Vd/Vt) and duration of mechanical ventilation in children with CDH who required ECMO support. Additionally, we wanted to determine the ventilatory support 30 days after discontinuation of ECMO. METHODS: A retrospective database review was performed on patients with CDH requiring ECMO support. Patient weight, sex, age, Vd/Vt immediately after discontinuation of ECMO support, mechanical ventilator days post ECMO and respiratory support 30 days after separation from ECMO were recorded. Data was collected using MS Excel (v11.8342.8333, Microsoft, Redmond, WA). Statistical analysis was completed using Prism (v 5.01, GraphPad Software Incorporated, La Jolla, CA). Mean and standard deviation (SD) were used to describe patient demographics. Spearman correlation was used to determine the relationship between Vd/Vt and duration of mechanical ventilation after discontinuation of ECMO. RESULTS: Fourteen patients (10 males) were included in the analysis. Age (mean±SD) at cannulation was 1.4 ± 1.6 days, weight was 3.1 ± 0.6 kg. The mean duration of ventilation post ECMO was 44.75 days. Correlation between Vd/Vt and duration of ventilation was statistically significant (R=0.62, P=0.0302). At post ECMO day 30, 9 patients remained on conventional ventilatory support, 3 patients on nasal cannula, and 2 on CPAP via face or nasal mask. CONCLUSIONS: A statistically significant relationship was observed between Vd/Vt and duration of mechanical ventilation after ECMO. Duration of ventilation may be associated with increased length of ICU stay and morbidity. Measurement of Vd/Vt may help clinicians determine long term care needs of children with CDH. Because these findings were not evaluated prospectively, further research is in order.

Sponsored Research - None

1418023

A COMPARISON OF POSITIVE PRESSURE THERAPY AND CONVENTIONAL CHEST PHYSIOTHERAPY FOR THE PREVENTION AND TREATMENT OF POST-OPERATIVE ATELECTASIS IN CHILDREN AFTER CARDIAC SURGERY.

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Background: Atelectasis after pediatric cardiac surgery is a common problem; however, no standard measure exists for its prevention and treatment. Objective: Compare two commonly used respiratory therapies to prevent and treat atelectasis: positive pressure (PEP/PAP) and conventional chest physiotherapy (CPT). Method: A prospective randomized study was conducted on 16 patients who underwent cardiac surgery at Le Bonheur Children's Hospital. Patients 0-5 years were randomized to CPT or EZPAP®. EZPAP® was provided via mask at 5 cm H2O with flow set at 5-8 lpm. Flow was provided via an oxygen blender using the same oxygen concentration the patient was receiving before starting the therapy. Patients performed 10 breaths, rested for 1 minute and repeated for a total of 5 cycles (50 breaths). Patients 6-18 years were randomized to conventional chest physiotherapy or TheraPEP®. TheraPEP® was provided via a mouthpiece with the patient exhaling for 3-4 seconds against 10-20 cm H2O for 10 breaths. A rest period of 1 minute followed and the therapy was repeated five more times for a total of 50 breaths. All treatments were given following extubation for a total of 72 hours. Baseline and subsequent daily chest radiographs were evaluated using an ordinal scoring system to measure the degree of atelectasis on chest radiographs until therapy was stopped. Results: The median age of patients receiving CPT was 6.2 years and for the PEP/PAP group was 10.2 years. There were 7male patients. There was a trend towards statistically significant improvement in atelectasis score in PAP/PEP group compared to CPT group (p = 0.086). There were no significant adverse events during or after CPT or PEP/PAP. Conclusions: CPT and PEP/PAP are safe therapies to prevent and/or treat atelectasis after cardiac surgery in children. There was a trend towards higher effectiveness in the PEP/PAP group.

Sponsored Research - None

1418237

LACK OF CORRELATION BETWEEN ACT VALUES AND HEPARIN LEVELS DURING ECMO.

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Background: Bleeding and clotting complications during extracorporeal membrane oxygenation (ECMO) can have catastrophic consequences. Activated clotting time (ACT) is traditionally the primary parameter monitored as part of routine ECMO anticoagulation management. Recently, aPTT, antithrombin III levels, and heparin levels are being increasingly monitored. We hypothesize that heparin levels correlate more closely with aPTT than ACT values. Method: As part of a Performance Improvement initiative, data were collected prospectively. ACT, heparin levels, aPTT, and antithrombin III were measured and heparin dose (units per kg) recorded for neonatal and pediatric ECMO patients between January and May 2012. Result: Data were collected for 17 consecutive ECMO patients (median weight 3.7 kg, (5th, 95th %ile = 2.9, 65)). Median heparin dose was 34.3 units/kg/hr (14.2, 69.2). Median duration of ECMO was 205 hours (22.5, 1028). Median ACT was 163 sec (135, 194), and median aPTT was 79.6 (37.8, 150). A weak correlation was noted between heparin level and aPTT with a Spearman's correlation coefficient of 0.64. No correlation was noted between heparin level and ACT (Spearman's correlation coefficient 0.27). The Spearman's correlation coefficient between ACT and aPTT was 0.54. Conclusion: Despite the routine use of heparin infusions for ECMO management, the optimal monitoring of anticoagulation remains uncertain. Our results prompt speculation that a more comprehensive assessment of heparin dosing beyond ACT monitoring, to include heparin levels and aPTT measurements, is needed. Heparin dosing using these methods may result in longer circuit life, decreased blood product exposure, and improved outcomes.

Sponsored Research - None

1435188

SURVIVAL AND IMPROVEMENT OF PHYSIOLOGIC DEAD-SPACE DURING ECMO IN CHILDREN WITH CONGENITAL DIAPHRAGMATIC HERNIA.

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INTRODUCTION: Congenital diaphragmatic hernia (CDH) is a rare birth defect that is characterized by mal-development of the diaphragm and the presence of abdominal viscera in the thorax. CDH is associated with varying degrees of pulmonary hypoplasia and persistent pulmonary hypertension. Despite therapeutic interventions such as inhaled nitric oxide (iNO) and extracorporeal membrane oxygenation (ECMO), mortality remains high. We sought to determine the relationship between the physiologic dead-space fraction (V_d/V_t) and survival in infants with CDH requiring ECMO. **METHODS:** A retrospective review of all patients with CDH who required ECMO from September 2006 to September 2011 was conducted. Patient demographics, side of defect, survival, use of iNO, age at cannulation and type of ECMO support were recorded. V_d/V_t was calculated utilizing the Enghoff modification of the Bohr equation. P_aCO_2 was obtained from an indwelling arterial catheter and mixed expired CO_2 was measured using a commercially available mainstream capnograph. All patients were cycled; whereby the patient was transiently separated from the ECMO circuit. V_d/V_t was obtained for the initial and final cycle during ECMO support. Data was recorded using MS Excel and statistical analysis was performed utilizing Prism Graphpad. The Wilcoxon signed rank test was used to assess the difference between initial and final cycle V_d/V_t measurements in the survivor and non-survivor groups. **RESULTS:** Twenty patients (n=14 male) were included in the analysis. The age at cannulation (mean±SD) and was 2.3 ± 4.6 days and the weight was 3.0 ± 0.6 kg. Sixteen (80%) patients survived to ICU discharge. Eighteen patients had left sided defects, 20 required veno-arterial ECMO and all received iNO. No relationship was observed between V_d/V_t and side of defect, iNO usage or type of ECMO support. Survivors exhibited a statistically significant decrease in V_d/V_t from 0.70 to 0.65 (P = 0.0331) during their ECMO course. There was no significant change in V_d/V_t of the non-survivors (see figure: horizontal bars = mean, whiskers = standard error). **CONCLUSIONS:** An improvement in V_d/V_t during ECMO support was associated with survival. The decreased V_d/V_t may reflect an improvement in pulmonary performance and specifically an improvement in pulmonary hypertension. Serial measurement of V_d/V_t in patients with CDH may prove to be useful in determining severity of disease and likelihood of survival.

Sponsored Research - None

1418333

PRESSURE AND VENTILATION EFFECTS OF NONINVASIVE RESPIRATORY SUPPORT DEVICES IN A SPONTANEOUSLY BREATHING LUNG MODEL.

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INTRODUCTION-Heated/humidified high flow nasal cannula (HHHNC) and continuous positive airway pressure (CPAP) are two forms of non-invasive respiratory support strategy that are widely used in spontaneously breathing infants with RSV Bronchiolitis. We designed a series of descriptive studies to compare differences in lung model pressure and carbon dioxide elimination between these two forms of support. METHODS: An anatomically accurate infant nasal airway model, fabricated using a 3D printer and dimensions obtained from a CT-scan of an infant, was attached to a spontaneously breathing test lung (ASL 5000, Ingmar Medical; settings: Inspiratory muscle pressure=-13 cmH2O, R=300 ml/cmH2O, and C=2 mL/cmH2O, RR=30br/min, and Tidal Volume=26 mL, and active expiratory pressure=5 cmH2O. Prior to testing, a fixed amount of carbon dioxide was bled into the lung model to obtain a baseline ETCO2 measurement~100 mmHg during unsupported spontaneous breathing. The nasal airway model was then affixed with each of the following devices and their respective proprietary nasal airway interfaces: 1) Vapotherm Precision FLow HHHFNC, 2) Fisher-Paykel HHHFNC, 3) Carefusion Infant Flow CPAP and 4) Fisher-Paykel Bubble CPAP. Lung model pressures and ETCO2 changes were measured at baseline (no support) and after adjusting flows at 2, 4, 6, 8 L/min. RESULTS: We observed differences in the pressure delivered in the test lung between different non invasive respiratory support devices. See figure. CONCLUSION/DISCUSSION: These data suggest that both the Vapotherm and the Fisher Paykel HHHNC devices provided distending pressure to the lung model, although the Fisher Paykel system showed no increase in distending pressure after 3.5 cmH2O. We feel that the lower distending pressure from the Fisher Paykel HHHNC was attributed to its circuit pressure pop off which vents gas once circuit pressure reaches 35-45 cmH2O. Both NCPAP devices provided the set 5 cmH2O CPAP when common flows for clinical use were used. All systems tested exhibited comparable CO2 flushing capabilities, although the Infant flow NCPAP systems CO2 flushing was slightly lower than the continuous flow systems. We feel that its variable flow design impacted its ability to flush CO2, although we do not know whether this would be clinically relevant.

Sponsored Research - None

1435899

EVALUATION OF PRESSURE DELIVERY USING THE PHILIPS RESPIRONICS NEOPAP IN A SPONTANEOUSLY BREATHING NEONATAL LUNG MODEL.

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INTRODUCTION: The Philips Respironics NeoPAP is a combined Nasal Continuous Positive Airway Pressure (NCPAP) Heated Humidified High Flow Nasal Cannula (HHHNC) device that uses a single nasal cannula style interface. We performed a bench evaluation of the NeoPAP's NCPAP and HHHNC modalities. We designed a series of studies to evaluate the performance of the NeoPAP in a premature neonatal spontaneously breathing lung model with and without a large simulated oral leak. Data on differences in lung model pressure were collected between these two forms of support. METHODS: An anatomically accurate premature neonatal nasal airway model, fabricated using a 3D printer and dimensions obtained from a CT-scan of a 28 wk. premature neonate. The nasal airway model was attached to a spontaneously breathing test lung (ASL 5000, Ingmar Medical; settings: R = 100 cmH20/L/sec and C= 0.5 ml/cmH2O RR 50 br/min and Tidal Volume 5 mL. The nasal airway model was then affixed using the Philips Respironics proprietary nasal airway interface: Lung model pressures were measured at 2, 4, 6, 8, and 10 cmH2O of set NCPAP. We then repeated lung model pressure measurements in the HHHNC mode at flows rates of 2,4,5,6, and 7 L/min. Both sets of measurements were then repeated with a large simulated oral leak in an attempt to evaluate the devices leak compensation function. RESULTS: See figure. CONCLUSION/DISCUSSION: These data suggest that while lung model pressures dropped with both modalities in the presence of a large simulated oral leak, the leak compensation available during NCPAP improved the devices ability to maintain stable lung model pressure as compared to HHHNC. From our testing we feel the NCPAP mode on the NeoPAP is better at maintaining stable pressure delivery in the presence of a oral leak.

Sponsored Research - None

1435912

THE RETROSPECTIVE REVIEW OF THE RESPONSE TO APRV IN TWENTY SIX PICU PATIENTS WITH RESPIRATORY FAILURE BEFORE AND AFTER THE IMPLEMENTATION OF APRV.

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BACKGROUND: Airway Pressure Release Ventilation (APRV) is used to provide a constant airway pressure with minimal release phases. APRV allows for the optimization of alveolar recruitment during a long time-high, thus improving oxygenation, and allows for ventilation during short release phases or time-low. By using lower inflation pressures and preserving spontaneous breathing, APRV acts as a lung protective strategy. In this study, we evaluated the recruitment capabilities of APRV and used the PaO2/FIO2 (P/F) ratio and Oxygen Index (OI) as proxies to evaluate this outcome. METHOD: Retrospective chart review of 26 pediatric patients up to 18 years of age diagnosed with respiratory failure and placed on APRV were assessed. Patients were transitioned to APRV from other modes of ventilation due to decompensating clinical status with oxygenation difficulty. Parameters analyzed included the P/F ratio and OI content at both 2 and 24 hours before and after conversion to APRV. The data was evaluated for significant differences over time using a mixed linear model with a random effect for each patient. RESULTS: Both the P/F ratio and OI improved dramatically once patients were converted to APRV (table 1. The P/F ratio was increased by a mean difference of 28.5 (CI 3.44 to 58.51). The OI steadily increased for the 24 hours prior to APRV conversion and then steadily declined for the 24 hours after. Improvements in the P/F ratio and OI within 24 hours of conversion to APRV exhibit promising results for rapid pulmonary re-recruitment in severe lung injury and have implications for pediatric patients in respiratory failure. CONCLUSION: APRV implementation in infant and pediatric patients demonstrates potential for improvement in oxygenation for patients afflicted with respiratory failure. The need for randomized controlled trials to assess the efficacy of APRV in children with respiratory failure is needed.

Sponsored Research - None

P/F ratio and OI Parameters before and after APRV initiation

	-24 hours prior to APRV	-2 hours prior to APRV	+2 hours after APRV	+24 hours after APRV	Mean difference (95% CI)
P/F	127.2	111.9	156.9	198.9	28.4 (3.4-58.5)
Oxygenation Index	19.3	22.8	22.3	18.2	3.6 (-3.8-9.6)

1417006

VENTILATOR DISPLAYED TIDAL VOLUME MAY NOT ACCURATELY REFLECT DELIVERED TIDAL VOLUME IN PRESSURE LIMITED MODES IN NEONATES.

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Background: Circuit compliance algorithms in newer generation ventilators compensate for the volume of gas 'lost' due to the distensibility of the ventilator circuit. However, these algorithms are generally only active in volume targeted modes. We hypothesized that in pressure targeted modes, tidal volume (Vt) measurements at the endotracheal tube (ETT) would be significantly lower than at the expiratory valve of the ventilator, especially for neonatal circuits. Methods: Every 6 hours, tidal volumes were measured at the expiratory valve of the ventilator (AVEA; CareFusion) and at the ETT with a standalone monitor and pneumotachometer (NICO or NM3; Philips-Respironics) for a heterogeneous group of pediatric patients. Ventilator settings were at the discretion of the clinical care team as part of routine care. We report median and interquartile ranges and performed pairwise comparisons of the distribution of Vt measured by the different modalities using the non-parametric Wilcoxon signed-rank test. Analyses were conducted using Stata 12, and $p<0.05$ was considered statistically significant. Results: A heterogeneous population of 63 patients were enrolled in the Pediatric ICU and Pediatric Cardiac ICU. When performing pairwise comparisons for each circuit type, ventilator and ETT measured Vt (see Table) are significantly different for the neonatal circuit ($p <0.001$), but no difference was found for the adult ($p=0.07$) and pediatric ($p=0.5$) circuits. The overall correlation between pairs of tidal volumes (ventilator vs. ETT) was high ($R2=0.92$). Conclusion: In ventilator modes in which circuit compliance is not active, clinicians should be aware that the tidal volume displayed at the ventilator does not accurately reflect the volume seen at the endotracheal tube for neonatal circuits. This difference occurs as the percent of volume 'lost' due to the distensibility of the circuit can represent a relatively large percent of the tidal volume delivered. This discrepancy was not noted for pediatric or adult circuits. Further investigation is needed to determine the effect of time as the compliance of the ventilator circuit may change. Clinicians should consider monitoring tidal volume at the endotracheal tube for neonates ventilated in modes without circuit compliance algorithms (e.g., pressure limited modes).

Sponsored Research - None

Tidal volumes as measured at the ventilator and ETT.

	Adult circuits	Pediatric circuits	Neonatal circuits
Ventilator Vt	310 (240, 340)	131 (98, 169)	50 (43, 61)
ETT Vt	304 (216, 372)	135 (102, 171)	30 (23, 39)

Data displayed as median (25th, 75th %ile).

1435648

USE OF HIGH FREQUENCY PERCUSSIVE NASAL CPAP DURING NEONATAL TRANSPORT.

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Introduction: Many infants requiring medical transport are on nasal continuous positive airway pressure (NCPAP). Traditionally we provide invasive ventilation using a high frequency device during transport of these patients. To support efforts to avoid intubation we wanted to be able to transport neonates using current device to deliver High Frequency Percussive Nasal CPAP (HFPNCPAP) and deliver humidification, with an overall desire of maintaining lung volume and decreasing the adverse risks of intubation. **Design:** An anonymous retrospective chart review analysis of demographical, categorical, and physiological data of a non-randomized convenience sample of patients. Thirty-four neonates were transported on HFPNCPAP during November 2010 and October 2011. **Methods:** HFPNCPAP was initiated when a patient was stable on a CPAP device, on HFNC, or the flight team predicted the patient could be supported non-invasively based on physical exam and history of stability. NCPAP, frequency and amplitude were adjusted to obtain oxygenation and ventilation. **Results:** Data was abstracted from 34 patient charts. Subgroups were identified that had complete data on the variable of interest (N 23-34). Demographics were (M+/-SD) BW: 2.0(0.2) kg; GA: 32 (1) wks, PNA at transport time: 27 (6) days, weight at transport 2.3 (0.2) kg. Primary transport time: 35% had RD/RSV, 32% procedure/back transport, 12% CHD/PDA, 9% hydrocephalus. Respiratory outcomes: Pre HFPNCPAP FiO2 (Median 25-75%) 37% (30%-50%); arrival at referral facility FiO2 33% (30% to 45%); blood gas descriptive statistics were (M+/-SD) pH: 7.32 (0.01); 52 (2.19). Transcutaneous CO2 values (M+/-SD) 51 (11) compared to pCO2 52 (11) were not statistically different. Other data: one pt. was not successfully transitioned to HFPNCPAP and was intubated pre-transport; 3 pts were transported on HFPNCPAP and iNO. **Conclusions:** In our experience using the HFPNCPAP in our transport environment we found that the patient's FiO2 need decreased slightly over duration of transport, the blood gas values were within physiologic range in the majority of patients, and transcutaneous carbon dioxide monitoring was a reliable tool. While implementing this we verified that providing noninvasive support is as cumbersome and challenging in transport as it is at the bedside. In our experience HFPNCPAP fills a need in safe transport of neonates using a less-invasive technique without causing deterioration in physiologic status.

Sponsored Research - None

1408373

USE OF A NEW NASAL CANNULA TO DELIVER NASAL VENTILATION TO NICU PATIENTS.

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Background: Non-invasive respiratory support is increasingly used for neonates, including extremely low weight infants. However, the efficacy of non-invasive support is frequently limited by the need for cumbersome headgear interfaces, which can cause nasal skin breakdown and significant leaks leading to inadequate support. Recently the Neotech RAM® cannula was introduced for use with both nasal continuous positive airway pressure (NCPAP) and nasal ventilation (NV). We report our experiences using the Neotech RAM® cannula to provide NV in newborn intensive care unit (NICU) patients weighing between 0.5 and 5.3 kg Method: NICU patients who met our standard criteria for NV were managed with the Neotech RAM® nasal cannula. The Servo I® and Crossvent 2i® ventilators were used to deliver NV. Response to NV was assessed according to (1) nasal skin injury, and (2) adequacy of support defined as needed for intubation or re-intubation. Results: Nine NICU patients weighing between 0.5 and 5.3 kg were managed in our NICU with the Neotech RAM® nasal cannula providing NV. The table below gives the indication for beginning NV as well as patient characteristics, rate of nasal injury, and rate of intubation or re-intubation. Conclusion: The Neotech RAM® cannula appears to be safe and effective at providing NV to a wide range of NICU infants with relatively low FIO2 requirements. It was our subjective assessment that these infants were more stable than similar infants who had previously received NV via another interface, presumably because of the excellent design and fit of the cannula to the nares. We now use this cannula as our primary interface for providing NV to our NICU infants.

Sponsored Research - None

Indication	N	Weight (kg)	FiO2	Nasal Injury	(Re)intubation
Extubated to NV	4	0.50- 3.73	0.21-0.25	0	0
Failed NCPAP	3	0.90- 5.34	0.21- 0.25	0	0
Failed NC	1	2.50	0.21	0	0
Primary mode	1	0.71	0.21	0	0

1417383

DOES THE RAM CANNULA REDUCE THE NEED FOR INTERMITTENT INTERVENTION TO PROVIDE CPAP TO THE PREMATURE INFANT?

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Background: In 2011 our intensive care nursery made the decision to transition to the RAM cannula as the primary interface for non-invasive ventilation on neonates. The anticipated benefits of these prongs were that they would be easier to manage device than our previous prongs, the Hudson prongs. In addition to bench testing the device, we also surveyed the number of times that the patient needed to be intervened with due to prongs being misplaced with the Hudson prongs versus with the RAM cannula. The proposed benefits of fewer interventions may include fewer opportunities to break the hand hygiene chain, loss of FRC, skin breakdown and neural developmental care of the infant. Methods: Nurses and Respiratory Therapists working in the Intensive Care Nursery kept track of how many times that they had to intervene with a patient on nasal CPAP. An intervention was defined as intentionally adjusting the prongs to assess the nares as per standard on the unit every 4 hours or because the prongs were misplaced. Totals were collected in twenty four hour periods. Results: The average number of interventions for the Hudson prong group was 12.08 (n 13, SD 7.9) in twenty four hours. The average number of interventions for the RAM cannula was 6.89(n 57, SD 3.26). Conclusion: Maintaining the RAM cannula in optimal position is easier than with the Hudson prongs, resulting in forty seven percent fewer interventions in a twenty four hour period. The benefits of these prongs may include maintenance of FRC, fewer opportunities for infection, less skin breakdown due to misplaced prongs and neural-developmental benefits from fewer noxious stimuli of prong misplacement and readjustment. The main limitation of this observation was the small number of days on Hudson prongs versus the RAM.

Sponsored Research - None

1426596

HELIOX DELIVERED VIA HIGH FREQUENCY JET VENTILATOR AUGMENTS CARBON DIOXIDE REMOVAL IN AN EXTREMELY PRETERM INFANT.

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Introduction: The Bunnell Life Pulse High Frequency Ventilator (HFJV) has been used for many years to ventilate preterm infants with severe lung disease, including pulmonary interstitial emphysema (PIE). Heliox (HeO2) has been used to enhance CO2 elimination in multiple patient populations, particularly where gas trapping is a significant problem. However, we are unaware of previous reports of combined HFJV and HeO2 to manage preterm infants. We report here the successful use of HeO2 combined with HFJV to augment CO2 elimination in an extremely premature infant with gas trapping. Case Summary: This patient was born at 27 weeks gestation with a birth weight of 825 grams. He had severe respiratory distress syndrome and was treated with three doses of surfactant. He later developed severe bilateral PIE and left tension pneumothorax. He was placed on HFJV to treat the PIE with HFJV settings chosen to minimize gas trapping while providing appropriate ventilation and oxygenation. Despite multiple HFJV adjustments, he continued to show PIE on chest radiograph and hypercarbia on blood gas and correlated transcutaneous monitor (PtcCO2). Due to persistent hypercarbia and PIE, we trialed HeO2 combined with HFJV to improve ventilation. A HeO2 blender was used to accurately titrate the FIO2. The HeO2 mixture was connected to the gas inlet port of the Life Pulse HFJV so that HeO2 was the driving and delivery gas of the ventilator. Within 5 minutes of starting HeO2, PtcCO2 decreased by 20 mm Hg, and we began decreasing HFJV settings. The patient was treated with a total of 11 days of combined HeO2 and HFJV. He had progressive resolution of his PIE, was successfully extubated, and was subsequently discharged home. Discussion: HeO2 may be a useful adjunct to HFJV for enhancing CO2 elimination and allowing decreased levels of PIP for patients with significant lung disease characterized by air-trapping and hypercarbia. The use of HeO2 is limited to patients who can be managed with a relatively low FIO2.

Sponsored Research - None

	HFJV PIP	PEEP	HFJV Rate	FIO2	PtcCO2
Pre-HeO2	32	6	240	60	70s to 80s
5 min Post HeO2	32	6	240	45	50s

1418310

A BENCH EVALUATION OF MINUTE VOLUME DELIVERY THROUGH INTRAPULMONARY PERCUSSIVE VENTILATION USED IN CONJUNCTION WITH THE DRAEGER EVITA.

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Abstract Background: In the summer of 2011 Primary Children's Medical Center began using the Percussionaire IPV 1C (Sandpointe, Idaho) in conjunction with the Draeger Evita XL (Luebeck, Germany) with the Cone head adapter. Questions soon arose about the Minute Volume and the Tidal Volume being delivered. Little research was available. The goal was to discover how much minute ventilation increased with the introduction of the IPV to the current ventilator in a pediatric lung model. Method: The IPV1C with Phasitron and Cone Head were placed in line with the Draeger Evita XL. A TSI Certifier FA plus Ventilator Test System (Shoreview, Minnesota) was attached to a SmartLung Adult (Imtmedical Ag, Switzerland). The lung was set to Compliance of 15 mL/mbar and Resistance of 20 mbar/L/second. The ventilator was set to pressure control. Settings were PCV + mode (Pressure Control SIMV) Pips of 21, 25, and 29, I-times .7, .8, and .9 seconds, Peep 5, Breath Rate 20 Pressure Support off. The IPV 1C was set to driving pressures of 25 and 30 PSI with Percussive knob settings at full left (FL), 9 o'clock, 12 o'clock, 3 o'clock, and full right (FR). TheTSI Certifier measured VT, VE, Peak Flow, Pip, PEEP, Mean, and Rate. Each cycle was run for approximately one minute. Results: At Ventilator Pip of 21 and driving pressure of 25 VE increased from 2.04 l/min to 9 and 10 l/min, at a Driving pressure of 30 VE increased to 9.6 and 10.9 L/min. The VE decreased as the percussion knob was rotated from far left to far right. With Ventilator Pip 25 Driving Pressure 25 VE increased from 2.8 L/min to 9.2-9.7 L/min and at Driving pressure 30, VE Increased to 9.6-10.3 LPM. With a Ventilator Pip of 29, and driving pressure of 25 VE Increased from 4.0 to 8.9-9.7, at a driving pressure of 30 VE increased to 9.8 to 10. The VE decreased as the percussion knob was rotated from far left to far right with all combination. Conclusion: Minute Ventilation significantly increases with the introduction of the IPV 1C in conjunction with mechanical ventilation. The Increase in VE at PIP of 21 was average 414%-448%.The Increase in VE at PIP of 25 was average 304%-323%. The Increase in VE at PIP of 29 was average 209%-227%. Increasing Driving pressure subsequently shows to increase VE. Further studies need to involve use of CO2 monitoring devices when the IPV is placed on a patient. Bench studies looking at Varying peep levels also need to be researched.

Sponsored Research - None

IPV Study Results

Vent Pressure (CMH2O)	21	21	25	25	29	29
IPV Setting (PSI)	25	30	25	30	25	30
Pre IPV VE	2.08	2.08	2.9	2.9	4.1	4.1
Max VE	9.92	10.29	9.79	10.38	9.31	10.12
Min VE	7.5	7.56	8.12	7.79	6.91	8.18
Average VE	8.61	9.72	9.91	9.35	8.55	9.29
Max % Increase	477	495	338	358	237	247
Min % Increase	362	363	277	269	168	198
Avg % Increase	414	448	304	343	209	227

1415139

PROFILE OF ACCIDENTAL EXTUBATIONS IN A 96 BED LEVEL III NICU.

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Background: Accidental extubation (AE) in a mechanically ventilated neonate is defined as an unexpected or non-elective removal of the endotracheal tube. In neonates, the incidence of AE reported in the literature ranges from 0.72 to 5.3/100 vent days. Accidental extubation is a concern because it may pose an increased risk to patient safety and trauma to the airway. The incidence of accidental extubations/100 vent days in the 96 bed level III NICU at All Children's Hospital was unknown but perceived by staff to be high. It is important to know the incidence of AE and related causes in order to develop systems that improve patient safety and quality of care. **Hypothesis:** The incidence of AE in the NICU at All Children's Hospital would be ≥ 3.0/100 vent days. **Materials/Methods:** Using six sigma methodology, a systematic approach was taken to evaluate the incidence of AE in the NICU at All Children's Hospital. A data collection tool was developed to track AE events for a period of 7 months from May to November 2011. The Respiratory Care staff was instructed to complete the form as soon as possible after an AE event. Completed forms were collected and processed by the Neonatal Coordinator using Excel and Minitab software. Data collection tool components included date/time, patient demographics, type of ventilator, endotracheal tube securing method, reason for reintubation and factors that contributed to the AE event. **Results:** During the 7 month data collection period, the All Children's Hospital NICU had 47 AE events and 2081 vent days. The incidence of AE during this period was 2.3/100 vent days. Patient movement was the most frequent cause of AE. The rate of reintubation after AE was 83% (39/47) and the majority who required reintubation (35/39) were reintubated within 24 hours. Accidental extubation occurred most commonly in infants ≤ 29 weeks who were 10-30 days old. During the observation period, the incidence of AE decreased from 3.0/100 vent days to 1.1/100 vent days. **Conclusion:** The incidence of AE at All Children's Hospital was lower than expected; however, AE still represents a significant risk to patient safety. Quality improvement initiatives to reduce the incidence of AE should focus on a high risk population of preterm infants ≤ 29 wks who are 10-30 days old. It is possible that overall staff awareness of AE surveillance may have contributed to the decrease in the incidence of events during the observation period.

Sponsored Research - None

1415865

VAP PROPHYLAXIS IMPLEMENTATION IN A LARGE PEDIATRIC CENTER.

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Introduction: Our organization consists of 525 total inpatient pediatric beds, 147 of which provide ICU level care (ventilator capable), spread among 7 units in 2 hospitals. In 2005, each ICU adopted and implemented the IHI VAP bundle recommendations for which supporting evidence focused on adult ventilated patients. The year following implementation our VAP rate (VAPs/1000 vent days) decreased but rose again in 2008 and 2009 (fig 1). In August 2009, a multidisciplinary group convened to both improve compliance with our current VAP bundle and to discuss additional VAP prevention practices to be implemented. We report the process of implementation and our VAP rates before and after. **Method:** Our team of RCPs, RNs, MDs, and representatives from infection control and clinical informatics, met monthly. Reviewing the literature a list of clinical practices was created. Twenty three practices were adopted and divided into 4 sections: Basic Hygiene (5); Management of the Artificial Airway (4); Ventilator Management (8); Secretion Aspiration Management (6). Each was ranked for the strength of its supporting evidence[1] then scrutinized for age and clinical exclusions. During the first 8 months of 2010 we incrementally implemented 21 practices into the care routines of each ICU. To serve as a reminder and create an audit trail, a VAP section was added to the electronic medical record (EMR). A RCA (root cause analysis) tool was modified from the Pediatric Affinity Group[2] and used to review the EMR documentation of each VAP patient. **Results:** Prior to implementation our VAP rates for 2007, 2008 and 2009 were 2.31, 1.42 and 0.72 respectively with zero VAPs for 39% of 36 months. Post implementation our VAP rates diminished to 0.06 and 0.17 for years 2010 and 2011 respectively with zero VAPs for 85% of 27 months. We measured general VAP documentation compliance of the EMR for 3 months in 77% (2010), 81% (2011) and 85% the first three months of 2012. Practices not implemented are related to artificial airway management which involves acquiring equipment and training additional disciplines outside of the ICUs. Use of our RCA tool to review the EMR of VAP patients has consistently implicated non-compliance with routine mouth care and HOB elevation. **Conclusion:** Implementing adult evidence-based VAP practices can also reduce VAP rates for pediatric ventilator patients. [1] US Preventive Services Task Force [2] How-to-Guide Pediatric Supplement Ventilator Associated Pneumonia

Sponsored Research - None

1418001

EVALUATION OF INTERVENTIONS TO TREAT AND PREVENT PRESSURE ULCERS ASSOCIATED WITH MASK INTERFACES DURING PEDIATRIC NON-INVASIVE VENTILATION.

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Background: Many factors place pediatric patients at risk for developing pressure ulcers (PUs). Previous data collected at our institution revealed 57% of pediatric PUs were related to medical devices. A large number were caused by face masks used for NIV and 46% of pediatric patients with PUs were found to have conditions related to craniofacial anomalies. This factor may further complicate mask fit. Applied pressure from the device itself and increased hydration due to occlusion at the mask/skin interface may also contribute to PUs. Moist skin may result in more friction leading to skin trauma, blister formation, etc. Our collaborative team designed a study to measure hydration underneath the face mask of patients on NIV. We hypothesized that there would be no difference in hydration measurements of skin directly under the mask in comparison to the control sites when utilizing one of 3 interventions to treat or prevent PUs. Methods: Patients who developed either visible redness or a PU received 1 of 3 interventions depending on respiratory support and availability of alternative interfaces : 1) Mepilex lite® between the mask and skin, 2) Vigilon® (a gel substance) between the mask and the skin or 3) Sleepweaver® (Circadiance, Export, PA) cloth nasal mask. Twenty-seven patients were enrolled to generate data on face masks alone (n=111), Mepilex (n=24), Vigilon (n=6), and Sleepweaver (n=62). Skin hydration was measured as capacitive reactance using the NOVA Dermal Phase Meter 9003™ (NOVA Technology, Glouster, MA) immediately following mask removal. Normal skin areas adjacent to the mask, were measured as a control at each site. Data was analyzed using general linear models with significance at $p<.05$. Results: Hydration was significantly increased at the mask/skin interface compared to the control at all measured sites. The skin under both Vigilon® and Mepilex Lite® are directionally more hydrated than the control. The skin hydration at contact points of the Sleepweaver® was not different than the control ($p=.24$). None of the patients developed a PU while wearing the Sleepweaver® mask. Discussion: Skin hydration increases under face masks during pediatric NIV. The Sleepweaver® utilizes a more breathable cloth material which may decrease risks of accumulating moisture underneath the mask. Barriers such as Vigilon® and Mepilex Lite® may reduce hydration, but additional data is need to define their role in preventing and treating PUs.

Sponsored Research - None

1416363

COMPATIBILITY OF A NOVEL AEROSOL DELIVERY SYSTEM WITH THREE NEONATAL VENTILATORS: VN-500, SERVO-I AND AVEA.

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Background: Different ventilators and different modes of ventilation create different flow conditions that may influence the effectiveness of inhaled therapies delivered to neonates. A novel aerosol delivery system (Afectair® Duo, Discovery Laboratories, Inc.) incorporates a bypass circuit that diverts a portion of the inspiratory gas flow from the standard ventilator circuitry to entrain an aerosolized medication. This delivery system has been developed to facilitate aerosol delivery to ventilated neonates. **Aim:** The aim of the study was to test the function of this novel aerosol delivery system under different neonatal ventilatory conditions when used with ventilators that have different operational characteristics. **Methods:** Three different neonatal ventilators were used in this study: Babylog® VN-500 (Draeger, Luebeck, Germany), Servo-i (Maquet, Solna, Sweden), and Avea® (CareFusion, San Diego, CA). Ventilator conditions studied were PEEP=5 cmH_2O, IT=0.35 s, RR=30 and five different PIP settings: 12, 16, 20, 25, 30 cmH_2O delivering ventilation to an expandable test lung. A mass flow meter (TSI Series 4100) was used for flow measurements within the inspiratory arm of the circuit and at the bypass nebulizer arm. **Results:** All ventilators presented a similar correlation between flow at the bypass nebulizer arm and PIP (R^2 = 0.7809) and tidal volume (R^2 = 0.6394) [Figure 1: Relationship between tidal volume and nebulizer or peak inspiratory flows]. There were no leaks or ventilator compensation observed with any of the ventilators tested. The bypass aerosol arm flows were within the 10th and 90th percentile ranges of peak inspiratory flows for premature infants. **Conclusions:** This novel aerosol delivery system appears to be compatible with VN-500, Servo-i and Avea ventilators when used to provide neonatal ventilation and inspiratory flows (2.5-11.0 L/min), and potentially provides optimal aerosol flow conditions.

Sponsored Research - Poznan University of Medical Sciences, Poznan, Poland provided financial support.

1426952

BENCH COMPARISON OF THREE SUCTION REGULATORS IN THE NEONATAL POPULATION.

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BACKGROUND: In the neonatal population, it is important to closely monitor and limit the suction pressure being delivered to the patient during endotracheal suctioning. With the Ohio Digital suction regulator, pressures are limited to a max pressure of 100 mmHg to promote improved patient safety in the neonatal population. We tested the hypothesis that there was no difference in set versus measured pressure with the Ohio Analog, Ohio Digital, and Ohmeda Analog Suction regulators at set pressures under 100 mmHg when setting pressure properly via a tubing occlusion method. METHODS: Set and measured pressure were compared for the Ohio Analog, Ohio Digital, and Ohmeda Analog suction regulators tested. Pressure was set at four different pressure range increments from 40- 100 mmHg by occluding the suction tubing for twenty seconds. Delivered pressure was recorded for both the suction regulator reading and independent pressure calibration meter. The independent monitor was calibrated prior to testing. Three measurements were recorded for each testing condition. Statistical Analysis was performed using ANOVA with post hoc analysis in Sigmaplot version 11. The mean pressure was reported for each testing condition. RESULTS: See Chart CONCLUSION: The Ohmeda Digital Suction Manometer has a set pop off of 100 mmHg to decrease risk of delivering high suction pressure to neonates. When setting pressure using the tubing occlusion method, there was no statistical difference in delivered suction pressure when comparing the three suction regulators. Using any of the three devices will give the patient safe suction pressures when set appropriately.

Sponsored Research - None

Comparison of Pressure in mmHg

Set Pressure	Ohio Analog	Ohio Digital	Ohmeda Analog	P value
40	45	41	39	.12
60	64	61	60	.18
80	83	81	81	.39
100	105	105	101	.25

1381900

A REMINDER TO ALL RESEARCHERS AND AUTHORS

Registration of Clinical Trials

The *FDA Amendments Act of 2007* requires registration of, 1) controlled clinical investigations of drugs and biologics subject to FDA regulation, and 2) controlled trials with health outcomes of devices subject to FDA regulation.

Consult the Research Office of your institution for help registering your study. Your Research Office can help you decide whether your study needs to be registered and they can help you register it if necessary.

Approval by Institutional Review Board

All studies that include human subjects must indicate in the Methods section that approval was received from the appropriate local institutional review board(s) (IRB), and/or that the procedures were conducted in accordance with the ethical standards of the *World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects* (http://www.wma.net/e/policy/b3.htm).

Disclosure of Potential Conflict of Interest

The Journal does not consider potential conflicts of interest to be unethical. However, failure to fully disclose such potential conflicts is unethical.

Each author must disclose potential conflicts of interest for the previous 2 years. Authors should disclose *all* potential conflicts, whether or not related to the content of the paper. See the statement on *Conflict of Interest in the Field of Respiratory Care* in the end pages of this issue.

COST ANALYSIS OF COOL MIST UTILIZATION IN PATIENTS FOLLOWING UPPER AIRWAY SURGERY.

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Introduction: Respiratory Care Departments are very cost conscious and frequently looking for ways to increase efficiency and reduce waste. Cool mist (CM) administration by hood is ordered by our ENT Service for patients after undergoing upper airway surgery (UAS) to reduce mucosal edema. Anecdotal observation by staff led to discussion regarding this practice as CM devices were observed not being used. CM via hood is on the pre-printed order set we use, and is checked by the MDs to be set up on most patients following UAS. We investigated CM set-up and utilization to determine if this practice could be modified. **Methods:** Initial data collection included a retrospective review of patients undergoing UAS to determine the scope of the issue. Between 1/11–6/11, ~900 patients underwent UAS (tonsillectomy and adenoidectomy) at our institution. Upon completion of this review, prospective data collection was undertaken to obtain a data set with current information regarding set up and patient utilization. Data were collected from 11/11–3/12. CM costs were determined, along with time spent cleaning reusable equipment. Charge capture rate was also reviewed. **Results:** Prospective data was collected on 86 patients. Average age was 62.8 months (range = 2 months-17 years) and average time spent in post anesthesia recovery unit (PACU) was 69.1 minutes (range = 15-178 minutes). Data revealed that 61 (70.9%) patients had CM ordered, but only 9 (14.8%) used the CM of which 3 (4.9%) used CM long enough to generate a charge (>1 hour). Interestingly, 81 (94.1%) patients received CM in PACU. **Discussion:** The data collection revealed very little CM utilization once the patient was discharged from PACU. Extrapolating the data to an annual basis, ~1800 patients would undergo UAS. Utilizing the results of the data sample, there would be ~1275 (70.9%) CM set ups but only ~190 (10.4%) patients would use CM and charge recapture would only occur on ~62 (3.5%) patients on an annual basis. The cost of expendables and labor cost in cleaning is ~$13.00 per set up. This results in a total expenditure of > $14,000 per year in costs for patients not utilizing CM devices. This information will be utilized in discussions to consider elimination of CM as an option from the pre-printed order sets. The goal will be to determine a more appropriate alternative in ordering CM devices as needed for patients that truly require this intervention versus ordering on most patients as is current practice.

Sponsored Research - None

1425952

IMPROVING CHARGE CAPTURE, PRODUCTIVITY TRACKING AND STAFF SATISFACTION WITH CHARGE ON DOCUMENTATION.

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Background – Upon implementation of the hospitals Electronic Medical Record (EMR), the charging for Respiratory Care services remained on paper. Random audits of this paper system were completed and errors in accurate charging were found. A multi-disciplinary team was formed to design Charge on Documentation (COD) within the EMR. The team comprised of staff from the Respiratory Care Department, Information Services, and Patient Financial Services. The goal was to link charge capture, charge entry, and productivity tracking to therapists' documentation. Initial steps in the process were to review all billable procedures on the hospitals charge master as well as those tasks with time standards as outlined in the AARC Uniform Reporting Manual. All charge codes and time standards were then captured within the EMR by either re-programming current rows or adding new rows to documentation. Method – For the first two weeks of implementation, the Respiratory Care staff continued to complete paper charge sheets. Procedures and services documented with COD were captured and reported daily. Of the 130 procedures and tasks that COD is able to track, 68 of them were able to be compared to the paper charge sheets. After COD go live, respiratory therapist were surveyed to determine if they felt COD saved time and improved job satisfaction. Results – The Respiratory Care Department increased charge capture by $21,000 the first two weeks and increased productivity an average of 13 hours a day. Of the 60 staff members surveyed, 45 of them responded. On average therapist felt they saved 37 minutes a day with COD. The time saved has allowed therapist to spend more time with patients and reviewing their charts. After implementation of COD 89% of the therapist surveyed stated it had improved their job satisfaction. Conclusion – Implementation of COD improves charge capture, productivity as well as job satisfaction among respiratory therapist. Therapist no longer rely on memory to charge for procedures and services rendered. Removing tedious non-patient care tasks has helped therapist improve their patient practice.

Sponsored Research - None

1404558

LESSONS LEARNED DURING THE IMPLEMENTATION OF A SHARED GOVERNANCE MODEL IN A RESPIRATORY THERAPY DEPARTMENT.

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Background: The concept of shared governance or shared decision-making is evident in many business sectors. A shift from hierarchic decision-making, shared governance involves team members providing diverse and creative input, which results in them owning a stake in the bigger picture. It has been suggested that only 10% of departmental decisions should be made by management, allowing all members to have a voice in the decision-making process1. The Department of Respiratory Care at the Penn State Hershey Medical Center implemented shared governance in 2007. Since implementation, the leadership team has sought to strengthen the council structure by periodically reviewing outcomes. Education, clinical practice, and quality of work life are areas encompassed by the department's shared governance model. Method: Ninety-five members of the Departments of Respiratory Care & Pulmonary Diagnostics were surveyed in March 2012. The survey was distributed to all respiratory therapists and support staff within the two work areas. Recipients of the survey were asked to rate four statements related to the department's shared governance model and decision-making processes. Results: Twenty-four members (25%) of the department responded to the survey related to shared governance. When asked if shared governance positively affected the department, 45.9% of respondents agreed with this statement. In terms of having the ability to influence decision-making, only 33.3% believed this to be an accurate statement. 67.7% of respondents agreed there are opportunities to improve the share-governance model within the department. Conclusion: The low response rate and perception that team members have in their ability to influence decision making within the Respiratory Care and Pulmonary Diagnostics work area could be the result of many factors. It is apparent to the author that there are numerous opportunities to improve the understanding of core principles related to shared governance. The survey results will help drive the next phase of shared governance within the department, realizing that individuals closest to the point of impact are pivotal in identifying issues, developing strategies for problem solving, and making decision that move the team forward. Sponsored research—none. 1. Porter-O'Grady T, Hawkins, MA, Parker ML. (Eds.). Whole-Systems shared governance: Architecture for integration. Gaithersburg, MD: Aspen Publishers.

Sponsored Research - None

1402161

TRANSITION MANAGEMENT FOR RESPIRATORY CARE DEPARTMENTS.

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INTRODUCTION: The respiratory care profession is embarking upon a period of tremendous development, and change typically elicits a wide range of emotions. The 2015 and Beyond initiatives (Kacmarek, Barnes, Walton, 2009) highlight the many changes that the profession may experience in the coming years. The current economic climate also portends tighter departmental budgets, necessitating difficult financial decisions that may impact employee morale. The Respiratory Care Services (RCS) department at The Johns Hopkins Hospital recently underwent a major transition to two new medical towers. The RCS department utilized an established transition management model (Bridges, 2009) to help staff navigate this period of uncertainty. This model details three phases that take place during transitions: Letting go, the neutral zone, and a new beginning. Staff first experience a period of grieving and resistance, followed by ambivalence, and eventually achieve full engagement in the process. Management of this process is guided by the "4-Ps": Purpose, picture, plan, and part. Leaders of change must clearly identify the purpose of the change, provide a detailed picture of the final goal, develop a thorough action plan, and give each person a part in the transition. This model of transition may be of benefit to departments undergoing major change. METHOD: The hospital conducted two departmental satisfaction surveys during the transition period (September 2011 - April 2012). The 7-question survey utilized a Likert scale (1 = "strongly disagree" and 5 ="strongly agree") to quantify employee morale. Measures of central tendency were compared between the two surveys to assess the effectiveness of the transition plan. RESULTS: Summarized in table 1. CONCLUSION: The RCS department successfully managed a major transition using Bridges' (2009) transition management model, indicated by an increase in the mean, median, and mode of the survey scores. It is important to note, however, that participation in the second survey was significantly less than the first. Effective transition management skills are imperative as the profession undergoes potentially major changes. Departments also have to face the possibility of operating with smaller budgets, necessitating potentially unpopular financial decisions. It may be difficult to maintain employee morale during these periods of uncertainty, so leaders must be well-equipped to manage the challenges of major transitions.

Sponsored Research - None

Table 1.

	October 2011 (n = 61)	February 2012 (n = 31)
Mean	3.86	4.29
Median	3	4
Mode	3	4

Summary of measures of central tendency for each survey.

1408100

PRECIPITATE FORMATION SIGNIFICANTLY INCREASED COST OF HIGH-LEVEL DISINFECTION.

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Introduction: High-level disinfection solutions (SOLN) are commonly used in hospitals for cleaning medical equipment. We changed from 2.4% gluteraldehyde (GLU) to ortho-phthalaldehyde (OPA) due to a shorter soak time (GLU–45 minutes/OPA–12 minutes). Both SOLN are supposed to remain viable for 14 days of use. The change would save therapist time and produce faster equipment readiness. Unexpectedly, we experienced adverse issues with the OPA product. **Methods:** With the first use of OPA, Pulmonary Lab staff noted white specks in the solution at ~5 days and a copious precipitate (PREC) two days later. The OPA was deactivated and disposed of. The second use of OPA formed the same PREC at 5 days. The manufacturer advised it could be a reaction to residual organic material, ammonia, or hard water and recommended disposal of any PREC solution as a precautionary measure. Over the next 50 days, PREC formed at an average of every 5.56 days (~40% of the expected 14-day use). With unsuccessful resolution over 50 days, we stopped using OPA. We followed up with three 14-day trials using 3 different basins containing OPA: one new stainless steel bowl (Basin 1), one clean used stainless steel bowl (Basin 2), and one clean used plastic cleaning bin (Basin 3). All bins were covered with acrylic lids and kept under a ventilation hood. No cleaning occurred in these basins which were observed for PREC formation. **Results: Trial 1**-PREC in Basin 1-Day 9 & Basin 2-Day 10; Basin 3-none. **Trial 2**-PREC in Basin 1-Day 6 & Basin 2-Day 12; Basin 3-none. **Trial 3**-No PREC in Basin 1 or 2, appeared in Basin 3-Day 9. All passed effectiveness testing throughout the trials. **Conclusion:** The change from GLU to OPA was projected to increase annual costs ~$1335. This was justified in time saved for disinfection and quicker equipment readiness. However, we found used OPA formed a PREC at an average of every 5.56 days. Five of nine unused solutions formed PREC before Day 14 for no discernible reason. We followed the manufacturer's recommendation to dispose of OPA with PREC more than doubling our cleaning expense. Projected cost to neutralize and replenish used OPA every 5.56 days vs. 14 days would be ~$5,796 more per year with OPA. A second cleaning room in our department had comparable PREC formation. Projected annual cost for both areas would be ~$11,592 more than GLU. Unable to identify a specific cause for the PREC formation or to find a correctible solution, we discontinued use of the OPA.

Sponsored Research - None

1409155

REDUCTION IN DENIED PAYMENTS WITH THE INITIATION OF PAPERLESS DOCUMENTATION SYSTEM TIED TO BILLING.

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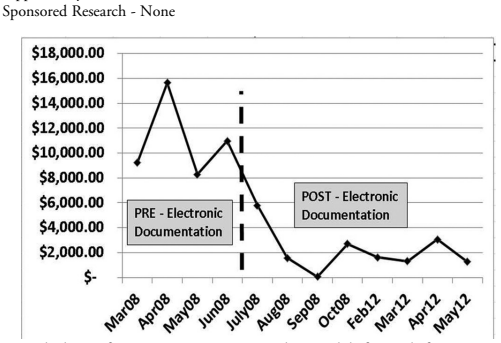
BACKGROUND: There are many benefits to an electronic documentation system. One of the benefits is to tie billing directly to documentation and reduce denied payments or medical audit bill adjustments for respiratory care services. Respiratory Care at our hospital system converted to an electronic documentation system tied to billing from a separate paper documentation and electronic billing system in July 2008. Once converted, we were 100% paperless for documentation. We acquired wireless computer carts and began live electronic documentation. We wanted to determine if denied payments for respiratory services were reduced after initiating a electronic documentation system. METHODS: We conducted a retrospective review of respiratory service denied payments in which our auditing department reduced hospital bills due to services that were charged but were not supported in the documentation. We retrospectively reviewed 4 months prior to electronic documentation (April - June 2008, PRE period), 4 months after initiation of electronic documentation (July - October 2008, POST period) and the 4 most current months (February - May 2012, CURRENT period). RESULTS: See the chart for monthly denied payments before and after initiation of the electronic documentation system. Average denied payments were $11,028 per month in the PRE period, $2,526 in the POST period and $1,806 in the CURRENT period. Denied payments dropped by more than 75% after initiation of electronic documentation system. CONCLUSIONS: Initiation of an electronic documentation system that ties charges directly to clinical documentation can reduce denied payment charges or audits that adjust charges. We demonstrated that current denied charges remain as low as right after initiation. An electronic documentation system can contribute to financial strength of an institution as well as reduce risks associated with charging for services that are not supported by documentation and thus are audited or denied.

Sponsored Research - None



Denied Charges for Respiratory Care services by month before and after initiation of electronic documentation tied to charges.

1433176

LEADING CHANGE: ONE DEPARTMENT'S EXPERIENCE IN CREATING A NEW WORKFLOW-PARADIGM.

William Hissner, Joseph Camacci; Penn State Hershey, Hershey, PA

Introduction: To align the mission and values of our Respiratory Therapy department with organizational goals around patient and family satisfaction, patient safety, and length of stay (LOS) at the Penn State Hershey Medical Center (PSHMC), our department spearheaded a hospital-wide change initiative. The initiative involved respiratory therapists (RT) scheduled on site each shift in the emergency department (ED), instead of traditionally being paged in as needed; concurrently RTs would relinquish all hemodynamic-monitoring duties house-wide to bedside Registered Nurses (RN). Background: Since the early 1980's, RTs at PSHMC have assisted physicians in completing all invasive hemodynamic-monitoring tasks. Also, when RT assistance was needed in our ED, which is designated a Level 1 trauma center, the RN or physician would access us by page as needed—that is, RT staffing was not readily available to provide immediate patient care. Method: First, our RT department offered to assist the ED by dedicating an RT each shift to this area. Next, in order to find the extra time necessary to make on-site RT staffing in our ED a reality, we approached our Interdisciplinary Adult Intensive Care Unit Committee with the proposal of supporting hemodynamic throughout 2010, but commencing 2011 all hemodynamic-monitoring tasks house-wide would be performed by the bedside RN. PSHMC nursing employs a shared-governance model in our four adult-ICUs, with each ICU having both an education and clinical-practice council. It was through these councils which hemodynamic training for RNs was initiated. After one year of house-wide training, each adult-ICU went live with bedside RNs performing all hemodynamic tasks. We then we rolled out our ED initiative which involved having an RT imbedded in this patient care area each shift. Results: The result of having the RT department relinquish hemodynamic monitoring duties' house wide to bedside-RNs enabled RTs to be in the ED each shift. This resulted in improved patient/family and ED staff satisfaction, and helped alleviate patient-safety concerns surrounding responses to real-time ventilator alarms. Conclusions: Our Shared-Governance model at PSHMC proved very effective in enabling us to change the culture at our organization, aligning nursing and respiratory duties in such a way as achieve organizational goals concerning patient/family and staff satisfaction, as well as patient safety in our ED.

Sponsored Research - None

1409198

DECREASE INHALED NITRIC OXIDE UTILIZATION AT A CHILDRENS HOSPITAL FROM A DRUG USE EVALUATION AND GUIDELINE IMPLEMENTATION.

Donna Parker, Joyce Baker; Children's Hospital Colorado, Aurora, CO

Background: Inhaled Nitric Oxide (iNO) is only FDA approved in the treatment for hypoxic respiratory failure associated with pulmonary hypertension of the neonate. The majority of utilization of iNO is off label at our institution; constituting 89.1% of our total utilization and contributing to a 27.7% increase in expense annually. Method: A drug utilization evaluation (DUE) was done to compare utilization of iNO from 2008 and 2010. This included review of diseases, hours of utilization, appropriate use, length of therapy, and physician management. Literature review was done for three specific patient populations (AHRF, PPHN, Post op Cardiac) looking at efficacy of therapy and standard length of time on therapy. Based on our findings, guidelines for these three disease processes were written and implemented in Q2 of 2011. The guidelines focused on stricter inclusion criteria, establishing lowest tolerable dose, timeline to implement weaning, weaning process to prevent rebound, and stricter criteria for discontinuation. Education with the respiratory therapists and medical staff was done emphasizing specifics of the guidelines and weaning procedure. We also found value in educating the medical staff on the overall expense to the patient if left on iNO for an extended period of time. Results: Comparing total hours of iNO consumed from 2010 to 2011 we had an overall 16.1% reduction, with a potential $256,756 savings to the hospital. A review of iNO in each of the targeted disease processes found utilization in acute hypoxic respiratory failure patients decreased by 15.1% and persistent pulmonary hypertension of the newborn decreased by 14.7%. Our post operative cardiac utilization; which was already within the standard length of therapy reported in literature, increased by 23% in 2011 despite the same number of patients who received iNO. This is prospectively related to an increase complexity of the patients. Evaluation of additional disease processes outside our selected patient population revealed chronic lung disease and congenital diaphragmatic hernia patients had decreased consumption by 22.3% from 2010 to 2011. Conclusion: Implementation of inhaled nitric oxide (iNO) guidelines after an extensive drug utilization evaluation and aggressive education of the various health care teams has assisted in decreasing unnecessary use of iNO with an overall expense reduction to the hospital.

Sponsored Research - None

1414149

DIFFERENCES IN THE PERCEPTION OF RESPIRATORY CARE STAFFING USING PATIENT VS PROCEDURE DRIVEN METRICS.

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Background: Reductions in the RCP workforce beyond critical levels can result in missed therapy, misallocation of therapy, inability to respond, complications and errors that can result in negative outcomes. This concern provided reason to better assess if managers perceived they were short staffed and if so, did it make a difference if their staffing system was based on counts related to the number of patients or the number of procedures. Methods: We utilized a survey designed by the North Carolina Respiratory Care Board, who initiated a similar inquiry in 2011. The survey was distributed through the contact list maintained by the California Society of Respiratory Care. California managers were surveyed to report their perception of being short staffed, inclusive of what metric they apply to adjust staffing levels. Reported metrics were then grouped as being patient driven or procedure driven. Analysis was performed to better determine the relationship between understaffing and the use of either patient driven or procedural driven metrics. Results: Of approximately 440 hospitals in California, 130 centers responded. It was the general perception of 30% of respondents that they did not have adequate staff over the course of the past year, with 21.5% reporting the conditions as chronic and ongoing. Of the 21.5% reporting being chronically short staffed, 53% use workload assessment counts considered procedure driven. Of the 88.5% that did not perceive conditions of being chronically understaffed, 83% use procedure driven metrics. Conclusions: Data reflects that procedure driven metrics are applied in the majority of staffing models. It is apparent however, that those reporting they are chronically understaffed; there is a greater usage of patient driven metrics. Patient driven metrics do not account for a specific determination of the types of respiratory interventions required, and thus may not be the best indicator to determine how much practitioner time is required. We suggest use of procedure driven metrics as recommended in the AARC Uniform Reporting Manual.

Sponsored Research - None

1409656

CALIFORNIA MANAGERS PERCEPTION OF REASONS FOR BEING SHORT STAFFED.

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Background: Reductions in the RCP workforce beyond critical levels can result in missed therapy, misallocation of therapy, inability to respond, complications and errors that can result in negative outcomes. This concern provided reason to better assess the status of staffing respiratory care departments and manager perception of the cause of staffing shortages. Methods: California managers were surveyed to report their observations regarding staffing and the cause of shortages, as well as practices in place that may directly impact staffing. The survey was designed by the North Carolina Respiratory Care Board, who initiated a similar inquiry in 2011. The survey was distributed through the contact list maintained by the California Society for Respiratory Care. Results: Of approximately 440 hospitals in California, 130 centers responded. It was the general perception of 30% of respondents that they did not have adequate staff over the course of the past year. In such situations managers identified reasons for being short staffed as listed in the table. The most significant reasons for chronic understaffing were extended medical leave and delays in the onboarding process. Conclusion: One can assess that for those who identified a reason for understaffing 35% of the time it was a result of poor metrics, administrative targets, hiring freezes or budget related. For 65% of responders the key reasons for being understaffed were the result of more department/system issues related to managing leaves, turnover, and the processes involved in the recruiting/hiring of new staff. This indicates that California Managers of Respiratory Care not only need tools that will help decision makers in setting staffing targets for the provision of RC services, but are in need of better systems to manage leave and filling of vacancies.

Sponsored Research - None

Reasons Identified for Being Short Staffed

REASON	COUNT	%
Sick Call and Leave	25	33%
Onboarding Process	19	25%
Productivity Metrics	12	16%
Unreasonable Targets	7	9%
Budget Restraints	6	8%
Staff Turnover	5	7%
Hiring Freezes	1	1%

1410060

UTILIZING QUALITY IMPROVEMENT AND PERFORMANCE MANAGEMENT TO RAISE THE BAR FOR INCREASING THE COMPLIANCE OF SCANNING BARCODES FOR MEDICATIONS.

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BACKGROUND: With the emergence of the EMR (electronic medical record), both the Joint Commission and Centers for Medicaid and Medicare Services have placed high emphasis on the adherence of barcode scanning to prevent errors in the delivery of medications. The Respiratory Care department was charged with improving compliance for scanning barcodes to improve the safety of medication delivery. From the data collected at CCHMC for RT's in the PICU, our team formed an SMART (Specific, Measurable, Actionable, Reliable, Time bound) aim statement to increase the compliance of the EPIC barcoding process from 82.7% to 96% for the scanning of medications, and 83.1% to 98% for the scanning of patients by December 1, 2011. The leadership teamed incorporated the yearly performance management evaluation system to promote synergy and to reach a unified team goal for improving bar code scanning compliance during medication delivery. METHOD: In our institution, we are able to generate weekly compliance reports for medication delivery by user through EPIC EMR and pyxis. A task force was united and rapid cycle quality improvement (RCQI) methods were applied to accelerate the results. The team used a process map and a survey to identify the principal failures and to plot a pareto chart. Additional tools that were employed were the FMEA (failure mode effect analysis), key driver, root cause analysis (ask why 5 times method), and the PDSA (plan do study act). All of the interventions applied to this project were level 1 (1-2 failures per 10 or 80-90% and level 2 (<5 failures per 100 or 95% reliability). RESULTS: The team reached a median rate of 97.2% for scanning medications and 98.7% for scanning patients, both exceeding the goals of 96% and 98% respectively by December 1, 2011. As of May 15, 2012 in preparation of the performance management evaluations that conclude in June, the team has sustained both of the goals. CONCLUSIONS: The use of RCQI methodology proves to be an effective strategy for improving processes. The implementation of small test of change for trial and learn with routine data analysis has not only resulted in increased compliance but was a low cost strategy to reach results. A second sequence of RCQI should be executed to reach a goal of 99.5%, which would require level 3 (<5 failures per 1000 or 99.5%) interventions resulting in a highly reliable system.

Sponsored Research - None

1414851

LEVERAGING THE ELECTRONIC MEDICAL RECORD TO STRATEGICALLY ENGAGE THE HEALTH CARE TEAM FOR CHILDREN'S ASTHMA CARE CORE MEASURE COMPLIANCE.

Lisa Wright, Lynda Bennett, Jeff Bennett, Barbara Latham; Respiratory Therapy, UK HealthCare, Kentucky Children's Hospital, Lexington, KY

Background: At Kentucky Children's Hospital, completion of the Children's Asthma Care (CAC) Home Management Plan of Care (HMPC) requires coordinated involvement among nurses, clerks, respiratory therapists and physicians. Historically, the respiratory therapist was responsible for HMPC delivery but perfection was repeatedly missed due to overlooked criteria. The respiratory therapist was often struggling at the time of discharge to get the clerk, nurse and physician to complete their piece of the process. Delays in discharge created a conflict that put perfect completion of the HMPC process at risk. Numerous small cycles of change were implemented over time. Indeed these changes did improve CAC compliance from <50% to 70%. It was clear that reaching the overarching goal of 100% was going to require major process transformation. Method: A respiratory therapy led multi-disciplinary process improvement team was assembled to redesign standard work for children's asthma. The team mapped out a process resulting in a complete HMPC within 24 hours of admission. Clinical decision support tools, such as electronic medical record (EMR) generated emails and clinical documentation alerts, were designed to initiate the process on admission and keep it flowing. The new process remains RT driven but engages all care providers earlier and more consistently through EMR alerts and visual cues. With the guidance of informatics, the team designed a simple electronic HMPC document that maps all pertinent information to a patient-friendly color Home Management Plan of Care report. Strategic hard stops were built in so the report cannot be generated until all team members have completed their role. Deliberate EMR alerts signal the need for process input at specified time points. Results: CAC compliance sustainably increased from 70% to 95% immediately following implementation of the transformed process. The revised process also positively impacted numerous other quality, safety, efficiency and patient/staff satisfaction domains (see table). Conclusion: By engaging the entire healthcare team and utilizing electronic tools, a respiratory therapy led multidisciplinary team boosted CAC Core measure compliance immediately and sustainably to well above the UHC average. The improved process also resulted in numerous advantages in quality, safety, efficiency and patient/staff satisfaction.

Sponsored Research - None

1416438

LEAN APPROACH TO ADDRESS WORKLOAD SURGES.

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Background: Recent employee engagement surveys revealed dissatisfaction regarding efficiency of departmental handling of workload surges. Current surge plan: 1) Increase staffing so all ordered therapy given 2.)Extra staffing comes from support staff (e.g. educators, supervisors which are available 7am to 10pm, M-F), voluntary overtime (OT) and nightshift on-call (11pm to 7am); 3) Manual tracking of assigned acuity levels so if all ordered therapy cannot be performed, highest acuity patients are readily identified and treated first. Method: Lean Rapid Improvement Team created to develop Standard Work (SW) to address increased workloads or decreased staffing. The SW identifies when and how to implement a RCS surge plan . Also, use of visual management (VM) tools to clearly communicate to the department when surges are occurring. An additional goal to develop electronic acuity alert system and a mechanism to evaluate the impact on patients when Red condition occurred. Results: Improvements included 1. Creation of traffic light system to be displayed in department to alert staff when surges occur. Green light indicates enough staff on duty to perform ordered therapy . Yellow light indicates shortage of 1 to 2 staff per projected need with support staff, on-call and OT in use. Red light condition indicates shortage of 3 or greater staff projected based on calculated need . During Red light condition, patients are assigned a triage level (1 highest acuity, 3 lowest) and therapy given to highest acuity patients first. Additionally, automatic approval of OT for patient assessor to assure compliance with RCS protocols. Creation of a RCS electronic handoff form in the EMR was approved by management and is in process of development by IS. This form enables written communication of patient acuity level between staff but is not a part of the permanent medical record. 2. Progress back to green light condition triggers debrief process in order to analyze effectiveness of implementation of surge plan and review cases of missed therapy to assure no patients suffered adverse consequence. Conclusions: Low efficiency in handling workload surges was dissatisfying to staff. Implementation of lean SW and VM tools aid in efficiency and safety when managing our resources when workload demands exceed staffing levels. Follow up staff surveys will be conducted to evaluate the effectiveness of the interventions .

Sponsored Research - None

1434283

A ONE YEAR REVIEW OF RESPIRATORY CARE SUPPORT FOR AN ACADEMIC MEDICAL CENTER RRT PROGRAM.

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Background: The growth of Rapid Response Teams (RRT) since the 2004 recommendation by the Institute for Healthcare Improvement has been analyzed extensively. The focus of these studies have been impact on morbidity/mortality, number of non ICU codes, health providers' perception of patient safety and quality of education for critical decision making. Evaluating respiratory care support in RRTs may help department planning in resource allocation, staffing and training. We retrospectively reviewed all RRTs' responded to by our respiratory care department for 2011 and measured interventions by the practitioners. Method: We electronically reviewed all Rapid Response patients that had Respiratory Therapy (RT) documented interventions for 2011 (n=671 or an average of 1.83/day). Respiratory therapy interventions were considered RRT related if documented 15 minutes before RRT initiation time and up to 60 minutes following. Allotted minutes for each activity were based on institutionally approved time standards. Table reports averages for all RT activities at the 671 RRT events. Results: See Table Conclusion: This review supports the need for ready available skilled RT practitioners for critical care management and the requisite equipment for RRTs.

Sponsored Research - None

RT Activity	% of RRTs	Minutes per RRT
Travel and assessment	100.0%	20
Maintaining airway patency	36.0%	20.14
Transport after RRT	29.0%	16.53
ABG sampling	28.0%	6.6
Instituting NIV	10.0%	6.4
Aerosol administration	4.0%	0.67
Extended monitoring	4.0%	1.74
Ventilator initiation	4.0%	2.41
Airway Suction	3.0%	0.25
Intubation	1.0%	0.38
CPAP	1.0%	0.26
Total time per RRT	NA	75.38

1417388

THE PULMONARY INITIATIVE – A MODEL FOR REDUCING LENGTH OF STAY AND REDUCING COST/CASE IN COPD PATIENTS.

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Background and Method: UHC benchmark data indicated opportunities for improvement in cost/case and length of stay (LOS) for COPD (DRG 88) patients. A multidisciplinary team was formed which developed the strategic objective of improving or maintaining safe, quality care while improving financial outcomes. Utilizing the LEAN performance improvement methodology, the team identified the problem, current situation, benchmark standard, discrepancy, and potential causes. An analysis of the root causes was performed. Defined were short and long term countermeasures with specific responsibilities, expectations, and timelines. These were utilized to evaluate the success of the plan. A primary component of the Pulmonary Initiative was the development of the Acute Pulmonary Unit (APU). The APU which included telemetry and remote pulse oximetry technology became the primary admission area for COPD or other pulmonary patients. Other elements included staff education program, scope of service criteria, "pull" process identifying COPD patients early in their hospitalization to facilitate admission or transfer to the APU, revitalization of the COPD pathway and order sets, development of a "60 second walk test," which evaluated patient functionality in limited spaces similar to the home environment and an advanced role for respiratory therapists, called the Respiratory Clinical Specialist (RCS). RCS duties included facilitating/streamlining care with other professionals, performing patient/caregiver teaching, defining appropriate care/discharge needs, follow-up after discharge, and case managing those patients with frequent readmissions. Results: An analysis compared FY2008 - FY2011 for COPD (DRG 88) patient discharges and is shown in the table. The Pulmonary Initiative produced shortened LOS and a decreased cost/case resulting in considerable financial improvement. Conclusion: With a 20% increase in the number of patient cases, this team was able to positively impact hospital financial margins. Our strategy and process allowed us to achieve a positive net margin of 53% in 4 years. In the 4th quarter of 2011, we implemented a discharge phone call process and saw a dramatic decrease in the 30 day readmission rate to 2.4% in the 1st quarter of 2012. We believe our organized approach and not one particular factor has contributed to the overall success of this initiative.

Sponsored Research - None

DRG 88 Jan-Dec	2008	2009	2010	2011	% change 2008-2011
# of Cases	356	351	419	428	20%
Average LOS	5.94	5.41	5.73	5.61	-5%
Average ICU LOS	.65	.48	.56	.42	-35%
Average PCU LOS	.73	.56	.39	.50	-31%
Average Net Margin	-$3624	-$2460	-$2854	-$1398	61%
Average Total Cost	$9930	$9193	$9440	$9075	-9%
Ave. Average CMI	0.9733	1.0026	.9656	.9739	0%
ICU Admission	17.4%	14.0%	16.2%	11.9%	-32%
30 Day Readmission Rate	9.6%	3.7%	7.9%	8.1%	-16%
Net Margin					53%

1423261

IMPLEMENTATION OF THE NEOTECH RAM CANNULA ™ IN THE PEDIATRIC INTENSIVE CARE UNIT.

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Background: Patients with broncholitis, Respiratory Syncytial Virus (RSV), and apnea can require all levels of respiratory support from a nasal cannula to intubation. As a patient's respiratory status deteriorates the only options available are Non-invasive Positive Pressure Ventilation (NIPPV) or intubation. Current NIPPV interfaces are often uncomfortable, ill fitting, and time intensive for hospital caregivers. Intubation can lead to complications ranging from airway trauma, infection, and increased lung damage. "The Neotech RAM Cannula™ is clinically proven as a safe, effective, gentle and adaptable interface to deliver NCPAP or NIPPV/NIMV for respiratory support for the neonatal and pediatric population." (http://www.ramcannula.com) Our unit trialed this device to assess impact on intubated days and average length of stay (ALOS) of our PICU patients. Methods: In this study we compared data from patients 2010-2011 with prospective outcomes of care using the RAM cannula. We assessed rate of intubation and ALOS. Target population: Patients ≤ 8 months of age, with a diagnosis of broncholitis, RSV or apnea requiring non-invasive ventilation or intubation. Patients meeting inclusion criteria were placed on the RAM Cannula. Results: In 2010-2011, 23 patients ≤ 8 months of age were admitted to the PICU with a diagnosis of broncholitis, RSV or apnea with an ALOS of 5.15 days. In 2010, 14% of patients meeting inclusion criteria were intubated and 25% in 2011. In Jan 2012 we implemented the use of the RAM cannula. From Jan 1 to April 1, 31 patients ≤ 8 months of age were admitted who met inclusion criteria, with an ALOS of 4.1 days. 7% of these patients were intubated and 35% received non-invasive ventilation via the RAM Cannula. Based on clinical assessment, many of these patients would have required intubation without implementation of the RAM cannula. Intubated patients after they met clinical indicators were placed on the RAM Cannula and did not require re-intubation. Conclusion: Implementation of the RAM Cannula guidelines resulted in a decrease in rate of endotracheal intubation and ALOS. We developed guidelines for use of the RAM Cannula that allow our PICU to standardize care and provide a comfortable interface for patients. We will continue to monitor outcomes of our usage of the RAM Cannula in a broader patient population.

Sponsored Research - None

1412231

CLINICAL OUTCOMES OF PEDIATRIC PATIENTS TREATED WITH HEATED HIGHFLOW NASAL CANNULA ON THE PEDIATRIC WARD.

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Background: Heated Highflow Nasal Cannula (HHFNC) therapy has been used successfully to treat both adults and children with impending respiratory failure. Traditionally neonates and pediatric patients treated with HHFNC are managed in a critical care setting. During 2009/2010 H1N1 pandemic, we developed a clinical management algorithm that would safely manage pediatric patients with HHFNC needs on our acute care wards Method: The Respiratory Care department instituted a multidisciplinary task force consisting of representatives from the pediatric intensive care unit (PICU), Hospitalist service, Pulmonary division and Hospital leadership. We developed a strict clinical protocol for appropriate patient identification, initiation, escalation and weaning of patients managed on this protocol. Nurse staffing ratios were 1 nurse per 3 HHFNC patients. Thrice daily bedside rounds were mandated with physician, nurse and respiratory therapist trios to insure that patient management was proceeding as desired. A Fisher & Paykel 850 heater and RT329 heated high flow circuits were used to deliver HHFNC therapy to these patients, using flow rates of 3L/min – 8L/min, and FIO2 ranging from 1.0 – 0.4. Capillary blood gas analysis was required for initiation and at least one more timepoint after initiation of HHFNC. A retrospective chart review was completed for the first 16 patients managed on this algorithm from 02/2010 – 02/2011. Patients ranged in age from 1 week to 1 year old; 10 patients had a diagnosis of Respiratory Syncytial Virus (RSV), 3 with non-RSV broncholitis, 2 with pertussis and 1 patient with lobar pneumonia. Of the 16 patients only 2 required admission to the PICU and only one required intubation. Most patients evidenced a marked improvement in ventilation and pH. There were no significant changes in oxygen saturation or respiratory rate. Conclusion: A multidisciplinary HHFNC pathway with strict criteria for patient identification, initiation, escalation and weaning as well as required bedside patient re-evaluation can be used to safely and effectively treat pediatric patients in an acute care setting. Ventilation can be significantly improved which may decrease the need for invasive mechanical venitlatory support. Sponsored Research – None

Sponsored Research - None

Variable	Pre HHFN Median (Range)	4 Hrs Post HHFNC Median (Range)	p value
Respiratory Rate	58 (48,100)	47 (36,100)	0.41
pH	7.28 (7.19,7.35)	7.36 (7.28,7.43)	0.002
PaCo2	64 (50,100)	50 (40,82)	0.002
O2 Saturation	100 (97,100)	100 (97,100)	0.08

1427327

DEVELOPING, IMPLEMENTING, AND ASSESSING AIRWAY PRESSURE RELEASE VENTILATION GUIDELINES IN THE PEDIATRIC INTENSIVE CARE UNIT.

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Background: Pediatric Respiratory Care at the Mayo Clinic developed and initiated "Airway Pressure Release Ventilation (APRV) guidelines" in the Pediatric Intensive Care Unit (PICU). A multidisciplinary team recognized inconsistencies and knowledge deficit when initiating and adjusting APRV settings. The main goal in instituting APRV guidelines was to increase consistency when initiating and weaning APRV. Method: Information and content for the APRV guidelines was collected from researching evidence-based articles, case reports, reviewing ventilator manuals, and advice from the Intensive Care on-line Network representatives. The guidelines were reviewed by a Pediatric Intensivist and the Pediatric Respiratory Therapists then approved by the Medical Director and PICU Operations Committee. Clinical guidelines and educational opportunities were made available throughout the last 1½ years. To evaluate the guidelines effectiveness a survey was given to 44 Therapists involved in pediatric care, resulting in 29 respondents. The survey consisted of new graduates and experienced Respiratory Therapists using a Likert scale. Results: Of 29 respondents, 75% of the therapists were involved with a patient requiring APRV. Survey results reflected 65% of the participants agreed the guidelines were beneficial for initiating APRV or found the guidelines useful when making changes according to blood gases with 35% possessing a neutral response (no participants disagreed). In the past year, 55% of the survey participants felt more confident in recommending APRV if the mode of ventilation could benefit a patient (38% had a neutral response and 7% disagreed). Conclusion: APRV has proven to be a valuable mode of ventilation used for recruitment in lung injured patients. Lack of knowledge in the mode can lead to respiratory and hemodynamic instability or failure to consider using APRV. Survey findings showed APRV guidelines instituted in the PICU can be beneficial in guiding bedside ventilator management and used to educate residents and new respiratory staff. Further evaluation could be conducted simulating case scenarios to assess guideline effectiveness.

Sponsored Research - None

1415809

EVALUATION OF THE NEOTEE T-PIECE INFANT RESUSCITATOR.

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INTRODUCTION: The NeoTee is a novel manually-cycled, pressure-limited, and flow powered infant resuscitator that allows clinicians to adjust preset pressures and inhalation occurs when the operator occludes a restrictor valve. We hypothesized that there would be no differences between preset pressures on the NeoTee and those measured in a test lung following changes in PIP, PEEP, flow, and frequency with the NeoTee resuscitator. METHODS: An Ingmar ASL-5000 test lung (C:2, R:50) was attached to a NeoTee. The operator manually ventilated the lung model for two minutes with: 1) Pressure (PIP/PEEP) 10/5; 20/5, 40/5; 2) flow (L/min) 5, 10, 15; 3) rate (f/min) 20, 40, 60 and 4) different flow/PEEP combinations. Each test was repeated in triplicate using new NeoTee resuscitators (n=3). Pressures observed on the NeoTee were recorded in a lab notebook and lung model pressures were stored in the ASL software. Wilcoxin signed-ranks test, Kruskal-Wallis H test and Spearman correlation were used to compare differences between pressures. RESULTS: Changing flow from 5, 10, 15 L/min on the NeoTee had no effect on the PIP (P = .71) or PEEP (P = .31) delivered to the test lung. There were significant differences between set PIP and PEEP on the NeoTee manometer and PIP and PEEP delivered to the lung model but there was good correlation between the set and delivered pressures (PIP: P = .000, [rs: 0.76 r2 0.58] ; PEEP: P = .01,[rs: 0.74 r2 0.55]). Changing the ventilatory rate from 20, 40, 60 had no effect on the PIP delivered to the lung model (rs -.03. r2 -.09); however, when NeoTee was operated at 60 min the lung model PEEP was ~1.81 cm H2O greater than the preset value. Operating the CONCLUSIONS: Based on these data, the NeoTee manual resuscitator operated within a clinically acceptable range for the majority of testing and well within the manufacturer's specifications for all testing conditions. We recommend operating the gas flow >5 L/min and frequently observing airway pressure measurements during resuscitation.

Sponsored Research - Devices were provided by Mercury Medical, Inc.

1430971

CORRELATION BETWEEN ADHERENCE TO A VENTILATOR WEANING PROTOCOL AND SUCCESSFUL EXTUBATIONS IN AN INTENSIVE CARE.

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Background: Chronic lung disease (CLD) is a multi-factorial respiratory disease of the preterm neonate for which mechanical ventilation is a significant contributor. Mechanical ventilator weaning protocols have been shown to reduce the duration of mechanical ventilation. A ventilator weaning protocol (VWP) based on Level I-III evidence was instituted in 2004. Compliance with existing VWP is unknown. CLD rates in our unit have increased over the past 3 years. Assessment of and understanding protocol compliance is an important first step in identifying internal factors which may contribute to CLD. Based on increasing rates of CLD, we hypothesize that compliance with existing VWP falls below 80%. Method: Retrospective review of neonatal charts between 10/2004-10/2011 to assess the degree of compliance to VWP. VWP compliance is defined as weaning Peak Inspiratory Pressure to 8-12 cmh20. At this point, patients are eligible for extubation. Successful extubation is defined as no mechanical ventilation for >72 hours. Results: Since the implementation of the Jefferson VWP, 62% of eligible babies had protocol initiation from birth. Median gestational age was 27wks and average weight was 1023g. 80% received surfactant. In 2004-2006, compliance with the VWP was achieved 75% of the time with a 92% extubation rate. 93% of these patients remained extubated for >72 hours. From 2007-2011, compliance with VWP declined to 54% with a 61% extubation rate. Patients in this group who were extubated when extubation criteria were met, remained off of mechanical ventilation for >72 hours 86% of the time. Conclusion: While the acuity and patient population have not changed, compliance with ventilator weaning protocol and evidence based strategies have decreased in recent years. Poor compliance to VWP may correlate to the increase in CLD in our unit. Our next steps are to understand the barriers and identify the "gaps" associated with the decrease in compliance. Successful re-implementation of the VWP may lead to improved weaning and successful extubation. Compliance coupled with the institution of evidence-based guidelines could lead to decrease days of mechanical ventilation and ultimately may positively impact CLD rates.

Sponsored Research - None

1434507

CAN HIGH FLOW NASAL CANNULA BE DRIVEN BY A CPAP MACHINE? ANALYSIS OF PRESSURE AS RELATED TO FLOW USING FOUR TYPES OF NASAL CANNULAS.

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Background: There is increasing interest in the use of nasal cannula type interfaces for non-invasive respiratory support in the pediatric population because they are more comfortable and better tolerated. With hospital use, these interfaces are typically connected to systems with prescribed flow, driven by a wall pressure source. However, they are sometimes connected to a flow/pressure generator such as a CPAP or BiPAP system or a ventilator. We wanted to understand the relationship between flow and pressure for different nasal cannula interfaces to evaluate whether connecting them to a flow/pressure generator was as effective as using a wall pressure source. Methods: A flowmeter connected to a wall pressure source was used to deliver gas flow to the four types of nasal cannula devices we evaluated. Flow rates were varied between 0-15 lpm. Pressures were measured upstream of each nasal cannula device using a Bio-teck DMP+ universal pressure meter. There was no downstream resistance at the end of the test device. The devices evaluated were the standard length Airlife™ pediatric nasal cannula by Carefusion, the Fisher and Paykel pediatric HFNC, the Vapotherm pediatric HFNC, and the infant size RAM cannula™ by Neotech. Results: As seen in the attached graph, the flow/pressure relationship was non-linear. The pressures required to drive prescribed flow rates were much higher with the standard length nasal cannula than the other devices and would not be achievable with a portable flow/pressure generator. The prescribed flows were achieved at the lowest pressures with the RAM cannula. Discussion: We demonstrated that the relationship between flow and pressure varied widely with the nasal cannula devices tested. With some of these devices, reasonable flows could be achieved with a portable CPAP/BiPAP sytem. Appreciating the different flow/pressure relationships of these interfaces should be considered when using them with alternative modes of flow generation. Of course, the benefit of flow from these interfaces will depend on how they fit into the patient using them. A fit with less leak may benefit the patient because of increased airway pressure instead of flow. More investigation must be done to further understand how these different nasal cannula interfaces have an effect in managing respiratory failure in pediatric patients.

Sponsored Research - None

1435775

PEAK PRESSURES MEASURED AT THE DISTAL TIP OF PEDIATRIC ENDOTRACHEAL TUBES DURING AN INTRAPULMONARY PERCUSSIVE VENTIALTION CYCLE: A BENCH TEST.

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Background: Airway clearance is often impaired in intubated pediatric patients. The use of sedation, bypass of the glottis, and decreased airway diameter due to the presence of an artificial airway all significantly affect expiratory flows and the ability to clear secretions. The use of Intrapulmonary Percussive Ventilator therapy (IPV) inline with the circuit of a conventional ventilator has been shown to be an effective means of clearing secretions as evidenced by comparison of chest xrays, however concerns have been raised surrounding the lack of knowledge of PIPs delivered at the distal end of the ETT and thus, the safety of the treatment. This bench test is designed to give a point of reference for PIPs at the distal tip of an ETT during such a treatment and identify the effects of ETT size and IPV settings. Method: An IPV was teed into a pediatric/adult vent circuit with a one way valve to allow the system to maintain PEEP. PIP data was gathered with the IPV set at an Operational Pressure of 25, 35, and 45psig. Percussion was set to 10, 8, and 6.5 at Operational Pressure setting. Test was performed on 4.0, 5.0, and 6.0 ETTs on a PEEPs of 5 and 10 in PC SIMV, f10, Ti 0.8, and deltaP 10. A BioTek VT Plus analyzer was used to monitor PIPs at the distal end of the ETT followed by a test lung. The highest value seen during a one minute cycle on each setting was recorded. Results: PIPs increased as ETT size increased when compared to like settings on the IPV and ventilator. As frequency (percussion) decreased on the IPV, there was a modest variation in PIPs, though not necessarily an increase. ETT size and Operational pressure seemed to have the greatest affect on PIPs. The highest PIPs observed were on the 6.0 ETT on a PEEP of 10, and IPV set at 45psig and percussion at 6.5; PIPs as high as 35 were achieved. Conclusion: IPV can be safely delivered when teed into a circuit on a conventional ventilator, but the practitioner should be cognizant of the effect of the inverse relationship the percussion has on PIPs, the direct relationship ETT size has on PIPs, and carefully consider risk/benefit when using an operational pressure of 45psig on larger ETT sizes. A higher operational pressure may be necessary to be effective patients with smaller ETTs due to the high degree of attenuation.

Sponsored Research - None

1435490

A BENCH EVALUATION OF TIDAL VOLUME DELIVERY THROUGH VARIOUS NASAL INTERFACES USING A NEONATAL AIRWAY AND INFANT MODEL.

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Background: A common method of support in the NICU is Nasal CPAP (NCPAP) and Nasal Intermittent Mandatory Ventilation (NIMV). The aim of this study was to test various devices and interfaces for their ability to deliver Tidal Volume (Vt) and Minute Ventilation (VE). **Method:** A Evita XL and Babylog ventilator was prepared. 3 nasal devices were used for each model. The Neonatal Airway (NA): 0 Hudson (Research Triangle Park, North Carolina), Infant Fisher & Paykel (F&P) HFNC (Auckland, New Zealand) and Preemie Ram (Valencia, California). The Infant Model (IM): 3 Hudson, Pediatric F&P HFNC and Infant Ram. The NA is a 700 gram preemie. The IM is a 2-3kg infant. Prongs were attached to models to get occlusive seal. Model was attached to TSI certifier FA Plus (Shoreview, Minnesota) and infant IMTMedical Smartlung (ag, Switzerland). Smartlung set resistance 5 mbar/L/s and compliance 5ml/mbar. Evita XL settings: Rate 20, It .4, PIP/PEEP 14/6 and PIP/PEEP 20/8. Babylog settings where same as Evita except flows of 8, 10 and 12 were measured as well. **Results:** NA: PIP/PEEP 14/6cmH2O: Average Vt was 8.6ml. Largest Vt measured was 15ml. Smallest Vt measured was 5ml. Average VE measured was .160L/m. Largest VE was .296L/m. Smallest VE was .88L/m. NA: PIP/PEEP 20/8cmH2O: Average Vt was 11.3ml. Largest Vt was 20ml. Smallest Vt was 6ml. Average VE was .220L/m. Largest VE was .399L/m. Smallest VE was .103L/m. IM: PIP/PEEP 14/6cmH2O: Average Vt was 15.1ml. Largest Vt was 18ml. Smallest Vt was 12ml. Average VE was . 297L/m. Largest VE was .368L/m. Smallest VE was .236L/m. IM: PIP/PEEP 20/8cmH2O: Average Vt was 22.1ml. Largest Vt was 31ml. Smallest Vt was 16ml. Average VE was .435L/m. Largest VE was .450L/min. Smallest VE was .305L/m. **Conclusion:** The largest Vt measured in both models was with the Hudson prongs and Evita XL. The Infant RAM cannula achieved Vt within 15% of maximum Vt. No direct relationship was established between increasing flows on the Babylog and increased Vt. Comparison minimum to maximum: Vt increased an average of 79% in NA and 42% in IM. VE increased 102% in NA and 47% in IM. The difference in Vt was directly related to device and type of interface.

Sponsored Research - None

1403510

EXHALED BREATH CONDENSATE AND TRACHEAL ASPIRATES IN MECHANICALLY VENTILATED NEWBORNS-A WINDOW INTO THE LUNG.

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Background:Monitoring of exhaled breath condensate (EBC) has been shown to be valuable in determining the extent of acute lung injury.Decreased pH in EBC can be seen in inflammatory processes such as asthma,COPD,and pneumonia. Exhaled nitric oxide in EBC may also be useful in titrating steroid therapy in patients with asthma.Premature and ill newborns are at increased risk for oxidant-induced injury,particularly in the lung.Glutathione(GSH),an essential antioxidant in the lung is gestationally deficient in the premature newborn and is required for optimal functioning of resident cells in the lung,such as the alveolar macrophage(AM).Determining the GSH status of the neonatal lung requires invasive measurements such as collection of tracheal aspirates(TA) from intubated newborns.EBC have been described as a less invasive technique to evaluate oxidative stress markers in the lung,but little data exists of its use in the premature population.We hypothesized that GSH in the TA of mechanically ventilated newborns would directly correlate to the GSH found in EBC.Further,we hypothesized that the GSH status of the resident AM would be reflected in the TA and/or EBC. Methods:TA and EBC measurements were obtained after informed consent on 16 stable neonates in the newborn intensive care unit. An R-tube(Respiratory Research,AustinTx) was adapted to the expiratory limb of the circuit proximal to the airway and EBC samples were collected over thirty minutes.GSH and the percentage of oxidized glutathione disulfide (%GSSG) were measured via high performance liquid chromatography(HPLC).AM were isolated from TA and cellular GSH status determined via immunofluorescence. Statistical analyses was performed via SPSS. Results:TA GSH and %GSSG significantly correlated with EBC GSH(p=0.002) and %GSSG (p=0.002). Furthermore,EBC GSH significantly correlated with AM GSH(p=0.029).Finally,TA and EBC GSH negatively correlated with the fraction of inspired oxygen on the ventilator. Conclusion:Our preliminary data suggests that redox measurements of a non-invasive EBC highly correlates to TA measurements and are indicative of cellular status.Further studies are necessary to determine whether EBC measurements in premature newborns are indicative of adverse clinical outcomes.Early identification of the premature newborn most at-risk for oxidant-induced injury may help tailor potential patient specific therapies.

Sponsored Research - None

1416595

STRATEGIES TO REDUCE UNPLANNED EXTUBATIONS IN THE NEONATAL INTENSIVE CARE UNIT.

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Introduction: National patient safety guidelines focus on improving patient safety and reducing errors that reach the patient.Unplanned extubations expose patients to potential airway damage, ventilator associated pneumonia, and increased ventilator days which can escalate medical costs rapidly.Here we describe a quality study in which several practice changes were implemented in the NICU at Children's Healthcare of Atlanta, (CHOA) to reduce our unplanned extubation rate. Methods:In October of 2010 we identified that our accidental extubation rate was significantly higher than other NICU's with comparable patient populations. In an effort to improve this we put several practice changes into place .First, we increased the visual inspection of the landmark on the ETT, and adhesiveness of the securing device from Q12 to Q4. Second, Q7 day changes of the ETT securing device were implemented. Third, all patient positioning requires two caregivers. Fourth, all tubes are secured with the same brand of tape and secured in the same fashion.Fifth, all patients admitted with ETT's secured without a NeoBar(Neotech,Valencia,Ca) will be converted to a NeoBar within 2 hours of admission. RCP's and RN's were extensively educated prior to implementing these changes in January of 2011.All accidental extubations are documented through an online notification system as well as accidental extubation forms to track specifics of each event. In conjunction with these practice changes CHOA formed a system task force to evaluate practices across three campuses including ETT securing methods, sedation usage, caregiver to patient ratio and patient holding by parents or staff while intubated. Results: The average unplanned extubation rate in the NICU at CHOA for 2010 was 7 extubations in 260 ventilator days, or 2.73 extubations per 100 ventilator days. Following the implementation of the practice changes described above the average rate for 2011 in our NICU decreased to 4 extubations in 271 ventilator days, or 1.38 extubations per 100 ventilator days. Conclusions: Reduction of unplanned extubations can be instrumental in minimizing medical errors and controlling costs. Here we demonstrate a significant reduction in unplanned extubation rates after increased staff education, improved monitoring, and multiple practice changes. Since the changes in practice occurred at the same time and were not monitored separately we cannot conclude that any one change resulted in improvement.

Sponsored Research - None

1417375

NON INVASIVE VENTILATION IN PRETERM NEONATES- NASAL CONTINUOUS POSITIVE AIRWAY PRESSURE VERSUS NASAL INTERMITTENT POSITIVE PRESSURE VENTILATION- A RANDOMIZED CONTROL TRIAL.

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Background – The use of non invasive ventilation (NIV) in preterm neonates have increased in the past few decades, the main objective being to reduce the exposure to invasive ventilation. It proves to be safe and effective but the 'best' option is yet to be determined. The objective was to determine, if nasal intermittent positive-pressure ventilation (NIPPV) compared with nasal continuous positive airway pressure (NCPAP) decreases the need for mechanical ventilation in first 48 hours when given as a primary respiratory support or post extubation respiratory support in preterm neonates. Method – In this single-center, randomized controlled trial, preterm neonates (gestational ages 28-36 weeks) with respiratory distress were randomly assigned to receive NIPPV or NCPAP either as the primary mode of respiratory support or post extubation respiratory support. The primary outcome was the need for mechanical ventilation within the first 48 hours of life. Results – A total of 49 neonates were randomly assigned in the early NIV group and a total of 32 neonates in post extubation NIV group after stratification to gestational age of 28-32 weeks and 33-36 weeks. The primary outcome did not differ in early NIIPV (19.2%) and early NCPAP (21.7%) groups. Similarly, the primary outcome in post extubation NIV in both NIPPV (11.1%) and NCPAP (7.1%) did not differ. The complications associated with these modes were also compared and analyzed. There was no difference noted. Conclusion - NIPPV did not decrease the need for mechanical ventilation compared with NCPAP, overall, in the first 48 hours of support. It could be considered as safe and beneficial as compared to NCPAP. However, further studies are required to assess the potential benefits and complications associated with NIPPV in preterm neonates.

Sponsored Research - None

1414595

PROTOCOL-DRIVEN VENTILATOR MANAGEMENT IN CHILDREN WITH CONGENITAL HEART DISEASE: A COMPARISON TO NON-PROTOCOL CARE.

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Background: Prospective, randomized, controlled studies suggest that the use of ventilator weaning protocols, particularly extubation readiness testing by respiratory therapists, can decrease the duration of mechanical ventilation, the length of ICU stay, and significantly reduce cost, when compared to traditional methods. The concept of early liberation from mechanical ventilation following cardiac surgery with the help of protocols is not new and is standard of care in adult facilities. The use of protocols has not gained the same traction in pediatric care. We sought to change this practice. Methods: In October of 2010 we developed a respiratory therapist-driven mechanical ventilation support and weaning protocol that provides consistent clinical practice and timely interventions. Following staff training we implemented the protocol in January of 2011 as an option for physicians to order. Six months following the implementation we modified the protocol to offer adjustable goal parameters such as pH, pCO2, pO2 and SPO2; as well as a fast track option for patients whose anticipated ventilator course was < 24 hours. Patients were stratified using the Risk Adjustment for Congenital Heart Surgery-1 (RACHS-1) scoring system. Protocol patients were matched to control patients by RACHS-1 score and month of admission. All non RACHS-1 scored patients (non-surgical) were excluded from analysis. Data was collected retrospectively from the electronic health record and randomly audited for accuracy. Results: We reviewed data for all patients placed on the protocol during 2011. There were 121 protocol patients and 120 matched controls. Statistical analysis was performed using a paired t-test. The combined outcome measures for all 6 risk categories showed a trend toward improvement in the protocol group but did not reach statistical significance: average intubation time (0.9 vs 1.6 days, p=0.06), ICU stay (5.5 vs 8.7days, p=0.16), and average hospital stay (12.4 vs 18.9, p=0.14) (Figure 1). There was no difference in adverse events between the protocol and control groups (7 vs 9, p=0.49). Conclusions: Respiratory therapist-driven ventilator support and weaning is a safe and effective method of ventilator management in patients following surgery for congenital heart disease. The use of respiratory therapist-driven ventilator management protocols in this group of patients may improve medical provider efficiency and resource utilization in a complex ICU environment.

Sponsored Research - None

1432658

OPTIMIZATION OF EXTUBATION WITHIN THE BPD POPULATION UTILIZING A PARAEXTUBATION PROCESS.

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Background: Extubating patients with bronchopulmonary dysplasia (BPD) from mechanical ventilation is often difficult. There is little data in the literature to predict successful extubation in this group. The Comprehensive Center for Bronchopulmonary Dysplasia (CCBPD) is a chronic care facility focused on infants with BPD and has significant experience extubating such patients. While the majority of outcomes are positive, the CCBPD felt that improvement could be made if a standard approach to the extubation process were to be created. Objective: Our objective is to improve the overall success rate of extubations in the CCBPD through the initiation of a Paraextubation Process. We defined successful extubation attempts as avoiding the need to intubate for at least 72 hours. Methods: A multidisciplinary work group consisting of neonatologists, neonatal nurse practitioners, registered nurses and respiratory therapists was created. This group developed a set of tools to guide the care team in the determination of readiness to extubate (Extubation Checklist Tool), the process of the extubation procedure (Extubation Timeline Tool), and the care of the patient in the 48 hours following the extubation (Post Extubation Score Card and Interventions Tool). The team then provided education to the staff of the Paraextubation Process and utilization of the corresponding tools. Results: Prior to the initiation of the Paraextubation Process the CCBPD had a success rate of 65%. Following staff education and initiation of the Paraextubation process we found an increase in success of 12% to a total 77%. Conclusions: This study suggests that by creating a standardized approach to the extubation of the BPD infant through utilization of the Paraextubation Process we can potentially improve outcomes. It is our hopes that through continued use of this process we will note a more measureable improvement in our outcomes.

Sponsored Research - None

	Pre Intervention	Post Intervention
Extubation Attempts	94	26
Success (#)	61	20
Success (%)	65	77

1430945

RESPIRATORY THERAPISTS IMPACT DEVELOPMENTAL CARE IN THE INTENSIVE CARE NURSERY THROUGH SOUND REDUCTION.

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Background: Respiratory equipment is commonly used in the Intensive Care Nursery (NICU). Noise generated by this equipment often exceed the 45 dB recommended limit. Environmental stressors, including noise, can impact the normal integration of neural pathways in the developing brain. This can lead to physiological and behavioral disorganization. We attempt to quantify sound levels of various equipment/procedures in the NICU environment. Methods: Five neonatal products were monitored over 3-5 min. with and without a sound absorbing intervention: 1) Airlife CPAP system, 2) Bunnell Jet ventilator, 3) Drager 8000 ventilator, 4) Neosucker with suction tubing, and 5) Drager isolette. Sound data were collected using a SL-814 digital sound meter. We compared median sound measurements before and after each intervention using the non-parametric Wilcoxon Rank Sum test. Analyses were performed using Stata 12, and we considered $p < 0.05$ as statistically significant. Results: Three to four trials were performed with and without intervention with each piece of equipment. Data displayed as median (5th, 95th %ile). Conclusions: All sound levels were above 45 dB. With intervention, noise levels decreased by 3-10 dB. Based on previous research, a 3 dB change equates to a sound pressure level variation of about 50%. Respiratory therapists should consider noise levels when performing daily activities.

Sponsored Research - None

EQUIPMENT	SOUND LEVEL WITHOUT INTERVENTION (dB)	SOUND LEVEL WITH INTERVENTION (dB)	P
Airlife CPAP System	70.9 dB (62.5, 76.9) (exhalation tubing in isolette)	65.0 dB (58.9, 66.3) (exhalation tubing outside isolette)	0.008
Bunnell Jet (HFJV)	70.5 dB (58.3, 74.8) (jet box uncovered in isolette)	62.8 dB (56.8, 68.6) (jet box covered with 2 cloth diapers)	0.172
Drager Isolette	58.8 dB(55.5, 66.3) (routine closing without lifting door latches)	57.7 dB (51.3, 59.1) (gently closing after lifting door latches)	0.187
Drager Ventilator	60.6 dB (54.5, 67.9) (alarm with isolette doors open)	58.5 dB (52.3, 64.9) (alarm after isolette doors closed)	0.046
Suction Tubing / Neosucker	75.5 dB (66.5, 87.4) (secretions remain in tubing)	59.6 dB (51.0, 61.5) (tubing rinsed with saline)	0.004

1435118

HIGH ALTITUDE SIMULATION TESTING OF THE NEONATE CAN EFFECT DISCHARGE PLANNING.

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Background: Neonatal Intensive Care Units often discharge patients to living environments where the elevation may be higher than that of the hospital. While newborns may maintain normal SPO2 in the hospital setting, there is no guarantee that level will be sustained at an increased elevation. Neonates that fail to oxygenate well are at risk for hypoxemia, tachypnea, increased work of breathing, tachycardia, and bradycardia, leading to respiratory failure. To insure that newborns being discharged, or traveling to an increased elevation, do not experience hypoxemia and its adverse side effects, we developed a method for performing High Altitude Simulation Testing (HAST) to assess a newborn's response to changes in elevation prior to discharge. We sought to answer two fundamental questions. Did the HAST alter discharge plans? Was there a correlation between discharge elevation and oxygen dose? Method: Patients were referred for testing by their attending neonatologist and generally met the pretesting requirements of being born at 37 weeks gestation or younger, with a planned discharge or travel to an elevation ≥ 4000 feet. Infants were placed into a sub-ambient O2 environment to simulate the expected PIO2 at a specified elevation. We collected target elevation, pre and post test oxygen requirements, test outcome and its effect on discharge planning. We examined the correlation between oxygen dose and discharge elevation using the Microsoft Excel function CORREL. Results: We examined the results and conditions of all HAST studies performed for Loma Linda University Children's Hospital between July 1, 2010 and December 31, 2011 (n=80). As a direct result of these HAST studies, the discharge plan changed for 50% of the patients tested (n=40). Of the eighty tests conducted, 64 (80%) began with an FIO2 of 0.21 and 16 (20%) began with an FIO2 greater than 0.21. Of the patients beginning the test with an FIO2 =0.21, 28 (43.8%) required oxygen to maintain target SPO2 at simulated elevation. The patients beginning the test with FIO2 >0.21, 12 (75%) had an increased oxygen requirement at elevation. For the patients requiring oxygen at discharge we did not observe a correlation between discharge elevation and O2 dose, R=0.017. Conclusion: High altitude simulation testing altered discharge oxygen dose. There was no correlation between elevation and O2 dose requirement in this population.

Sponsored Research - None

1417619

EFFECTS OF CONDENSATE IN THE EXHALATION LIMB OF NEONATAL CIRCUITS ON AIRWAY PRESSURE (PAW) DURING BUBBLE CONTINUOUS POSITIVE AIRWAY PRESSURE (B-CPAP).

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Background B-CPAP is a form of noninvasive respiratory support that is frequently used in spontaneously breathing infants with lung disease. Recently, we observed condensate in the patient circuit oscillating as the bias gas flowed through the circuit. We questioned whether this partial or intermittent obstruction of gas flow could impact pressures delivered to the patient. Methods An anatomically accurate nasal airway model of a preterm infant was attached to an IngMar ASL 5000 lung model configured with R:150 cmH2O/L/s, C:0.5 mL/cmH2O, and tidal volumes of 5 mL (Pes:-10). A Fisher & Paykel B-CPAP system set to 5 cm was attached to the nasal airway with bi-nasal short prongs. The bias flow was set to 8 L/min. Airway pressures at the circuit "wye" were monitored digitally at 1024 Hz and analyzed to obtain mean airway pressures (MAP) and to estimate the amplitude of oscillations in airway pressure caused by the water oscillating in the circuit plus the oscillations caused by bubbling at the water seal of the CPAP generator. Measurements were obtained using a dry patient circuit and then repeated following the addition of 20 mL of water in the expiratory limb of the patient circuit. The circuit was U shaped to simulate a low point for condensate accumulation. Results The Figure shows dramatic alterations in the airway pressure waveforms when water was added to the exhalation limb of the patient circuit. The MAP increased from 6.1 cmH2O while using the dry circuit to 15.7 cmH2O when water was added. The amplitude of oscillations in airway pressure increased from 3.5 cmH2O (dry) to 11.9 cmH2O (wet). Discussion/Conclusion The major finding of this study was that condensate in the exhalation limb of the patient circuit during B-CPAP can greatly increase the MAP delivered to the patient. In addition, the intermittent obstruction causes oscillations in Paw that are much greater than the oscillations created by gas bubbling through water. Based on these findings, it is recommended that pressure be monitored at the nasal airway interface during B-CPAP. In order to avoid potential complications associated with barotrauma during B-CPAP, we encourage frequent assessment of condensate in circuit and removal when necessary, verification of proper heated humidifier settings, and application of a high pressure "pop-off" valve to the system.

Sponsored Research - None

1415797

COMPARISON OF PEDIATRIC PATIENTS ADMITTED WITH ACUTE RESPIRATORY FAILURE WHO WERE TRIALED ON NON-INVASIVE VENTILATION VERSUS PATIENTS WHO WERE INTUBATED.

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Background: An assisted ventilation database allows us to identify trends in our practice and develop quality improvement projects. Non-invasive ventilation (NIV) use in pediatrics seems to be increasing as a first line treatment for respiratory distress. We report the use of NIV in patients with acute respiratory failure (ARF) in order to determine the differences in mortality and duration of ventilation between those patients who were trialed on NIV and those who were not. Method: A retrospective review was conducted using the database (MS Access) in patients admitted with ARF over a 1 year period. The admitting diagnosis, sex, device hours (hrs), NIV failures, outcome, and the reason for respiratory support were queried. The data was exported to Prism GraphPad for analysis. The Mann-Whitney U Test was used to compare ventilator hours between the two groups. The Fisher's exact test was used to compare the survival to ICU discharge and patient sex. Results: There were 25 patients diagnosed with ARF (see Table). Overall, there were 12 patients (48%) trialed on NIV with a 100% failure rate. The mean duration of NIV prior to intubation was 7.9 hrs with a range of 1-33 hrs. The NIV group required HFOV more than the No-NIV group (83% vs. 62%). The NIV group had a longer duration of ventilation (P <0.05). The survival to ICU discharge was worse in the NIV group (P <0.05). The majority of NIV failures and deaths were oncology patients who tend to be our sickest ICU population. Conclusions: In a small cohort of patients, NIV support did not prevent intubation. These results indicate the need to identify variables that will help us differentiate those patients who require intubation from those who can be successfully managed on NIV. It is possible that the application of NIV is delaying intubation in those patients who have progressing lung disease.
Sponsored Research - None

Variable	*No-NIV*	*NIV*	*P*
n	*13*	*12*	*ns*
Male	*8*	*2*	*<0.05*
Duration of NIV (hrs)	*-*	*7.9 (1.25-13)*	*-*
Required HFOV	*8 (62%)*	*10 (83%)*	*ns*
Required ECMO	*1 (8%)*	*1 (8%)*	*ns*
Duration of CMV (hrs)	*203 (127-370)*	*329 (118-784)*	*ns*
Duration of HFOV (hrs)	*101 (70-136)*	*190 (74-429)*	*ns*
Total duration of ventilation (hrs)	*370 (187-451)*	*787 (305-928)*	*<0.05*
Survived to ICU discharge	*13 (100%)*	*7 (58%)*	*<0.05*

Device hours are expressed as Median (interquartile range)

1417343

AGREEMENT BETWEEN TRANSCUTANEOUS AND ARTERIAL CARBON DIOXIDE LEVELS IN A COHORT OF CRITICALLY ILL PEDIATRIC PATIENTS DURING HIGH-FREQUENCY OSCILLATORY VENTILATION.

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Introduction: High-frequency oscillatory ventilation (HFOV) is commonly used to treat patients with acute lung injury (ALI) and acute respiratory distress syndrome (ARDS) in the pediatric intensive care unit. Continuous monitoring of ventilation is problematic during HFOV as end-tidal CO_2 monitoring and volumetric capnography cannot be applied. Serial arterial blood gas analysis and transcutaneous CO_2 ($P_{TC}CO_2$) monitoring are therefore applied. This study was conducted to assess the agreement between $P_{TC}CO_2$) monitoring and arterial partial pressure of CO_2 ($PaCO_2$) during HFOV in a cohort of critically ill children. Methods and Materials: A retrospective review of patients aged 1 to 18 years of age who were ventilated using a high-frequency oscillatory ventilator (Carefusion 3100A or 3100B, Yorba Linda, CA) and were continuously monitored using the SenTec Digital Monitoring System (Fenton, MO) from January 2010 to January 2012 was conducted. All arterial blood gas (ABG) data were recorded as well as $P_{TC}CO_2$ levels. MS Excel was used to record data and Prism Graphpad was used to perform analysis. Linear regression and Bland-Altman plotting were used to assess the agreement between $P_{TC}CO_2$ and $PaCO_2$. Results: Nineteen patients were treated with HFOV during the eligibility period. Twelve patients (n=8 female) met inclusion criteria and were included in the analysis. Eight were ventilated with the 3100A and four with the 3100B. The age (mean ± SD), pH, $PaCO_2$, and $P_{TC}CO_2$ were 7.4±6.3 years, 7.335 +0.089, 68.1+16.8, 71+18 respectively. A total of 111 sample sets were included in the analysis. Linear regression analysis revealed a slope of 0.96 and an r2 of 0.80 (p<0.0001; see Figure 1.). The mean bias was 2.9 mmHg between $PaCO_2$ and $P_{TC}CO_2$ and limits of agreement were -13.1 to 19.0 (See Figure 2.). Conclusion: We found a statistically significant relationship between $P_{TC}CO_2$ and $PaCO_2$; however the limits of agreement were wide. The wide limits may be related to variable perfusion which can adversely effect accuracy. The $P_{TC}CO_2$ monitor is an important noninvasive tool for the clinician to use during the management of ventilation during HFOV. However, serial ABGs remain necessary.
Sponsored Research - None

Figure 1.

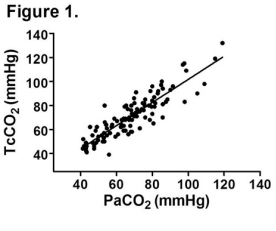
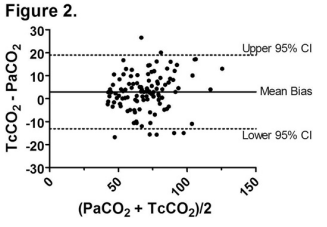


Figure 2.



1417303

SIGNIFICANT VIBRATORY FREQUENCIES ARE PRESENT IN BUBBLE CPAP PRODUCED BY THE BABI.PLUS.

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Background: Nasal Continuous Airway Pressure (NCPAP) has long been used to provide ventilatory support in the NICU. The form of CPAP selected may be critically important in the management of neonatal respiratory distress. Studies have suggested that vibratory impulses present in bubble CPAP may enhance the effectiveness of this mode of ventilation. However, the frequencies may differ between devices and may also differ on the basis of changes in the level of CPAP provided as well as flow and compliance changes in the lung as well. We asked if the Babi.Plus, a novel CPAP device, produced vibratory frequencies that may be in the useful range for neonatal ventilation. Methods: A Babi.Plus nasal CPAP device (A Plus Medical) was interfaced with a test lung of varying compliance. Flow was varied from 2 to 8 LPM, CPAP was varied from 4 to 8 cm H2O, and compliance was varied from 0.2 to 1.0. Pressure and flow measures were obtained from the side port of the test lung using a Fleisch pneumotachograph interfaced with Validyne flow and pressure sensors with sampling at 1000 Hz to Easy Sense for the IBM PC. FFT analysis was performed in Sigview V2.4.0. Frequencies over 50 Hz were excluded. Relational analysis and graphing was performed with Statistica 10 (Statsoft). Results: Primary frequencies were identified in waveform analysis that we within the index range. Conclusions: Waveforms inherent in bubble CPAP may improve CPAP tolerance and effectiveness through propagation of a vibratory waveform. These vary according to device, flow, CPAP level and lung compliance. The Babi.Plus CPAP device may provide useful vibration that can improve the efficiency of CPAP. Further clinical correlation is required to define the useful range.
Sponsored Research - None

1417222

REGIONAL DISTRUBUTION OF VENTILATION DIFFERENCES BETWEEN NAVA AND PSV IN CRITICALLY ILL CHILDREN.

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INTRODUCTION: Apart from enhanced patient-ventilator synchrony, the specific mechanisms by which neurally adjusted ventilatory assist (NAVA) may benefit subjects who are breathing spontaneously is poorly understood. This study was conducted in order to compare the regional distribution of ventilation differences between NAVA and pressure support ventilation (PSV). **METHODS**: A randomized cross-over design was implemented during which patients received 4 hours of PSV and 4 hours of NAVA. CO_2 elimination (VCO_2) and oxygen consumption (VO_2) were recorded. Regional distribution of ventilation was recorded by electrical impedance tomography (EIT) using a 16 electrode belt. The belt was connected to the EIT Evaluation Kit 2 (Drager Medical, Lubeck, Germany). Data was recorded and later analyzed offline using EIT Data Review software (V5.1, Drager Medical, Lubeck, Germany) and SPSS statistical software. The lung region was divided into 4 equally sized regions of interest (ROI) along the ventral-dorsal axis. A repeated measures ANOVA utilizing Bonferroni corrected paired T-Tests was used to compare the proportions of ventilation in each ROI between NAVA and PSV and overall in order to compare homogeneity. **RESULTS**: Three patients with a mean age (± SD) of 11.2 ± 6.8 years were enrolled in the study. All subjects completed the investigation. VCO_2 was similar between NAVA and PSV. Although not reaching significance, VO_2 was lower during NAVA (184.1 ± 86.0 vs. 212.5 ± 105.5 ml/min). Statistically significant increases in ventilation in ROI 1 and 4, with decreases in ROI 2 and 3 were observed during NAVA (see Table.). Overall distribution of ventilation was more homogenous during NAVA (P<0.001). The image is a reconstruction of tidal breath impedance changes during PSV and NAVA for subject 1 along the transverse plane of the caudal lung region and shows a homogenous distribution of ventilation during NAVA. **CONCLUSIONS**: In these critically ill children, we observed an increase in ventilation in the most ventral and dorsal lung regions during NAVA and a more homogenous distribution of ventilation compared to PSV. Although not statistically significant, a modest decrease in oxygen consumption during NAVA was observed and could represent reduced oxygen cost of breathing. Because the number of patients reported in this investigation is small, further research is necessary to validate these findings.
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1418251

NITRIC OXIDE DELIVERY IN NEONATAL NONINVASIVE RESPIRATORY SUPPORT DEVICES.

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INTRODUCTION: Inhaled Nitric Oxide (iNO) is an effective pulmonary vasodilator used in intubated neonates with hypoxic lung disease. Recent evidence supports using noninvasive respiratory devices as an initial form of support and following extubation from mechanical ventilation. However, there are no data describing the effects of iNO delivery using these devices. We conducted a descriptive bench study to evaluate: 1) stability of lung model parameters, 2) Nitrogen Dioxide (NO2) and 3) NO levels in a neonatal lung model with all different types of neonatal noninvasive respiratory support. METHODS: A realistic infant nasal airway model was attached to a spontaneously breathing lung model (ASL 5000, Ingmar Medical) with RR 40, Pes 12, R: 25 cmH2O/L/s, and C: 2 mL/cmH2O. A KMNO_4 and charcoal filter was placed at the lung model to scrub iNO and eliminate rebreathing of NO. Each of the noninvasive respiratory support devices (see Table) were attached to the lung model and baseline pressures and volumes were recorded. The INOmax DS (Ikaria, Seattle) was attached and tracheal NO (chemiluminescent sensor), INOmax DS NO and NO2 levels were measured between the filter and nasal airway model while adjusting the preset iNO level between 5, 20, and 40 ppm. Lung model parameters were also measured simultaneously at each of the iNO settings (n=40 breaths). RESULTS: Neither gas sampling nor the addition of iNO had any effect on the measured volume nor pressure within the lung model under any of the testing conditions. There were no clinically relevant differences between the pre-set iNO level and those measured in the simulated neonatal trachea using all forms of support but the HFNC. In all HFNC testing conditions where iNO was used, the NO levels measured by the INOmax were similar to the preset values but tracheal NO was approximately 50% of the pre-set iNO value. The NO2 levels were ≤ 2 ppm for all testing conditions. DISCUSSION/CONCLUSIONS: Accuracy and potential safety of iNO therapy appears to be sufficient when using FDA approved noninvasive "pressure" devices; however, accuracy is compromised when using high flow nasal cannula. We believe this is related to the leaky nature of this nasal airway interface which can result in air entrainment and dilution of the iNO dose.

Sponsored Research - This study was funded by a grant from Ikaria

1429741

FLOW VARIATIONS DURING FREE-FLOW OXYGEN DELIVERY USING THE T-PIECE RESUSCITATOR.

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Background: Neonatal resuscitation often involves the use of free-flow oxygen delivery as a means of supporting a spontaneously breathing yet cyanotic newborn. The T-piece resuscitator is recognized by the AAP/AHA Neonatal Resuscitation Program (NRP) as an approved device to deliver oxygen in this manner. Current evidence for this application is limited to reports documenting actual oxygen concentrations delivered with the PEEP valve occluded or open. Clinically, respiratory distress can also be treated with prescribed oxygen flows independent of concentration. As a result, the aim of this study is to determine the significance of gas flow variations during free-flow oxygen delivery using a t-piece with PEEP valve occluded as well as open under normal operating conditions. Method: We simulated delivery of free-flow oxygen with a Neopuff t-piece resuscitator (Fisher & Paykel, New Zealand) using three independent disposable circuits by Fisher & Paykel, NeoForce (Ivyland, PA), and Neo Tee (Mercury Medical, Clearwater, FL). Simulated free-flow oxygen delivery was performed as the distal port on the tee of each circuit was connected to a neonatal flow sensor on a Drager Evita XL ventilator (Telford, PA). Flow calculations were observed on the Drager and recorded for three different adjusted PEEP levels (0, 5, 10 cmH2O) and three different set flows (8, 10, 12 Lpm). Paired t-tests were used to compare results of occluded versus open PEEP valve. ANOVA tests were applied to the multiple circuit evaluation. Results: The circuits were evaluated at 18 combinations of set flow, PEEP level, and status of PEEP valve occlusion. There is a statistical difference in flow when the t-piece is occluded versus open, regardless of set flow or PEEP settings ($p<0.05$). The difference in delivered flow between occluded and open PEEP valve decreases as set PEEP increases. Further, the difference in delivered flow between open and occluded PEEP valve increases as the set liter flow increases. Finally, choice of circuit brand has no effect on flow variability whether occluded ($p=0.079$) or open ($p=0.76$). Conclusion: While previous reports have shown no difference in delivered oxygen concentrations when a t-piece PEEP valve is occluded or open, our results suggest that the flow delivered varies significantly when the PEEP valve is occluded versus open. However, these results are not necessarily suggestive of clinical significance.

Sponsored Research - None

1432514

MULTIDISCIPLINARY APPROACH TO DECREASING EXTUBATION TIME FOR CARDIOVASCULAR SURGERY PATIENTS.

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Background – Cardiovascular Surgery (CVS) Extubation Committee was formed in January 2010 to investigate prolonged intubation times for CVS patients. The multidisciplinary committee comprised of RCPs, RNs, CVS surgeons, pulmonologist and anesthesiologist. Method – The committee first reviewed the data collection process and identified areas in need of clarification. Times of intubation, extubation and reason for prolonged intubation were difficult to find in charting. Time of intubation was defined as time out of OR as charted on the Surgical Summary Report. Documentation of extubation time was standardized to one location. Respiratory therapist and CVICU nurses were educated on the new standards and were asked to document spontaneous breathing trials (SBT) attempts or reasons unable to perform SBT once every four hours. The goal was to extubate patients within six hours after surgery. As documentation improved, reasons for prolonged intubations were staff availability, level of sedation and hypoxia. An increase awareness of delays around shift change and improving collaboration between RNs and RCPs was encouraged. Review and re-evaluation of the reversal protocol showed opportunities for improvement. Staff were re-educated on the reversal process and were encouraged to look for alternative for pain management instead of sedation. Anesthesiologists began the reversal process in the OR if appropriate. A lung recruitment protocol was developed and added to the CVS order set. This enabled RCPs to perform a lung recruitment maneuver on hypoxic patients if their P/F ratio is less than 200, are hemodynamically stable and no pneumothorax documented on chest x-ray. Results – In the fourth quarter 2009 the median extubation time was 9.77 hours and had decreased to 6.17 hours by second quarter 2010. The lung recruitment protocol was implemented in June 2010 and additional improvements were seen. Results for third quarter 2010 had decreased to 4.36 hours. Conclusion – Standardization of documentation, improved collaboration and unified goals have improved extubation times of our CVS patients.

Sponsored Research - None

Extubation Times

	4Q09	1Q10	2Q10	3Q10	4Q10	1Q11	2Q11	3Q11	4Q11
n	87	88	101	56	74	71	75	103	97
median (hours)	9.77	6.83	6.17	4.36	4.75	4.85	4.8	4.95	4.3

1417845

EFFECTS OF THE WATER CHAMBER LEVEL ON DELTA PRESSURE AND MEAN AIRWAY PRESSURE ON THE 3100A HIGH FREQUENCY OSCILLATOR.

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Background: The Sensormedics 3100A High Frequency Oscillatory Ventilator (Viasys Healthcare) utilizes a rapid rate and small tidal volume ventilation concept. Oxygenation and ventilation are managed by manipulating the mean airway pressure (MAP) and delta P pressure (ΔP). The 3100A uses a low-compliance circuit with heated pass-over humidification system. The degree of humidity achieved is dependent on time of exposure and surface area of gas/water contact. The purpose of this study was to determine if changes in humidification chamber water levels has an effect on MAP or ΔP. Methods: The3100A HFOV was calibrated with a HFOV circuit (CareFusion 38" Flexible Patient Circuit) and humidifier canister connected to an Ingmar Neonatal Demonstration Lung Model (Ingmar Medical, Pittsburgh, PA) with a compliance set at 2 mL/cm H20. The 3100A was set at the following parameters: bias flow 20 lpm, power 3, Hz 12, and MAP 15 cm H2O. MAP and ΔP were measured using the airway pressure line located at the patient connection. MAP and ΔP were measured under three conditions: humidification chamber empty, half full (150 mL), or full (300 mL) with sterile water. Data was recorded for MAP and ΔP measurements for the three describe humidification water levels. MAP and ΔP pressure differences at different water levels were compared using a paired t-test with a statistical significance set at $p < 0.05$. Results: Means pressures and standard deviations are reported in the table below. P values measured for conditions were 0.001. Conclusions: A change in water level in the humidification chamber during simulated HFOV had no significant impact on desired pressure targets for ΔP or MAP.

Sponsored Research - None

	MAP (cmH2O) Mean (SD)	Delta P (cmH2O) Mean (SD)
Humidifier Empty	14.92 +/- 0.041	30 +/- 0
Humidifier Half Full (150 ml)	15.08 +/- 0.041	29 +/- 0
Humidifier Full (300 ml)	15.11 +/- 0.045	28 +/- 0

1430875

EFFECT OF POSITIVE EXPIRATORY PRESSURE ON PEAK EXPIRATORY FLOW DURING AIRWAY PRESSURE RELEASE VENTILATION.

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BACKGROUND Airway Pressure Release Ventilation (APRV) is a mode of mechanical ventilation classified as pressure controlled intermittent mandatory ventilation with inverse I:E ratio. This mode allows for unrestricted spontaneous breaths and is used to treat Acute Respiratory Disease Syndrome (ARDS). Prolonged time in the high pressure (P-high) phase with short time at low pressure (P-low) allows for greater mean airway pressures, potentially resulting in greater alveolar recruitment and oxygenation. Alternating periods of high and low pressure (ie, creating mandatory breaths) helps eliminate carbon dioxide. It has been postulated that P-low = 0 cm H_20 is optimal because setting P-low > 0 cm H_20 would decrease peak expiratory flow and instigate an expiratory delay (Crit Care Med 2005;33(3): S228 –S240). The purpose of this study was to test these assumptions. Our hypotheses were that peak expiratory flow would be unchanged and that no delay would exist when comparing P-low settings. **METHODS** A lung simulator (ASL 5000, Ingmar Medical, Inc) modeled an adult ARDS patient. Simulator settings: compliance = 0.035 L/cm H_20, resistance = 10 cm H_20/L/sec, chest wall passive. Outcome variables were the change in peak expiratory flow (ΔPEF) and the change in peak flow delay (ΔPFD) calculated as value at P-low = 15 cm H_2O minus value at P-low = 0. Data were obtained from two ventilators: Avea (CareFusion) and Evita XL (Dräger). Ventilator settings: T-high = 0.4 sec, T-low = 0.6 sec, T insp rise = 0%, ΔP of 25 cm H_20. Mean values from 3 breaths were compared with t-tests with P < 0.05 indicating significance. **RESULTS** The peak expiratory flow for P-low = 0 cm H_20 was significantly less than that for P-low = 15 cm H_20 (Table) for both ventilators. There were no differences in peak flow delay. **CONCLUSIONS** Data from this study on 2 ventilators refute the assumption that during Airway Pressure Release Ventilation, P-low = 0 cm H_20 increases PEF.

Sponsored Research - None

VENTILATOR	ΔPEF (L/min)	P VALUE	ΔPFD (sec)	P VALUE
Avea	8.6	0.0002	0.014	0.269
Evita XL	13.6	0.0011	0.001	0.84

differences calculated as value at P-low = 15 cm H_20 minus value at P-low = 0 cm H_20

1415663

COMPARISON OF A SINGLE HUMIDIFICATION SYSTEM VERSUS A DUEL HUMIDIFICATION SYSTEM USING THE VDR-4: AN EXPERIMENTAL STUDY.

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BACKGROUND Airway humidification plays an essential role in the maintenance of ventilatory function. Mucus plugging and bronchial casting has often been contributed to the use of high frequency ventilation. During invasive mechanical ventilation these two relative complications can significantly impair the ventilatory support required for adequate ventilation. The use of high frequency ventilation with the Volumetric Diffusive Respirator (VDR-4) (Percussionaire® Corporation Sandpoint, Idaho) offers a unique mechanism in which to humidify the applied gases being delivered [1]. As a customary approach we have been employing a duel humidifier system method in order to maximize gas hydration. We hypothesized that a circuitry using a two (2) heated pass over humidified systems would enhance the humidity to the tracheal bronchial tree. METHOD After the Institution's Quality Review Board approval, we conducted an experimental study comparing the effects of one versus two pass-over heated humidification systems (Fisher-Paykel Healthcare, Auckland, New Zealand) with the VDR-4. The tests were performed on a mechanical lung (5600i Pneuview® System, Michigan Instruments Inc., MI) at the same predetermined ventilator settings (FiO2 0.21, Bias Flow 30 L/min, low and high rate 16 and 500/min respectively, peak and end expiratory pressures were 30 and 5 cmH2O respectively). We compared the humidification and temperature output of each configuration at the wye connector using the MFW 300 hygrometer (Cooper®, Middlefield, CT). RESULTS Independent data was recorded every hour for temperature and humidity during a period of twelve (12) hours for the respective configuration. Comparative analysis displayed no statistical difference in the temperature or the relative humidity regardless of using the single or duel humidification approach, (CI 95%) (p=0.575, p=0.174) respectively. CONCLUSION In this study design the use of a duel humidification system in the VDR-4 to further enhance gas hydration to the tracheobronchial architecture proves to be of no benefit and does not warrant added disposable cost.

Sponsored Research - None

1416663

DURATION OF THE SPONTANEOUS BREATHING TRIAL IS A PREDICTOR OF REINTUBATION.

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Background: Nearly 40% of the time spent on mechanical ventilation is devoted to the weaning process. When extubation happens on the same day of the first spontaneous breathing trial (SBT) is called a simple weaning. Prolonged weaning has been associated with increased mortality in the intensive care unit (ICU). While SBTs are typically performed between 30 min and 2 h to determine readiness for extubation, we wanted to evaluate if the time spent on the SBT was a predictor of successful extubation in a group of patients admitted to three different medical-surgical ICUs in the US. Methods: In this observational study, we enrolled patients who were considered ready to undergo a SBT by the physician in charge in medical and surgical ICUs of three participating centers in the US. Information recorded for up to three SBTs per patient included demographics, duration of the SBT, if passed or failed SBT, extubation, and reintubation rates. The patients were followed until 48h post extubation or until discharge from the ICU. SBTs were classified according to duration in 3 categories: 1. SBT <30min; 2. SBT 30min-2h; 3. SBT >2h. The IRB of each participating institution approved the study protocol with a waiver of informed consent. Descriptive statistics and correlations were performed using SPSS 17.0. Results: A total of 151 patients with orders to be placed on SBT were selected for analysis. Although the 3 centers reported different overall mean duration of SBTs (29 min, 69 min, 76 min), the majority of patients remained on SBT between 30 min and 2 h despite the number of breathing trials required prior to extubation (SBT1: 38 min; SBT2: 38 min; SBT3: 51 min). Forty nine (32%) patients required SBT2, and 24 (16%) required SBT3. Patients were deemed to be ready for extubation in 157 out of 231 SBTs performed during the study. However, only 80% of those events resulted in an order to extubate. Information on 131 subjects 48 hours post extubation revealed an overall reintubation rate of 9.2%. There was a significant but weak correlation between the overall duration of the SBT (58 min, r=.212, p=0.026), the duration of the last passed SBT (79 min, r=.211, p=0.027) and reintubation rates. Conclusion: Our study suggests that placing patients on SBT for more than 30 min may be a risk factor for reintubation.

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SBT Duration	SBT 1 - n (%)	SBT 2 - n (%)	SBT 3- n (%)
< 30 min	40 (26.5%)	15 (30.6%)	5 (20.8%)
30 min-2h	88 (58.3%)	27 (55.1%)	16 (66.7%)
> 2h	23 (15.2%)	7 (14.3%)	3 (12.5%)

1434731

VARIABILITY OF DYNAMIC PRESSURE AND FLOW IN HOSPITAL MEDICAL OXYGEN GAS OUTLETS.

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Background: It has been our experience that medical gas outlets throughout our hospital do not perform equally. This becomes apparent when using newer devices requiring high gas flow while maintaining specific pressure levels to allow the device to operate according to manufacturer's specification. Hospital medical gas outlets are tested annually by certified technicians as to static pressure, purity and flow rate. These values are specified by NFPA99 regulations. However many medical devices have requirements (dynamic flow and pressure requirements) that are not stipulated in these codes. In our facility we tested random wall oxygen outlets measuring maximum flow and noted old, new or head rail type outlet. Methods: We used a Phillips Respironics V60 set to diagnostic mode that allows adjustment and verification of exact flow rate and subsequent driving pressure. We checked 19 outlets randomly throughout the facility and documented the flow rate at which the "inlet pressure" dropped to 44psig. Results: The average of flow rate of all outlets while maintaining 44psi was 141 LPM, the avg. of new type was 165LPM, avg. of head rail type 156 LPM, avg. of old type 93 LPM. The highest flow was 168, lowest 88 and difference (high to low) was 80LPM. Conclusion: There is a significant difference in flow performance between older and newer type oxygen outlets. Some older outlets would not meet certain manufacturer specific gas specifications (for devices such as mechanical ventilators and bi-pap devices) even though they do meet current national standards that apply. Discussion: Clinician's should be aware of gas outlet performance in their institutions relative to device manufacturer's specifications. There is a need for more specific testing by medical gas certification companies to test for and document dynamic pressure/flow measurements. It would also be helpful if NFPA codes or other regulatory entities were to establish gas outlet performance standards in order to avoid potential conflicts between infrastructure and device performance.

Sponsored Research - None

1420972

NOISE LEVEL COMPARISON OF THREE DIFFERENT DISPOSABLE EXHALATION VALVES USED WITH SINGLE LIMB PASSIVE BI-LEVEL VENTILATOR CIRCUITS.

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Background: Noise pollution is a common problem in hospitals, and is caused both by medical equipment and baseline noises in the environment itself. Adverse effects of noise pollution include impact on physical health, pychological health, and cognition. The World Health Organization, (WHO) recommends noise levels in homes at 35dB with 30dB for bedrooms to decrease sleep disturbances. In hospitals, noise levels should not exceed 40dB during the day. Medical equipment that is inclusive of Respiratory Therapy equipment is a common source for elevation of noise levels. The objective of this bench study was to compare noise levels with 3 different exhalation valves used for both invasive and non-invasive ventilation with our single limb passive ventilator circuits. Methods: The Trilogy ventilator (Phillips Respironics, Carlsbad, CA) was used in all testing conditions and set up with a standard passive single limb circuit. The circuit was connected to a TTL lung model 560li (Michigan Instruments, Grand Rapids, MI). Three different Phillips Respironics (Carlsbad, CA) exhalation ports were tested in the circuit for 5 minutes each during the study: 1) Whisper Swivel II 2) Disposable fixed exhalation port/multi hole 3) Disposable fixed exhalation port/single hole. The ventilator was placed in CPAP mode to maintain a consistent leak and peak noise level during the testing. Both a CPAP level of 15 cmH20 and 20 cmH20 were tested with each exhalation port. A Cirrus CR:812C Sound Level Meter was used to measure noise emitting from the exhalation port. Data was downloaded and analyzed in Deaf Defier 3.3 software. Noise data is reported in decibels (Db). Results: See chart below for mean noise levels of each exhalation valve and the low and high level Trilogy ventilator alam. Discussion: Noise levels for all three exhalation valves exceed WHO recommendations for noise levels in both the hospital and home environment. Noise levels increased with all three exhalation valves as pressure settings increased. The Whisper swivel II exhalation valve was the quietest exhalation port at both tested CPAP levels. The new Phillips Respironics multi hole DEP is10 decibels quieter at both CPAP settings compared to the old style fixed orifice single port exhalation port. Utilizing a quieter exhalation port may impact noise levels and patient/family satisfaction when using single limb passive circuit that requires insertion of an exhalation leak port.

Sponsored Research - None

1408590

A COMPARISON OF LEAK COMPENSATION IN ACUTE CARE VENTILATORS DURING NON-INVASIVE VENTILATION; A LUNG MODEL STUDY.

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Background: Ventilators used for non-invasive ventilation (NIV) must be able to synchronize in the presence of system leaks. We compared the ability of 5 ventilators to compensate for leaks during NIV. Method: Using an ASL5000 lung simulator, the Maquet Servo-i, Drager V500, Covidien PB840, Respironics V60, and Hamilton C3 were compared during increasing (n=6) and decreasing leaks (n=6). Leak levels used were: BL (baseline 3-4L/min), L1 (9-10L/min), L2 (26-27L/min) and L3 (35-36L/min). Lung model inspiratory and expiratory resistance were 10, and 20 cmH2O/L/sec with compliance 60 ml/cmH2O (Obstructive model) and inspiratory and expiratory resistance 5, and 5 cmH2O/L/sec with compliance 20 ml/cmH2O (Restrictive model). Ventilator settings were non-invasive ventilation mode, pressure support, PEEP5, and 10 cmH2O and pressure support level 12 cmH2O. The number of breaths to synchronization was recorded for each leak scenario. Results: With the exception of the V500, all ventilators exhibited synchronization to increasing and decreasing leaks in both the obstructive and restrictive models. V500 could not synchronize to leaks L2 and L3. Number of breaths to synchronization for increasing leaks differed from decreasing leak with median breaths (25th, 75th) of 2 (1, 3) and 0 (0, 1) ($p < 0.0001$) respectively. Significant differences were observed for number of breaths to synchronization between the obstructive 2 (0, 3) and restrictive model 0 (0, 2) ($p < 0.0001$) and with PEEP 5 cmH2O 0 (0, 2) and 10 cmH2O 1 (0, 3) ($p = 0.002$). PB840 required less breaths to synchronize to increasing and decreasing leaks in both obstructive and restrictive lung models and with PEEP 5 cmH2O and 10 cmH2O compared with all other ventilators ($p < 0.0001$). Conclusions: The leak compensation in non-invasive ventilation modes can correct partially or completely for leak interference within 4 breaths, but there are wide variations between ventilators. Grant support; COVIDIEN Inc, Boulder, CO

Sponsored Research - Covidien Inc. Boulder CO

1414436

PROVIDING INITIAL LUNG PROTECTIVE VENTILATION IN ALI/ARDS PATIENTS: A RETROSPECTIVE REVIEW.

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BACKGROUND: Limiting VT and ventilating pressure has become critical in managing patients with ALI/ARDS. Current ARDSnet protocol suggests a VT of 6 ml/kg of predicted body weight (PBW) while limiting plateau pressure (Pplat) to 30 cmH2O. A VT up to 8 ml/kg/PBW is allowed for asynchrony provided Pplat is maintained. A concern is that without careful monitoring, pressure ventilation VT's may be more variable and exceed recommendations. We sought to characterize our ARDS ventilation management and to determine compliance with providing initial lung protective ventilation (LPV) using volume or pressure ventilation. METHODS: A retrospective review of a ventilator management database was performed on all patients meeting AECC definition of ALI/ARDS during 2011. Data included PaO2/FiO2 at ALI/ARDS onset, age and the following on the first full day of ventilation: mode of ventilation, peak pressure (Ppeak), Pplat, VT in mL/kg PBW, PaCO2 and pH. We defined LPV as a Pplat <30 cm H2O with a VT <8 mL/kg PBW. To assess LPV, Pplat was used for the volume modes and Ppeak as a surrogate for Pplat in pressure modes. Each patient was classified into one of four groups based upon their initial VT:pressure (P) relationship (lowVT/low P, low VT/high P, high VT/low P, high VT/high P). The information was analyzed using SPSS software. RESULTS: 160 patients met ALI/ARDS criteria; 94 (59%) were ventilated with a volume mode and 66 (41%) with pressure. The volume group was older (53.3 vs. 46.8 yr), had a higher PaO2/FiO2 (148 vs. 112); a lower Ppeak (27.5 vs. 33.7 cm H2O), PEEP (8.9 vs. 14.9 cm H2O), PaCO2 (38 vs. 49 mmHg); and a similar VT (7.2 vs. 7.1) and pH (7.39 vs. 7.38). To assess LPV use, pressure data was missing from 1 pressure (P) and 42 volume (V) patients, leaving 117 patients (65 P, 52 V). The 52 volume patients were similar to the original 94 in all measures. The % of patients in the 4 VT/P groups are: 1) lowVT/low P: 69 vs. 17%, 2) low VT/high P: 10 vs. 60%, 3) high VT/low P: 19 vs. 11%, and 4) high VT/high P: 2 vs. 12%. LIMITATIONS: It was a retrospective review with only the initial day of ventilation assessed. CONCLUSION: More patients were ventilated with volumes and pressures aligned with a protective strategy when using volume ventilation. There appears to be a tendency to use a higher pressure during pressure ventilation, in spite of VT's > 8 ml/kg/PBW. Further investigation as a quality improvement project is warranted.

Sponsored Research - None

1418446

BENCH STUDY OF THE RELATIONSHIP BETWEEN HFOV AMPLITUDE AND ENDOTRACHEAL TUBE OCCLUSION.

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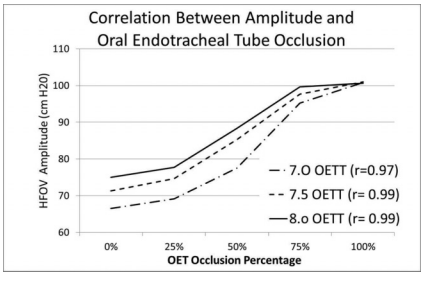
Background: The SensorMedics 3100B (HFOV) is the only FDA approved high frequency oscillatory ventilator for the pediatric and adult population. One of the well-known issues with this device is its limited patient monitoring capabilities and diagnostic feedback. Tube occlusions are a major concern for HFOV patients due to humidification concerns and reduced suctioning attempts. When a patient requires HFOV there is no objective way to assess tube occlusion outside of bronchoscopy. In this bench study we investigated if there was a correlation between changes in HFOV amplitude (AMP) and oral endotracheal tube (OETT) occlusions. Methods: Three different adult sized OETT were used in this study (7.0, 7.5, and 8.0). Each OETT was fit with the SonarMed Airwave™ (SonarMed, Indianapolis, IN) airway monitoring device adapter to observe the percentage of occlusion. The OETT's were attached to Michigan Instruments Dual Adult TTL® test lung with the Cst of 30 mL/cmH20 and Raw of 5 cmH20/L/sec. The HFOV was maintained at the following settings throughout the study: MAP 30, Hz 5, Power 5.0, It 33%, Bias Flow 30, and FiO2 1.0. A clamping device was used to obtain the following OETT occlusion percentages: 0% (baseline), 25%, 75%, and 100% (95-98% occlusion). The position of the occlusion was alternated to 3 different sections of the OETT. Each trial was repeated 3 times for accuracy. The resulting AMP was recorded for each trial. One additional trial was performed using a simulated epoxy airway occlusion instead of the clamping device which provided a 25%-28% occlusion in the OETT. This trial was performed to assure that the change in shape of the OETT was not a major factor in the results. Results: Change in AMP had a strong correlation to the percentage of occlusion in each OETT (average r=0.98). The position and type of occlusion (clamp vs simulated) had no effect on the resulting AMP. The largest change in AMP occurred between the 25% to 75% occlusions. There smaller changes in AMP during the 0% to 25% and 75% to 100% occlusion transitions. See the graph for more information. Conclusion: In this bench study we found that the amplitude increases consistently as the OETT occlusion worsens. This predictability could be a trending tool used to observe airway obstruction when managing patients on HFOV. Further studies will need to be performed to ascertain if the same trend is observed in vivo.

Sponsored Research - None



1433140

EXPLORATION OF VAP IN A LEVEL 1 TRAUMA CENTER.

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Background: Ventilator-associated pneumonia (VAP) is the most common health-care associated infection in the intensive care unit. Methods: With IRB approval, we conducted a retrospective chart review of all mechanically ventilated patients who developed a VAP at our trauma center and compared them to a matched control group who did not develop a VAP from January 1 through September 31, 2012. Comparisons were made using demographic and diagnostic information and therapeutic interventions. Results: 24 patients who developed VAP were compared to 24 who had no incidence of VAP. The VAP group had 21 males and 3 females compared to 19 males and 5 females in the control group. There were no significant differences in age, height, or weight between the 2 groups. Intrahospital transports were significantly higher in those patients with VAP compared to the control group. (mean incidence of VAP 7.63 vs. 4.79, p = 0.002). Bronchoalveolar lavage (BAL) via bronchoscopy was performed significantly more in the VAP patients (mean of 2.96 vs. 1.67, p = 0.011). The bacteria that affected the largest percent of the VAP patients was Methicillin-resistant Staphylococcus aureus (MRSA). An average composite score for ventilator bundle compliance showed no significant difference between the 2 groups. 45.8% in the study group suffered from pulmonary contusion compared to 29.2% in the control group. Trauma related to other organs/systems did not appear to contribute to the incidence of VAP (including liver or splenic laceration, rib fractures, closed head injury, and subarachnoid hemorrhage). Glascow coma scale scores showed no significant difference. There was a significant increase in the average number of days of mechanical ventilation (MV) for the VAP patients (22.87 vs 15.42,p = 0.008), and the averaged LOS in the ICU (27.71 vs 19.67, p=0.0065) but the average LOS in the hospital was not significantly different. Conclusion: We found that the number of intrahospital transports, the number of BALs performed, and pulmonary contusions were clinically significant in developing VAP. In addition, days on MV and LOS in ICU was significantly different in the VAP patients.

Sponsored Research - None

1432364

A COMPARISON OF NON-INVASIVE PROPORTIONAL PRESSURE VENTILATION AND SPONTANEOUS/TIMED MODES ON TOTAL PATIENT INSPIRATORY WORK OF BREATHING IN A LUNG MODEL.

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BACKGROUND: Proportional pressure ventilation (PPV) automatically adjusts support as patient effort varies. Spontaneous/Timed mode (BiPAP) delivers pressure at a set level without adjustment based on patient effort. To better understand the effect non-invasive PPV has on total patient inspiratory work of breathing (TPiWOB) versus the standard BiPAP mode, we compared TPiWOB, tidal volume (VT), peak inspiratory pressure (PIP), and mean airway pressure (MAP) between these modes using a two-compartment mechanical lung model (Michigan Instruments Inc., Grand Rapids, MI) to simulate spontaneous breathing. METHODS: TPiWOB was estimated using a CO2SMO plus monitor (Respironics California, Inc., Carlsbad, CA) as follows: TPiWOB= WOB(B+A) – WOBB, where WOBB was first measured on lung B using tidal volumes of 300, 400, 500, 600 mL with peak flows of 40, 60, 80 L/min via a sine wave. WOB(B+A) was then measured at these settings using lung B to drive lung A with a compliance of 40 mL/cm H2O and a resistance of 2.7 cm H2O/L/sec, decreased compliance of 20 mL/cm H20), and increased resistance of 20 cm H2O/L/sec. Lung A received assistance from either CPAP of 5 cm H2O, BiPAP of 10/5 or 15/5 cm H2O, PPV at 50% or 80% using a Philips Respironics V60 Ventilator (Respironics California, Inc., Carlsbad, CA). Elastance and resistance were manually set on PPV at a level below which "run away" occurred. WOB, VT, PIP, and MAP were collected on the CO2SMO plus monitor as a 10 breath average. TPiWOB was converted from joules to joules per liter (J/L) based on the delivered tidal volume to lung A. An ANOVA with a post hoc test (Newman-Keuls) was used to determine significant differences ($p < 0.05$). RESULTS: See Table 1. CONCLUSIONS: PPV 80% significantly lowered TPiWOB and provided a higher VT and PIP compared to other modes tested under all conditions. The lowest driver volume used was 300 mL and results may differ in some of the individual conditions tested. The method used to set elastance and resistance needs further clinical investigation.

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Table 1. Mean data for all conditions tested.

MODES	Adjusted TPiWOB (J/L)	Inspired VT (mL)	MAP (cm H2O)	PIP cm H2O
CPAP	1.23	331	5.0	7
BiPAP 10/5	0.90a	360	5.8d	11d
BiPAP 15/5	0.69a,b	414d,e	6.3d,e,g	15d,e
PPV 50%	0.67a,b	379	6.1d,e	14d,e,f
PPV 80%	0.35a,b,c	471d,e,f,g	7.1d,e,f,g	21d,e,f,g

a = Significantly less than CPAP
b = Significantly less than BiPAP 10/5
c = Significantly less than BiPAP 15/5 and PPV 50%
d = Significantly greater than CPAP
e = Significantly greater than BiPAP 10/5
f = Significantly greater than BiPAP 15/5
g= Significantly greater than PPV 50%

1434406

EFFECTS OF LEAK COMPENSATION ON CUFF LEAK TESTS: A BENCH STUDY.

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Background: It has become a standard practice to conduct an airway or cuff leak test in patients at risk for post-extubation upper airway obstruction. Typically, the ventilator is set to a predetermined VT and the exhaled volume observed. The endotracheal cuff is then deflated and the expired volume assessed. The use of automatic leak compensation on many modern ventilators is intended to increase the inspired volume to maintain a set delivered volume in the face of a system leak. Study Objective: We hypothesize that active automatic leak compensation will provide a false result suggesting a minimal leak when there is actually a significant leak. Methods: A ventilator (Evita Infinity V500, Drager Medical) was connected to a lung simulator (ASL 5000, Ingmar Medical) set to a single lung model with a compliance of 25 mL/cmH2O, a resistance of 10 cmH2O/L/sec, and a passive cycle. A "T" piece with a 12 inch length of corrugated tubing was attached to the simulator and represented the trachea. An endotracheal tube was inserted into the tubing and attached to the ventilator set to a VT of 500 mL with leak compensation inactive. Baseline measurements were obtained with the cuff fully inflated. Cuff pressures were decreased incrementally to 15, 10, and 5 cmH2O and measurements taken at each level. Measurements from the ventilator included: inspired VT (VTi), expired VT (VTe), peak inspiratory pressure (Ppeak) and % Leak. Each condition was studied in triplicate. Leak compensation was activated and the process repeated. The Perceived Leak (Set VT – VTe) and Actual Leak (VTi – VTe) were calculated and compared to each other. Results: With leak compensation off Actual Leak was not different from the Perceived Leak. The results with leak compensation on are shown in the table. A % Leak displayed from the ventilator of >20% seemed to be associated with a leak >110 mL. Conclusions: When leak compensation is active, exhaled volume readings can be altered and affect the clinical decision to extubate patients. Using either an audible assessment or the ventilator displayed % Leak may be more appropriate in this situation.

Sponsored Research - None

	Set VT (mL)	Cuff Pressure (cmH2O)	Perceived Leak (mL)	Actual Leak (mL)	% Leak
ETT 7.0	500	15	42	108	18
	500	10	50	137	21
	500	5	64	213	30
ETT 8.0	500	15	33	77	13
	500	10	52	147	23
	500	5	88	382	47

1418409

EFFECT OF CIRCUIT VARIATIONS ON TIDAL VOLUME DELIVERY AND GAS EXCHANGE DURING HIGH FREQUENCY OSCILLATORY VENTILATION.

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Objective. Substantial variation exists in clinical practice for the setup of high frequency oscillatory ventilator (HFOV) circuits based on clinician preference, departmental policies, and individual patient requirements. Clinicians may place a variety of adapters in an HFOV circuit to assist with suctioning and/or positioning. Others avoid placing adapters in-line due to the belief that tidal volume (Vt) delivery and/or gas exchange may be negatively impacted. We hypothesize that inserting any adapter in-line adversely affects delivered Vt and gas exchange by combined pressure amplitude attenuation and deadspace effects. Methods. To assess the effect of in-line adapters with a HFOV circuit, three juvenile swine (9.7 ± 0.81 kg) were studied on a 3100A Oscillator. A pneumotachometer using a pulmonary mechanics monitor was placed between the ventilator circuit and endotracheal tube. Data were collected with six circuit setups at frequencies of 4-10 Hz in increments of 2 Hz. Amplitude and mPaw were maintained at 45 and 20 cm H2O, respectively. Circuit variations studied: no adapter, elbow adapter, Y-adapter, and flexible adapter as well as two combinations of adapters (Y- and elbow adapters each placed in line with the flexible adapter). Continuous Vt data were collected over a 4 min period for each combination of frequency and adapter. Arterial blood gases were obtained at the end of each 4 min period to assess effect on gas exchange. Main Results. The highest Vt (mean, sd) was measured with the elbow adapter at 4 Hz (3.96, 0.317), and the lowest Vt was measured with the combination of Omniflex+Y-adapters at 10 Hz (1.22, 0.194). When controlling for adapter deadspace, only the Y adapter remained associated with a statistically significant increase in PaCO2 (6.70, p=0.027), irrelevant of a decrease in Vt. Conclusion. The addition of any adapter to a HFOV circuit can affect delivered Vt. Gas exchange can also be detrimentally affected, from either pressure attenuation or the addition of deadspace. These findings provide the clinician with additional information regarding the potential impact on Vt and gas exchange when considering HFOV circuit setup.

Sponsored Research - None

1429072

NEURALLY ADJUSTED VENTILATORY ASSIST IMPROVES PATIENT-VENTILATOR SYNCHRONY AND REDUCES MEAN AIRWAY AND PEAK INSPIRATORY PRESSURE IN PEDIATRIC CARDIAC PATIENTS.

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Background: Neurally adjusted ventilatory assist (NAVA) is a mode of ventilation that senses the electrical activity of the diaphragm (Edi) through the use of an esophageal catheter with electrodes, and provides proportionally assisted support to a patient's spontaneous breaths. Published studies have shown that its use can improve patient-ventilator synchrony and reduce mean airway pressure (MAP) and peak inspiratory pressure (PIP) during mechanical ventilation. OBJECTIVE: To evaluate the use of NAVA in a pediatric cardiac post-operative population in terms of patient-ventilator synchrony, MAP, PIP and oxygen requirements. METHODS: Fifteen children with congenital and acquired heart disease were assessed post-operatively. Patients were converted from conventional mechanical ventilation (CMV) to NAVA when appropriate strength of signal was being received by the Edi catheter (average of 10 microvolts per breath). The NAVA support level was set initially between 0.5 and 2.0cmH2O/uV to achieve a tidal volume of 5 to 6ml/kg body weight. We evaluated work of breathing, defined as subcostal or suprasternal retractions, oxygen saturation, tidal and minute volume, MAP, PIP and Edi for a period of two hours before and after transitioning to NAVA. RESULTS: In all patients, MAP was reduced by an average of 11% and PIP was reduced by an average of 28% in NAVA as compared to CMV. For one patient recovering after a Bi-Directional Glenn operation the MAP and PIP were reduced by an average of 27% and 47% respectively. Oxygen saturation improved on NAVA from 73% to 75% whilst the need for Nitric Oxide decreased from 40 to 10 ppm after four hours on NAVA. It was noted that in NAVA mode there is significant variability in tidal volumes due to the fact that each breath is delivered proportionately to the patient's demand. CONCLUSION: In pediatric cardiac patients NAVA improved patient-ventilator synchrony, reduced MAP and PIP, and decreased oxygen requirement. This observation reveals a physiological benefit of NAVA in patients in whom cardiopulmonary interactions may be affected by increased MAP/PIP. Such potential benefits seen in this limited experience would call for further and larger prospective studies in this specific population.

Sponsored Research - None

1415810

THE IMPACT OF THE ADULT CRITICAL CARE RESPONSE TEAM ON PATIENT CARE AND ICU STAFFING.

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Background: The Adult Critical Care Response Team (ACCRT) was implemented at the University of Mississippi Medical Center (UMC) in Jackson, Mississippi in October 2009. UMC is the only level one trauma center and teaching facility in Mississippi. The adult critical care tower of UMC houses 70 intensive care beds dedicated to Surgical, Medical, Cardiac, and Neurological services. The initial goal of the ACCRT is to continue the advanced level of care to critically ill patients outside the critical care unit/setting (i.e. MRI, CT, and Interventional Radiology). Method: Over the past fifteen years, UMC has seen a tremendous increase in the number of critically-ill, mechanically ventilated patients being transported to procedures throughout the hospital. These procedures created a stressful dilemma for the ICU staff. The ICU had to shuffle assignments to relieve a nurse and respiratory therapist for a procedural transport. This resulted in a staffing shortage in the ICU. To alleviate the stress involved in these transports, UMC's Respiratory Department created the ACCRT. The Adult Critical Care Response Team was developed in October 2009 at UMC to transport and assume the responsibility of care for critically ill patients in specialty areas (MRI, CT and nuclear medicine). Results: The ACCRT is composed of Registered Respiratory Therapists and Registered Nurses with a minimum of two years critical care experience, BLS, and ACLS certifications. In addition, each team member must complete the Adult Airway Management Program and cross train between the two disciplines. Some of the shared roles of the ACCRT are intubations and difficult airways, intraosseous access, peripheral vascular access and mechanical ventilation. A year after initiation of the team, the demand had grown and additional staff was added for night coverage. The extension of the department and hours of operation led to an expansion of the team's responsibilities. In addition to transporting critically ill patients, the ACCRT is also serving as primary team members of the Code Blue, Adult Rapid Response, Code STEMI and intra- hospital Code Stroke (Gray) teams. Conclusion: As of June 2011, the ACCRT has performed more than 3,000 critical transports. This equates to over 2,400 hours, or an average of 6 hours per day. The number of Rapid Responses that turned into a code blue has been on the decline since the inclusion of the ACCRT.

Sponsored Research - None

1314910

USING SIMNEWB TO DEVELOP A DECISION-MAKING SIMULATION FOR SURFACTANT ADMINISTRATION AND MANAGEMENT OF A 28-WEEK GESTATION INFANT IN RESPIRATORY DISTRESS.

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Background: Respiratory care graduates' decision-making ability is assessed on attempting the clinical simulation exam (CSE) portion of the RRT credential, including one neonatal patient as part of this exam. National first time pass rate for the CSE has hovered around 60%. NBRC results summary describe one of these neonatal patients as a 28-week gestation infant in respiratory distress. Many of our students struggle with decision making on this particular case and 38.7% (n =48) failed this decision-making section. Although one of our primary neonatal clinical affiliates provides excellent learning opportunities with a Level III NICU and over 5000 births per year (approximately 2% are in the 28-32 week gestation range), the instability of neonates and the crowded NICU can preclude direct hands on experience. High fidelity simulators have been used to improve decision-making and hands on training in high acuity neonates. Using these simulators, we have developed simulations that address the management and decision-making for a 28-week gestation infant that requires intubation, surfactant replacement, and mechanical ventilation. Method: We modified Laerdal's SimNewB such that the Ingmar ASL 5000 controls breathing. Using actual patient cases, we created infants that present in distress and require surfactant replacement. Students participate in the care and management of these infants from delivery room to the NICU, including administration of surfactant and adjustment of ventilator parameters. Results: These scenarios insure that all students are provided with the same NICU experience. We implemented the use of these scenarios with our junior class after their neonatal course and before their NICU rotations that occur in the Spring. Students will be tested with these scenarios at three different time points in the Fall semester before they attempt the CSE. Conclusion: We hypothesize that use of these scenarios will improve decision-making ability. Outcome measures used to assess improvement will be performance on the developed scenarios and the students' decision-making scores on the CSE neonatal patient. Our students (n = 48; 6 cohorts) have averaged a score of 10.6 +/- 3.14 on decision making of the 28-wk gestation CSE (minimum passing score =11). We anticipate that introduction of this specific activity will improve their performance and decision-making scores.

Sponsored Research - None

1416539

STRATEGIES FOR SIMULATION-BASED EDUCATION IN A LARGE MULTI-CAMPUS ACADMEIC MEDICAL CENTER RESPIRATORY CARE DEPARTMENT.

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Background: The Cardiopulmonary Service departments at the University of Minnesota Medical Center and the University of Minnesota Amplatz Children's' Hospital employs 92 clinical staff. Respiratory therapists are involved in pediatric/neonatal transports, intensive care units, medical and surgical general care units, and provide care for newborn, pediatric and adult patient populations. To enhance our therapists training and bedside skills, we have been using simulation to provide scenario based education on all ventilators, transports and assessing staff readiness after orientation. It was our goal to continue to integrate simulation in all training and encourage more therapists to be engaged in simulation. Method: Interested RT's were invited to become Simulation Champions. Training on scenario creation, simulation and debriefing was provided. The simulation champions were asked to write scenarios that reflected any clinical knowledge gaps. The scenarios were reviewed by the champion group and then the final 2 were selected. All clinical staff were divided by skill mix and frequency of required simulation attendance and were assigned a sim quarter. Scheduling of the quarters occurred within their existing schedules and overtime was avoided. Department education was distributed to staff regarding the objectives of the simulations, how scheduling of the simulation quarters would be handled and the expectations of the department leadership team. As part of their sim quarter staff were given a simulation appropriate for their skill mix. They were also given time to complete all hospital required learning and participate in a hands on skill lab that included Intra Cranial Pressure (ICP) monitoring set up, IABP competency, ETT securing and MDI administration using new in line adapters. Results: Staff Evaluation Results Conclusions: This model has been a positive experience for staff and leadership. All hospital required learning is complete and staff actively interacted during simulations. Staff engagement is increasing and feedback is positive. Staff were surveyed and we found that half of the staff that have participated have requested more frequent simulations and would prefer them twice a year. We have been able to effectively train staff and ensure competency in a safe and supportive environment that encourages learning and open dialogue among respiratory therapists.

Sponsored Research - None

1401420

DEVELOPMENT OF AN INTER-RATER RELIABILITY TRAINING TOOL.

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Background: The burdens of accreditation for a respiratory care program are not trivial. One hurdle that programs are struggling with is CoARC accreditation standard 3.11. CoARC revised the Interpretative guidelines to state: "this process must include a comparison of student evaluations completed by clinical instructors in order to identify variability among evaluators. Statistical analysis can be used but is not required. When variability is identified, the program must have a plan of action which includes remediation, timeline, and follow-up...". This interpretation reduced the burden but many programs are at a loss for how best to handle the challenge. We have videotaped all our students performing competencies in a pre-clinical setting for several years. Videos provide feedback to students on areas of strength and weakness, and are also used to train our clinical instructors. We describe use of these videos to measure, collect, and assess rater agreement. Agreement amongst raters is assessed with the intra-class correlation coefficient (ICC) and we demonstrate how that analysis can be accomplished with SPSS or Microsoft Excel. Method: We have developed a videotape library of students in the pre-clinical setting performing clinical competencies. Raters are shown videos and evaluate performance with a modified nine question evaluation form that utilizes a five-point Likert scale. Assessment data are collected with either Blackboard (individual training) or with an audience response system (group training). Once collected the data are organized for import into SPSS or Excel. SPSS has a straightforward process that will return a value for both ICC single measures and ICC average measures. Using Excel the data are analyzed with a two-way ANOVA and the results from this are plugged into a relatively simple formula for determining the ICC single and average measures. Results: We implemented the use of the video library for training clinical preceptors. Data from training sessions was used to assess consistency of raters (ICC) as determined by two different means: SPSS and Microsoft Excel. When we identified variance, discussion with the raters helped to determine whether raters need further training or the grading rubric needed to be modified or both. Conclusion: This process allowed for the development and implementation of action plans for program improvement. We believe that this process and analysis will satisfy CoARC Standard 3.11.

Sponsored Research - None

1418159

PARTNERS IN PULMONARY HEALTH: A STUDENT-LED COMMUNITY SERVICE LEARNING PROJECT.

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Background: Community service learning (CSL) in respiratory care affords a mutually beneficial means of meeting objectives such as addressing access to care for underserved populations while refining student-patient education skills. It is well documented that patients with COPD are under-diagnosed and lack understanding of key elements of self-management such as correct aerosol device technique and compliance with oxygen therapy. This results in significant numbers of patients with a high risk of morbidity and mortality due to potentially preventable exacerbation. Methods: A student led program called Partners in Pulmonary Health (PIPH) focused on teaching disease management skills composed of disease education, breathing techniques, medication delivery, and oxygen titration, to senior citizens with COPD at a local community center. They assessed the seniors' level of education on their pulmonary disease using a pre and post Pulmonary Health Questionnaire (PHQ) and were asked to complete a brief survey to determine their subjective quality of life via the SF-36 ™ Questionnaire. Patients (n=6) were evaluated individually and addressed according to their needs. Results: 5 out of the 6 participants demonstrated an increase in their initial and exit PHQ. Overall the pre-intervention mean PHQ was 43% and post-intervention mean PHQ was 59%. As a whole, PIPH observed an average of 37% increase on the exit PHQ. Pre-intervention mean SF-36 score was 52% indicating a subjective reduced quality of life. Conclusion: Participants demonstrated an increased knowledge of their disease process along with successful teach-back technique for their prescribed medication's device technique. Participants received useful equipment such as aerosol chambers and fingertip pulse-oximeters. While this CSL project successfully achieved the mutual goals of helping to optimize self-management of older adults in the community while allowing for student patient education skill refinement, additional needs were identified through interaction with patient stakeholders such as the need for bilingual educational handouts. In addition, obstacles to participation such as concurrent events in the community center were identified. As a result, future CSL projects need to incorporate target populations in the early project design phase to ensure optimal implementation.

Sponsored Research - None

1409106

EVALUATION OF A MECHANICAL VENTILATOR EDUCATION PROGRAM FOR INTERN PHYSICIANS IN AN INTENSIVE CARE NURSERY.

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Background: Thomas Jefferson University Hospital is a large urban Academic Medical Center with a level III Intensive Care Nursery (ICN). A new group of pediatric interns rotate through the ICN every year and receive limited education on mechanical ventilation. We developed a live, one hour training session performed by a Respiratory Therapist and a Respiratory Challenge Test to be completed by the physicians before and after each session. Clinical training was defined as routine training acquired during daily rotation in the ICN. We hypothesized that classroom and clinical training would be more effective than clinical training alone. Method: After a one week clinical rotation, fourteen Pediatric Interns received a ten question, multiple-choice, written Respiratory Challenge Test followed by a one hour training session on mechanical ventilation. After the training session, the physicians received the same Respiratory Challenge Test and results were compared. Results: The average test score after clinical training alone was 57.1%. The average score following clinical coupled with classroom training was 72.9%. There was a 27.6% increase in test results following the one-hour training session (p= 0.0007). Conclusion: The development of a live, one hour classroom training session performed by a Respiratory Therapist has been proven to significantly improve test scores when compared to clinical training alone. We believe that this program will improve patient quality and safety in our Intensive Care Nursery.

Sponsored Research - None

1434667

IMPROVING COMMUNICATION BETWEEN CAREGIVERS AND SPANISH SPEAKING PATIENTS.

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Background: Located on the U.S./Mexican border, UCSD Health System serves a broad population of patients who speak only Spanish. In an effort to improve communication between these patients and their caregivers, we identified the need for a translation tool that included terminology that respiratory therapists commonly use in the clinical setting. The goal was to create a written and on-line reference to improve patient safety and quality of care by ensuring a higher level of clarity and mutual understanding. Methods: In 2010, a team was created to identify the best approach to help our staff improve communication with their Spanish speaking patients and their families. We drew from the experience of our bilingual respiratory therapists, an equipment technician, the nursing staff, community members, and a critical care pulmonologist. An English list of the most important terms and ideas were identified, along with a dedicated section for patient assessment. Our document was then formatted to list the English phrase or term, then the Spanish translation, followed by a phonetic example. To avoid possibly confusing explanations, we designed patient inquiries to be answered in "yes or no" responses. We elected to use a simple and polite Spanish that most could understand, regardless of country of origin or level of education. Results: The document was published and made available to staff. Employees have been responsive to using this bedside tool. With the addition of online availability, it is common to see the document on bedside monitors in the rooms of Spanish speaking patients. With our initial trials over, future plans are to conduct training sessions and broadly expand our distribution to include all interested hospital staff. Conclusions: By taking a proactive approach to our rapidly growing Spanish speaking population, we prepare our staff for current and future challenges. Strengthening our ability to communicate will allow us to improve patient outcomes, customer service, and the overall experience of our patients and their families.

Sponsored Research - None

1411945

DEVELOPMENT OF AN ONLINE EQUIPMENT SETUP MANUAL: STANDARDIZING EQUIPMENT SETUPS TO COMPLEMENT PATIENT SAFETY AND STAFF EDUCATION.

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Background: Education and standardization of respiratory equipment setups is an important factor when considering patient safety. New equipment and therapies are continually advancing and transforming the way respiratory care is delivered. Respiratory Therapists (RT's) have a professional responsibility to themselves and their patients to stay competent on the latest therapies and equipment. To ensure ongoing safety and to complement the education we provide, an online tool was devised to standardize the respiratory equipment setups done throughout our 507-bed institution. An equipment setup manual was formulated to help facilitate ordering the supplies for the setups and the actual setup process. The equipment manual encompasses: color photos of all equipment setups, corresponding charge-capture numbers, detailed setup instructions, and the divisional guideline/policy associated with each piece of equipment. The manual was designed in a PDF format so the RT's can quickly view and print the desired equipment setup. This manual was placed on our hospital's intranet system, via the Respiratory Care Division's intranet site, for easy accessibility. Method: An anonymous survey was developed and distributed to our institution's 200 RT's to evaluate the effectiveness and usage of the online equipment manual. Questions were based on manual usage within the past twelve month period. Results: There was a 45% (n=90) compliance from the RT's in completing the survey. Survey results revealed the following: 34.4% (n=31) indicated that they access the equipment manual at least one day per month, 18.9% (n=17) accessed the manual at least six times within the past twelve months, and 22.2% (n=20) accessed the manual at least once in the past twelve months. Additionally, 77.7% (n=70) of the respondents thought the information provided within the equipment manual was relevant to their daily practice. Furthermore, 84.5% (n=76) thought that maintaining/updating the equipment manual was a worth-while investment for the division. Conclusion: Based on the survey results, not only is the respiratory equipment manual utilized often, but it appears to be a useful adjunct to annual education that is valued as a resource by the RT's within our institution. In addition to being a worth-while investment for the division, the equipment manual ensures that all of respiratory equipment setups are done in a safe and consistent manner.

Sponsored Research - None

1415535

AN EVALUATION OF CULTURAL AWARENESS IN THE OSU SCHOOL OF HEALTH & REHABILITATION SCIENCES.

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BACKGROUND: Cultural awareness among healthcare professionals is becoming increasingly important as the U.S. population becomes more diverse. It is the responsibility of the educational system to prepare future health care professionals to interact with patients from different cultures. OBJECTIVES: The purpose of the study was to determine the extent to which programs in OSU HRS are educating their students about cultural awareness; measure students' cultural awareness levels using a validated instrument; and compare cultural awareness levels between students who receive < 15 hours of instruction during their professional programs (including the Respiratory Therapy program) to students who have completed a course on that topic. METHODS: HRS Division Directors completed a questionnaire designed to determine the extent to which they currently address cultural awareness in their programs. Senior students enrolled in HRS undergraduate programs were also surveyed using a 36-item valid, reliable questionnaire designed to measure their level of cultural awareness. Student's paired t-tests were used to compare cultural awareness levels between students who received < 15 hours of instruction to students who completed a course on the topic. $p < 0.05$ was considered to be statistically significant. RESULTS: Responses from 65 students who completed a course on cultural awareness were compared with those of 97 students who received < 15 hours of instruction on the same topic. Statistically significant differences were found in 28% (10/36) of the survey questions. All seven division directors completed faculty surveys; students from six/seven HRS divisions completed surveys. CONCLUSIONS: Survey items that elicited information about students' personal beliefs surrounding cultural differences were not statistically different between the two groups. Questions that asked specifically about the degree to which HRS instructors prepared students to interact with people from other cultures revealed a statistically significant difference between groups. According to the study results, students who complete coursework on cultural awareness report that they feel better prepared to care for patients from different cultures.

Sponsored Research - None

1415603

INTER-RATER RELIABILITY OF A RESPIRATORY THERAPY PRECEPTOR TRAINING PROGRAM.

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Background: While most respiratory therapy (RT) programs rely heavily on the preceptor model to provide clinical education, there is currently no standardized training program for clinical preceptors. New accreditation standards issued by the Commission on Accreditation for Respiratory Care (CoARC) in June 2010 mandated that respiratory therapy programs provide evidence of inter-rater reliability among preceptors who perform student evaluations. The purpose of this study was to develop a standardized clinical preceptor training program that can be used by RT programs in preparing instructors to deliver effective clinical education and meet CoARC requirements. METHODS: The authors developed a training program entitled, Clinical PEP (Practices of Effective Preceptors), which included brief PowerPoint presentations and videos illustrating both effective and ineffective implementation of clinical teaching. Modules were evaluated by 33 respiratory therapists and preceptors at Wexner Medical Center at The Ohio State University Medical (OSUWMC) in order to determine inter-rater reliability based on percentage agreement. Four RT researchers individually evaluated eight videos and identified 21 ineffective behaviors. RESULTS: Thirty-three participants evaluated eight videos and identified 21 ineffective behaviors. Four RT researchers then categorized preceptor responses. Inter-rater reliability was as follows: excellent for four behaviors, good for six behaviors, moderate for 10 behaviors, and slight for one behavior. CONCLUSIONS: The study revealed that the Clinical PEP Preceptor Training Program has a moderate to substantial degree of inter-rater reliability when used by therapists who may or may not be preceptors. Further, this program could be used nationally to fulfill an important RT education program accreditation requirement.

Sponsored Research - None

1415596

THE EFFECTS OF SKIN CARE EDUCATION FOR THE RESPIRATORY THERAPY STAFF ON RESPIRATORY THERAPY RELATED PRESSURE ULCER INCIDENCE.

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BACKGROUND Hospitals currently do not receive reimbursement for care directly related to the treatment of institution acquired pressure ulcers. Therefore, more resources are being invested to reduce wound incidence. Respiratory care equipment such as nasal cannulas, noninvasive ventilation masks, and artificial airways often contribute to the incidence of pressure ulcers. However, respiratory therapists receive little or no education regarding skin care assessments. The purpose of this study was to determine if providing education to the respiratory therapy staff might be associated with a decrease in the incidence of respiratory related pressure ulcers. **METHODS** Staff education was comprised of a slide presentation (30 slides). The presentation was posted online for therapists to view and confirm their participation. The objectives of the presentation were to recognize and explain: the incidence of pressure ulcers from respiratory devices, the stages of pressure ulcers, the risk factors associated with skin breakdown, and strategies for preventing and managing pressure ulcers caused by respiratory devices. In addition we gave in-services to answer staff questions. After training, therapists were explicitly asked to look for and document evidence of pressure ulcers. Daily surveillance of wound occurrence was performed by nursing staff. Average monthly wound incidence was recorded as the total monthly wounds divided by the average daily census, expressed as a percent. The average wound incidence for the 6 months prior to and after training was compared with a t-test, with $P < 0.05$ indicating significance. **RESULTS** After education, therapists' documentation of pressure ulcers did not increase. The 2011 monthly incidence of respiratory care related wounds is shown in the graph. There was no difference in average monthly incidence of respiratory care related pressure ulcers before and after staff education (mean 1.8% vs 1.5%, $P = 0.520$). However, the power was low (0.05) due to the small sample size. The graph shows what seems to be a large drop in wound incidence just after initial education (July) and after subsequent sessions (September and December). **CONCLUSIONS** Providing education to respiratory care staff regarding therapy related pressure ulcers was not associated with a decreased incidence of wounds over a 6 month period. However, it appears that monthly educational efforts might be effective.

Sponsored Research - None

1418308

USE OF STANDARDIZED PATIENTS IN RESPIRATORY CARE: PRECLINICAL EXPERIENCE IN A BACCALAUREATE PROGRAM.

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Background: Standardized patients (SPs) are routinely used across the US to prepare 3rd and 4th year medical students (MDS) for their US Medical License Examination (USMLE) Step 2-Clinical Simulation and evaluate their clinical assessment skills. These SPs are given scripted scenarios that are "played" during the patient encounter in a mock examination room. To the best of our knowledge, this is the first study evaluating the use of SP interaction on RT students (RTS) prior to their first clinical rotation. Methods: RT faculty (RTF) revised a previously validated 13-item Likert type scoring instrument used to gauge interviewing skills for the USMLE. After consensus 8 items deemed most relevant to the role of a RT (proper introduction, appearance, organization, types of questions, listening, nonverbal facilitation, comfort during physical, and closure of the interview) were analyzed. A "cough and shortness of breath" scenario was selected and RTS utilized material learned from the Patient Assessment course to obtain a history and physical examination of the chest. The RTS were evaluated by RTF and SPs and were also asked to score themselves on their performance. Pearson correlations, chi square and descriptive analysis were performed using SPSS 11.0. Results: Overall RTS mean scores (1 to 3 scale) were 2.59 by RTF (n=4), 2.78 by SPs (n=4), and 2.35 by RTS (n=24). Perceived competence was significantly different between RTS and SPs (p=0.001) and between SPs and RTF (p=0.005) but not between RTF and RTS (p=.078). Chi square analysis indicated no significant difference in rating between RTF ($\chi 2$=6.00, df 4, p=.199). No significant correlation was found between any individual item and the mean overall score. Conclusions: While no individual item had a significant relationship to overall RTS score, the chi square results demonstrate inter-rater reliability for RTF on an assessment used almost exclusively for MDS. While RTS had a significantly lower perception of their competency when compared with scores given by SPs, their scores were not significantly different from those by RTF. Ex post facto qualitative statements provided by the SPs revealed the perception that RTS performed at or above the level of the typical MDS. While further research is needed to determine the validity of this comparison, this study attests to the potential viability of using the simulated patient encounters as a valid means of evaluating clinical assessment skills in RT students.

Sponsored Research - None

1429828

PROBLEM-BASED LEARNING AS A TEACHING METHOD VERSUS LECTURE-BASED TEACHING IN RESPIRATORY THERAPY EDUCATION.

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BACKGROUND: Although Problem-based learning (PBL) approach is a common teaching technique in medical education, its use in the field of respiratory therapy is somewhat controversial. With so many programs adopting PBL strategies, it is important to examine whether there are differences between PBL and traditional teaching approaches in regards to learning outcomes. Therefore, the purpose of this study was to investigate if there are any significant differences between PBL and lecture-based program students in their cognitive abilities in mechanical ventilation. METHODS: Two universities with BS programs in respiratory therapy were chosen—one uses PBL (15 participants) and on uses lecture-based method (24 participants). All 39 participants were given10 multiple-choice questions related to mechanical ventilation derived from the NBRC RRT written exam forms (C & D) as a pre and a post test. RESULTS: The dependent t-test showed a significant difference between the pre and post test of the lecture-based and the PBL groups, resulting in a p value of 0.006 and 0.025 respectively. The independent t-test showed a significant difference in the pre-test favoring the lecture-based group (p = 0.039). However, the independent t-test showed no significant difference in the post-test (p=0.085) CONCLUSIONS: PBL is increasing in popularity despite the fact that studies of its efficacy have been thus far inconclusive. This study has shown PBL to be effective, but not significantly more effective than traditional lecture-based methods in regards to objective test scores.

Sponsored Research - None

1431286

COMPARISON OF A SIMULATION SCENARIO-BASED VENTILATION INSTRUCTION WITH TRADITIONAL LECTURE.

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Background: Research suggests that simulation technology has potential to enhance student achievement particularly for students having a preference for hands-on learning. The aim of this study was to compare ventilation learning outcomes in students attending traditional lecture versus students using an active learning ventilation simulation.Methods: A comprehensive computer simulation (the Virtual Ventilator ICU©) was developed to advance students' learning of the complexities of respiratory physiology as applied to mechanical ventilation. Using a cross-over experimental design, 41 students were divided into two strata based upon class performance rankings (UPPER and LOWER) and were then randomly assigned to work through scenarios on a ventilation simulation or view a lecture. Two distinct ventilation topics, one procedural (CONTROLS) and one conceptual (CLINICAL), were developed for each instructional method. Students completed an exam on the content in the lectures or simulation scenarios 3 weeks following each intervention as well as a survey concerning each of the content delivery methods at the end of the experiment. A third exam was administered 6 weeks after the last intervention. The effect of instructional strategy (lecture or simulation) and class rank (UPPER or LOWER) on student exam performance was evaluated using a 2 x 2 ANOVA using a p value < .05. Results: Students in the UPPER ranking category outperformed students in the LOWER ranking category on the CLINICAL exam. A trend (p=.06) toward improved performance of students who had learned the CLINICAL topic by use of the simulation was identified. The survey indicated that students wished to have the simulation available during their clinical ICU rotations, were more engaged as learners when using the simulation, and agreed that the simulation allowed them to see the direct results of their case management decisions. Conclusions: The simulation was at least equivalent as an instructional intervention for all students compared with the traditional lecture on the procedural CONTROLS topic while students showed a tendency to achieve higher scores when using the simulation to learn the conceptual CLINICAL ventilation topic. The simulation was perceived as an engaging and desirable instructional tool that provided immediate feedback.

Sponsored Research - None

1409340

NATIONAL BOARD FOR RESPIRATORY CARE WRT EXAMINATION SCORES AND THE RELATIONSHIP TO ACADEMIC DEGREE.

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BACKGROUND: Eligible candidates for NBRC examinations in 2011 achieved an associate or higher degree from an accredited respiratory care education program. In 2011, 92% of eligible candidates applying to challenge the WRT examination had earned the associate degree. The relationship between academic degree earned upon completion of respiratory care educational program and WRT examination score is unknown. The present study was designed to identify any relationship that may exist between NBRC WRT examination score and the academic degree earned upon completion of the candidate's respiratory care educational program. METHODS: Ordinary least squares analysis was employed to regress NBRC WRT examination z-scores on academic degree earned from candidate's respiratory care education program, controlling for the effects of age, gender, application status (new or repeat), and application type (WRT only or WRT and CSE). The use of WRT z-scores permits comparison across WRT test forms and satisfies the underlying assumptions of normal distribution of data and linearity of transformations associated with inferential analysis. WRT z-scores ranged from -2.753 to 3.044 in 2011. The analysis employed census data from the population of 11,677 individuals who challenged the NBRC WRT examination in 2011. RESULTS: Twenty one percent of the variance in WRT z-scores was explained by variation in the additive effects of academic degree and the control variables. After controlling for the effects of age, gender, application status, and application type, the regression coefficient indicates that status of having earned a baccalaureate degree from an accredited respiratory care education program was associated with a 0.18 z-score unit increase in WRT examination score, on average. Interactions between academic degree and the other control variables in the prediction of WRT z-scores were not statistically significant. CONCLUSION: The status of having earned a baccalaureate degree upon completion of an accredited respiratory care education program is associated with a gain in WRT z-scores, though the coefficient for the effect is small. Data employed for this analysis represents the entire population of individuals who applied to challenge the NBRC WRT examination in 2011, and might be expected to support inferences regarding future WRT examination attempts.

Sponsored Research - None

National Board for Respiratory Care WRT Examination Scores and the Influence of Academic Degree

Independent Variables	Unstandardized Coefficient (b)	Robust Standard Eror
Degree	.181***	.029
Log of Age at Exam	-.401***	.032
Gender	.195***	018
Application Status	.533***	.020
Application Type	.377***	.021
Constant	3.241***	.296
R^2	.213	
RMSE	.873	

*** p<.001

1408788

ADVANCED CARDIAC LIFE SUPPORT: SURVEY OF INTEGRATION IN ASSOCIATE DEGREE AND BACCALAUREATE-DEGREE GRANTING RESPIRATORY CARE EDUCATION CURRICULA.

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BACKGROUND: Associate and baccalaureate degree-granting Respiratory Care education programs prepare students to challenge NBRC CRT and RRT examinations, and to effectively treat cardiopulmonary emergencies in professional practice. Detailed content outlines for the CRT and RRT examinations indicate that the examinations could include items evaluating ACLS objectives at the recall, application, and analysis levels. The stated goal of the ACLS course is to prepare health care providers to manage cardiovascular emergencies. The extent of ACLS integration in RC education program curricula is unknown. METHOD: Electronic surveys were created to explore the current state of integration of ACLS guidelines in the curricula of CoARC accredited RC educational programs. Survey items were constructed to gather information about integration of ACLS guidelines and provider requirements into the program's curriculum. When responses indicated that the guidelines or requirements were not integrated into the curriculum, respondents were invited to identify reason(s) for this curricular decision. When responses indicated that the guidelines or requirements were integrated into the curriculum, respondents were invited to identify details about the curricular integration. Identical surveys were distributed to program directors of 385 associate degree-granting and 53 baccalaureate degree granting RC educational programs. RESULTS: Responses were received from 206 associate degree-granting programs (54% response rate) and 30 baccalaureate degree-granting programs (57% response rate). Of the responding program directors, a majority report curricular integration of ACLS guidelines and ACLS provider requirements. Reasons for electing not to include ACLS guidelines and provider requirements differed between program types. Curricular integration for associate degree-granting programs was most commonly described as a required component in another for-credit, unidisciplinary, face-to-face course, 1 week or less in duration, facilitated by RT program faculty. For baccalaureate degree-granting programs, the course was most commonly described as a required stand-alone, for-credit, unidisciplinary, face-to-face, 12-16 week course facilitated by RT program faculty. CONCLUSIONS: For programs represented by survey responses, a majority of associate and baccalaureate degree-granting RC educational programs integrate ACLS guidelines and provider requirements into their curricula.

Sponsored Research - None

Percentage of RC Education Programs Integrating ACLS

RC Program Type	Curriculum includes ACLS guidelines	Curriculum includes ACLS provider requirements
Associate degree-granting	94.7%	79.9%
Baccalaureate degree-granting	96.7%	89.7%

1408705