2014 Open Forum

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RESPIRATORY CARE

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The Open Forum at the AARC Congress 2014 is an unique opportunity for attendees to experience the results of scientific studies performed by their colleagues. Respiratory Care is proud to present this year's Open FOrum. Once again, respiratory care professionals have stepped forward and analyzed the things they do with critical eyes. For the first time ever, this year posters will be presented in one of 3 formats:

Editors' Choice – The top 6 abstracts in 2014. On the first two days of the Congress the Editors' Choice posters will be displayed by the entrance to the Exhibit Hall. On the third day, each presenter will discuss their findings in a 10-minute slide presentation, which will be followed by a 10-minute question and answer period.

Poster Discussions – Sixteen sessions, grouped by topics, will be presented over the four days of the Congress. During the first part of the session attendees will be able to review the posters and discuss them with the authors. In the second part presenters will expand on the work shown on the poster with a brief oral presentation (no slides).

Posters Only – Posters will be displayed inside the Exhibit Hall during the three days of exhibits. Different categories each day. Authors will be present for questions and answers from 12:00 pm to 1:30 pm.

Open Forum Sessions

Tuesday, December 9

Posters Only #1 11:30 am – 3:30 am	Neonatal/Pediatric Ventilation/Ventilators
Poster Discussions #1 3:15 pm – 5:10 pm	Aerosols/Drugs – Part 1
Poster Discussions #2 3:15 pm – 5:10 pm	Monitoring/Equipment – Part 1

Wednesday, December 10

Poster Discussions #3 10:00 am – 11:55 am	Ventilation/Ventilators – Part 1
Poster Discussions #4 10:00 am – 11:55 am	Diagnostics
Posters Only #2 10:30 am – 2:30 pm	Aerosols/Drugs Asthma/Pulmonary Disease Case Reports Home Care Sleep/Pulmonary Rehab O_2 Therapy
Poster Discussions #5 12:30 pm – 2:25 pm	Neonatal/Pediatric – Part 1
Poster Discussions #6 12:30 pm – 2:25 pm	Education – Part 1
Poster Discussions #7 3:10 pm – 5:05 pm	Asthma/Pulmonary Diseases
Poster Discussions #8 3:10 pm – 5:05 pm	Home Care/O_2 Therapy

Thursday, December 11

Poster Discussions #9 9:30 am – 11:25 am	Aerosols/Drugs – Part 2
Poster Discussions #10 9:30 am – 11:25 am	Management
Editors' Choice 9:30 am – 11:55 am	Top 6 abstracts in 2014
Posters Only #3 10:30 am – 2:30 pm	Airways Care Diagnostics Education Management Monitoring/Equipment
Poster Discussions #11 12:30 pm – 2:25 pm	Airways Care
Poster Discussions #12 12:30 pm – 2:25 pm	Ventilation/Ventilators – Part 2
Poster Discussions #13 3:15 pm – 5:10 pm	Case Reports
Poster Discussions #14 3:15 pm – 5:10 pm	Education – Part 2

Friday, December 12

Poster Discussions #15 9:00 am – 10:55 am	Neonatal/Pediatric – Part 2
Poster Discussions #16 9:00 am – 10:55 am	Monitoring/Equipment – Part 2

See pages OF83-OF89 for Open Forum Author Index

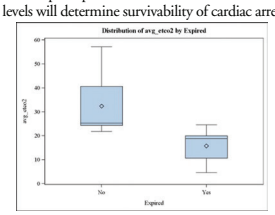
2003074

END TIDAL CAPNOGRAPHY UTILIZATION IN DETERMINING CARDIAC ARREST OUTCOMES IN THEEMERGENCY DEPARTMENT

Nancy Graff[1], Julie Elsner[1], Kimberly Plant[1], Alyssa Woodwyk[2]

1. Respiratory Care, Spectrum Health, Grand Rapids, MI. 2. Research, Spectrum Health, Grand Rapids, MI.

Background: While there is significant literature related to pre-hospital use of PetCO2 in cardiacarrests, much less is correlated to use in the hospital setting leaving a knowledge gap between pre-hospital andhospital information. Pre-hospital data shows a rise in PetCO2 when effective compressions are being done, or whenthere is a return of spontaneous circulation (ROSC). Likewise PetCO2 levels decrease significantly when the patient'sspontaneous circulation is lost or there are ineffective compressions are performed. Hypothesis: End tidalcapnography measurements will determine survivability of cardiac arrests in the Emergency Department (ED).Method: Subjects included in this retrospective, IRB approved study were; 18 years of age or older, presenting to theED in cardiac arrest or patients who decompensated into cardiac arrest while in the ED. Patients who received CPRfor less than 5 minutes, patients who were pronounced dead upon arrival to the ED and traumatic arrests wereexcluded from the study. Documentation of the PetCO2 levels on the resuscitation record was done with each pulsecheck for up to 20 measurements. A source document was used to collect the results of the PetCO2 levels. SampleSize Determination: A power of 0.95 and alpha equal to 0.05 were used in the sample size calculation. The samplesize was determined using group means of 15 (ROSC) and 7 (no-ROSC) and a pooled standard deviation of 4.528mm Hg. A power calculation using these values produces a sample size of 20 subjects. Statistical Methods: Theaverage PetCO2 levels were investigated for normality assumptions required for the t-test. With an overall skewnessvalue of 1.60 and kurtosis of 4.21 the data is left skewed so does not meet the normality assumption. We used theWilcoxon Rank Sum test to investigate whether or not the median PetCO2 value is lower for patients that haveexpired. Results: The Wilcoxon Z test-statistic was significant with a one-sided p-value of 0.0007 so there is significantevidence that the median value of PetCO2 level is lower for those patients that have expired. Specifically, the medianPetCO2 value for expired patients was 18.83 and for patients that survived it was 25.29. Conclusions: The medianPetCO2 level for expired patients is well below the median for the patients that survived, thus we conclude thePetCO2 levels will determine survivability of cardiac arrests in the ED.



The boxplots represent the distribution of the EtCO2 levels. The bar in the middle of either box represents the medianvalue. The box on the right represents those that have expired and the box on the left represents those that survived. As seen, the median EtCO2 level for expired patients is well below the median for the patients that survived.

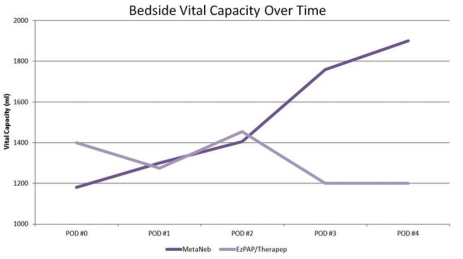
2017931

A COMPARISON OF POSITIVE PRESSURE MODALITIES IN A RESPIRATORY THERAPIST DRIVENPROTOCOL FOR PATIENTS POST ANATOMIC LUNG RESECTION

Jenny Hsieh[1], Michelle Prickett[2], Nicole Willis[1], Malcolm DeCamp[3], Alberto de Hoyos[3]

1. Respiratory Care, Northwestern Memorial Hospital, Chicago, IL 2. Pulmonary Medicine, Northwestern Memorial Hospital, Chicago, IL 3. Thoracic Surgery, Northwestern Memorial Hospital, Chicago, IL

Background: The incentive spirometer (IS) has been a standard of care for post-operative patients.While IS remains widely utilized in post-operative care, there has been a transition towards other devices for thoracicsurgery patients. This study aimed to compare different modalities of positive pressure therapies in patientsundergoing anatomic lung resections (ALRs). Methods: We prospectively randomized patients undergoing electiveALRs to a standardized protocol. A respiratory therapist (RT) driven protocol administered positive airway pressure(PAP) and positive expiratory pressure (PEP) therapy based on vital capacity (VC) and ambulatory status. Patientsreceived PAP/PEP devices versus combination continuous PEP and high frequency oscillation (CPEP-HFO).Outcome measures included VC, length of stay (LOS) and device cost. Results: Of the 98 patients included in theanalysis, 61 received standard PAP/PEP devices, while 37 received CPEP-HFO. Patient characteristics were similarin gender, age, and preoperative lung function. There was no difference in the number of treatments received by bothgroups (median of 8 per group). Daily VC demonstrated an increase with CPEP-HFO compared to standard PAP/PEPdevices (See figure1). Absolute change in VC at discharge compared to first postoperative measure was significantlyincreased in patients receiving CPEP-HFO (408±594 vs. 135±632, p<0.05). LOS was not significantly differentbetween groups, however there was a cost savings with CPEP-HFO. Conclusions: The use of CPEP-HFO resulted ina significant improvement in VC over time compared to standard positive pressure devices in patients with ALRs.These devices have the potential to decrease post-operative complications, however their impact necessitates furtherstudy.



2018944

INFANT PULMONARY FUNCTION TESTING AND HIGH RESOLUTION CONTROLLED VENTILATIONCHEST CT AS PREDICTORS FOR EXTUBATION IN ENDOTRACHEALLY INTUBATED INFANTS WITH SEVEREBRONCHOPULMONARY DYSPLASIA

Courtney R. Cira[1], Erin Wishloff[1], Frederick Long[1, 2], Robert Castile[1, 2]

1. Center for Perinatal Research, Nationwide Children's Hospital, Columbus, OH. 2. The Ohio State University Wexner Medical Center, Columbus, OH

Background: Infant Pulmonary Function Tests (IPFTs) and Controlled Ventilation High Resolution CTs(CV-HRCT) of the chest can be used to determine the level of lung impairment in infants with bronchopulmonarydysplasia (BPD). We hypothesized that measures of lung function and severity of air trapping (AT) on CV-HRCT maybe helpful for predicting length of time to extubation. Methods: Infants were sedated with 100 mg/kg of chloral hydrate.CV-HRCT scans were accomplished by capturing breathing by manual ventilation. Images were then obtained duringa brief period of apnea following a passive expiration to 0 cmH2O. Leak free IPFTs were accomplished inendotracheally intubated infants by using cuffed endotracheal tubes during testing. AT was scored (by quadrant using0-3 severity score) by an experienced radiologist who was unaware of the IPFT results. IPFT measures includedforced volumes (FVC, FEV 0.5), forced flows (FEF25-75), functional residual capacity (FRC), residual volume (RV)and total lung capacity (TLC), all reported in percent of predicted (PP). Results: Nineteen endotracheally intubatedinfants with severe BPD underwent CV-HRCT and IPFTs (mean gestational age at birth 25.5 ± 1.7 wks, post-conceptual age at testing 46.0 ± 9.1 wks, length 49.6 ± 5.1 cm, weight 3.8± 1.4 kg). PP results for spirometry wereFVC 83.5 ± 29.7, FEV0.5 41.2 ± 18.8 and FEV0.5/FVC 50.1 ± 15.9. For lung volumes PP RV was 93.4 ± 42.1, FRC82.3 ± 33.2, TLC 97.1 ± 35.6, and RV/TLC 109.9 ± 21.4. Mean time from IPFTs to extubation was 111.5 ± 193.5 days.There were strong correlations between PP RV, PP FRC, and PP TLC, and PP RV/TLC and days to extubation (p0.0001, p 0.0017, p 0.003, and p 0.016 respectively). There were no correlations between spirometry measures anddays to extubation. In addition, there was strong correlation between AT score on CV-HRCT and days to extubation (p<0.0001). Conclusions: These results demonstrate that results obtained during CV-HRCT of the chest and IPFTs arepredictive of time to extubation. Infants with higher PP RV, FRC and TLC values spent more time on the ventilatorprior to extubation. Direct assessment of AT using expiratory CV-HRCT imaging provided the best predictor of daysfrom IPFTs to extubation. Spirometry results were not predictive of time to extubation. Measures of AT on CV-HRCTimages and plethysmographically measured fractional lung volumes appear to be helpful for ventilator management inintubated infants with severe BPD.

2021277

USE OF A RESPIRATORY CARE PRACTITIONER DISEASE MANAGEMENT (RCP-DM) PROGRAM FORPATIENTS HOSPITALIZED WITH COPD

Robin Kidder[1], Brittany Eads[1], Darnetta Clinkscale[1], Peggy Watts[1], Carolyn Lora[1], Michael Quartaro[1], Debbie Bennet[1], Marin Kollef[2], Mario Castro[2]

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Background: Patients with COPD exacerbations often require repeated hospital admissions and/orvisits to the ED within 30 to 180 days following discharge from a COPD exacerbation. There are no data examiningthe impact of a RCP-DM team to facilitate the hospital discharge of patients with COPD to the outpatient setting.Method: A prospective, randomized trial conducted at an urban university hospital. Informed consent obtained fromadults aged 18 to 65. Eligibility criteria include COPD diagnosis confirmed by spirometry and high risk for repeathospitalization or ED visits. Exclusion criteria include patients not expected to survive their hospitalization, presence ofmetastatic cancer, bed-bound individuals, non-English speaking patients, and patients unable to provide informedconsent. Patients assigned to usual care will have their discharge planning and orders done in the conventionalmanner and will receive a one-page handout containing a summary of the principles of COPD. Patients assigned tothe RCP-DM arm will receive referral information for outpatient therapy as warranted and a 1-hour educational in-service conducted by a respiratory therapist case manager. In addition to education, subjects receive an individualizedwritten action plan. For both groups, follow-up calls at 48-72 hours, 7-10, 30, 90 and 180 days post discharge occur.Results: 302 patients were enrolled at the time of the analysis (152 intervention, 150 control). The number of ED visitswas statistically greater with the intervention group (40.7% v. 26.1%, p = 0.018). Hospital readmissions were similarbetween groups (53.1% v. 53.9%, p = 0.902). The overall hospital LOS was similar between both groups (mean, 7.19d v. 8.03 d, p = 0.499) as was the ICU LOS (mean, 0.35 d v. 1.28 d, p = 0.216). The number of ICU admissions wasstatistically less among intervention group (6.2% v. 15.7%, p = 0.033). Conclusion: Among a population of urbanpatients with COPD hospitalizations, our RT driven intervention resulted in significantly more ED visits but significantlyfewer ICU admissions. These data suggest that the intervention may have prompted patients to seek care sooner andmore frequently in the ED resulting in less severe disease at the time of re-hospitalization as manifested by a lesserneed for ICU care. Further studies are needed to determine the optimal utilization of RT management plans forpatients with COPD following hospitalization in order to improve their outcomes.

2021785

ACCURACY OF THE ELECTRONIC HEALTH RECORD: PATIENT HEIGHT

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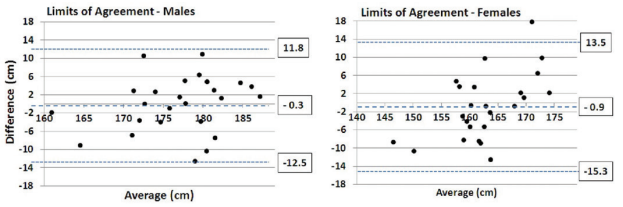
1. Respiratory Institute, Cleveland Clinic, Cleveland , OH

Protective lung ventilation requires calculation of predicted body weight (PBW) from gender and height. Thus, inaccuracy of height data in the electronic health record (EHR) is a risk factor for volutrauma. A study byBojmehrani et al shows that bedside tape measurements or visual estimates of height in ventilated patients may behighly inaccurate but height predicted by ulnar length might be an alternative (Respir Care 2013 Nov;Epub). In ourinstitution, height records are often based on patient self-reporting, with uncertain accuracy. The purposes of thisstudy were (1) to evaluate the difference between patient height of unknown origin recorded in the EHR and predictedheight (PH) from ulnar length and (2) to determine the effect of height difference in setting VT during ventilation.METHODS: The study was deemed quality improvement by our Institutional Review Board. Patient height data fromthe EHR were collected for all patients from several ICUs. For those patients, ulnar data were collected by measuringspan (cm) between the olecranon process and the styloid process of the ulna. An average of 3 measurements wasused in prediction equations. Predicted height (cm): Male PH = 79.2 + 3.60 × ulnar length; Female PH = 95.6 + 2.77 ×ulna length. For each patient, PBW was calculated from height recorded in EHR and from predicted height. PBW (kg):Male PBW = 50 + 0.91 × (height – 152.4); Female PBW = 45.5 + 0.91 × (height – 152.4). Then VT was calculated as 8mL/kg PBW. Bland-Altman analysis of height and VT differences (recorded – predicted) determined bias and limits ofagreement. RESULTS: For white males (n = 27) the mean (SD) height from EHR was 177 (7.5); predicted height was178(6.9). For white females (n = 24) height from EHR was 162 (9.3); predicted was 163 (5.5). Bias and limits ofagreement for height shown in Figure. Bias and limits of agreement for VT (mL/kg) were 0 (1.4, -1.2) for males and 0.8(2.2,-1.2) for females. CONCLUSION: For individual patients, the absolute difference between height of in EHR andthat predicted by ulnar length could be as large as 15 cm and the set VT difference could be > 2 mL/kg. The odds ratiofor developing ALI/ALI is reported as 1.3 for each mL above 6 mL/kg [Crit Care Med 2004;32(9):1817–24]. Wesuggest calculating a predicted height for all patients and then using the lower of recorded vs predicted for VTcalculations. DISCLOSURES: Chatburn consults for Hamilton, Invacare, and IngMar.



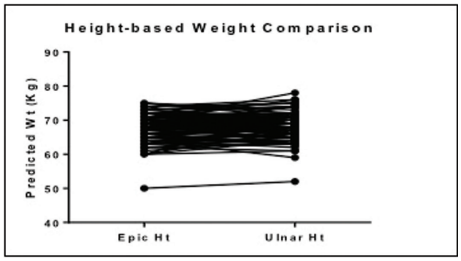
2021845

LACK OF COMPLIANCE WITH LUNG-PROTECTIVE VENTILATION IS NOT DUE TO INACCURATEHEIGHT MEASUREMENT

Terry L. Forrette[2], Conor Coogan[3], Patrick Greiffenstein[1]

1. Surgery, LSUHSC, New Orleans, LA. 2. Cardiopulmonary Science, LSUHSC, New Orleans, LA 3. School of Medicine, LSUHSC, New Orleans, LA

Introduction: Lung protective ventilation (tidal volume 6mL/kg) has been shown to be associated with-improved outcomes in ventilated patients. Although it is an institutional guideline, compliance with this parameter wasin question based on anecdotal accounts. One explanation was that there was inaccuracy in the recorded height and,consequently, in the predicted body weight (PBW). Hypothesis: Failure to adhere to lung protective ventilationstrategies is due to inaccurate data regarding calculated patient lung volumes based on height. Methods: Weexamined 103 consecutive patients undergoing conventional mechanical ventilation in our trauma/surgical critical careunit. First we questioned whether the lack of compliance was due to inaccurate height measurements and lungvolume estimates. Recorded patient heights (Epic Ht) were used to calculate predicted body weight (PBW, kg) andthese were compared to PBW calculated from measured ulnar length (Ulnar Ht) using an established, validatedmethod. Statistical analysis was performed using student's T-test to compare two means (Graphpad Prism). IRBapproval was obtained prior to collecting these data. Results: There was no significant difference between the two-height measurements, Epic Ht and Ulnar Ht (p>0.999, Graph). When comparing the set tidal volumes (SVt) topredicted tidal volumes (PVt), we found a significant discrepancy between the two averages (p<0.05). Moreover, thereappeared to be little correlation between the SVt and PVt with only 10% of the patients observed having SVt within 5%of VtP, 20% within 10% of PVt and 43% within 20% of PVt. Nearly 35% of patients had SVt that diverged by morethan 30% of PVt. Conclusions: Only 10% of patients in our series underwent lung protective ventilation (SVt = 6mL/kg,+/- 5%). Recorded PBW was highly accurate when validated using ulnar-length measurements. Despite readilyavailable accurate data regarding the patient's PBW, practitioners most often utilized larger-than-recommended tidalvolumes during conventional ventilation of intubated patients in our trauma/surgical critical care unit. Further studieswill be needed to identify the source of this non-compliance in order to correct it.



OPEN FORUM Editors' Choice

2003690

SUBSTITUTING INHALED EPOPROSTENOL FOR INHALED NITRIC OXIDE IN ADULT ICU PATIENTS WITH PULMONARY ARTERY HYPERTENSION, RIGHT HEART FAILURE, OR REFRACTORY HYPOXEMIA IS SAFE AND COST EFFECTIVE.

Gail Drescher, Eric Kriner, Edward Palmer, Joseph Lynott; Medstar Washington Hospital Center, Washington, DC

Background: Inhaled pulmonary vasodilators such as INO and epoprostenol are used to selectively induce smooth muscle relaxation and reduce PVR in both cardiac and ARDS patients. However, INO is expensive, lacks FDA approval in adults, and is not reimbursable. Inhaled epoprostenol (IE) is less costly, easier to implement, and has fewer risks. We sought to determine whether these treatments were comparable. Methods: Our department began a standardized protocol to substitute IE for INO using a vibrating mesh nebulizer. We then conducted a retrospective study comparing costs and mortality between treatments in all medical, surgical, and burn ICU patients with significant pulmonary artery hypertension (mPAP >30 mm Hg, sysPAP >40 mm Hg), right heart dysfunction (CVP >16 mm Hg or CI <2.2 L/min*m2) or refractory hypoxemia (P/F <150 or OI >15). Our research qualified for an IRB waiver as data collection was retrospective. All patients receiving either INO (n = 49, June 2009 - July 2010) or IE (n = 56, June 2010 - July 2011 [G1]; n = 77, Aug 2011 - July 2012 [G2]) in our ICUs were included. Demographic, comorbidity, and cost data were collected. Outcomes were compared between the INO group and each time period (G1 or G2) for patients receiving IE using Student's *t* test for quantitative data or chi-square analysis for categorical information. Results: There were no significant differences comparing INO to IE for age (P = .31 [G1]; P = .95 [G2]), sex (P = .79 [G1]; P = .29 [G2]), ICU LOS (P = .49 [G1]; P = .43 [G2]), or hospital LOS (P = .35 [G1]; P = .72 [G2]). There were also no significant differences in the CCI between INO and G1 (P = .65). Significant differences were found comparing INO to G2 for CCI (P = .04), with a higher score in patients receiving IE. Mortality for all indications was significantly lower in both IE groups (P = .02 [G1]; P = .001 [G2]). When mortality rates were separated into CV and pulmonary indications, mortality was significantly lower in patients receiving IE for CV indications (P = .02 [G1]; P = <.001 [G2]), but not for pulmonary indications (P = .53 [G1]; P = .94 [G2]). The actual cost of INO was $407,381 from June 2009 - July 2010, which was significantly higher than the IE costs of $18,392 (G1, P = .007), and $30,875 (G2, P = .009) . The introduction of IE saved our institution $1,051,341 over the 2 year study period. Conclusions: Inhaled epoprostenol is a safe and cost effective alternative to INO in select adult ICU patients.

Sponsored Research - None

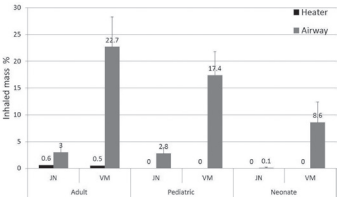
2006816

EVALUATION OF AEROSOL DELIVERY THROUGH HIGH FREQUENCY OSCILLATORY VENTILATION.

Hui-Ling Lin[1], Shu-Hua Chiu[2], Tien-Pei Fang[2]; [1]Department of Respiratory Therapy, Chang Gung University, Taoyuan, Taiwan; [2]Department of Respiratory Therapy, Chang Gung Memorial Hospital Chiayi Branch, Chiayi, Taiwan

Background: High frequency oscillatory ventilation (HFOV) is used with critically ill patients with failed oxygenation on respiratory distress syndrome or acute respiratory distress syndrome as a rescue therapy. However, the efficiency of aerosol delivery during HFOV has not been tested extensively with different devices. Objective: The purpose of this in vitro study was to determine aerosol delivery by various devices on HFOV with adult, pediatric, and neonate lung models. Methods: A Sensormedics 3100A ventilator was set to simulate HFOV of infant: (1) mean airway pressure (MAP) 10 cmH2O, bias flow 10 L/min, frequency 15 Hz, inspiratory time 33%, and power 3 cmH2O for infant model; pediatric (2) MAP 18 cmH2O, bias flow 25 L/min, frequency 8 Hz, inspiratory time 33%, and power 7 cmH2O. In addition, a Sensormedics 3100B ventilator was used to delivery adult parameters at MAP 10 cmH2O, bias flow 10 L/min, frequency 15 Hz, inspiratory time 33%, and power 3 cmH2O. Two aerosol devices were chosen for testing: 1) a continuous small volume jet nebulizer (JN, Galmed Inc) with a unit-dose of 5.0 mg/2.5 mL salbutamol (GSK Corp.) diluted into 4 mL run for 15 minutes; 2) a vibrating mesh nebulizer (VM, Aerogen Inc) with 2.5 mL unit-dose run for 5 munities. Both aerosol devices were placed 1) between the ventilator circuit and the endotracheal tube (ETT); and 2) at the inlet of the ventilator humidifier (n = 5). A bacterial filter was placed distal to the ETT, and drug collected in the filter was eluted and analyzed with a spectrophotometer (Thermo Fisher Scientific). Independent t- test and one-way analysis of variance with Scheffe test were used for statistical analysis (p< 0.05). Results: Inhaled drug delivered with 3 lung models expressed as percent (mean ±SD) of total dose is shown in the figure. Aerosol delivery during HFOV was greater with a vibrating mesh nebulizer vs jet nebulizer (P <.01). The aerosol device placed at the heater delivered negligible (0-0.5%) drug regardless the device used. Conclusion: Aerosol delivery with a vibrating mesh nebulizer placed between the ETT and the ventilator circuit was more efficient than a jet nebulizer during high frequency oscillatory ventilation with infant, pediatric and adult settings.

Sponsored Research - None



Comparison of inhaled mass among settings

2009056

ESTABLISHING CONTINUOUS NEBULIZATION WITH VIBRATING MESH NEBULIZER.

Mary Dawson, James Chisholm, Chris Chambers; Respiratory Care, Fletcher Allen Health Care, Burlington, VT

Introduction: After treating a pediatric patient in status asthmaticus, our Pediatric Intensivist challenged the efficacy of the "continuous" nebulizer system. The physician observed waxing and waning of the patient's level of distress that coincided with the lag time between nebulization times. Our primary goal was to confirm the lag time between drops. Our secondary goal was to determine the rate to establish "continuous" nebulization. Methods: We used the Medfusion 3500 Infusion Pump, Aeroneb Solo vibrating mesh nebulizer, and Aerogen 60 ml syringe/tube set. We measured time between drops, volume of each drop, volume required to create "aerosol" production, and length of actual nebulization time. These were measured specifically from 5mg/ml and increased incrementally by 5mg/hr, through 50 mg/hr. The output from the syringe pump equaled 1ml/hr per 5mg/hr, up to an output of 10ml/hr. The times were measured between drops and the duration of nebulization was measured manually via a digital stopwatch. Total volume delivered and volume of each drop was measured directly from the Medfusion 3500 Infusion pump. Based on our initial results, we discovered that we had not achieved continuous nebulization even at 10ml/hr. Additional testing included 12 ml/hr (the recommended nebulizer maximum output), 14 ml/hr and 15 ml/hr to determine if we could achieve continuous nebulization. Results: Three trials at a rate between 1ml/hr to 15ml/hr were conducted to measure consistency. The ranges of mean times between drops at 1ml/hr were 137± 2.10, 132± 2.13 and 160± 3.31 seconds. At 15 ml/hr the ranges 9.80± .47, 9.17± .33 and 9.59± .91 seconds. The mean drop size was .037±.002ml and the Aerogen nebulizer required two drops for nebulization to occur and lasted for 8 seconds. While testing the larger volumes, it was noted that solution was being trapped between the inner and outer lumen of the Luer lock. This resulted in the drop size doubling to .077 with increased time between drops as well as time between nebulization. Conclusion: We were unable to provide continuous nebulization even after exceeding the maximum dosage recommended by Aerogen. It was determined that the drop size of the solution is relative to the amount of time between nebulization, the larger the drop size the longer the delay between nebulization. We further confirmed that this method of delivery required 2 drops to produce nebulization.

Sponsored Research - None

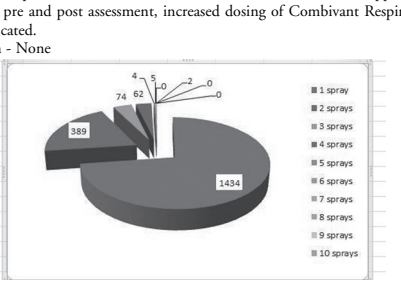
2014950

BRONCHODILATOR PROTOCOL: CONVERSION FROM COMBIVENT METERED DOSE INHALER TO COMBIVENT RESPIMAT.

Suzan Herzig, Fernando Gonzalez, Katrina Derry, Timothy Morris; Respiratory Care, UC San Diego Health System, San Diego, CA

BACKGROUND: Since 2002 our patient driven bronchodilator protocol provided a dosing range of 2- 20 puffs. Based on patient assessment and response, we titrated the dose to achieve a change in peak flow or breath sounds. This approved range had been utilized without report of adverse events. When it was learned that the format of Combivent would be changed from MDI Respimat soft mist inhaler we sought to determine if alternative dosing would be required. METHOD: We searched the literature for information on the soft mist inhaler and its effect on dose. The recommended dose for Combivent Respimat had been reduced from its predecessor to 1 spray 4 times daily; not to exceed 6 sprays. We learned that this was due to the soft mist's release at a slower velocity providing prolonged spray duration and lung deposition. We also searched for studies with higher than recommended doses. We located one study that was conducted in patients with COPD. This study compared Combivent Respimat, at twice the approved dose, Combivent CFC 36/206mcg 2 inhalations 4 times daily, ipratropium 40mcg via Respimat 1 inhalation 4 times daily, and placebo. By indirect comparison, the overall incidence and types of adverse events seen with the 40/200mcg dose was similar to those seen with Combivent Respimat 20/100mcg. RESULTS: We modified the protocol to initiate a new range of 1-10 sprays using the same protocol assessment and response criteria. From July 2013 to April 2014 staff delivered 1970 treatments to nearly 200 patients using Combivent respimat. The highest dose delivered was 8 sprays. Only two patients received this dose; one treatment each. Three patients received one dose of 6 sprays and one patient received 6 sprays twice. 5 Sprays were delivered four times, 4 sprays a total of sixty-two treatments, seventy four treatments of 3 sprays, 2 sprays three hundred eight nine, and one thousand four hundred thirty four treatments of 1 spray each. There was only one incident of reported increase in heart rate. CONCLUSIONS: With appropriate utilization and comprehensive pre and post assessment, increased dosing of Combivant Respimat can be safely delivered when indicated.

Sponsored Research - None



Doses delivered from July 2013-Apil 2014

2015365

COMPARISON OF AEROSOL DELIVERY USING HAMILTON G5 OPTIONAL INSPIRATION, EXPIRATION, AND CONTINUOUS NEBULIZER MODES WITH AEROGEN NEBULIZER.

Philip Delcore, William R. Howard, Paul F. Nuccio; Respiratory Care, Brigham and Women's Hospital, Boston, MA

BACKGROUND: Ventilators having the capability of a nebulizer option historically aerosolize medication during the inspiratory phase only. The Hamilton G5 ventilator, (Hamilton Medical, Reno, NV), has an integrated Aeroneb system (Aerogen, Galway, Ireland), as an optional feature. This nebulizer is controlled through the user interface panel with the choice to aerosolize during inspiration only (default), expiration only, or continuously during both inspiration and expiration. We wanted to know if there would be a difference in delivered medication to the patient dependent upon the selected breath phase of aerosol activation. METHODS: The Hamilton G5 ventilator was attached to an ASL-5000 breathing simulator, (IngMar Medical Ltd, Pittsburgh, PA), using an Airlife RT-210 patient circuit, (CareFusion, San Diego, CA), and a Fisher & Paykel MR-290 humidifier chamber, (Fisher & Paykel Healthcare, Inc, Irvine, CA). The Aerogen-Solo nebulizer cup was attached to the humidifier chamber inlet. Two Portex #2873 filters, (Smiths-Medical, Keene, NH), were placed between the wye and the breathing simulator. The filter closest to the wye was weighed before each test with a Sartorius Practum 213-1S digital scale, (Data Weighing Systems, Elk Grove, IL). The ventilator settings were: AC-mode, VT 500 mL, RR 12 BPM, PEEP 5 cm H2O, I:E ratios 1:1, 1:2, 1:3, 1:4. 4 mL of 10% saline was aerosolized to completion with each test during inspiration only, expiration only, and combined inspiration and expiration. Each filter was re-weighed upon completion of nebulization. The data were analyzed with Excel Data Analysis ToolPak, (Microsoft, Seattle, WA), for mean difference (MD) in the weight (± SD) of the filters and paired t-tests performed ($p \leq 0.05$). RESULTS: The Table below illustrates the MD in filter weight gain (± SD) during the active aerosol phases of breath delivery. Aerosol delivery in the combined inspiration and expiration setting was significantly higher than either inspiratory or expiratory only phases. The MD in filter weight gain comparing inspiration to expiration only was not statistically significant. CONCLUSION: This bench study demonstrates that the G5 Aeroneb delivers more aerosol in the combined breath phase than either inspiratory or expiratory only phase. This suggests that the default to aerosolize during inspiration only mode may not be optimal.

Sponsored Research - None

	Continuous compared to Inspiratory only	Continuous compared to expiratory only	Inspiration only compared to expiratory only
MD (g)	0.30	0.34	0.29
± SD	0.12	0.13	0.12
p-Value	0.03	0.003	0.48

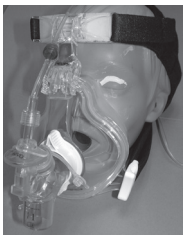
2016895

CONTINUOUS AEROSOL DRUG DELIVERY DURING NON-INVASIVE VENTILATION USING VIBRATING MESH TECHNOLOGY AS PART OF THE MASK SYSTEM.

Paul F. Nuccio, William R. Howard; Respiratory Care, Brigham and Women's Hospital, Boston, MA

BACKGROUND: Continuously administered inhaled therapies such as epoprostenol and bronchodilators have the potential of benefiting patients managed with NIV, similar to that of invasive mechanical ventilation. Additional benefits may include preventing the need for intubation and earlier extubation. The NIVO/Pro-X vibrating mesh nebulizer (Philips Respironics, Murrysville, PA) facilitates aerosol drug delivery during non-invasive ventilation (NIV). In its original design for intermittent nebulization, it was demonstrated to have greater drug mass delivery. We hypothesized that with minor modification continuous and significantly higher drug delivery would result compared to standard nebulizer location. METHODS: For phase-1 of the study a Respironics V60 NIV (Philips Respironics Murrysville, PA) was connected to a Respironics AF531 mask designed to accept a NIVO nebulizer (Aerogen, Galway Ireland). A F&P model 850 humidifier (Fisher & Paykel Healthcare, Irvine, CA) and single-limb heated-wire patient circuit was set to the non-invasive mode. A mannequin head was fitted with the mask and on the opposite side of the oral cavity, a pre-weighed Portex #2873 filter (Smiths Medical, Keene, NH) was connected. The circuit was attached to an ASL-5000 breathing simulator (IngMar Medical, Ltd, Pittsburgh, PA) with compliance and resistance of 40 mL/cm H2O and 5 cm H2O/L/sec respectively. The NIVO nebulizer was continuously supplied with 3% hypertonic saline from a CME Bodyguard 575 infusion pump (CME America, Golden CO) using their proprietary administration set at a pre-programmed infusion rate for epoprostenol of 0.05 mcg/hour. After 2 hours the study filter was weighed and compared to its pre-test weight. Phase-2 of the study used the same setup except with an Aerogen Solo nebulizer mounted on the dry side of the F&P humidifier. The post-nebulization filter weight was recorded and the data analyzed using ANOVA. RESULTS: The filter weight MD (±SD) from the NIVO test phase compared to the filter weight during the humidifier mounted Aerogen Solo nebulizer phase was 0.59g (± 0.002) $p < 0.05$. CONCLUSIONS: Our data confirms that with minor modification, the NIVO nebulizer is more effective in delivering continuously administered aerosol. This suggests that patients managed with NIV may receive superior inhaled medication delivery with the mask-mounted NIVO nebulizer.

Sponsored Research - None



2016960

COMPARISON OF THE SMALL VOLUME NEBULIZER TO THE AERONEB SOLO NEBULIZER FOR THE GROWTH OF INFECTIOUS MICROORGANISMS.

Robert Prestia; Health Professions, Youngstown State University, Youngstown, OH

The purpose of this study was to investigate the growth of infectious microorganisms, specifically Staphylococcus species and Pseudomonas aeruginosa, on the small volume nebulizer (Hudson RCI Micro-Mist Nebulizer) compared to the Aeroneb Solo nebulizer by Aerogen. The types of growth were explored through a bench study demonstrated in a respiratory care laboratory. Current respiratory students were presented with a task to complete aerosol treatments on both devices. A mock scenario was given to represent intensive care patients whom were intubated, receiving mechanical ventilation through the Puritan Bennett 840 ventilator and requiring medicated aerosol therapy inline. The prevalence and types of infectious organisms were explored. One hypothesis was tested: The small volume nebulizer will grow significantly more microorganisms than the Aeroneb Solo nebulizer due to its equipment structure/handling. Informed consent was obtained. Methods: Each nebulizer was swabbed with a sterile swab moistened with sterile saline over the course of 4 days. Mannitol Salt Agar (MSA) was streaked for isolation of Staphylococcus species and MacConkey Agar (MAC) was streaked for isolation of gram-negative bacilli, Pseudomonas aeruginosa in particular. Plates were incubated at 35°C and observed for growth at 24 hours and 48 hours incubation. Results: Analysis indicates a growth of coagulase-negative staphylococci (CoNS) and other infectious agents on the small volume nebulizer, but the hypothesis was proven incorrect. However, the data proves that there was only a very slight difference with the growth of Staphylococcus species between each device with the Aeroneb Solo just having one more positive colony on the MSA. Conclusion: The fact there was a harmful staphylococcus species growing is an eye opener because this research study was conducted in just an academic facility not a true clinical setting. Now just imagine what could be found in an actual clinical setting.

Sponsored Research - None

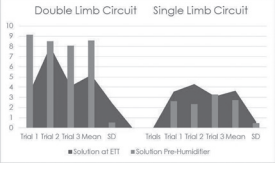
2019911

A STUDY TO EVALUATE THE MAXIMAL AEROSOL DOSE ADMINISTRATION AT TWO DIFFERNT LOCATIONS IN TWO DIFFERENT VDR 4 HIGH FREQUENCY PERCUSSIVE VENTILATOR (HFPV) CIRCUITS.

Jeff L. Heltborg, Beth S. Kobza, Lawrence A. Nilson; Respiratory Therapy, Legacy Health System, Portland, OR

Background:The purpose of this study was to determine if the positioning of a Aerogen® Aeroneb solo nebulizer at different locations in two different VDR4 ventilator circuits would result in differing dose administrations. Determining the location with the maximal dose administration could allow clinicians to deliver more medication.. We hypothesize that placement near the endotracheal tube will provide greater dose deposition. The VDR4 is a high frequency ventilator that combines a convective and percussive high frequency rate. The Aerogen® nebulizer is a low velocity vibrating mesh nebulizer. Methods: The VDR4 ventilator was used with the Hudson RCI Double or Single Limb Circuit connected to an 8.0 ETT tube with a collecting filter attached to a passive lung with these settings : PIP 30, PEEP 12,Convective rate 15,Tinsp 2 seconds, Texp 2 seconds, High frequency rate 500 Humidification was provided by the Hudson RCI ConchaTherm Neptune Humidifier. Administration of the dose was done through the Aerogen® nebulizer placed in-line with the ventilator circuit either before the humidifier or between the endotracheal tube and the VDR 4's Phasitron. A unit dose of 0.5 mg/2.5mL of Albuterol was delivered until duration for the trials. Each trial was performed three times. After the medication was delivered to the test lung, the filters were sent to a lab where the mass of the drug was eluted from the filters using a UV spectrophotometer at 276nm. Using this data, the percent dose delivered was calculated. Data validation was measured with standard deviation. Results: With the double limb circuit, the deposition to the end of the endotracheal tube was greater when the nebulizer was placed before the humidifier (8.6%), rather than near the endotracheal tube (5.2%). The single limb circuit showed contrasting results, with greater deposition when the nebulizer was placed near the endotracheal tube (3.65%), as compared to the placement pre-humidifier (2.62%). Conclusions: Maximal dose was achieved between the two circuits when the Aerogen was placed before the humidifier using the double limb circuit. The results were unexpected, We anticipated that the proximity of the medication to the test lung with either VDR 4 circuit would increase medication deposition. We hypothesize now that releasing the medication into the circuit where the air is already saturated with water may possibly decrease the uptake of medication. Further studies need to be done.

Sponsored Research - None



2020866

INHALED TREPROSTINIL DELIVERY USING A VIBRATING MESH NEBULIZER IN MECHANICALLY VENTILATED ADULT, PEDIATRIC, AND INFANT LUNG MODELS.

Donna K. Parker[1], Shuijie Shen[3], Jiang Zhiang[3], D. Dunbar Ivy[1,5], Delphine Yung[2,4], Robert M. DiBlasi[2,3]; [1]Respiratory Care Department, Children's Hospital Colorado, Aurora, CO; [2]Respiratory Care Department, Seattle Children's Hospital, Seattle, WA; [3]Center for Developmental Therapeutics, Seattle Children's Hospital, Research Institute, Seattle, WA; [4]Department of Pediatrics, University of Washington, Seattle, WA; [5]Department of Pediatrics, University of Colorado, Aurora, CO

BACKGROUND: Tyvaso® (treprostinil) Inhalation Solution (iTre) is a prostacyclin analogue approved for treatment of Pulmonary Arterial Hypertension in adults. It has also been shown to be effective in pediatric patients. ITre is FDA approved for delivery using the Tyvaso Inhalation System (TIS) which consists of an OPTINEB®ir (NEBU-TEC, Elsenfeld, Germany) programmed for intermittent medication delivery. While there have been reports of the TIS being adapted for use in mechanically ventilated patients and delivery of iTre using a standard jet nebulizer; neither of these systems is ideal. Vibrating Mesh Nebulizers (VMN); used in many institutions for delivery of inhaled medication to mechanically ventilated patients, have been shown to provide greater drug delivery in ventilated patients than jet nebulizers and do not affect ventilator function. This study was designed to test the hypothesis that there were no differences in medication delivery at two nebulizer circuit locations during conventional ventilation (CMV) and one during high frequency oscillatory ventilation (HFOV). METHOD: A test lung (ASL 5000, Ingmar Medical) configured for neonatal, pediatric, and adult, models was attached to an ETT with a filter placed on the distal end. The test lung was ventilated for each model with a Servo-i® (Maquet, Solna, Sweden) for CMV and Sensormedics Oscillator A & B (Carefusion,Yorba Linda, CA) for HFOV. The Aeroneb®Solo nebulizer was placed in 2 different positions in CMV; proximal to the patient wye and distal inlet of the humidifier. With HFOV it was placed between the patient wye & the ETT. 1 ml (660mcg) of iTre was nebulized. Each condition was repeated in triplicate with 3 different nebulizers. The treprostinil mass was quantified using high pressure liquid chromatography. Differences between mean treprostinil mass were compared at each condition using ANOVA with Tukey post-hoc tests. RESULTS: Under all testing conditions HFOV provided greater drug delivery than CMV ($p<0.05$). During CMV, greater drug delivery was obtained with the nebulizer placed prior to the humidifier during pediatric and adult ventilation ($p<0.05$). There were no differences in position during neonatal ventilation. DISCUSSION/CONCLUSIONS: Tyvaso drug delivery is best achieved when the nebulizer is placed proximal to the patient-wye during neonatal ventilation and prior to the humidifier with pediatric and adult ventilation. Drug delivery appears to be adequate when using iTre with HFOV.

Sponsored Research - Salary and Travel support was provided through a study grant awarded by United Therapeutics.
Tyvaso drug and Tyvaso Delivery systems/supplies were provided by United Therapeutics

1998867

ETTCO2 MONITORING WITH HFOV, A BENCH STUDY.

Jeffrey W. Wright, Mandy Maas, Kevin Crezee; Respiratory Care, Primary Children's Hospital, Salt Lake City, UT

INTRODUCTION: The study was to determine if Endotracheal Tube Carbon Dioxide (ETTCO2) could be monitored, when using CareFusion (San Diego, CA) 3100A High Frequency Oscillatory Ventilator (HFOV). If ETTCO2's were sufficient enough to read, it was theorized that a correlation of ETTCO2's and test lung CO2 (LCO2) could be reached. If a conversion factor could then be determined this may allow for ETTCO2 to be used as a trending tool when HFOV is being utilized. **METHOD:** A 310ml semi-rigid test lung with a compliance factor of 0.62mL/cmH2O was affixed with a 3.5 endotracheal tube (ETT) to a performance checked and calibrated HFOV. Additional ports in the test lung allow for injection of blended CO2/Air gas (2), and sampling of LCO2 for analysis (2). Both injected CO2/Air and sampling flow were balanced at 0.3 Lpm. A sample line was adapted at the ETT to measure the ETTCO2. The ventilator ran through a series of setting changes (Hertz, Amplitude and Bias Flow). After each HFOV change the LCO2 would be adjusted to the target concentrations. After LCO2 stabilized at targeted concentration the measured ETTCO2 was recorded. **FINDINGS:** It was found that ETTCO2 could be detected. The ETTCO2 values when compared to the LCO2 (ETTCO2/LCO2) varied dependent upon the ventilator settings. More dynamic HFOV settings revealed higher ETTCO2/LCO2 of as much as 0.7. When the HFOV was at less dynamic settings the ETTCO2/LCO2 was as low as 0.38. The averaged ETTCO2/LCO2 was slightly less than 0.5. **CONCLUSION:** ETTCO2 can be measured. If conversion factor of 1.4 to 2.7 were applied to the ETTCO2 a similar value to the LCO2 could be found, but a direct correlation between the ETTCO2 and LCO2 is not entirely apparent. A conversion factor of 2X ETTCO2 would provide trend able numbers. Further investigation is needed to determine the viability of using ETTCO2 with HFOV and for identifying contributing factors that may improve development of a conversion factor.

Sponsored Research - None

MEASURED ETTCO'S

		BIAS FLOWS			BIAS FLOWS			BIAS FLOWS			BIAS FLOWS		
		10	15	20	10	15	20	10	15	20	10	15	20
HTZ	AMP	LCO 30			LCO 40			LCO 50			LCO 60		
6	15	12	11	11	15	15	15	19	18	18	23	22	22
6	20	12	12	12	18	18	18	23	22	22	27	26	27
6	25	16	15	15	21	19	19	26	26	25	31	30	30
6	30	16	16	15	22	21	20	27	27	26	33	33	31
6	35	18	17	15	23	23	23	28	27	27	37	34	32
6	40	18	18	16	24	22	21	30	28	27	36	33	32
8	15	10	10	10	14	14	14	17	17	14	21	21	20
8	20	13	12	12	18	16	15	20	20	19	25	25	24
8	25	14	14	14	19	19	18	24	23	23	30	27	27
8	30	16	15	13	21	20	18	27	25	24	31	30	29
8	35	17	16	15	24	23	21	28	28	27	36	35	33
8	40	18	17	15	24	23	22	30	29	27	38	35	33
10	15	12	12	12	16	15	16	21	21	21	24	23	23
10	20	13	12	12	18	18	16	23	21	20	31	29	29
10	25	15	14	13	21	19	18	26	24	24	31	29	29
10	30	16	15	14	21	20	18	26	24	24	33	29	28
10	35	17	15	24	22	22	30	30	27	36	34	32	
10	40	19	17	18	28	26	25	35	32	30	39	36	35
Averages		14			19			24			29		

DATA TABLE

2003277

COMPARATIVE STUDY OF TWO HYPERINFLATION SYSTEMS USED IN A PEDIATRIC INSTITUTION

Tom Leisenring[1], Gary R. Lowe[1], Randy Willis[1], Shirley Holt[1], Tracy Thurman[3], Mark Heulitt[1,2]; [1]Respiratory Care, Arkansas Children's Hospital, Little Rock, AR; [2]Department of Pediatrics, Critical Care Medicine, University of Arkansas for Medical Sciences, Little Rock, AR; [3]Arkansas Children's Hospital Research Institute, Little Rock, AR

Background: Hospitals who are members of group purchasing organizations (GPO) are occasionally faced with equipment changes due to pricing considerations. Our institution allows us to remain with existing equipment if it is shown to be superior to the replacement. We were informed that a change in the hyperinflation systems (HIS) was pending and a comparative study was performed between the two HIS. **Methods:** This was an in-vitro study comparing Ventlab (VEN) and Medline (MED) ½ L and 1 L HIS. Five Respiratory Therapists (RTs) utilized the VEN and MED HIS (½ L and 1 L) to ventilate a test lung (Ingmar Neo Test Lung for the ½ L bag and Ingmar Quick Lung for the 1 L bag) with compliance 2 mL/cmH_2O and a 3.5 ETT for ½ L bag, and compliance 10 mL/cmH_2O and resistance 20 cmH_2O/L/S for the 1 L bag. Five different bags of each type and size (for each RT) were utilized. Each RT ventilated the test lung with the VEN and MED systems with target PIP/PEEP of 25/5, 30/7 and 40/10 cmH_2O and a target RR of 20 bpm. Measurements of flow and pressure were acquired using the Biopac MP-100 System. Data were collected for one (1) minute for each RT, HIS, and PIP/PEEP targets. Six (6) breaths for each RT, bag size, HIS, and PIP/PEEP targets were measured for PIP/PEEP, Mean Peak Inspiratory Flow (mPIF), and V_T. In addition, total number of breaths was counted, and the mean pressure was measured for the one minute collection period. The difference in target and measured PIP/PEEP and RR was calculated as measured value – target value; therefore, a negative difference indicated the measured value was less than the target value and a positive difference indicated the measured value was greater than the target value. Mean pressure for one minute, V_T and mPIF; and mean difference values for PIP/PEEP, and RR were used for analysis. Results are presented as mean±SD. Comparisons between the VEN and MED systems were made using a t-test with significance set at $p<0.05$. **Results:** Overall for the ½ L HIS, there were no differences between the VEN and MED for PIP/PEEP, RR, mPIF, and mean V_T. For the 1 L bag, overall mean difference for RR was more for the MED compared to the VEN ($p=0.04$), but no differences were noted in PIP/PEEP, mPIF, and mean V_T. **Conclusion:** Neither HIS was shown to be superior during the functionality testing. Based on that information, we changed to the new product on contract with the GPO. With our estimated utilization, this would save ~$14,000 annually.

Sponsored Research - None

2007497

CONTINUOUS CUFF PRESSURE MONITORING USING CUFF SENTRY AND ITS ROLE IN PREVENTING MICROASPIRATION AND VENTILATOR ASSOCIATED PNEUMONIA IN CRITICALLY ILL PATIENTS.

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BACKGROUND: Ventilator Associated Pneumonia (VAP) is associated with significant mortality and morbidity with increased need for mechanical ventilation in critically ill patients. A common cause of VAP is due to microaspiration from underinflation of the endotracheal or trachestomy tube cuff. Maintaining continuous cuff pressures >20CM H2O (cwp) using an automated device may help to prevent microaspiration and VAP caused from low cuff pressures. This study compared the efficacy of a continuous cuff pressure (CCP) device to maintain cuff pressures within a target range as well as BAL amylase levels as an assessment of microaspiration. METHOD: We prospectively studied cuff pressures for two 8 months periods in all mechanically ventilated patients in the medical intensive care unit (MICU) using either conventional manometry with manual inflation or with a CCP device. During the control period, cuff pressures were manually assessed every 4 hours and adjusted to maintain a pressure between 20-30 cm H2O. In the following 8 months period, the experimental group used a CCP device to maintain constant pressures within the same range without the need for manual inflation and pressures were similarly recorded every 4 hours. Outcome measures included documented cuff pressures, ventilator days and documented fluid amylase in all patients in which bronchoalveolar lavage (BAL) was performed. RESULTS: Recorded cuff pressure were more consistently in the target range using the continuous cuff pressures device 19 instances of cuff pressures < 20 cm H2O in 3307 ventilator days compared to manual monitoring and inflation with 801 instances of cuff pressures < 20 cm H2O in 3333 ventilator days. BAL fluid amylase was used a marker of aspiration and was lower in specimens collected from patients in the CCP device compared to patients receiving routine manual monitoring and inflation suggesting reduced micro aspiration. CONCLUSION: Use if a CCP device results in improved ability to maintain cuff pressures within a target range. BAL fluid amylase was also lower in the patients on a continuous pressure device compared to routine manual inflation suggesting lower risk of microaspiraion with CCP device use. Routine use of CCP devices may be an effective measure to reduce VAP.

Sponsored Research - None

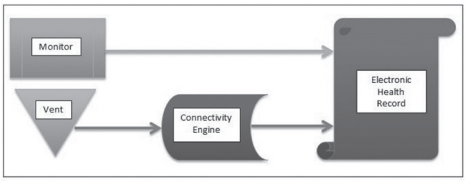
2011284

MULTI-DISCIPLINARY COLLABORATIVE IMPLEMENTATION OF A CONNECTIVITY ENGINE TO INTEGRATE POINT OF CARE (POC) VENTILATOR AND MONITOR DATA WITH THE ELECTRONIC HEALTH RECORD (EHR).

Tammy M. Angeletti, Daniel R. McLellan; Respiratory Care, Penn State Children's Hospital, Hershey, PA

Background: The opening of a new Children's Hospital (CH) at Penn State Hershey Medical Center (PSHMC) required the institution of more efficient approaches to patient care while maintaining high standards of quality and safety. The Department of Respiratory Care sought to integrate POC ventilator data automatically into the EHR. Method: Leadership in the Respiratory Care (RC) department at PSHMC-CH, along with front line staff and the departments of Information Technology (IT) and Nursing worked on a plan to assimilate the data from a standard ventilator (Maquet Servo I,) and our monitoring system (Drager Xfinity Delta XL) to the EHR (Cerner). A Cerner connectivity engine was deployed to integrate the ventilator and EHR. The goal was to improve time standards, retrieval of patient data at any given time, utilization and access to patient information, as well as facilitating direct input into the patient EHR. Collaboration took place between IT staff and bedside RT's to facilitate a common language between all systems. The system was implemented in our 18 bed PICU (with intentions to eventually deploy in all ICU's of the facility.) Results: After the initial trial period and subsequent implementation of the process, it was determined that the integration was a success. We were able to capture patient data from the POC and ventilators at any given time during that patient stay. This was performed by choosing and opening a section in the EHR where the information automatically populated. This resulted in a reduction of patient/ventilator assessment time to 13 minutes, capturing the data immediately versus manual input into the EHR. From a labor perspective, this can potentially free up six hours every 24 hours based on an average daily census of 9 ventilator patients. Another positive outcome is the ability of the respiratory therapist to instantly capture data in emergency situations. Conclusion: Implementation was successful as we were able to demonstrate a much more efficient process compared to manual input of data into the EHR. In the future, data placed into the EHR with this implementation has the capability to be used in research, retrospective studies, or to further delve into patient conditions and situations. While it was a lengthy initial integration, future implementation in other ICU's within the facility will be by rapid implementation. Disclosures: None.

Sponsored Research - None



2018396

ACCURACY AND USEFULNESS OF TRANSCUTANEOUS CO2 IN ASSESSING THE EFFICACY OF TREATMENT OF CHRONIC HYPOVENTILATION WITH NON-INVASIVE VENTILATION.

Sigurd Aarrestad[1], Elin Tollefsen[2], Jean-Paul Janssens[3], Anne L. Kleiven[1], Magnus Qvarfort[1], Ole H. Skjønsberg[1]; [1]Pulmonary, Oslo University Hospital, Oslo, Norway; [2]Pulmonary medicine, St. Olavs Hospital, Trondheim, Norway; [3]Pulmonary medicine, Geneva University Hospital, Geneva, Switzerland

Background: Residual hypercapnia can be present in daytime or during sleep in patients with chronic hypoventilation treated with non-invasive ventilation (NIV); thus CO2 should be monitored both during daytime and sleep. Aims: 1) to compare arterial CO2 (PaCO2) measured by radial puncture with transcutaneous CO2 (TcCO2), 2) to measure overnight drift of the TcCO2 sensor and 3) to evaluate the contribution of overnight TcCO2 vs. solely using pulse oximetry (SpO2) for detecting nocturnal hypoventilation (NH) Methods: 65 patients with: neuromuscular diseases (34), central hypoventilation syndrome (5), obesity hypoventilation syndrome (16) and restrictive thoracic disorders (10) were studied. PaCO2 (room air) was compared with simultaneously measured TcCO2 values. Overnight drift of the transcutaneous CO2 sensor was estimated by measuring a defined gas concentration in the evening, after calibration of the sensor, and repeating this measurement in the morning without recalibrating. Overnight TcCO2 and SpO2 were measured during NIV. Definition of: NH: TcCO2 > 55mmHg≥ 10 minutes or ≥ 10mmHg increase to above 50mmHg ≥ 10 minutes. Normal SpO2: SpO2 < 90% in <10% of the recording time. Results: TcCO2 correlated significantly with PaCO2 (r = 0.95 p<0.0001). The Bland-Altman plot showed a mean bias of 1.7 mmHg (Limits of agreement; -2.5 – 6.0). Mean technical drift was 0.12 mmHg/h (± 0.5). NH was found in 23 patients, 13(57%) had normal and 10(43%) had an abnormal overnight SpO2. Conclusions: TcCO2 accurately reflects PaCO2 in patients with chronic hypoventilation and can be used to monitor CO2 overnight during NIV without any clinically significant drift. Detection of NH is missed in 57 % of patients when monitored by nocturnal SpO2, without additional TcCO2 measurement.

Sponsored Research - None

2018663

COMPARISONS OF THE SPO2 AND HR MEASURED BY NONIN ONYX 9590 AND CHOICEMMED OXYWATCH PULSE OXIMETERS IN NON-CRITICALLY ILL PATIENTS.

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BACKGROUND: Health care professional have been using personal portable pulse oximeters to measure a patient's pulse oximetry (SpO2) and heart rate (HR). The purpose of this study was to determine whether the less expensive personal pulse oximeter performs as well as the higher priced pulse oximeter commonly available in the hospitals. METHODS: IRB approval was obtained before the study. Thirty-two alert and non-critically ill patients gave permission and participated in the study. Patients who could not give consent (e.g., unconscious and intubated patients) were excluded from this study. Two pulse oximeters (Nonin Onyx 9590 and Choicemmed Oxywatch) were used to measure the SpO2 and HR. For 50% of the patients, the Nonin oximeter was first placed on the index finger for one minute and the SpO2 and HR were recorded. This procedure was repeated immediately using the Choicemmed oximeter. For the other 50% of the patients, the Choicemmed oximeter was used initially. The same procedure was repeated immediately using the Onyx oximeter. The SpO2 and HR data from both devices were analyzed using the paired t-tests. RESULTS: There was no significant difference for SpO2, $t(31) = 0.382$, $p < 0.05$, between the Nonin and Choicemmed oximeters. For the HR data, there was no significant difference, $t(31) = 1.34$, $p < 0.05$, between the two oximeters. CONCLUSIONS: The results showed no significant differences in the SpO2 and HR data measured by the Nonin Onyx 9590 and the Choicemmed Oxywatch pulse oximeters. The less expensive oximeter (Choicemmed) performed as well as the higher priced Nonin Onyx 9590 oximeter. Limitations of this study include the small sample size and the exclusion of critically ill patients.

Sponsored Research - None

2019466

A RETROSPECTIVE EVALUATION OF PEDIATRIC PRESSURE ULCERS CAUSED BY PULSE OXIMETER PROBES.

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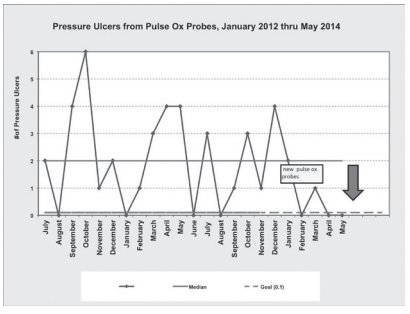
Introduction: Hospital Acquired Pressure ulcers (HAPU's) remain at the forefront of organizational dashboards for improving patient safety. At our facility, one of our top causes of device related PU's has been from pulse oximeter probes. As part of a quality improvement effort, we have introduced multiple PDSA interventions in an effort to lower the rate of PU's. We designed a retrospective study to evaluate the impact of the interventions on the incidence of PU's, patient age, PU stage, and PU location. Methods: A retrospective chart review was performed for of all patients who developed a PU from a pulse ox probes from January 2012 to May 2014. Age, Gender, PU stage, and location of PU were recorded, analyzed, and reported as median in an excel spreadsheet. A control chart was maintained to evaluate the impact of specific interventions over time. Results: See figure with run chart. 29 patients were included in this data set with 41 unique PU's. Median age was .83y/o (10 months old) with a range of 1wk to 30y/o. 55% of these patients were < 1 year of age. PU's were noted in eight different locations. 46% occurred on either the Right or Left Great toe. 54% of the PU' were stage I, and 46 % were Stage II. Since implementation of a new lower profile pulse ox probe in January 2013, only one stage I pressure ulcer has occurred. Discussion: Our retrospective data indicates that children under 1 year of age had a higher incidence of developing a PU from a pulse ox probe. Based on data following our January 2014 intervention to change to a lower profile pulse ox probe, this intervention appears to be trending with a lower incidence of PU's. In addition, several chronic patients who had frequent recurring PU's, have not had a PU since the change to the new device. Data needs to continued be monitored to more extensively evaluate clinical impact, but this intervention appears promising as a prevention tool.

Sponsored Research - None



2020501

ETCO2 MONITORING DURING INTERNAL TRANSPORT TO IMPROVE PATIENT SAFETY.

Anita Arnsperger, Shannon Short, Thomas Cahill, Cynthia White; Division of Respiratory Care, Cincinnati Childrens Hospital Medical Center, Cincinnati, OH

Introduction: ETCO2 monitoring is an established practice in the pediatric population, and has become an expectation for monitoring airway patency and acute changes in ventilation. It has also proven to be a valuable monitoring tool to utilize during patient transport. Our global plan was to establish a policy to have all patients in our facility transported with ETCO2 monitoring as an effort to improve patient safety. As part of an initial pilot project, one of our transport RT's began transporting all patients with ETCO2 in January 2014. The objective of this study is to collect data from patients that were transported with ETCO2 monitoring during this initial pilot initiative to evaluate the impact on patient safety and outcomes. Methods: The study was approved by the IRB. The following retrospective data was collected on all patients who were transported with ETCO2 monitoring: ventilator settings and ETCO2 on the ICU vent prior to transport, ventilator settings and ETCO2 after transition to the transport vent, airway size, and any ETCO2 and ventilator changes that occurred during the transport. Statistical analysis was performed in SPSS ver. 21. A paired t test was performed to evaluate changes in ETCO2 pre and post transition to a transport vent. Data is reported as mean and SD. Results: Twelve patients were included in the study. Mean ETCO2 pre and post transition to a transport vent was 37.18 (+/-7.22) and 42.73 (+/-13.27), p= .047. 100% of the patients required a change in ventilator settings after transitioning to a transport ventilator. Eight of the patients (66%) needed additional changes during the transport secondary to either increased ETCO2 or administration of sedation during a procedure. Discussion: Monitoring ETCO2 throughout the transport appears to detect changes in ventilation more quickly than clinical status or pulse oximetry alone. All patients required ventilator settings prior to transition to a transport vent. This alone may be an indication for this additional monitoring ability on transport.

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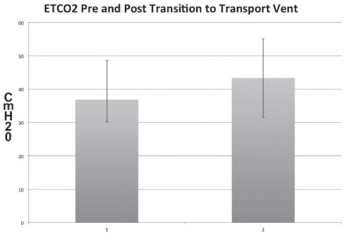

2020727

ASSESSMENT OF CLINICIANS ABILITY TO IDENTIFY INDIVIDUAL BREATHS IN A DIFFICULT CO2 WAVEFORM.

Lara Brewer, Preston Erickson, Joseph Orr; University of Utah Health Sciences Center, Salt Lake City, UT

Background: Traditionally, capnometers have been used in operating rooms to monitor patients under anesthesia. The CO_2 waveform (capnogram) obtained from an intubated patient in the operating room is easily interpreted to indicate not only respiratory rate, but also the sufficiency of ventilation, the presence of patient effort during controlled mechanical ventilation, the respiratory rate, etc. Now that capnometers are becoming more widely used outside of the operating room, clinicians are presented with capnograms which are more difficult to interpret because patients often exhibit more spontaneous ventilation effort, their lungs are less healthy, and the gas sample may be obtained from a nasal cannula or mask in addition to the endotracheal tube. It is not known how easily healthcare professionals can interpret capnograms which are more complex and irregular. For example, if a capnometer were to display an incorrect respiratory rate, could a clinician successfully interpret the capnogram in order to learn the true respiratory rate? In this study, we evaluated whether clinicians could accurately count the number of breaths shown in a capnogram. Using capnogram data which had been previously collected from patients, we compared the clinician's breath count to the reference count from a flow meter. **Methods:** A data set of simultaneously collected clinical respiratory data signals (PCO_2 and flow rate) was previously collected from over 200 adult, pediatric, and neonatal patients using IRB-approved protocols. The patient types included: intubated ICU and OR patients and sedated volunteers wearing a tight-fitting mask. From these data, twenty data segments, each thirty seconds in length, were selected for thirty clinical experts (12 MDs, 8 RTs, 3 CRNAs, 3 RNs, 4 Anesthesiology Residents) to evaluate. **Results:** Table 1 shows the percentage of clinicians who provided the correct breath count for each data type. Accurate breath count was observed on average less than 50% of the time for all patient types. **Conclusions:** We observed that healthcare professionals have a difficult time interpreting the number of breaths displayed in a capnogram when the waveform is irregular. Irregularities in the waveform caused by conditions such as rebreathing, cardiogenic oscillations, curare clefts, and apnea resulted in correct breath count less than half the time. Analysis of respiratory rate is perhaps one of the simplest capnogram interpretation tasks.

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	Adult Intubated OR Patient: Simple Pattern (n=1)	Adult Intubated OR Patient: Difficult Pattern (n=2)	Adult Intubated OR Patient: Rebreathing (n=3)	Adult Intubated OR Patient: Oscillations (n=3)	Adult Intubated ICU Patient (n=3)	Adult Non-Intubated, with mask (n=3)	Pediatric ICU Patient (n=3)	Neonatal ICU Patient (n=2)
Exact Breath Count	80.0%	28.3%	4.5%	23.0%	30.0%	25.2%	55.6%	8.6%
Breath Count within +/- 25%	100.0%	40.0%	19.2%	24.1%	63.3%	56.3%	75.9%	19.0%

Table 1. Percentage of survey respondents who correctly counted the number of individual breaths presented in the 30-sec CO_2 waveform. The "n" indicates the number of waveform samples presented in each clinical category.

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THE UTILIZATION OF THE PRESSURE-VOLUME TOOL TO DETERMINE THE LOWER INFLECTION POINT TO MAINTAIN LUNG INFLATION DURING EXTRA CORPOREAL MEMEBRANE OXYGENATION (ECMO).

Kenneth Miller, James Wu, Rita Pechulis, Kenton Clay; Respiratory Care, Lehigh Valley Health Network, Bath, PA

Minimizing ventilator induced lung injury is a major concern when providing ventilation for patients with acute lung injury. The gold standard for lung protection is ARDSnet Protocol. If the oxygenation end-point cannot be achieved ECMO may be another intervention. Recently the utilization of ECMO has demonstrated a reduction in lung injury and improved outcomes. Gas exchange is managed by ECMO while the ventilator's goal is to maintain lung inflation at the lowest pressures possible. The utilization of the Pressure-Volume Tool (P/V Tool) can help determine the lower inflection (LIP) and upper inflation points (UIP) and to provide recruitment maneuvers if required. The P/V Tool (Hamilton Medical Inc, Reno Nevada) is a systematic ventilator application that allows the clinician to set lower and higher starting pressures, along with a Phigh (PEEP) for a sustained time frame if desired for a recruitment maneuver. After the maneuver, a pressure/volume graph is visualized to assess the inspiratory and expiratory limbs of the P/V loop. Also a loop hysteresis is available to determine if there is potential additional lung to be recruited. The P/V tool is performed every 12hrs for LIP/UIP assessment and recruitment maneuvers are performed if Clt <20cm/h20 for all patients placed on ECMO. The P/V Tool has been utilized on a daily basis to determine the lower and upper inflection points on twenty-eight patients placed on V-V ECMO for ALI management. On thirteen of the patients whose lung compliance was <20cm/h20 (8 cm/h20 to 14 cm/h20 Q6hr recruitment maneuvers were performed for 30 seconds at a PEEP of 30 cm/h20 to improve lung compliance. All patients' lung compliance was maintained > 20cm/h20during the ECMO utilization by performing sequential P/V tool assessment or recruitment maneuvers. The utilization of the P/V tool helped our clinical team maintain lung inflation during ECMO. The ability to assess and adjust ventilator settings or perform recruitment maneuvers if indicted helps to maintain lung compliance during ECMO management.

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1982829

THE UTILIZATION OF INDEPENDENT LUNG VENTILATION VIA HIGH FREQUENCY PERCUSSIVE VENTILATION (HFPV) DURING EXTRACORPOREAL MEMBRANE OXYGENATION (ECMO).

Kenneth Miller, James Wu, Rita Pechilus, Chad Traub; Respiratory Care, Lehigh Valley Health Network, Bath, PA

Introduction: Minimizing ventilator induced lung injury is a major concern when providing ventilation for patients with acute lung injury. If the oxygenation end-point cannot be achieved by conventional ventilation, ECMO may be initiated. However in some patients, gas exchange and secretion removal may not be adequate with ECMO and conventional ventilation. Management is especially challenging when the pathologic process differs from right lung to left lung. We describe a case study of a patient with H1N1 influenza and ARDS requiring ECMO who developed multiple pneumothoraces of the right lung and significant consolidation in the left lung. To adequately manage the patient, independent lung ventilation (ILV) was provided by two Volumetric Diffusive Respirators (VDR). Method: A twenty four year old female was admitted with H1N1 influenza which progressed to ARDS requiring ECMO. On day fourteen the patient developed a right pneumothorax which was decompressed via tube thoracostomy. Two days later, pneumothorax reoccurred on the right necessitating placement of another chest tube with significant air leak. Gas exchanged deteriorated (ABG 7.01/75/42) oxygenation and sweep gas were maximized via ECMO with marginal improvement. Radiographic imaging revealed unchanged right sided infiltrate and worsening severely consolidated left lung. The decision was made to institute independent lung ventilation with two VDRs via dual lumen endotracheal tube. The reason HFPV was selected as a ventilator strategy was to provide lung protection to the injured right lung (low pressure/PEEP/percussive force), while providing aggressive mucokinesis via for the obstructed left lung (high pressure/PEEP/percussive force). ECMO settings remained at 100%/10LPM sweep. Results: Within forty-eight hours gas exchange had improved (ABG 7.32/48/76) ECMO parameters were weaned to 80%/5 LPM sweep. Subsequently the patient was transitioned to conventional ventilation via single lumen endotracheal tube with no deterioration in gas exchange. Radiographic imaging revealed an improvement in left lung consolidation. . Conclusion: In this case study, ILV via VDR maintained adequate gas exchange by improvement aeration of the left lung without contributing to increased injury of the right lung while on ECMO. After stabilization the patient was return to conventional ECMO management.

Sponsored Research - None

2011007

RETROSPECTIVE ANALYSIS OF PROCESS IMPROVEMENT STRATEGIES TO DECREASE VENTILATOR LOS.

Debora M. Williams, Skip Bangley, Joseph Hollowell; Respiratory Care, Vidant Medical Center, Greenville, NC

Background: Ventilator length of stay (VLOS) impacts patient outcomes and overall hospital LOS. The length of time a patient spends on a ventilator increases the possibility of a VAE (ventilator-associated event) previously called a VAP. Increased LOS is associated with increased morbidity and mortality. **Objective:** To develop a series of procedural changes in a step approach that would result in a reduction of ventilator LOS. **Methods:** Data from the VMC ventilator database was compiled. A retrospective analysis of all strategies employed at VMC to decrease overall ventilator length of stay (VLOS) was also completed. A comparison of ventilator LOS data to implemented strategy dates was then compared. The VLOS data was analyzed beginning in 2005. All VLOS data was captured except for the year of 2008 due to a new EHR implementation. Ventilator database calculations: Actual start time to actual stop time of ventilator. Patients who are restarted within 48 hours of extubation are considered the same LOS. **Results:** Notable baseline strategy review began with 2005 and previous ventilator management protocols. No significant changes occurred until 2008. A few of the implementations reviewed include: (see table) **Conclusions:** VMC had a 45 % increase in the number of ventilator patients from 2005-2013. The overall VLOS decreased by 34.9% (5.90 days to 3.84 days). Between June 2007 and June 2009 a 38 % increase in ventilator patients is noted with the opening of the East Carolina Heart Hospital (ECHI) in Jan 2009, adding significantly to the RCP workload. The VMC average respiratory case mix index (CMI) is consistently at 2.5 throughout this timeframe. We also noted the percentage of patients on the ventilator remain constant. The AARC benchmark compare group VLOS is currently 4.46 days (university affiliated > 500 bed facilities) our average LOS is approximately 14 % below the AARC benchmark reporting. The key steps taken appear to show that this study reveals the impact of increasing respiratory staffing on ventilator LOS which resulted in our ability to implement respiratory driven protocols such as post extubation evaluation and follow up, and a Sedation Vacation/SBT team concept in TCU and RIU. We are continuing to evaluate the sedation medication usage over this timeframe. This will be added to the study.

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Results

Year	
2008	Added vent weaning unit (RIU) - 4 bed unit
2009	Increased RIU to 12 bed unit (added a dedicated Pulmonary Medicine PA)
2009	Added Pediatric Transitional Care Unit (TCU)
2009	East Carolina Heart Institute opened- added 40 ICU level beds
2007-2009	a 7.6% decrease in VLOS from 5.61 to 5.18
2010	Increased respiratory therapy positions by 20
2011	A Q6 respiratory post extubation evaluation by RCP's initiated
2011	An obesity weaning study began and increasing mobility of ventilator patients
2009-2011	an insignificant change in VLOS from 5.18 to 5.17
2012-2013	Sedation Vacation /SBT's implemented
2011-2013	a 25.7 % decrease in VLOS from 5.17 to 3.84

2015872

EFFECTS OF ALCOHOL WIPE AND FOAM DISINFECTANT ON MICROBES THAT HARBOR ON THE SURFACE OF PB840 VENTILATOR.

Abdulelah Aldhahir, David Chang, Michael Spector; University of South Alabama, Mobile, AL

BACKGROUND: Mechanical ventilators are frequently contaminated by pathogens. It is recommended that the surface of ventilators be routinely decontaminated by alcohol or other chemical agents. Alcohol wipes (70% isopropyl alcohol) have been used as an disinfectant for equipment and foam disinfectant (60% alcohol) is commonly used on the hands of health care providers. The purpose of this study was to compare the effectiveness of alcohol wipe and foam disinfectant as disinfecting agents for the surface of mechanical ventilators. METHODS: IRB approval for this study was obtained before implementing the study at a regional hospital in Alabama. Patient consent was not required for this study. Sixteen PB840 ventilators that had been used in the ICUs for at least two days were included in this study. The main control rotating knob was selected for the disinfection and collection of culture samples because it was the knob most often touched by health care providers. Each of the 16 knobs received a pre-decontamination culture swab. Eight knobs were decontaminated by alcohol wipes and the other eight by foam disinfectant. Following decontamination with alcohol or foam disinfectant, each knob was allowed to dry for one minute and re-swabbed. Pre- and post-decontamination samples were inoculated onto blood agar plates. The agar plates were incubated for 48 hours in a large carbon dioxide enriched incubator. The number of colonies on each agar plate at the end of the incubation period was recorded and analyzed by the t-test. The type of microbes were identified by gross examination. RESULTS: The disinfectant types (colonies) for 16 paired samples were as follows: Alcohol pre-decontamination (9,6,24,8,5,4,11,4), alcohol post-decontamination (0,0,0,0,0,0,0,0); Foam pre-decontamination (4,4,6,6,14,6,42,21), foam post-decontamination (0,0,0,1,3,0,0,0). The t-test comparing the post-decontamination colonies showed insignificant difference between alcohol wipe and foam disinfectant, $t = 1.32$ at $p < 0.05$. The types of microbe identified (colonies) were: Staphylococci (48), Alpha Haemophilus (10), Streptococci (58), Bacilli (37), and other unidentified microbes (21). CONCLUSIONS: The results show that 70% alcohol wipe and foam disinfectant (60% alcohol) are both effective disinfectants for the surface of mechanical ventilators. One limitation of this study is the small sample size.

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2017547

ARDS OR NOT: DIAGNOSTIC CHANGE BY BERLIN DEFINITION.

Teramachi Ryo, Taniguchi Hiroyuki, Kondoh Yasuhiro, Kimura Tomoki, Kataoka Kensuke, Matsuda Toshiaki, Yokoyama Toshiki; Respiratory medicine and allergy, Tosei General Hospital, Seto, Japan

Background: In 2012, new criteria of Acute Respiratory Distress Syndrome (ARDS) was defined as the "Berlin definition". The previous AECC definition on 1994 classified ARDS by PaO2/FiO2 regardless of the level of positive end-expiratory pressure (PEEP). Because a minimum level of 5 cm H2O PEEP is included in the updated definition of ARDS, it is unclear how many cases meeting the AECC definition of ARDS (ARDS-A) are excluded from ARDS by using Berlin definition (ARDS-B). Among patients with ARDS-A, we evaluated them by Berlin definition and studied prognostic factors. Method: Patients with medical ARDS-A from May 2007 to March 2013 at Tosei General Hospital were studied. After the initial diagnosis of ARDS-A, all patients treated with noninvasive positive pressure ventilation (NPPV) and PaO2/FiO2 were re-evaluated with 4-5 cmH2O PEEP. According to the latter PaO2/FiO2, we divided them into two group (not-ARDS on Berlin definition (non-ARDS-B) group: PaO2/FiO2 >300 and ARDS on Berlin definition (ARDS-B) group: PaO2/FiO2 ≤300). The 90 days mortality of non-ARDS-B and mild, moderate, severe ARDS-B were compared. The prognostic value of PaO2/FiO2 with PEEP and clinical variables for survival to 90 days were evaluated based on the Cox proportional-hazards model. The study protocol was approved by Tosei General Hospital ethics committee. Results: Fifty-two patients were enrolled in this study. The mean age was 74.5 ± 12.7 years, and 61.5% of the subjects were men. Acute physiology and chronic health evaluation (APACHE) II score and PaO2/FiO2 before starting NPPV were 12.8 ± 3.8 and 168.3 ± 54.0, respectively. Twenty-two patients (42%) showed PaO2/FiO2 > 300 with 4-5 cmH2O PEEP, and were diagnosed as non-ARDS-B. Patients met criteria for mild, moderate, and severe ARDS-B were 15(29%), 13(25%), 2(4%), respectively. The 90 days mortality of non-ARDS-B, mild, moderate, severe ARDS-B were 22.7%, 26.7%, 30.8%, 0%, respectively. Multivariate analyses showed that age (hazard ratio 1.112; p=0.005) and serum albumin (hazard ratio 0.126; p=0.007) were the significant predictors of 90 days mortality, whereas PaO2/FiO2 with PEEP was not (p=0.718). Conclusions: In this study, 42% of patients who met the AECC definition were excluded from ARDS based on the Berlin definition, and there were no significant differences between non-ARDS-B group and ARDS-B group in the rates of 90-days mortality. Disclosure: The all authors had no relation with industry for previous 2 years.

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2018040

NONINVASIVE VENTILATION IN POST-OPERATIVE LUNG TRANSPLANT PATIENTS.

Andrew G. Miller, Maria Lynn-Hays, Dean VanHart, Arick Goeckerman, Neil R. MacIntyre; Duke University Medical Center, Durham, NC

Background: Currently, there is limited evidence available describing the use of noninvasive ventilation (NIV) in patients who develop respiratory failure post-operatively following lung transplantation. The purpose of this report is to describe the use of NIV in subjects with respiratory failure post extubation following lung transplantation in our institution. Methods: Following IRB approval, retrospective data were collected on patients receiving NIV post lung transplantation between January 2010 and July 2012. Subjects who used NIV at home for sleep disordered breathing or received NIV for CO2 retention outside of the ICU were excluded. Data were extracted on subject demographics, arterial blood gases, time to NIV initiation, NIV settings, need for re-intubation, days receiving NIV and hospital length of stay (LOS). Data were analyzed with the Mann-Whitney rank sum test. Results: Forty-eight subjects, aged 53±17 years, 42% female, were included. Forty-four percent (21/48) required re-intubation. Thirty-eight percent (8/21) were re-intubated within 12 hours of NIV initiation and 62% (13/21) within 24 hours. NIV was initiated within 24 hours of extubation in 79% (38/48) subjects. Forty-four percent (21/48) had a respiratory acidosis, 31% (15/48) had hypoxemic respiratory failure, and 13% (6/48) had both. Eighty-five percent of subjects (41/48) survived to hospital discharge, all deaths occurred in subjects who were re-intubated. There were no statistically significant differences in age, gender, immediate post-extubation arterial blood gas results, type of post-extubation respiratory failure, time from extubation to NIV initiation, days receiving NIV and NIV settings between subjects who required re-intubation and those who did not (Table 1). Conclusions: In our institution, NIV use was associated with a 44% re-intubation rate, 75% of re-intubations occurred within 4 days. Re-intubation carried a 33% mortality rate, whereas 100% of those not requiring re-intubation survived to hospital discharge.

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Table 1

Table 1	Not re-intubated n=27			Re-intubated n=21			
	Median	IQR	Range	Median	IQR	Range	P-Value
Time (hours) from extubation to NIV initiation	7	2-17	0-454	7	4-26	1-73	0.56
Total Hospital LOS - Days*	17	11-24	7-103	39	28-57	20-126	<0.001
Days receiving NIV	2	1-6.5	1-78	1	1-4	1-50	0.24

IQR = Interquartile range. * - Calculated from date of transplant
All values analyzed with Mann-Whitney rank sum test.

2018376

HIGH-FREQUENCY OSCILLATORY VENTILATION WITH LOWER AMPLITUDE AND LOWER MEAN AIRWAY PRESSURE.

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Background: High frequency oscillatory ventilation (HFOV) has been shown to improve oxygenation of patients with severe respiratory failure. We previously reported that the HFOV could improve oxygenation, however increase barotrauma significantly. Actually, two major recent RCT could not show benefit of HFOV on mortality for adult ARDS. To reduce the possible harmfulness of total lung recruitment, we revised the strategy of HFOV; (1) lower amplitude, (2) higher frequency, and (3) lower mean airway pressure (MAP). The objective of this study was to compare the new and traditional strategy. Methods: This study is a historical case study in a single center. The study protocol was approved by the Tosei General Hospital ethics committee. Consecutive patients with acute and severe respiratory failure (PaO2/FIO2 <200 on mechanical ventilation (MV)) treated with HFOV (R-100®, Metran, Japan) were enrolled in the study during 2008 and 2013. In the first half of study period (2008-2010) the patients were managed with traditional strategy, and in the latter half of study period (2011-2013) the patients were managed with new strategy. We investigated the 30th-day mortality, trends of PaO2/FIO2, and incidence of barotrauma. Traditional strategy included (1) amplitude: 90cmH2O, (2) frequency: 5-8Hz, and (3) MAP was started at 5 cmH2O above MAP on conventional MV (CMV), and increased aggressively until the target oxygenation was achieved. New strategy included (1) low target amplitude: about 60cmH2O, (2) higher frequency: 8-10Hz, and (3) MAP was started at 5 cmH2O above MAP on CMV, and maintained lower as possible. Results: Twenty patients were enrolled (69.9±7.9y.o., male 11; female 9, ARDS 10; interstitial pneumonia 10), and assigned to traditional strategy group (n=11) or new strategy group (n=9). There were no significant difference in APACHE 2 score and PaO2/FIO2 before starting HFOV. The trend of PaO2/FIO2 after starting HFOV was improved similarly in both groups. The 30th day mortality of the new strategy was better than the traditional strategy (22.2% vs 63.6%, p=0.0923). The Kaplan-Meyer's survival curves were shown in Figure 1. The incidence of barotrauma of new strategy was lower compared to those of the traditional strategy (11.1% vs 45.5%, p=0.1571). Conclusion: New strategy of HFOV may improve oxygenation similar to the traditional strategy, and decrease the mortality and the incidence of barotrauma. Disclosure: The all authors had no relation with industry.

Sponsored Research - None

2019571

INTERACTIONS AMONG TIDAL VOLUME, EXPIRATORY TIME AND TOTAL-PEEP IN APRV.

Kimber Haug, Robert L. Chatburn; Respiratory Institute, Cleveland Clinic, Cleveland, OH

Airway Pressure Release Ventilation (APRV) is a mode of ventilation classified as pressure controlled intermittent mandatory ventilation with an inverse I:E ratio and unhindered spontaneous breaths. It is used to treat Acute Respiratory Distress Syndrome (ARDS). One method of setting APRV relies on autoPEEP generated by short expiratory times to maintain end expiratory lung volume [Crit Care Med 2005 Mar;33(3 Suppl):S228-40]. Volumes are created by a complex interaction of alternating pressures, times, and spontaneous efforts. **OBJECTIVES:** The purpose of this study was to describe the relationships among V_T, expiratory time (T_{LOW}), and total-PEEP in APRV. **METHODS:** The IngMar ASL 5000 lung simulator and the Covidien PB 840 ventilator were used. An ARDS patient model was created with parameters from published data. *Lung model:* ideal body weight = 60 kg, R_{insp} = 11 cm H_2O/L/s, R_{exp} = 16 cm H_2O/L/s, C = 29 mL/cm H_2O. *Effort model:* V_T = 216 mL (≈ 50 % effort), frequency = 25/min, Pmax = 10 cm H_2O, increase = 27.2%, hold = 0%, release = 19.6%. *Ventilator settings:* Mode = BiLevel, P_{HIGH} = 24 cm H_2O, f = 10/min, P_{LOW} = 0 cm H_2O. T_{LOW} was varied between 0.2 and 0.8 s. Measurements were averaged over 10 breaths from simulator waveforms. Total inflation volume (V_{TI}) was calculated as end inspiratory volume minus end expiratory volume. V_{TI} included the volume change for mandatory breaths ($P_{HIGH} - P_{LOW}$) and for spontaneous breaths (change in simulated muscle pressure during P_{HIGH}). TotalPEEP was obtained from the lung pressure waveform. **RESULTS:** For the passive patient model, V_{TI} increased and totalPEEP decreased as set T_{LOW} increased in the expected way. In contrast, for the active patient model, V_{TI} and totalPEEP remained constant as set T_{LOW} increased (see Figure). Measured T_{LOW} averaged 0.71 s across all set T_{LOW} values. **CONCLUSION:** For the active patient, totalPEEP was about 12 cm H_2O and V_{TI} was 650 mL (10.8 mL/kg) regardless of set T_{LOW}. This mode is designed to cycle off mandatory breaths (P_{HIGH}, T_{HIGH}) early if a spontaneous exhalation is detected in a synchronization window at the end of T_{HIGH}. As a result, the actual T_{HIGH} and T_{LOW} values were not as expected from the ventilator settings. The implication is that use of very short values for T_{LOW} make the generation of autoPEEP unpredictable. Hence the V_{TI} and level of mechanical assist during this method of APRV are uncontrollable. DISCLOSURES: Chatburn consults for Hamilton, Invacare, and IngMar.

Sponsored Research - None

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. RESPIRATORY CARE requires prospective registration of clinical trials (www.ClinicalTrials.gov) as a condition of consideration for publication.

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).

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

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2019587

IDENTIFYING POTENTIAL VENTILATOR AUTO-TRIGGERING AMONG ORGAN PROCUREMENT ORGANIZATION REFERRALS.

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Background: Brain death testing is not performed until all brainstem reflexes are absent. The presence of spontaneous breathing is an indication of brain activity; however, the ventilator sensitivity setting can auto-trigger additional breaths without patient effort. Previous authors have reported that ventilator auto-triggering can delay brain death testing, prevent brain death testing, or confuse healthcare providers and patient families. An algorithm to identify ventilator auto-triggering could potentially benefit organ recovery coordinators. The purpose of this project was to determine the number of referrals that would benefit from the use of a ventilator auto-triggering algorithm. IRB exemption was granted for this project. Methods: This retrospective study examined organ donor referrals from one organ procurement organization during 2013 that were closed due to the withdrawal of care and the referrals that lead to the recovery of organs for transplantation. Each referral was evaluated to identify the referrals that presented absent brainstem reflexes despite a spontaneous respiratory drive. For each identified referral, the amount of time with spontaneous breathing was determined. The time from extubation to cardiac time of death (CTOD) was determined for the referrals that resulted in the withdrawal of care. Descriptive statistics were used to analyze data. Results: We identified 42 out of 553 referrals that resulted in the withdrawal of care and 21 out of 119 referrals that resulted in the recovery of organs. The minimum amount of time for having spontaneous respirations was 54 minutes and the maximum amount of time was 4,341 minutes with a range of 4,287 minutes. There were 7 referrals that progressed to CTOD under 15 minutes, 4 referrals that progressed to CTOD in 15-30 minutes, 7 referrals that progressed to CTOD in 30-60 minutes and 7 referrals that progressed to CTOD in > 60 minutes following extubation. Ventilator auto-triggering was positively identified by the hospital for two referrals. Conclusions: We estimate that a ventilator auto-triggering algorithm would have been used for 63 referrals during 2013. The utilization of a ventilator auto-triggering algorithm by organ recovery coordinators may lead to earlier brain death determination or brain death determination previously missed by healthcare providers due to the positive identification of ventilator auto-triggering. Disclosures: The authors have no relations with industry.

Sponsored Research - None

2004471

DEVELOPMENT AND IMPLEMENTATION OF A LUNG NODULE PROGRAM.

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Background: The National Comprehensive Cancer Network (NCCN) published new Lung Nodule/Cancer Screening guidelines in 2012. We successfully implemented a Regional Lung Nodule Center accepting referrals from physicians who notice nodules identified during screening. Lung cancer is the leading cause of cancer death among men and women. Only about 30% of patients in the US are detected in the early stages of the disease, contributing to its low overall survival rate. Method: The SRMC Cardiopulmonary Services Department worked with a multidisciplinary team including RCP's, Nurse Navigators, Pulmonologists, Thoracic Surgeons, Radiologists and Oncologists to develop and implement a Lung Nodule Center. The center was designed around the 'NCCN Lung Cancer Screening/Treatment Guidelines' from November 2012. Our center reviews referrals with a multidisciplinary team to develop a plan of care per national guidelines, minimize unnecessary procedures or radiation exposure, alleviate patient anxiety, shorten the time from detection to treatment and provide patients access to comprehensive services through our Sutter Cancer Centers. The goals of our center are to provide our patients appropriate testing, follow up and intervention for suspicious lung masses using the latest technology, including CT, MRI, and PET scanning, Endobronchial Ultrasound (EBUS), Electromagnetic Navigational Bronchoscopy (ENB) and video-assisted thoracic surgery. The Respiratory Therapy department provides consultation and the bronchoscopy services used in this program. Results: We have reviewed 188 patients in our Center. We have confirmed cancer for 52 patients, ruled out cancer for 53 patients and continue to follow 83 patients per NCCN guidelines. This has generated a high volume of imaging, lab and diagnostic bronchoscopy procedures which have added volume and revenue to the RT department and quality for our patients. Conclusion: Implementation of a Lung Nodule Center by Respiratory Care Practitioners as part of a multidisciplinary team has successfully met the goal of detecting and treating lung nodules and cancer at an earlier stage. This program has improved relationships between RCP's, Cancer Nurse Navigators and physicians who see value in assessment by qualified RCP staff. Having RCP's expand their role into new areas of care such as a lung cancer center increase the value RCP's bring to patient care.

Sponsored Research - None

2016131

A COMPARISON OF ARTERIAL SAMPLER FILLING TIMES USING 25 AND 26 GAUGE NEEDLES.

Jillian Quintana, Timofey Petrenko, AnhThu Thai, Ashlee Causey, Nataliya Maytuk, Herbert Douce; The Ohio State University, Columbus, OH

BACKGROUND: ABGs are used to monitor cardiopulmonary status and make patient care decisions. Past studies determined significant differences in filling times of arterial and venous samples for 21 and 23ga needles, allowing clinicians to verify arterial sampling and to avoid mistaken venous sampling and errors in patient care. Another study found that 25ga needles caused less pain and smaller hematomas. The purposes of this study are to determine arterial sampler filling times using 25 and 26ga needles and to determine if there are significant differences between arterial filling times and venous volumes. METHODS: In a laboratory using traditional arterial samplers with 25ga x 1 in and 26ga x 0.9 in needles, we measured 1 mL filling times at 93 mm Hg, and we measured the blood volumes obtained at 120 seconds filling time at 10 mm Hg. We calculated an independent t-test, ANOVA and Tukey's HSD post-hoc comparison. RESULTS: At a MAP of 93 mm Hg, samplers with 26ga needles filled (64.3 s) significantly faster than with 25ga needles (70.5 s) ($P < 0.001$); there were significant differences among sampler brands with 26ga needles ($P=0.006$) and differences approached significance for the 25ga needles ($P = 0.051$). At a venous pressure of 10 mm Hg, there was no difference between sampler blood volumes for 25ga (0.21 mL) and 26ga needles (0.22 mL) ($P = 0.407$). There were significant differences among sampler brands for 26ga needles ($P < 0.001$) and 25ga needles ($P < 0.001$) for volumes collected at venous pressure. CONCLUSIONS: Using 25 and 26ga needles, clinicians can distinguish between arterial and venous blood samples based on sampler filling times and blood volumes. Although 25 and 26ga needles may be less harmful than 21 and 23ga, their sampler filling times may be too long for clinical applications.

Sponsored Research - None

	N	Pro-Vent®	PICO	Quik A.B.G.™	Pulset™	P
26g x 0.9 in @ 93 mm Hg	40	61.59* ^ (3.25)	65.49* (2.89)	64.00 (3.15)	66.12^ (2.04)	0.006
25ga x 1 in @ 93 mm Hg	40	70.40 (4.03)	70.90 (2.78)	68.52# (1.52)	72.13# (2.30)	0.051
26g @ x 0.9 in 10 mm Hg	40	0.18% (0.026)	0.31% & ∞ (0.046)	0.19& (0.021)	0.16∞ (0.021)	< 0.001
25ga x 1 in @ 10 mm Hg	40	0.16$ (0.030)	0.31$ @ ! (0.016)	0.18@ (0.035)	0.18! (0.036)	< 0.001

(* ^ $ & <@> ! % ∞ $P < 0.05$; # $P = 0.051$)

2021229

MEASURED FRACTIONAL EXHALED NITRIC OXIDE LEVELS IN ELEMENTARY SCHOOL CHILDREN WHO HAVE BEEN DIAGNOSED WITH ASTHMA.

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Background: Fractional exhaled Nitric Oxide (FeNO), is a noninvasive biomarker used to assist in the diagnosis of asthma and to monitor control of airway inflammation1. According to the American Thoracic Society, rising FeNO readings in Asthmatics indicates poorly controlled asthma2. Approximately 34% of children with asthma are not well controlled based on FeNO measurements3. It has been shown that elevated FeNO levels have a 88% positive predictive value of loss of asthma control. Methods: A portable FeNO measurement device, NIOX MINO (Aerocrine Inc, Solna, Sweden) was used in the study. The FeNO readings were incorporated in an asthma education and intervention program in several elementary schools of a local school district. The participants consisted of 68 children, ages five to ten years, who were previously diagnosed with asthma. Results: FeNO measurements identified 63% of participants were well controlled (FeNO <20), 13% under intermediate control (FeNO 20-35), and 24% were uncontrolled (FeNO >35). Local healthcare providers discussed the results with the parents and where appropriate suggested follow up with the child's healthcare provider of record. Conclusion: Our results indicated that 37% (25) of our subjects had sub-optimally controlled asthma as measured by FeNO, which may place them at increased risk for exacerbations, hospitalizations, and, in severe cases, mortality. Although further research is needed, our study supports previous studies that suggest high levels of FeNO continue to be found in previously diagnosed, and thus hopefully controlled, patients with asthma. References 1. Zitt M. Clinical Applications of Exhaled Nitric Oxide for the Diagnosis and Management of Asthma: A Consensus Report. Allergy and Immunolog. 2005;27(8):1238-1250. 2. Dweik RA, Boggs SC, Erzurum SC, Irvin CG, Leigh MW, Lundberg AO, et al. An Official ATS Clinical Practice Guideline: Interpretation of Exhaled Nitric Oxide Levels (FeNO) for Clinical Applications. Am J Respir Crit Care Med. 2011;184:602-615. 3. Green RJ, Klein M, Becker P, Halkas A, Lewis H, Kitchin O, et al. Disagreement Among Common Measures of Asthma Control in Children. Chest, 2013;143(1);117-122. 4. Jones SL, Kittelson J, Cowan JO, et al . The predictive value of exhaled nitric oxide measurements in assessing changes in asthma control. Am J Respir Crit Care Med. 2001;164(5):738-743.

Sponsored Research - None

2021944

HOME SPIROMETRY MONITORING IN PEDIATRIC LUNG TRANSPLANT PATIENTS: DEVICES SELECTION, PROCESS, AND COST CONSIDERATIONS AMONGST THE PEDIATRIC LUNG TRANSPLANT CENTERS IN THE UNITED STATES.

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Background: Spirometry is a basic pulmonary function test widely used for the detection of airflow restrictions. As healthcare evolves, the need for home care and telemedicine services, especially in regards to home spirometry, are higher than ever. Home spirometry is commonly used with pediatric lung transplant patients to monitor for early signs of graft dysfunction. Studies have shown that using daily home spirometry, specifically monitoring forced expiratory volume in 1 second (FEV1), can lead to early detection of infection and rejection in pediatric lung transplant patients. As these patients transition to adult centers, knowing the criteria for selection and trending monitored values with home spirometry, can overtime provide invaluable data to the referring center. Method: A survey on home spirometry was developed and conducted via telephone and/or email with the 9 pediatric lung transplant centers in the United States. Results: There was 100% (n=9) compliance from the pediatric lung transplant centers in completing the survey. Survey results revealed that 77% (n=7) of the centers require home spirometry monitoring. 100% (n=7) of the centers that require home spirometry monitor FEV1 with 43% (n=3) also monitoring forced vital capacity (FVC). 86% (n=6) of the centers require the patient to submit their daily home spirometry values on a weekly basis.57% (n=4) of the centers follow up with a more involved assessment and additional pulmonary function testing if the patient's home FEV1 consistently drops below 10% of baseline, while 29% (n=2) do a more involved assessment if the patient's home FEV1 consistently drops below 20% of baseline. The centers that require home spirometry indicated they chose their home units based on the following: ease of use, cost, and portability. Additionally, 29% (n=2) of the centers indicated that the ability to provide a flow-volume loop influenced their device choice. Conclusion: Based on survey results, home spirometry is a viable trending tool that is widely used to monitor pediatric lung transplant patients at home. In addition to being a worth-while investment for the lung transplant centers, the spirometry measurements collected can provide chronological data that can be utilized by the adult lung transplant centers upon transfer.

Sponsored Research - None

2022322

BIOLOGICAL QUALITY CONTROL VARIABILITY IN CARDIOPULMONARY EXERCISE TESTING (CPET).

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Background: Biological quality control (BioQC) subject testing is recommended as a component of a Pulmonary Function (PF) Laboratory's quality assurance program. There are published data related to general PF testing modules, however, little has been presented in the literature related to expected standard deviation (SD) and coefficient of variation (CV) in CPET BioQC variables. Methodology: Two normal biological subjects are included in the reported data. Both subjects performed testing at rest and during steady state exercise on a cycle ergometer. Metabolic measurements were collected while the subjects breathed through a mouthpiece with nose clips. A clean pneumotach was used for each test performed. Environmental factors were measured and entered into the testing system followed by gas analyzer and flow calibration according to manufactures specifications. Collected breath-by-breath data were averaged in 20-second intervals at each workload. The following "key variables" were analyzed to characterize mean, SD, and CV: VO2, VCO2, and VE. Result: Table Discussion: It is recommended and expected that laboratories perform BioQC testing on a regular basis; however, there are no guidelines for reproducibility of testing among such normal test subjects. Such data are critical for quality assurance. For example, at what degree of variation from normal should one suspect equipment malfunction or calibration error? In our laboratory, we track the mean, SD, and CV for BioQC test subjects in routine testing but also CPET. Two BioQC subjects are identified. BioQC 1 has more extensive data and may better represent true expected values. Conclusion: Both BioQC datasets provide values which may be helpful to laboratories as they establish their CPET BioQC programs.
Sponsored Research - None

BIOQC 1 n=66	Rest			100 Watts		
	VO2	VCO2	VE	VO2	VCO2	VE
Mean (L/min)	0.270	0.217	8.715	1.456	1.468	44.090
SD (L/min)	0.029	0.027	0.861	0.045	0.063	2.141
CV	11%	12%	10%	3%	4%	5%
BIOQC 2 n=10	Rest			75 Watts		
	VO2	VCO2	VE	VO2	VCO2	VE
Mean (L/min)	0.239	0.189	8.250	1.115	1.152	34.020
SD (L/min)	0.048	0.035	1.201	0.042	0.080	4.214
CV	20%	19%	15%	4%	7%	12%

2023154

EVALUATION OF COMMON ICU PARAMETERS TO PREDICT OUTCOME OF INFECTED CIRRHOTIC PATIENTS: A PILOT STUDY.

Cassaundra Song[2], Abdullah Alismail[3], Haneul Lee[4], Michael Terry[2], Danial Yanez[2], Jenaro Rodriquez[2], Jason Pakzad[2], Takkin Lo[1], David Bland[1]; [1]Pulmonary and Critical Care, Loma Linda University Medical Center, Loma Linda, CA; [2]Respiratory Care, Loma Linda University Medical Center, Loma Linda, CA; [3]Cardiopulmonary Sciences, Loma Linda University, Loma Linda, CA; [4]School of Allied Health, Loma Linda Uniersity, Loma Linda, CA

Background Patients with cirrhosis and end-stage liver disease are immunocompromised and have high mortality rates associated with infectious etiologies. There is no current method of risk stratification to assess these patients. Commonly utilized hemodynamic and laboratory parameters which can be associated with poorer outcome and higher mortality rates might serve as sensitive predictors to associate patients with high Model for End-stage Liver Disease (MELD) score and Systemic Inflammatory Response Syndrome (SIRS) with a higher mortality rate. The purpose of this study is to find parameters that can accurately predict outcomes associated with an infection and high MELD score. Methods A retrospective chart review was performed to examine all cirrhotic patients with MELD scores above 30 who also met SIRS criteria when admitted to the Intensive Care Unit (ICU). Demographic data included age, sex, date of admission and discharge from ICU and cause of mortality. Hemodynamic and laboratory parameters were taken from the date of admission and included temperature, glucose level, white blood cell count, heart rate and respiratory rate. Results A total of 1,422 patient charts were reviewed. Thirty-five subjects were evaluable. There were 17 females and 18 males with ages ranging from 22 to 83 years. All subjects had SIRS, and MELD scores ranging from 31 to 51. There were 20 deaths. Five had temperatures below 96.8°F, 1 had a temperature above 100.9°F. Seven had respiratory distress with a respiratory rate above 20 breaths/minute. Ten had a heart rate above 90 beats/minute. Thirteen had a white blood cell count above 12,000 cells /mm3. Eleven had an altered level of consciousness. Eleven had glucose levels less than 120 mg/dL. The parameters tested against mortality were: respiratory rate (p=0.612), heart rate (p=0.782), white blood cell count (p=0.272), temperature (p=0.331), glucose (p=0.753), altered level of consciousness (p=0.925). Conclusions In this preliminary report, there were no statistically significant correlations between laboratory/hemodynamic parameters, including respiratory rate values, and mortality in cirrhotic patients with SIRS and a MELD score greater than 30. A more comprehensive study is in progress to explore associations with laboratory/hemodynamic parameters and mortality in this population.
Sponsored Research - None

SPIROMETRIC CHANGES BETWEEN SMOKER AND NON-SMOKER PATIENTS UNDERGOING HYPERBARIC OXYGEN THERAPY.

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Background: Long-term continuous high concentration oxygen use has been associated with pulmonary damages from free radical production. Hyperbaric oxygen therapy (HBOT) consists of a patient breathing 100% oxygen within a chamber that raises the pressure to above sea level (>1.0 ATA). Some common clinical indications for HBOT are decompression sickness, carbon monoxide poisoning, diabetic ulcers and refractory osteomyelitis. Multiple conflicting studies of spirometric changes in patients undergoing (HBOT) have been previously reported. The purpose of this study is to evaluate the long-term changes in airway mechanics of HBOT patients. Methods: Spirometry was performed on former smokers and lifelong non-smokers before HBOT and within one year after (post), with a minimum of 20 HBOT. Particular attention was directed to determine whether former smokers resumed or that non-smokers began smoking after their HBOT. Each patient who consented to the study was tested before their first HBOT (pre-treatment) and 12-months after completion of their therapy (post-treatment). Changes in various respiratory parameters (FEV1/FVC, FEF25-75%, FVC)were analyzed. Results: A total of 26 patients were evaluated in the study with the average age of 65 years. There were 14 non-smokers and 12 former smokers. Post-HBOT spirometric measurements showed a significant difference in the degradation of flow dependent variables in patients who were smokers, FEV1/FVC from 76 to 71% (p< 0.002), FEF25-75% from 2.54 to 1.97L (p< 0.001) and FVC 3.78 to 3.71L (p=0.608). For non-smoker HBOT patients FEV1/FVC from 78 to 76% (p=0.365), FEF 25-75 from 2.54 to 2.02L (p=0.079) and FVC from 3.60 to 3.30L (p<0.010). Conclusion: There is a statistical difference in FEV1/FVC and FEF25-75% values in HBOT patients who were smokers. There was a significant statistical difference of FVC values for non-smoker patients. A more comprehensive study including test variance is in progress to determine the actual significance of change in pulmonary function test values for HBOT patients.
Sponsored Research - None

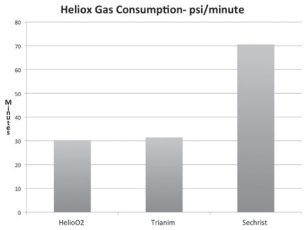
2008023

A COMPARISON OF FIO2 AND GAS CONSUMPTION OF THREE BLENDERS DURING HELIOX ADMINISTRATION.

Cynthia C. White, Carrie Haessig, James Johnson; Respiratory Care Division, Cincinnati Childrens Medical Center, Cincinnati, OH

Introduction: Little or no evidence exists to inform clinician which blenders are acceptable to use during Heliox administration. In most cases, either a flow meter is hooked directly to a tank with a preset Heliox mixture, or use a blender designed for use with oxygen and air is used. To the best of our knowledge, there is only one blender that is marketed for use with Heliox. We designed a series of studies to determine if there would be a difference in FIO2 accuracy or gas consumption when administering Heliox therapy with a Heliox compensated flow meter via the HelioO2 (Precision Medical, Northhampton, PA) blender compared to a Sechrist 3500 HL air oxygen mixer, and a Trianim High/Low flow air oxygen blender. Methods: A Heliox compensated flow meter was attached to each of the 3 blenders for each testing sequence. Flow was set at 15LPM on each flow meter, and each blender was set at 30% FIO2. A full E cylinder of 80:20 Heliox was used for each experiment. Prior to the test, the cylinder pressure was recorded from each pressure gauge. Each test was timed and ended when the tank was empty and flow dropped on the Heliox flow meter, or a blender alarm occured. FIO2 was continuously measured with a MaxO2 plus analyzer (Maxtec, Salt Lake City, Utah). Continuous Flow Output from the blender was measured and downloaded via a pneumotachometer (Hans Rudolph, Shawnee, KS). Additional FIO2 measurements were obtained at each blender at 5LPM and 10LPM to compare accuracy at lower flows. Results: Cylinder pressures varied between 1800 and 2000 psi, therefore psi per minute was calculated to compare gas consumption rates. See graph for comparison. FIO2 ranged from 24.9% to 30.5%. All FIO2 measurements were within ISO standards +/- 2% with the exception of the Sechrist mixer that only offers the a bleed option and ranged from 24.9-25.2% FIO2. Discussion: In order to conserve gas during Heliox tank use, it is helpful to use a blender that can be configured without a bleed. This capability appears to result in longer tank duration, quieter gas administration, and more accurate FIO2 delivery. Both the HelioO2 blender and the Trianim blender had similar delivered flow rates, gas consumption, and FIO2 delivery with Heliox when configured without a bleed in the system. We suggest the HelioO2 blender be marketed with a Heliox compensated flow meter for improved ease of use by bedside clinicians.

Sponsored Research - None



2007758

THE EFFECTS OF EXTUBATION ON RESPIRATORY SUPPORT IN NEONATES ON NAVA.

Bianca LoVerde[2], Howard M. Stein[1]; [1]Neonatology, Promedica Toledo Children's Hospital, Toledo, OH; [2]Pediatrics, University of Toledo Medical Center, Toledo, OH

Background: Neurally adjusted ventilatory assist (NAVA) is mode of mechanical ventilation that delivers airway pressure proportional to the electrical activity of the diaphragm (Edi) in synchrony to the patient's respiratory needs. Previous studies have shown that premature neonates control the delivered pressure through neural feedback despite changes in NAVA level. Systematically increasing NAVA level unloads the work of breathing and increases peak inspiratory pressure (PIP) while maintaining a constant Edi until a breakpoint (BrP) is reached. Further increases in NAVA level result in a plateau in PIP (the work of breathing is unloaded) and a decrease in respiratory drive (Edi). This study was performed to establish the relationship of the BrP, PIP and Edi on premature neonates ventilated on NAVA and then, post extubation, on NIV NAVA. Methods: IRB approval and parental consent were obtained. A NAVA titration study was performed immediately prior to extubation. The NAVA level was increased by 0.5 cmH2O/mcV every 3 minutes from 0.1 to 3.5 cmH2O/mcV. PIP, Edi, mean blood pressure (MBP), heart rate (HR), respiratory rate (RR), oxygen saturation (SpO2) and FIO2 were recorded. The neonate was then extubated to NIV NAVA and the titration study repeated. Statistics: Each variable was averaged for every NAVA level and the BrP was determined by visual inspection of the inflection point for when PIP no longer increased with increasing NAVA level. The data were combined by averaging each variable at the BrP and for each change in NAVA level above and below the BrP. Statistics: Paired t-test and 2 factor ANOVA were done to look for differences in BrP, PIP, Edi, HR, MBP, SpO2, FiO2 and RR. $p < 0.05$ was considered significant. Results: Fifteen infants were studied. PIP increased until the BrP was reached and then remained unchanged during both the intubated and extubated phase. On NIV NAVA, the BrP increased by 33% (figure 1), PIP plateaued 20% higher above the BrP (Figure 1) and Edi was 12% higher below the BrP compared to on NAVA. Edi decrease by 50% on NAVA and by 24% on NIV NAVA between the BrP and the highest NAVA level above the BrP. All other variables remained unchanged. Conclusion: Neonates demonstrated an increase in BrP, Edi and PIP when extubated from NAVA to NIV NAVA. This suggests that neonates require higher support non-invasively on NIV NAVA compared to invasively on NAVA.

Sponsored Research - None

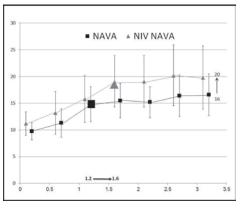


Figure 1

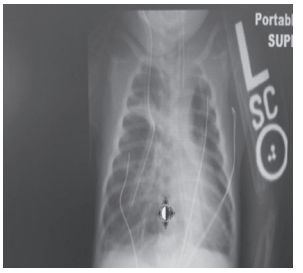
1991784

NEBULIZED 3% HYPERTONIC SALINE FOR TREATMENT OF POST ECMO ATELECTASIS AND MUCOUS PLUGGING-A CASE REPORT.

James Deckman; Respiratory Care, All Children's Hospital, Parrish, FL

Introduction: Meconium aspiration is a complication prior to birth which results in direct injury to the lungs causing an inflammatory response and subsequent pulmonary hypertension. In severe cases patients may require ECMO intervention which can cause even further lung injury resulting from atelectasis during treatment. Effectively re-expanding patient's lungs post- ECMO can be challenging when direct lung injury is involved. We hypothesized that treating patients with nebulized 3% hypertonic saline will result in no significant change for neonates who suffer from atelectasis and mucous plugging post-ECMO. Case Summary: This patient was born 41 weeks and suffered from meconium aspiration syndrome. The patient was admitted to NICU, placed on oscillatory ventilation for 2 days, and transferred to CVICU for ECMO initiation due to PO2 < 40 mm Hg onFiO2 1.0. The patient was successfully decannulated two weeks later. One week after decannulation the patient was transferred back to NICU for management. The ventilator settings were PRVC mode with the following settings: 45 breaths/min, VT 38mL, Peep 8 cm H2O, PIP measured 22-26 cm H20, 20 ppm nitric oxide, and .80-1.0% FiO2. Subsequently the patient's X-ray findings deteriorated, with complete left lung collapse despite receiving nebulized Pulmozyme BID and CPT Q2 hours. The patient was trialed on BID nebulized 3% hypertonic saline for 48 hours. After 24 hours the patient's chest x-ray revealed increasing aeration of the left lung and within 48 hours there was complete re-expansion of the left lobe. The patients FiO2 requirements decreased to less than .60 and nitric oxide was weaned off. Discussion: Infants who suffer from atelectasis and mucous plugging can be challenging to effectively ventilate. Current research suggests that nebulized 3% hypertonic saline can be an effective treatment in infants who suffer from viral bronchiolitis. The use of 3% hypertonic saline in neonates who suffer from symptoms similar to viral bronchiolitis has not been directly studied; however this case suggests it may be beneficial. It is suggested that further research in this population be done. Disclosures: None

Sponsored Research - None



48 hours post

2003296

STAFF SURVEY FOLLOWING THE IMPLEMENTATION OF A BETA AGONIST/AIRWAY CLEARANCE PATHWAY IN A PEDIATRIC INTENSIVE CARE UNIT

Gary R. Lowe, Randy Willis; Respiratory Care, Arkansas Children's Hospital, Little Rock, AR

Introduction: Clinical evidence indicates therapist driven protocols (TDP) can result in effective and efficient patient care. TDP have been utilized at our institution in general care areas for 25 years; however, they had not been implemented in the intensive care units. The Beta Agonist/Airway Clearance Pathway was introduced in the Pediatric Intensive Care Unit (PICU) for patients requiring inhaled medication and/or airway clearance modalities to provide better appropriateness and consistency of care. A survey of key personnel regarding their opinions about the BA/ACP was conducted after implementation. **Methods:** This study was not deemed human subject testing by the IRB. Implementation of the BA/ACP occurred in August 2013. Two survey tools were developed. One was emailed to Respiratory Therapists (RT) consisting of 23 questions. The other was emailed to Licensed Independent Practitioners (LIP) consisting of 17 questions. The initial notification occurred 6 weeks post BA/ACP implementation. The surveys differed for RT and LIP, but contained 12 identical questions. **Results:** RT response rate was 37% (17/46), 59% (10/17) were male, ages ranged from 25-40 years (47%, 8/17) and > 40 years (53%, 9/17), and a majority (71%, 12/17) had < 20 years of experience. LIP response rate was 28% (7/25), 71% (5/7) were female, ages ranged from 25-40 years (86%, 6/7) and > 40 years (14%, 1/7), and all (100%, 7/7) had < 10 years of experience. RT and LIP responders agreed that patient reassessment at 24 hours was appropriate (RT-88%, [15/17]; LIP-71% [5/7]); the assessment score resulted in adequately treating the patient (RT-77%, [13/17]; LIP-71% [5/7]); the BA/ACP provided consistency of care based on an objective scoring system (RT-77% [13/17]; LIP-71% [5/7]); and overall was an efficient system (RT-71% [12/17]; LIP-71% [5/7]). RT and LIP responders agreed the implementation of the BA/ACP elevated the status of RT (RT-71% [12/17]; LIP-71% [5/7]; and that RT had increased their value in PICU (RT-76% [13/17]; LIP- 71% [5/7]. **Conclusion:** The BA/ACP was implemented to provide more frequent patient assessment and improve consistency of ordered modalities based on severity of symptoms. This project illustrates the following points: most responders indicated that patients were adequately treated using the BA/ACP; it provided greater consistency of care; and was overall an efficient system. Also, RT increased their status and value as members of the interdisciplinary team.

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2003635

REDUCING NITRIC OXIDE USE IN THE NICU BY UTILIZING RESPIRATORY DRIVEN PROTOCOLS.

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Background: Inhaled nitric oxide (iNO) is widely and variably used in neonatal intensive care units despite FDA approval solely for the treatment of term newborns with reversible persistent pulmonary hypertension. Such variability in usage is associated with significant costs with little proven benefit. The goal of this project was to decrease variability in iNO usage by implementation of an evidence- and consensus-based respiratory therapy driven protocol. Methods: A multi-disciplinary QI team developed an evidence-based and NICU specific RT-driven protocol for the institution, maintenance, and weaning of iNO in our level 3c, 99 bed NICU. Once implemented, we tracked compliance with the protocol, hours of iNO use per patient, rates of extracorporeal membrane oxygenation (ECMO) therapy, and mortality rates. This data was then plotted in control charts to determine statistical improvements. Results: The iNO weaning protocol was initiated in January, 2013. In the year prior to initiation, the average patient required 198.03 hours of iNO therapy. After implementation, the average usage has decreased to 148.9 hours per patient. There has been no change in mortality or ECMO usage since implementation (23% mortality and 6 ECMO patients in 2012 vs. 22% mortality with 2 ECMO patients to date in 2013). Compliance with the protocol in 2012 was 6%. The compliance with the protocol in 2013 increased to 51%. Costs per patient were $12,565.25 for 2012, and for 2013 they were $9,645.98. Conclusion: Implementation of an RT-driven iNO protocol was associated with a significant decrease in hours of iNO use per patient, with a resultant substantial decrease in cost. It is reassuring that there was no change in the mortality rate or ECMO usage.
Disclosures: None
Sponsored Research - None

2007117

IMPLEMENTATION OF A BETA-AGONIST/AIRWAY CLEARANCE PATHWAY IN A PEDIATRIC INTENSIVE CARE UNIT

Randy Willis, Gary R. Lowe; Respiratory Care, Arkansas Children's Hospital, Little Rock, AR

Introduction: Therapist driven protocols (TDP) have been utilized in acute care hospitals for many years. Our department implemented TDP in the general care units 25 years ago. Recently there has been support from medical staff to initiate TDP in the Pediatric Intensive Care Unit (PICU). **Methods:** This study was not deemed human subject testing by the IRB. To determine if the introduction of the PICU Beta Agonist/Airway Clearance Pathway (BA/ACP) administered by Respiratory Therapists (RTs) impacted patient interventions, historical data of physician directed respiratory care orders were compared to TDP. Data were collected over a 3 month period after implementation of the BA/ACP and compared to the same 3 month period the previous year. Specific data elements included interventions associated with the BA/ACP (aerosol, MDI, CPT, IPV, and Incentive Spirometry), the daily census and the average daily acuity of the PICU population, and the individual number of respiratory interventions. The BA/ACP was comprised of a detailed clinical assessment resulting in a score. This score was used to initiate therapy frequency. A higher score resulted in more frequent interventions. The patient was re-evaluated every 24 hours. Based on the re-evaluation score obtained, the patient's frequency of therapy increased, decreased, or stayed the same based on objective data obtained during the clinical assessment. This process continued for the duration of the patient's PICU stay or therapy was discontinued. **Results:** The total number of interventions increased 25% in 10/13 compared to 10/12 (1742/1384), 54% in 11/13 compared to 11/12 (2174/1411), and decreased 1% in 12/13 compared to 12/12 (2832/2853). Interventions related to the daily average acuity showed increases of 18% in 10/13 and 40% in 11/13, and a decrease of 2% in 12/13 compared to a year earlier. Interventions related to patient days showed increases of 25% in 10/13, 26% in 11/13, and 10% in 12/13 compared to a year earlier. **Conclusion**: With implementation of the BA/ACP in PICU, there were more interventions in 2 of the 3 months studied. When compared to average acuity, a similar trend was noted. When compared to patient days, more interventions were noted in all 3 months. Benefits of the BA/ACP were standardized patient assessments at timely intervals and consistent administration of interventions based on a scoring tool. A more detailed study is planned to determine if this implementation impacted patient outcomes.
Sponsored Research - None

2008034

A RETROSPECTIVE EVALUATION OF PEDIATRIC PRESSURE ULCERS CAUSED BY DEVICES USED FOR NON-INVASIVE VENTILATION.

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Introduction: There continues to be interest in utilization of non-invasive ventilation (NIV) to prevent intubation and provide ventilatory support to pediatric patients. Previous QI data at our institution revealed that more than 50% of Hospital Acquired Pressure Ulcers (HAPU) were caused by devices. The most problematic devices were interfaces used during NIV. The majority of the PU's caused by NIV were stage II. The most common location for them to occur was the nasal bridge. In the summer of 2013, we implemented prevention standards and training for PU's to standardize care and raise awareness to all members of the multi-disciplinary team. New pediatric interfaces were also introduced designed to fit smaller patients and offload pressure from the nasal bridge. The objective of this study is to evaluate the impact of these interventions on the occurance of PU's from NIV, age, PU stage, and PU location. Methods: A retrospective chart review of all patients who developed a PU from an NIV interface was conducted during the time frame of July 2012-April 2014. Age, gender, PU stage, and location were recorded in an excel spreadsheet and reported as median and range. A run chart was also maintained to evaluate the impact of interventions on the number of PU's over time. Data from the past eight months was analyzed to look at the impact of new interventions since August 2013. Results: See run chart with interventions noted. 26 patients were included in this data set with 34 unique PU's. Median age is 6y/o with a range of 6wks to 29y/o. 41% of the pt's in this data set are 1y/o or younger. PU's were noted in six different locations on the face and neck. 62% occurred on the nasal bridge. 50% of the PU's were stage II. In the data since August 2013, 1 or 10% of the pt's were under the age of 1 yr., 30% were Stage II's, and 40% occurred on the nasal bridge. Discussion: The number of PU's from NIV interfaces, stage, occurance of a PU on the nasal bridge, and occurance of PU's on patients under the age of 1 yr have all trended downward over the past eight months. This followed the implementation of standardized prevention standards and new interfaces available designed to fit smaller patients and offload pressure from the nasal bridge.
Sponsored Research - None

2013026

HIGH FREQUENCY JET VENTILATION VS MID-FREQUENCY VENTILATION, DOES MINUTE VENTILATION AND CO2 WASHOUT MATTER?

Kevin Crezee, Jeffrey Wright; Respiratory Care, Primary Childrens Hospital, Salt Lake City, UT

Introduction: Advances in ventilation technology have significantly improved and some have suggested Mid-Frequency Ventilation (MFV) may be as effective and lung protective as High Frequency Ventilation (HFV). This study compares High Frequency Jet Ventilation (HFJV) to MFV in determining these mechanisms to ventilate by CO2 washout, Tidal Volume (Vti) and Minute Ventilation (MV). **Method:** The HFJV (Bunnell Salt Lake City, Utah) was set up with 3.5 LifePort (LP) adapter. A Drager Evita XL (XL) (Telford, PA) and F&P RT 235 Infant Circuit (Auckland, NZ) were attached to the LP. Both ventilators passed pre-use checks. The LP was connected to both a 3.0 and 3.5 ETT. The ETT connected to XL ETCO2 monitor. ETCO2 attached to a gas mixing chamber, CO2 bleed in port and IMT Infant Smart Lung (Switzerland). A CO2 delivery system maintained baseline CO2 at 63mmHg at 1Lpm. CO2 flow was verified by a TSI 4100 (Shoreview, MN) device. MV and Vti were measured with a TSI Certifier FA Plus post ETT. HFJV tested at PIP's of 20 and 30cmH2O with On-Time (Ot) of both 0.02 and 0.03 sec. HFJV rate 420 bpm and 5cmH2O PEEP by XL. MFV XL settings: rate 150bpm, Ti 0.1sec., PEEP 5cmH2O, and PIP of 20 and 30cmH2O. Test lung set at C 1, 2, 3 and 5 mL/Mbar and R of 5. **Results:** Overall comparison of all PIP's, Ot's, and compliances the HFJV provided most CO2 washout in 3.5 ETT group. HFJV had an average CO2 of 29mmHg, MV of 2.36L, and Vti of 5.6mL; compared to CV CO2 of 32mmHg, MV of 2.18L, and Vti of 14.4mL. The 3.0 ETT group CV CO2 of 32mmHg, MV of 1.73L and Vti of 11.5mL; compared to HFJV CO2 of 39mmHg, MV of 1.43L, and Vti of 3.4mL. The .03 Ot group had lowest average CO2 of 31mmHg with CV at 34mmHg and 0.02 Ot at 38mmHg. The 3.5 ETT group average Vti for HFJV was 5.6mL and CV was 14.4mL (256% higher). 3.0 ETT group average Vti for HFJV was 3.4mL and CV 11.5mL (335% higher). **Conclusion:** MV and CO2 washout are critical to ventilation and the manner in which these occur is dependent on chosen ventilation type. The data demonstrates two key hallmarks of HFV: CO2 removal at lower Vti; and attenuation of Vti with smaller ETT on HFJV vs. CV. CV is able to remove CO2, but the cost is significantly higher volumes. Increasing Ot is very effective at CO2 removal in the test lung. The 0.03 Ot was most common to have the lowest CO2 value in lower compliance states and the highest in MV across all groups.
Sponsored Research - None

2013885

THE DRISCOLL-RAINBOW MANEUVER: A NEW AIRWAY CLEARANCE TECHNIQUE IN MECHANICALLY VENTILATED PATIENTS WITH UNILATERAL DISEASE.

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Introduction: The presence of an endotracheal tube (ETT) in mechanically-ventilated children interferes with the normal mucociliary elevator and predisposes to atelectasis. In some cases, commonly employed respiratory techniques might not be sufficient to reopen the atelectatic lung. We present a new technique to assist in the airway clearance and re-expansion of atelectasis in mechanically ventilated children with refractory unilateral disease: the Driscoll-Rainbow maneuver (DRM). Case Summary: A 5 mo girl with spinal muscular atrophy type 1 was admitted to the PICU with respiratory failure. On day 2, she developed dense right lung atelectasis. Repeated applications of vigorous percussion, positioning, recruitment maneuvers, intrapulmonary percussive ventilation, and closed-suction did not yield any benefit. On day 4, the DRM was performed and results are shown (Figure). In brief, the DRM is a series of assisted manual ventilation maneuvers using a flow-inflating bag fitted with a manometer. The cycle begins with manual breaths that mimic the ventilator settings. Inspiratory pressure is then increased ~5 cmH2O from baseline while the palm of the operator's hand is used to restrict the rib cage on the unaffected side (left, in this case) to decrease hemi-chest wall compliance so ventilation is directed to the affected side. At the end of each inspiration, the operator's hand shifts position and the fingers are used to compress the affected side, assisting exhalation in a continued and forceful vibratory fashion. These alternated restricted inspirations and assisted exhalations are repeated until mucus can be seen in the ETT at the end of a forceful exhalation. The bag is then disconnected (zero PEEP) and in-line suction is performed while in the de-recruited state. The bag is re-connected, a constant distending pressure of 40-45 cm H2O is applied for re-recruitment, and a new cycle is initiated. Cycles are repeated until there is good air entry and chest wall motion on the affected side, and a clear suction pass at the end of a cycle. This patient required 5 cycles and results were typical. Discussion: We describe a new technique for the re-expansion of large unilateral atelectasis refractory to more standard approaches. When the DRM is used in older children and adults it requires dedicated operators for inspiration, restriction, and assisted exhalation. Disclosures: ATR has been a scientific advisory board member and speaker for Vapotherm, Inc.

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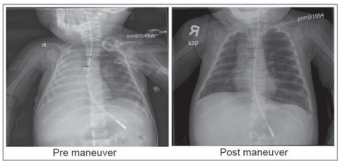

2015623

HIGH FLOW NASAL CANNULA THERAPY AS AN ALTERNATIVE TO NASAL CONTINUOUS POSITIVE AIRWAY PRESSURE IN PRETERM INFANTS: A POOLED ANALYSIS.

Richard H. Speicher[1,2], Steven L. Shein[1,2], Alexandre T. Rotta[1,2]; [1]Pediatric Critical Care, Rainbow Babies & Children's Hospital, Cleveland, OH; [2]Pediatrics, Case Western Reserve University School of Medicine, Cleveland, OH

Background: Heated, humidified high flow nasal cannula (HFNC) therapy has increasingly gained acceptance as a treatment modality in neonatal intensive care units worldwide. HFNC has been shown safe and convenient to use in children, comparing favorably to nasal continuous positive airway pressure (CPAP) with respect to the occurrence of nasal trauma. Recent prospective clinical trials in premature infants demonstrate non-inferiority of HFNC compared to CPAP for clinically relevant endpoints such as intubation. A pooled analysis of these studies may show superiority of one modality, or suggest variables associated with treatment success, such as the use of particular HFNC devices. We hypothesized that HFNC would not be inferior to nasal CPAP and that type of device utilized would not affect outcome in premature infants. Method: We performed Medline and Google Scholar searches to identify contemporary prospective randomized controlled trials of HFNC therapy in premature infants. Five clinical trials met inclusion criteria and had sufficient detail to permit a pooled analysis: Miller 2010; Collins 2013; Manley 2013; Yoder 2013; Lavizzari 2013. The outcome variable was the predetermined primary outcome (treatment failure, such as need for intubation) specifically set for each individual trial. Results: Of the five included trials, four compared nasal CPAP vs HFNC (Fisher & Paykel Healthcare, Hudson RCI or Vapotherm Inc) and one compared the Fisher & Paykel device vs the Vapotherm device. A total of 998 patients were analyzed: 510 randomized to HFNC and 488 randomized to CPAP. The HFNC and CPAP groups had similar rates of meeting the primary failure endpoint (19.6% vs 16.8%, risk ratio=1.167, 95% CI=0.895-1.512, p=0.252). Of the 510 patients randomized to HFNC, 181 were treated with the Vapotherm device, 17 with the Hudson RCI device and 312 with the Fisher & Paykel Healthcare device. When data were analyzed based on device type, the rate of meeting the primary failure endpoint was significantly lower for the Vapotherm system (14.4%) compared to other devices (22.5%, risk ratio=0.639, 95% CI=0.4245–0.9608, p=0.031). Conclusions: HFNC therapy and nasal CPAP appear to have similar efficacy in preventing respiratory failure in premature infants. Our data suggest that the device used to deliver HFNC may influence outcome and this warrants further prospective investigation. Disclosures: ATR has been a scientific advisory board member and speaker for Vapotherm, Inc.

Sponsored Research - None

2017888

A BENCH EVALUATION OF MINUTE VOLUME AND FLOW DELIVERY THROUGH VARIOUS NASAL INTERFACES IN NIMV.

Rick Carter, Kevin Crezee, Dre Bender; Respiratory Care, Primary Childrens Hospital, Salt Lake City, UT

Background: Nasal Intermittent Mandatory Ventilation (NIMV) is increasing in prevalence for support of neonatal patients for non-invasive ventilation. Effectiveness of NIMV delivery widely varies, based upon the interface. This study tested two different types of cannulas that are not approved for NIMV use. Minute Volume (MV) and Flow (V) delivery were measured using a closed lung model to test cannula effectiveness. **Method:** An Evita XL (XL) ventilator was prepared. Measurements were taken as XL settings were deployed through nasal devices on a capped and enclosed silicone neonatal test lung in a sealed chamber. Fisher & Paykel Optiflow Junior (F&P) (Auckland, New Zealand) Premature, Neonatal, Infant and Pediatric sizes were tested. For F&P testing, corrugated tubing was attached from XL to the humidifier chamber. A Tee adapter was attached to the humidifier outlet. Corrugated tubing was attached to the T-piece and XL expiratory valve. The F&P circuit was attached to top of the Tee adapter. RAM Cannula (Valencia, California) sizes Micro Preemie, Preemie, Newborn and Infant were tested using a neonatal ventilator circuit. All prongs were attached to the lung model for an occlusive seal. Measured values via TSI certifier FA Plus (Shoreview, Minnesota) were PIP, PEEP, V, and MV. XL settings of .5 Ti and rate of 20 bpm remained constant. PEEP of 6, 8, 10, 12, 14cmH2O, PIP of 20 and 25cmH_2O were set variables. **Results:** PIP and PEEP measured +/- 2 and +/- 1cmH_2O median across all groups. F&P Pediatric cannula achieved the highest V and MV in both PIP groups. V was 10.6 and 12.3lpm. MV measured 3.6lpm. RAM Micro Preemie cannula achieved the lowest V in both PIP groups. V was 2.7 and 3.9lpm. F&P Neonatal cannula achieved the lowest MV in both PIP groups. MV measured .4 and .3lpm. Generally V and MV increased with increases in cannula size as expected. **Conclusion:** In testing configuration, NIMV appears to work with the F&P. Both devices seem to work well when used with an occlusive seal. Larger V and MV were measured in all F&P sizes as compared to RAM sizes. Further testing of these products is recommended as they are only approved as oxygen delivery devices.

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2011270

CPR CERTIFICATION AMONG FACULTY AT ELEMENTARY SCHOOLS.

Jill Grove; Youngstown State University, Alliance, OH

The purpose of this study was to investigate cardiopulmonary resuscitation (CPR) and First Aid skill sets among elementary school faculty members. The prevalence, school setting, sources and feelings toward administering both CPR and First Aid were explored. One hypothesis was tested: Faculty in elementary schools are not prepared or trained to administer CPR or First Aid skills. Methods: A 16 question survey gleaned data to evaluate CPR and First Aid skills and feelings in regards to the training received. Informed consent was obtained. The survey was distributed electronically to elementary school teachers, grades K-5. Results: A total of 40 of a possible 40 (100%) participants completed the survey. All 40 participants (100%) surveyed had never resuscitated a victim while at school, while three (7.5%) of individuals, removed a foreign airway obstruction from a victim while at school. An alarming twenty two (55%) percent of individuals felt that they would not be able to handle an emergency situation that required CPR/ First Aid independently until help arrived. Thirty seven (90.24%) of the individual's job titles do not require them to hold a CPR certificate. All 40 (100%) of the participants responded that having a CPR/ First Aid certificate would be beneficial to the school and the students, however when asked if teachers should be required to obtain certification nine 22.50% of individuals are unsure if they individually should be required, and three (7.50%) responded they should not be required. When asked if the school had a crisis plan or procedure for medical emergencies, 23(60.53%) answered yes and 16 (42.11%) answered No. Conclusions: With proper CPR and First Aid training, encouragement and practice, elementary school staff can create a confident and safe environment for all of our society's youth. With CPR and First Aid training more individuals could become first responders to an emergency situation. Having more responders in an emergency or crisis situation would improve the time delay in saving a life. It seems that by the results of forty individuals 100% of them would agree that having a full staff CPR and First Aid certified would be beneficial to the school and the students. The more first responders there are in a crisis or emergency situation the better the outcome for a child will be. Not to mention the feeling of appreciation an individual or a family member would have for the first responder who saved the life of a loved one.

Sponsored Research - None

2018125

COPD OUTREACH THROUGH SERVICE-LEARNING IN RESPIRATORY THERAPY: STUDENT AND COMMUNITY PERCEPTIONS.

Jessica Liddil, Georgianna Sergakis, Sarah Varekojis, Jill Clutter; Respiratory Therapy, The Ohio State University, Columbus, OH

Background: COPD remains the third leading cause of death, which supports the crucial need for increases in prevention and early intervention efforts. Respiratory Therapists (RTs) play a pertinent role in COPD prevention and management, however, anticipated role expansions will impact the education and expected competencies of future therapists. Although service-learning has been found to have positive educational impact on students and the community in related health fields, there is limited research regarding service-learning in RT. Method: The purpose of this study was to explore the educational needs of the Hilltop community and describe the impact of a needs-specific pulmonary service-learning experience on community participants. Furthermore, this study aimed to describe the impact of service-learning on students studying respiratory therapy. Approval from the Institutional Review Board was obtained prior to beginning this study. Based on a needs assessment, four second-year RT students designed and implemented a service-learning event at two Hilltop dining centers. Twenty-two first-year RT students facilitated the event. All students completed pre/post surveys and post reflections. Community participants completed evaluations. Results: All community participants stated they enjoyed the event and would recommend it to others. A total of 73.6% of participants stated they would make a change because of what they learned. As a group, the RT students had increases on all pre to post mean scores and paired t-tests revealed statistically significant ($p \leq .05$) individual changes on 12 of the 19 items, including those regarding civic engagement, leadership, education and literacy, and poverty. Inductive analysis revealed four emerging themes from student reflections. Themes identified were: cultural competence, health communication, professional skill development, and value to RT education. All students recommend the continued use of service-learning in RT curriculum. Conclusions: There is a strong need in the Hilltop community for pulmonary health education. The positive impact of service-learning on the personal and professional growth of both first and second-year RT students makes it exceptionally valuable to RT education and future role expansion. Furthermore, feedback from community participants suggests it may be a useful tool for patient pulmonary education and COPD prevention and early intervention efforts. Disclosures: None to report.

Sponsored Research - None

2018172

ICU PHYSICIANS HAVE THE PERCEPTION THAT RTS ARE PREPARED TO MANAGE MECHANICAL VENTILATION AND RELATED PROCEDURES FOR PATIENTS WHO ARE IN THE ICU.

Abdullah Alqarni, Timothy Op't Holt; Cardiorespiratory Care, University of South Alabama, Mobile, AL

BACKGROUND: This study was conducted to determine if ICU physicians in a southeast U.S. metropolitan area agree with published role delineations for respiratory therapists in the ICU. It may help determine if ICU physicians are aware that RTs are able to manage the respiratory care of patients who are receiving mechanical ventilation. The research question is, "do ICU physicians have the perception that RTs are prepared to manage the mechanical ventilation and related procedures for patients who are in the ICU?" METHODS: An online questionnaire consisting of 15 Yes/No questions was sent to ICU physicians at a university and community hospital after obtaining permission from the USA IRB and the Respiratory Therapy departments in these hospitals. The researcher did not have physicians' email addresses. The survey was sent to ICU physicians: doctors who admit to ICU, cardiologists, intensivists, pulmonologists, and surgeons. Descriptive statistics were used to describe the data. RESULTS: Fifty-seven responses were received out of 130 distributed surveys (44% response rate). Board certification of physicians who participated in the study was as follows: Internal Medicine (n=19), Intensive Care (n=10), Pulmonary Medicine (n=18), surgeons (n=2), and Cardiologists (n=8). The results showed that ICU physicians agreed with published delineations of the role of the RT in the ICU. Eighty-four percent of the respondents indicated agreement with each question in the first part of the survey about the respiratory therapist's role in the ICU. Ninety-two percent of the respondents indicated agreement with each question in the second part of the survey about managing mechanical ventilator settings. Ninety-three percent of the respondents indicated agreement with each question in the third part of the survey about monitoring and measurement of patient mechanics during mechanical ventilation. CONCLUSIONS: The physicians' perceptions of the role of the RTs concurs with the model defined by the NBRC matrix for the certified and registered respiratory therapist. DISCLOSURES: None.

Sponsored Research - None

2018508

VIRGINIA SOCIETY FOR RESPIRATORY CARE MEMBERSHIP SURVEY OF BACCALAUREATE AND CREDENTIALING STANDARDS IN THE COMMONWEALTH.

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Background: The Virginia Society for Respiratory Care (VSRC) conducted a survey of VSRC members to gather opinions on present and future education and credentialing requirements for RCPs in the state. The purpose of the survey was to validate the position of the Society's Board of Directors that there was a community need for advancing education for respiratory therapists beyond the completion of the associate degree. The VSRC sought to encourage an advanced clinical practice BSRT articulation arrangement between the five state community college Respiratory Therapy programs and a state university. This position was consistent with the "2015 and Beyond" direction described by the AARC. A survey was conducted to determine the support within the VSRC membership for increasing the educational standards for licensure. Methods: An 18 question survey was developed and sent electronically to 1158 VSRC active members in Virginia. The survey included statements regarding: job category, education, work setting, present and future credentialing expectations, interest and support for advanced education degrees, and opinions regarding the level of credentialing needed for initial licensure. Results: 273 surveys were returned (23.6%). 220 respondents (19%) completed the entire survey. Only completed surveys were used for analysis. The majority of respondents work in acute care facilities (n= 189, 84%); 117 (54%) are bedside respiratory therapists. 77% (n= 173) of respondents believe the RRT credential should be required for entry level practice within the State. The majority of respondents (n = 208, 92%) identified that future education requirements should be increased. 89% (n= 203) indicated that articulation agreements between present associate degree and baccalaureate programs are important. Greater than two-thirds of respondents (n= 148, 66%) indicated that at least three staff members within their departments were likely to enroll in an advanced clinical practice BSRT degree completion program. Conclusions: A majority of survey respondents favor escalation of the entry level credentialing and education requirements for respiratory therapists who wish to practice in Virginia. Articulation agreements between existing community college Respiratory Therapy educational programs and BSRT programs are desirable.

Sponsored Research - None

2020951

BRINGING STANDARD WORK PRINCIPLES TO THE BEDSIDE: WEANING PROCESS.

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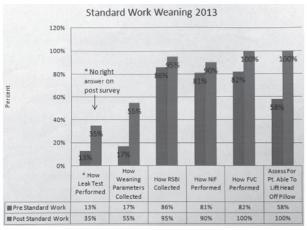
Background: Ensuring consistent practice allows for reliable process improvement and consistent outcomes. LEAN principles have been used in a variety of healthcare setting to improve quality and homogenize processes. We observed variations in practice among respiratory therapists (RT) surrounding assessment of weaning parameters. The objective of this study was to ascertain whether use of standardized work from LEAN principles would decrease practice variation among RT staff in assessment of readiness to liberate from the ventilator. Methods: At a 44 bed medical/ surgical ICU Level I trauma center, study was approved by hospital's research committee. An anonymous baseline survey was conducted amongst the 64 person RT staff to quantify current practices. An ad hoc team of RTs, pulmonary and surgical critical care physicians established and implemented guidelines for weaning process standard work based on most current literature. Weaning parameters included measurement of FVC; NIF; RSBI; leak test; lift head off pillow; and ventilator settings. Education regarding standard work was provided in the form of 15 minute on-shift in-services, one page cheat sheets, and badge cards. A progress note template was created to ensure consistent documentation. The standard work was audited for four weeks to ensure compliance with standard work through documentation and twice daily self-audits. If variation of standard work was noted RTs and physicians were reminded of process. A post-survey was given the end-of July 2013 to RT staff to determine if the education and standard work process was retained. Results: There were 108 ventilator patients with 493 vent days during this time period. 38 staff participated in self-audits and 53 charts were reviewed for documentation. 55 surveys were completed anonymously. Post survey results revealed that the majority (>89% or higher) of staff answered eight out of the ten questions correctly for standard work weaning process. One test question did not have any right answers but still showed improved with staff writing in the correct answer. Conclusion: Implementation of standardized work does reduce practice variability amongst respiratory therapists. Further application of standardized work across other respiratory therapy processes will continue to reduce variability and enhance process improvement efforts. Sponsored Research - None



2021272

AN ON-LINE PROGRAM IN CULTURAL COMPETENCY IMPROVES RT STUDENTS' KNOWLEDGE AND ATTITUDES ABOUT CULTURALLY DIVERSE POPULATIONS.

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Introduction: New standard 4.05 from the Commission on Accreditation for Respiratory Care (CoARC) requires "graduate competency in interpersonal and communication skills to effectively interact with diverse population groups." Georgia Regents University developed and implemented Healthy Perspectives, a required, interactive, online, inter-professional course designed to introduce health science students to cultural competency, its importance to their prospective practices and its role in minimizing health disparities. The aims of the course are to enhance the self-efficacy and communication skills that facilitate empathetic patient encounters and to provide respectful and culturally appropriate care to all patients. This IRB approved study evaluated the success of the program with RT students. Methods: In the fall of 2013 all first year health sciences students who would see patients enrolled in Healthy Perspectives (n=784), including Respiratory Therapy (RT) students (n=17). The course is structured into 6 modules. All students were required to complete a short series of validated pre- and post-tests to measure changes in six key domains (Table 1). These tests included Health Beliefs Attitudes Survey, Acceptance of Stereotyping Questionnaire and the Cultural Competence Assessment and Training Tool. Using SAS 9.3, changes in pre- and post-tests were determined for all students completing at least 90% of the instrument. The paired t-test or Wilcoxon Signed Rank test was computed for each domain to determine whether or not students had a change in aggregate scores. Results: Table 1 shows results of RT student performance for the program. RT students significantly improved their knowledge of cultural competency, had a positive and significant change in their beliefs about culture and their willingness NOT to accept stereotypes, made significant positive changes regarding health disparities and socio-cultural issues. Students agreed that communication, interdisciplinary work and understanding other professions are important for quality health care. In addition, 95.8% successfully demonstrated their ability to apply Culturally and Linguistically Appropriate Services standards. Conclusions: This study shows that RT students can improve their knowledge and attitudes regarding culturally diverse populations by taking an on-line course. It remains to be seen whether or not CoARC will accept results such as these as evidence of compliance with the new standard.
Sponsored Research - None

Table 1. Changes in Six Key Cultural Competency Domains for Respiratory Therapy Students

Domain	N	Pre-test	Post-test	Change	P
Knowledge	17	77.11	84.02	6.91**	0.020‡
Attitudes	16	70.05	76.16	6.11**	0.040‡
Health Disparities	15	3.32	4.14	0.83*	0.007‡
Socio-cultural issues	16	3.52	4.63	1.11*	0.005‡
Self-identity	16	4.06	4.40	0.33**	0.048†
Inter-professionalism	17	3.00	3.00	0.00	1.00†

* $p \leq 0.01$, ** $p \leq 0.05$, † Student t-test, ‡ Wilcoxon Signed Rank test

2021601

A STUDY OF A MECHANICAL VENTILATION EDUCATION CURRICULUM FOR MEDICAL INTENSIVE CARE UNIT RESIDENTS.

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Background: Mechanical ventilation (MV) is a critical component that residents aim to master during their Medical Intensive Care Unit (MICU) rotation. Since there is no formal curriculum, MV education hinges upon the amount of time the ICU Intensivist spends teaching about MV. Hence, the level of MV proficiency differs among batches. We aim to determine if a structured MV curriculum would be beneficial in teaching and standardizing MV education for residents. Methods: A curriculum that focuses on teaching basic MV concepts, recognizing ventilator waveforms, troubleshooting of MV problems, and solving various case scenarios was formulated. 4 batches, a total of 26 residents, were recruited over a period of 1 year. Each batch of residents did a 3 months ICU rotation. A questionnaire consisting of 20 multiple choice questions was developed evaluating basic MV knowledge (maximum score of 20). Firstly, residents performed the Pre-test to assess their baseline MV knowledge. Subsequently, they were taken through a series of lectures and hands-on teaching sessions on MV scheduled over the 3 months. Additionally, each resident was also attached to a Respiratory Therapist (RT) for a week. At the end of the rotation, residents were required to complete the Post-test to assess their gain in MV proficiency. This study was approved by the Institutional Review Board (IRB). Results: Residents were recruited with a level of medical training ranging from 1 year to 6 years post-graduation (Year 1: 3.9%, Year 2: 42.3%, Year 3: 11.5%, Year 4: 19.2%, Year 5: 19.2%, Year 6: 3.9 %). All the residents showed an improvement between pre-post test scores. The pre-test mean score was (8.96±2.34), and the post-test mean score was (14.15±3.02). Paired t-tests showed a significant increase in pre-post mean test scores ($p < 0.001$). Interestingly, there was no correlation between the number of years post-graduation and how well a resident improved in the tests ($R = 0.119$, $p=0.56$). Conclusion: A formal structured curriculum on MV was significant in increasing residents' test scores of a MV knowledge questionnaire, which was not related to the number of years post-graduation. This suggests that a formal structured curriculum on MV increases the proficiency of residents in MV. Future controlled studies in larger groups might be useful to confirm these results. Sponsored Research – None

2021885

EVALUATION OF LEARNING STYLES FOR PATIENTS WITH COPD.

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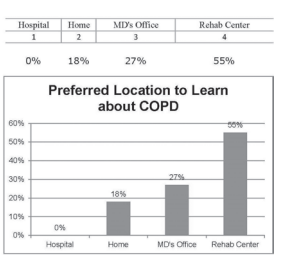
Background: Healthcare is currently undergoing a drastic transformation within the United States with the implementation of the Affordable Care Act. This pilot study aims to identify trends in preferred learning styles among patients with COPD in order to facilitate an improved approach to patient education and reduce 30-day hospital re-admittance rates. Method: After receiving IRB approval, 22 adult patients with a confirmed diagnosis of COPD who were enrolled in a Cardiac and Pulmonary Rehabilitation education course, were recruited to participate in a qualitative survey. The anonymous survey consisted of 11 multiple choice questions; answers were coded in a spreadsheet in order to determine common themes. Results: Most subjects (59%) reported that they want to know as much detailed information as possible pertaining to their disease. One-on-one (41%) and small groups (41%) were found to be the most preferred learning modalities, with more than half (55%) of the participants agreeing that they learn best at a rehabilitation center; 27% of the subjects stated they prefer to learn at a doctor's office. No subjects stated that they learn best at a hospital. Most subjects stated that they sometimes (46%) or never (32%) use the internet to learn about COPD, and instead choose to learn about COPD and their medications through discussions with a respiratory therapist or nurse (82%), followed by an MD (77%) and reading materials (64%). There was no statistically significant relationship between the time period for hospital admission and any of the demographic characteristics or questions about how, where, or from whom patients would prefer to learn about COPD and medications, with the exception of using the internet. In these instances, the four patients reporting that they would use the internet for these purposes had a hospital admission more than a year ago ($p< .05$). Conclusion: Based on our survey results, there needs to be a better job of tailoring information provided by place, modality and source when educating patients about COPD. Distinguishing a patient's preferred learning style is essential. Patients do not want to be "taught" about their COPD at the hospital; they prefer one-on-one or small groups outside the hospital setting. Respiratory therapists will need to be able to blend their role as a health care provider along with the role as an educator in order to maximize patient benefit. Disclosures: The authors have no conflicts of interest.
Sponsored Research - None



2005506

AIR QUALITY INDEX AND POLLEN EXPOSURE ON ASTHMATIC CHILDREN IN ARKANSAS

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Introduction: Increased air quality index (AQI) values and pollen exposures are known triggers for asthma exacerbations that produce adverse health effects in asthmatic children. Anecdotal evidence suggests an increase in total hospital admissions (THA), including inpatient and Emergency Department (ED) visits during times of increased AQI values and pollen levels. To determine if there are increases or decreases in THA, we examined retrospective data comparing daily AQI values and pollen levels to THA of pediatric asthma subjects seen at our institution. **Methods:** This study was not deemed human subject testing by the IRB. Data collection included daily AQI values from 3 reporting stations in central Arkansas obtained from Arkansas Dept. of Environmental Quality from 1/12 through 12/12. Pollen level data was inconsistently collected during the year, and this aspect of the study was abandoned. We also collected data on all subjects identified by ICD-9 codes for asthma seen in the ED or inpatient areas during the study period. Data was analyzed using Pearson correlation and paired t-test. **Results:** Data was reviewed on 1,605 asthmatic patients seen at ACH in 2012 (1162 ED patients and 443 inpatients) for asthma exacerbation. For 2012, the monthly average AQI levels/ THA were: Jan (23/88), Feb (28/126), Mar (30/143), Apr (35/154), May (47/145), Jun (60/64), Jul (50/81), Aug (53/121), Sep (36/189), Oct (30/188), Nov (29/150), and Dec (23/156). AQI levels were high in the summer but were associated with lower THA rates. Spikes were noted in THA in Mar, Apr, Sep, and Oct, but AQI levels were not as high as noted in the summer. We found no correlation between THA and AQI levels on the date of admission (r=0.06), 1 week prior to admission (r=-0.03), or 2 weeks prior to admission (r=0.05). Additionally, we found no statistical significance between THA and AQI levels one week prior to admission (p=0.968); however, THA and AQI levels two weeks prior to admission approached significance (p=0.163). **Conclusion:** In this retrospective study we concluded that no correlation could be found between THA and AQI levels on the date of admission, 1 week prior to admission, and 2 weeks prior to admission. Increased AQI may worsen symptoms; but not warrant admission. Further study is indicated looking at all known asthma triggers including AQI, pollen, grass, weed, and mold levels to determine if one of these factors is involved with increased THA for asthma.

Sponsored Research - None

2012995

CHEST WALL STRAPPING INCREASES EXPIRATORY AIRFLOW AND THE NUMBER OF SMALL AIRWAYS.

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Background: Chest wall strapping (CWS) induces breathing at low lung volumes. CWS causes increased lung elastic recoil and increased maximal expiratory flows. The interactions between elastic properties of the lung parenchyma and small airways are critical for pulmonary function. Method: After obtaining IRB approval, we obtained in four study subjects PFTs with spirometry, flow volume loops, airways resistance and lung volumes in the unstrapped control state and after CWS. Computer tomography (CT) scans were obtained at 50% of the control total lung capacity (TLC) in control and CWS state under spirometric control. The airway tree was analyzed via an automated airway segmentation algorithm. CT lung volumes were analyzed by CT volumetry. Results: CWS reduced TLC to 70% of control TLC (6.59±0.9 vs. 4.65±0.5 liter). Expiratory airflow at 50% of control TLC was increased by 192% by CWS (2.61±1.2 vs. 5.02±2.1 liter/second) and specific airways resistance reduced by 53% (5.58±0.4 vs. 2.64±0.7 kPa/ second). The automated CT airway segmentation algorithm detected 29% more airways on the CWS CT scans (602 vs. 466, $p < 0.05$). The number of airways with a diameter of 1-2 mm increased by 23%, 2-3 mm by 54%, and 3-4 mm by 18% with CWS ($p = 0.06$ for pooled analysis for airways < 5 mm). There was no difference in the number of airways with diameters > 5 mm in control compared to CWS state. CT volumetry showed that the absolute lung volume of the 50% TLC scans was not different between control and CWS scans (4.0±0.6 vs. 3.8±0.5 liter, $p = 0.9$). Conclusions: CWS increased the number of detectable small airways via an automated CT airway segmentation algorithm. CWS has been shown to increase lung elastic recoil, which via airway-parenchyma interaction could increase the size of small airways. These findings have implications for the understanding and possibly the treatment of diseases of small airways. Disclosures: No relevant disclosures

Sponsored Research - None

2014976

IMPROVED DISEASE MANAGEMENT OF THE COPD PATIENT THROUGH AN ELECTRONIC MEDICAL RECORD.

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BACKGROUND: The future addition of "COPD" to the CMS Hospital Readmission Reduction Program, gave us additional reason to determine how to prevent or reduce readmission in this patient population. Approaching this goal through our electronic medical record (EMR) was our starting point. METHOD: Unknowingly two teams had simultaneously begun to meet to address this goal; a team consisting of pulmonologist, hospitalists and pharmacist and a team of respiratory therapists including in-patient, pulmonary rehabilitation, and pulmonary function. Members of the teams merged efforts. The first goal of the combined group was to create an EMR clinical pathway through an admission order set. This was inclusive of bronchodilator protocols, Oxygen protocol, antibiotics, corticosteroids, smoking cessation education, CXR, PFTs (if not performed within the last year), a consult to Pulmonary with qualifying criteria and Ancillary consults to Occupational Therapy, Physical Therapy, Respiratory Therapy and Pulmonary Rehabilitation when indicated. The Respiratory team worked to create an EMR initial evaluation that included the COPD Assessment Test to provide information for disease staging and referral to pulmonary rehabilitation. To improve diagnosis, the GOLD Guidelines key indicators were also added to the evaluation. The creation of a dynamic multidisciplinary note to follow the patient's progress through each encounter was also established. RESULTS: Initial implementation of the patient evaluation provided insight to the need for education on pulmonary rehabilitation as well as outpatient barriers to care. After implementation of the physicians order set, "Ideal Care" increased to >80% within standards compared to previous numbers of 60%. This was with and without use of the order set. Those who used the order set were above 90% compliant. Referral to Pulmonary Rehabilitation substantially increased. Referrals to Pulmonary Function also saw increase. CONCLUSIONS: Multidisciplinary teams are paramount to comprehensive goal and the use of an EMR to manage the care of the COPD patient and improved diagnosis has proven to be successful.

Sponsored Research - None

2017797

A BASELINE REVIEW OF COPD "FREQUENT FLIERS" AT 22 HOSPITALS WITH TWO YEARS IN REVIEW —- COMORBIDITIES, HOSPITAL EVENTS & READMISSION RATES: 3 OF 3

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Background: Intermountain Healthcare (IM) owns & operates 22 acute care hospitals across the intermountain west. When the Centers for Medicare & Medicaid announced COPD as a core measure to track hospital readmission rates for 2014[1], we sought to identify what issues may contribute to COPD hospital "frequent fliers"/readmissions. **Method**: Pts were extracted by members of the corporation's financial team & included any patient with an Emergency Room (ER) &/or hospital admission assigned a COPD diagnosis (DRG 190, 191 or 192) during 2011 & 2012. A total of 2,424 were initially identified. Fifty-one pts were identified as COPD "frequent fliers" (greater than or equal to 5 hospital ER &/or hospital admissions). Detailed chart reviews were performed. Results: Sixteen variables were included. Patient comorbidities, 2013 hospital events, readmission rates & variable cost/visit are included in this abstract. **Results** are reported in Table One. Additional outcomes are reported in subsequent abstracts. **Conclusion**: While we did expect a higher incidence of anxiety or depression, we did not expect to identify "chronic pain" as frequently. This information was communicated to the corporation's Pain Service Team who is now tracking & monitoring these pts in the Chronic Pain Registry. Three of four pts with renal failure required hospitalization during dialysis due to respiratory distress. We felt this may be due to the rapid shift in fluid that occurs during dialysis. We originally wanted to know 30, 60 & 90-day readmission rates as earlier discussions regarding required reporting data was to include these; however, we reported only 90-day readmission rates. It was our impression decreasing 90-day readmissions would better reflect the impact of strategic care changes we are implementing in this subset of pts. Strategic care changes include but are not limited to COPD patient staging, protocolized care, patient/caretgiver education & referrals (i.e., pulmonary consults, PFTs, pulmonary rehabilitation). This protocol, though ordered by physicians, is primarily driven by Respiratory Therapists. It is our impression implementation of the COPD Exacerbation Protocol, scheduled for implementation October 1, 2014, will improve pt outcomes, decrease hospital lengths of stay & decrease hospital readmission rates. [1]CMS IPPS Proposed Rule. Retrieved on June 26, 2013 from http://www.gpo.gov/fdsys/pkg/FR-2013-05-10/pdf/2013-10234.pdf.

Sponsored Research - None

2017919

EARLY AMBULATION (EA) IN HIGH ACUITY PATIENTS IN MULITIPLE FACILITY INTENSIVE CARE UNITS: 5 YEARS IN REVIEW

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Background: Intermountain Healthcare (IM) owns & operates 22 acute-care hospitals in the intermountain west. Several years ago, IM selected a goal for early ambulation (EA) of high acuity pts in the adult Intensive Care Units (ICU) across the corporation. Early outcomes were reported previously with 1 facility reporting EA pts able to discharge from hospital directly to home rather than to a skilled nursing facility (SNF) & then home. We sought to determine what, if any, improved pt outcomes might be appreciated from aggregate EA data regarding acute care hospital ICU pts. **Method**: Retrospective data were extracted from the corporation's databases. Inclusion criteria were: 1) adult pts, 2) hospital ICU admission, & 3) on a ventilator > 72 hours. Outcomes of ICU high acuity pts with at least 1 EA event documented were compared to those who were never ambulated. Fisher's Exact Test was utilized for all statistical tests. **Results**: While other variables may also have bearing on our outcomes, it does appear that EA pts appreciated a statistically significant discharge from hospital to home when compared to pts who were never ambulated. Detailed outcomes are reported in Table One. **Conclusion**: The most formalized EA process exists at Hospital 2 as noted from direct observation. Further study is needed; however, it is our impression that replicating previous reports of pt discharge directly from the hospital to home validate the benefit of a formalized EA process. The trending decrease in 30-day readmission rate at Hospitals 2 & 4 may also be a benefit. Hospitals 3 & 4 do not appear to be regularly identifying & performing EA. At the time of this abstract, corporate leaders are strategizing to formalize the process to include readiness scoring, key EA process elements to monitor & documentation requirements. Education & a method to monitor & report compliance will be required. While Respiratory & hospital variable costs increased in the EA cohorts (average increase of $24,605 in total cost/pt across the 5 hospitals; range: $3,716 to $37,263 per pt), it is our impression that this is probably not due solely to EA. The cost savings from not splitting DRG payments for a SNF &/or 30-day hospital readmission may justify EA in this subset of pts. We are coordinating with financial experts to determine cost savings comparisons for inclusion in our review. Other improved pt activities of daily living have yet to be studied but are planned.

Sponsored Research - None

Table One: Five Year EA Outcomes of ICU Patients on a Ventilator > 72 Hrs

Facility	Total EA Pts # (%)	Total Non-EA Pts #(%)	Discharge from Hospital to Home		p-value	Hospital 30-Day Hospital Readmission Rates		p-value
			EA # (%)	No EA # (%)		EA # (%)	No EA # (%)	
Hospital 1 n=2280	526 (23)	1754 (77)	242 (46)	718 (41)	**0.0392**	17 (3)	43 (3)	0.3510
Hospital 2 n=366	226 (62)	140 (38)	138 (61)	63 (45)	**0.0035**	8 (4)	11 (8)	0.0895
Hospital 3 n=964	58 (6)	**906 (94)**	19 (33)	311 (34)	0.8870	5 (9)	46 (5)	0.2252
Hospital 4 n=333	3 (1)	**330 (99)**	1 (33)	123 (37)	1.000	0 (0)	5 (2)	1.000
Hospital 5 n=931	560 (60)	371 (40)	186 (33)	180 (49)	**<0.0001**	10 (2)	2 (<1)	0.1386
Total Pts n=4874	**1373 (28)**	**3501 (72)**	**586 (43)**	**1395 (40)**	**0.0746**	**40 (3)**	**107 (3)**	**0.8525**

2020668

MANAGING A PATIENT WITH STATUS ASTHMATICUS UTILIZING INTRAPULMONARY PERCUSSIVE VENTILATION AND A HIGH FLOW NASAL CANNULA AVOIDS ENDOTRACHEAL INTUBATION.

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Introduction: One of the most complicated issues in managing patients who have status asthmaticus non-invasively is the mobilization of secretions. Case Summary: A 18 year old female was admitted with status asthmaticus and severe respiratory distress. The patient had a cough with difficulty breathing two days prior to admission. Upon arrival to the ER, she received multiple doses of albuterol, magsulfate and started on steroids. The patient was admitted to the PICU and received albuterol via nebulizer Q1H. She was started on Bi-PAP resulting in decreased SOB as well as decreased use of accessory muscles but was still short of breath. Auscultation revealed poor bilateral air entry, minimal scattered wheezing and positive subcostal retractions. The patient was placed on Intrapulmonary Percussive Ventilation (IPV) Q3H. Following her first treatment the patient exhibited reduced WOB, decreased use of accessory muscles and reduction of heart rate by 15%. The patient remained on IPV for three days without SOB. In addition, the High Flow nasal cannula at 19L/min; FiO2-30% was employed. The patient was successfully discharged to go home on the sixth day of admission. Discussion: Intrapulmonary Percussive Ventilation is delivered by the IPV. IPV – is a pneumatically powered, pressure limited, time cycled, biphasic flow interrupter that creates an auto-cephalad flow of gas assisting in removal of secretions. The IPV delivers high frequency inspiratory mini pulses of flow ranging from 100-300 breaths per minute and an I:E ratio of 1:2.5 Conclusion: The addition of IPV to traditional treatment strategies may provide an important advantage for the patient who has life threatening asthma because it may provide better mobilization and clearance of difficult to remove retained secretions as well as possibly preventing an endotracheal intubation.

Sponsored Research - None

2021022

EFFECTS OF A COPD PATHWAY ON HOSPITAL READMISSION RATES.

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Background: When managing hospitalized patients with acute exacerbations of chronic obstructive pulmonary disease (AECOPD), adequate post discharge follow-up is inconsistently provided. These inconsistences may contribute to significant hospital re-admission rates and increased healthcare costs. We hypothesize that the use of an inpatient COPD pathway will have no significant effect on hospital readmission rates for patients with AECOPD. Methods: Over twenty six months, we followed 287 patients with an admitting diagnosis of AECOPD for readmission. In 2012, 163 patients were followed before the pathway was implemented. In 2013 and 2014, 124 patients were followed post pathway implementation. Patients 18 years and older met criteria for the pathway if they had a diagnosis of a COPD exacerbation. The COPD pathway protocol started on presentation to the emergency room and ended thirty days following discharge. While in the hospital, patients received education about COPD that included the proper use of an MDI and an MDI spacer. Prior to discharge, a registered respiratory therapist (RRT) met with each patient to schedule a follow up doctor's appointment and a pulmonary function test if needed. The RRT evaluated the patient for pulmonary rehabilitation. If applicable, the RRT offered smoking cessation counseling. Patients received calls from an RRT at days two, seven and twenty-one following discharge. The Respiratory Therapy Department continued to follow patients for 30-days to monitor for hospital readmission for COPD. Data was analyzed using the Analysis of variance (ANOVA) on SPSS 22.0 for Windows (Chicago, IL, USA). Alpha was set at 0.05. Results: We could not reject our hypothesis because the p value was calculated to be > 0.05. $F(1,282)=1.203$, $p=.274$. The use of a COPD pathway did not significantly reduce hospital readmissions and healthcare costs. Conclusion: Further studies need to be conducted on how to reduce hospital readmission rates and cost for COPD patients. The use of a COPD pathway may need to encompass more than just education, follow-up phone calls and doctors' visits.

Sponsored Research - None

2021872

PORTABLE CLINIC VISITS TO SCHOOLS IMPACT ASTHMA IN CHILDREN.

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Background: The University of South Alabama Breathmobile (USABM) program is a portable program that travels to schools using a recreational vehicle outfitted to be a mobile asthma clinic. It visits low-income and uninsured students at public schools in the Mobile, AL area. Similar programs have been found to decrease the amount of visits to the emergency room, missed school days, hospitalizations and/or ED visits, and improve asthma self-management. This study was done to determine if the USABM program had an impact on the above issues. Method: After IRB approval a retrospective chart review identified participants between ages 5 and 20 years old who were suspected of or diagnosed with asthma. All participants had three or more visits with the USABM program within a 15 month time frame. A statistical analysis was used to evaluate the program's effectiveness. Data was gathered using a survey to evaluate pre and post program measures. Results: The records of 50 participants were evaluated. In the study, 30 were between the ages 5-11 years old, 18 between the ages 12-18 years old, and 2 were 19-20 years old. The initial asthma classifications of the patients based on the EPR-3 classifications for asthma were as follows: 3 intermittent asthma, 19 mild persistent, 14 moderate persistent, and 14 severe persistent. Before the USABM program, the total number of hospitalizations was 35 (average 0.78), emergency room visits 103 (avg.2.29), missed school days 263 (avg. 5.75 days), and steroid bursts 98 (avg.2.18 uses). After the USABM program total number of hospitalizations decreased to 0 (avg. 0), emergency room visits dropped to 27 (avg. 0.54), missed school days dropped to 74 (avg. 1.58 days), and steroid bursts dropped to 9 (avg.0.18). Before the USABM program 45 patients had a reliever medication. After the program all 50 patients had a reliever medication. 26 patients were using controller medications (52%) prior the USABM program. After 45 of the patients (90%) were on controller medications. Conclusions: The program made a significant difference in the amount of hospitalizations, emergency room visits, missed school days, and steroid bursts the patients experienced. In addition, use of controller medications had a significant improvement.

Sponsored Research - None

2022022

SPACE WEATHER: THE NEXT FRONTIER IN ASTHMA RESEARCH.

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Background Weather conditions are among the most common triggers for Asthma. The American Lung Association (www.lung.org, Accessed May 31 2014) names extreme hot or cold temperatures, pollen count, humidity, and air pollution among atmospheric conditions affecting asthma patients. Variations in space weather conditions can be detected within earth's atmosphere, but research is only beginning to understand the effects of space weather events. Solar flares, a release of magnetic energy from the sun's atmosphere, are one of the most powerful space weather events and have a direct, measurable impact on earth's atmosphere. Do these major space weather events have impacts on asthma patients similar to those observed with changes in earth's weather? This study examines evidence for an association between solar flare events and incidences of asthma-related diagnoses. Method Solar flare data was obtained from the NOAA Space Weather Prediction Center (SWPC). Data about incidences of asthma-related diagnoses was obtained from the Insight by Practice Fusion database. The study examined week-over-week changes in the diagnoses' incidences surrounding 2013 solar proton events to determine whether there was a pattern in the direction or magnitude of the change seen around the events. Annual average week-over-week changes were also calculated. Descriptive statistics generated standard error, standard deviation and sample variation for the week-over-week changes in each diagnosis. Results Seven solar proton events were detected in the earth's atmosphere in 2013. Table 1 examines week-over-week percentage changes in the incidences of exacerbation of asthma and exercise-induced asthma surrounding the solar proton event. Conclusions The data revealed a pattern of significant decrease in the incidence of asthma-related diagnoses during the week of the event as compared to the previous week. In both diagnoses, the magnitude of the changes exceeded the standard errors. No consistent pattern was observed in the subsequent week percentage changes. As a preliminary investigation into a new research area, this study is limited. However, the initial results suggest additional research would be valuable to increase our understanding of the relationships between space weather and asthma. The next frontier awaits. Disclosures None

Sponsored Research - None

2022655

THE IMPLEMENTATION OF A RESPIRATORY CARE SERVICES INFLUENZA TESTING PROTOCOL.

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BACKGROUND: The 2013-2014 predominant strain of influenza (IF) was the H1N1 2009 pandemic strain. It was unique because it affected individuals 50 years old and younger the hardest and was more transmissible than previous seasonal strains. The University of Chicago Medicine (UCM) took an aggressive proactive approach to limiting the transmission of H1N1 to our patients and coworkers. As of January 3, 2014 Illinois had 122 IF-related admissions to ICU's and 6 deaths through December 28, 2013. UCM had 68 reported cases of IF. The Respiratory Care Services (RCS) department worked closely with Infection Control (IC) and implemented an IF testing protocol for all staff. It went live on January 7 continuing thru March 1, 2014. METHODS: If an employee (EMP) had a fever while at work they were sent to Occupational Medicine (OM) for nasal swab (NS) testing and then directed home and instructed not to return within 7 days. If the EMP developed respiratory symptoms while at work, including runny nose, cough, congestion or sore throat, it was mandated that they wear a mask, notify their manager and call the RCS Flu Response Pager to receive IF NS testing. RCS followed droplet precautions and performed NS testing in a negative pressure room. RCS provided the EMP with an H1N1 health questionnaire, and an IC tracking form. The forms were both scanned and sent to IC and occupational medicine and the NS sample was sent to the microbiology lab, where results were returned within 4-6 hours. The EMP would be notified of the results directly along with their manager. The EMP continued to work while wearing a mask during this time and was restricted from working in the adult or pediatric stem cell transplant units or the post-solid organ transplant unit. RESULTS: There was an early spike in employees (EMPS) swabbed and then a gradual decrease thru early February and then a slight resurgence at the end of February. As of 2/20/14 there had been a combined total of 404 EMPS screened by OM and RCS. RCS saw 54% (n=232) of the EMPS. Of the 232 EMPS, 3% came to RCS without paging or had a fever and were sent to OM, two EMPS paged and did not show (n=11). 9.2% had influenza A (n=366) and all but 2 were identified as H1N1 2009 strain (n=364). CONCLUSION: RCS was a driving force in the implementation and EMP testing leading to a decrease in the spread of IF A and H1N1 strain to our patients and coworkers. Our RCS department will lead this quality initiative again next flu season.

Sponsored Research - None

2022741

JCAHO REQUIREMENT: IMPROVING FOLLOW-UP APPOINTMENT RATE FOR ASTHMA PATIENTS.

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BACKGROUND: JCAHO requires that patient's discharged with the diagnosis of asthma have a documented follow-up appointment. The baseline data identified a current compliance rate of 32% with this measure. Working with a multidisciplinary team, a key driver diagram was developed to review the current process, identify system failures, test PDSA cycles and implement systems. The team developed a SMART aim to increase the % of patients with a follow-up appointment, date and time documented on asthma action plan from 32% to 85% by 11/20/13. METHOD: All patients admitted under the asthma pathway were tracked for compliance with having a documented follow-up appointment. Percentage of compliance was tracked weekly on a control chart. Interventions were trialed and rejected with one PDSA noted to have positive affect on the data. To increase engagement in the process, the whiteboard was used as a communication tool between hospital caregivers and families. A brightly colored appointment card was placed on the board with a space for the family to fill out the appointment. RESULTS: See attached control chart. Total patients reviewed: 917. Compliance with the JCAHO measure increased from 32% to initial range of 18 - 100% for six months. Reflecting a decrease in variability, the current range is 59-100%, median 77% and has been maintained for three months. When considering just the Monday-Friday control chart, a median of 90% has been achieved and maintained for three months. CONCLUSIONS: Sustainable outcomes were achieved by employing a quality improvement system. This led to developing a strategy to engage families, communicating the importance of follow-up care. Primary limitation to further improvement identified as limited availability of physician's offices on weekends and holidays.

Sponsored Research - None

2023270

INNOVATIVE MULTIMEDIA APPROACH FOR PATIENTS DISCHARGED WITH ASTHMA.

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Introduction: Asthma is the most common chronic condition in children and the third leading cause of hospitalizations. While discharge education is customarily provided in written and oral formats, several studies indicate using this format to deliver patient education is not effective for adherence to medications or overall care of the asthma patient. As 40% of Americans have low literacy, discharge instructions need to be provided in an understandable manner to achieve effective self-management. Method: Patients and their families were videotaped reviewing their personalized Asthma Action Plan, correct MDI use and the importance of medical follow-up. The completed video "stars" the patient reviewing the essential education as well as additional information on asthma disease management. Participants, ages 4-11, are screened with the Responsibility, Efficacy, Attitudes, Literacy and Stress (REALS) and the Survey for Adult Caregivers of Pediatric Patients with Asthma, a learning questionnaire that identifies preferred learning styles as well as access to media outlets. Focus group feedback was used to refine the interactive video process where families are engaged in their own discharge video. Results: 20 patients and caregivers were identified for inclusion in the pilot multimedia study. 85% of the participants completed follow-up calls with every study participant indicating they had viewed the video > 1 times. 82.5% had shared the video with other family members –siblings and extended family. 43% had shared it with a school nurse, teacher or coach. 41 families participated in the focus group; all stating they had access to DVD playback. While focus groups stated they would prefer pamphlets/brochures 73.2% of the time, however after viewing the video, 62.5% of the study participants found the video helpful. In addition, 31.25% preferred the combination of both the video and the paper Asthma Action Plan. A Rapid Estimate of Adult Literacy in Medicine (REALM) was completed with 50% having < 9th grade literacy level. Conclusion: A personalized multi-media approach has the potential to positively impact asthma self-management compared to standard written discharge instructions, especially for persons with low levels of health literacy. Education for self-management should be provided in various formats to improve understanding. (See attached).

Sponsored Research - None

2020949

THE VALUE OF ASTHMA EDUCATION IN PRODUCTIVITY TIME STANDARDS.

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Introduction: To improve key processes, respiratory care departments have been examining the value as well as productivity required to complete fundamental activities. Asthma is the most common chronic disease in pediatric patients and is the third leading cause of admissions to the hospital. Providing education for caregivers and families is one of the key components to reducing readmission. The AARC Uniform Reporting Manual provides times standards for many accepted practices however the standards do not apply to asthma education. We had an additional need to quantify productivity measures for the key pieces of the asthma protocol used at Cincinnati Children's Hospital Medical Center. Method: The key components that required quantification of productivity are review of the components of the Asthma Action Plan with a follow up appointment as required by JCAHO, and caregiver education to include MDI training. We also sought a productivity measure for time to completion of the Childhood Asthma Risk Assessment Tool (CARAT) which provides guidance to the plan of care. The time standard for the CARAT was obtained using the electronic medical chart with the review of the CARAT's completed in March (n=43). Fifteen additional patients were reviewed with an observer which provided the same measure with two exclusions due to interruptions. To obtain a valid number for the time standard to review the Asthma Action Plan, 16 patients from a previous videotaped study were used. Results: 917 patients were on asthma protocol from May 17, 2013 – May 17, 2014. CARAT time standard median=15 minutes. Review of Asthma Action Plan and MDI education = 15 minute average. Conclusion: Considering we have provided education for 917 patients, this represents 458 hours of patient education. Current productivity systems are not able to capture the value of patient education and self-management.

Sponsored Research - None

2021798

COMPARISON OF FLOW OUTPUT FROM COMPRESSORS USED TO RUN SMALL VOLUME NEBULIZERS.

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Introduction: In the pediatric population, adding additional flow through ventilator circuits can impact ventilator parameters and patient ventilator synchrony. Recent case reports have continued to demonstrate problems with administering small volume nebulizers (SVN's) through home ventilators. These reports have shown that the ability to control flow, and administer 6LPM vs. 8LPM or higher have decreased the incidence of patient compromise. Further complicating the problem in the home care setting, most of these SVN treatments are administered via a compressor where flow cannot be controlled. We designed a series of tests to compare some of the current compressors on the market and measure flow output of these devices. Methods: Flow from the following four compressors were compared to set flow of 6LPM and 8LPM on an oxygen flow meter: Mini Elite(Phillips Respironics, Carlsbad CA), Pari Vios (Pari, Midlothian, VA), and the Salter Aire and Salter Aire Plus (Salter labs, Arvin CA. Flow was measured measured via a Certifier FA Plus (TSI, Shoreview MN). Statistical analysis was performed in SPSS version 21 using a t test to compare mean outcome differences. Results: See chart below. Flow from all devices was different from each other (p<.01). There was little intra device variability (p=.07). Discussion: All of the compressors tested had flow output higher than 8LPM. When administering nebulizers through home ventilators, higher flows can increase the risk of missed breaths and patient ventilator dyssynchrony. Manufacturers may need to take this issue into consideration when developing future compressors.

Sponsored Research - None

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
FlowMeter6LPM	3	.20	6.41	6.61	6.5200	.10149
FlowMeter8LPM	3	.33	8.39	8.72	8.5833	.17214
Respironics	3	.68	11.01	11.69	11.3733	.34239
SalterAire	3	.34	10.42	10.76	10.5800	.17088
PariVios	3	.14	9.87	10.01	9.9567	.07572
SalterAirePlus	3	.12	10.47	10.59	10.5400	.06245
Valid N (listwise)	3					

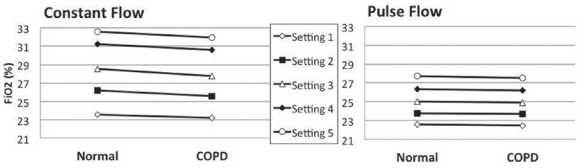
1964721

THE EFFECT OF ANATOMIC RESERVOIR ON FIO_2 FOR CONSTANT FLOW VS PULSE FLOW OXYGEN DELIVERY DEVICES.

Steven Zhou, Robert L. Chatburn; Respiratory Institute, Cleveland Clinic, Cleveland, OH

BACKGROUND: The FiO_2 for constant flow (CF) oxygen therapy via nasal cannula is dependent on a combination of factors including breathing frequency and the anatomic reservoir (AR). Patients with COPD have end expiratory flows which do not reach zero, potentially eliminating the AR and decreasing FiO_2. Pulsed flow (PF) devices do not use AR and FiO_2 should not be affected by loss of AR. The purpose of this study was to test 2 hypotheses: (1) loss of AR reduces FiO_2 for CF, and (2) loss of AR does not affect FiO_2 for PF. **METHODS:** An ASL 5000 lung simulator (IngMar Medical) modeled normal and COPD patients using published data. Normal: f = 20, R_{in} = 4, R_{out} = 4, C = 60, V_T = 685, Pmax = 12.31, increase = 33%, release = 28%; COPD: f = 20, R_{in} = 12, R_{out} = 25, C = 66, V_T = 685, Pmax = 24.52, increase = 35%, release = 23%. End expiratory flow for Normal was 0 L/min; for COPD it was 15 L/min. Standard low-flow nasal cannula and model nose were connected to lung simulator. PF was delivered using an Electric Oxypulse Conserver (Drive Medical). FiO_2 was measured with the simulator. Mean FiO_2s of 10 breaths were compared for different settings using paired t-tests with $P < 0.05$ considered significant. **RESULTS:** CF had higher FiO_2 than PF for both normal and COPD models. For CF, FiO_2 decreased 0.60% with COPD compared to Normal. For PF, FiO_2 decreased 0.13% with COPD. Due to the small simulation variability, all results were statistically significant. **CONCLUSION:** For CF, FiO_2 decreased when AR was eliminated by high end expiratory flow (COPD). For PF, FiO_2 also decreased but the change for CF was almost 5 times higher. In both cases however, the decrease was clinically unimportant.

Sponsored Research - None



1965628

ONE YEAR REVIEW OF HIGH FLOW OXYGEN DELIVERY SYSTEM OUTCOMES.

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Introduction: Improving gas exchange and decreasing work of breathing are clinical end-points when managing patients with respiratory failure. Often the interventions are to provide high flow oxygen via a mask or more aggressive form of clinical management like non-invasive or mechanical ventilation. High Flow Oxygen (HFO) delivery system provides an alternate or a bridge between high flow oxygen administration and forms of ventilation. High Flow Oxygen can be provided via a nasal cannula or via a tracheal adapter . By providing flow rates up to fifty liters a minute, high molecular humidity and a precise oxygen delivery, it may reduce the need for Non-invasive Ventilation (NIV) and intubation in selected patient populations. Methods: We examined the number of patients who were placed on HFO over a twelve month time frame in our medical-surgical ICU. All patients placed on HFO either had a Sp02<88% or had an increased work of breathing (noted by a respiratory rate>30 or the use of accessory muscles). Reasons for HFO flow utilization, duration of use, number of times placed on HFO and therapy outcomes were assessed. Results: Two hundred patients, 120 males and 80 females, were placed on HFO from January 1, 2013 to December 31, 2013. Patient ages ranged from twenty-one to ninety years old. One Hundred and thirty-three patients (67%) were placed on HFO for the improved of oxygenation and 67 patients (31%) were placed for increased work of breathing or for humidification enhancement. Outcomes are seen in Table 1. Conclusion: The utilization of High Flow Oxygen allowed our clinician team to improve oxygenation and decrease work of breathing without the need for the institution of non-invasive or invasive mechanical ventilation in over fifty percent of patients who were placed on it and ICU length of stay was reduced in this group. High Flow Oxygen delivery system provides another weapon in the arsenal of oxygen therapy in improving gas exchange and reducing work of breathing. It may reduce the need for more aggressive forms of therapy; reduce the need for intubation and duration of ICU stay. Larger clinical studies need to be conducted to determine its full impact on patient outcomes. Table 1

Sponsored Research - None

HFO Out Comes

	Males	Females	Oxygen	NIV	Mech Vent	Expired
HFO	120	80	105 (52.5%)	50 (25%)	40 (20%)	5 (2.5%)
ICU LOS			7.5 days	11.4 days	18.5 days	

2001723

HEALTHCARE PROFESSIONALS ACCURACY AND CONSISTENCY IN SETTING OXYGEN FLOWMETERS FOR PATIENTS IN AN INTENSIVE CARE UNIT.

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Background: Healthcare professionals routinely initiate, monitor, and maintain oxygen (O_2) therapy as ordered by Licensed Independent Practitioners (LIP). A comparative study was undertaken to determine if there was a difference between ordered flows and set flows for patients in a neonatal intensive care unit (NICU). **Methods:** This was an observational study, and not deemed human subject testing by the IRB. Data were collected over 3 days from 50 flowmeters (FM). All patients on O_2 via nasal cannula (NC) were included. FM were attached to blenders located 137 cm from the floor. During data collection, LIP ordered flow was verified. The patient's NC was switched to an adjacent FM set to the correct ordered flow. Using O_2 tubing connected to the FM and without adjustment, flows were measured with a Timeter Series RT-200 Calibration Analyzer. After measurements were taken, the patient's NC was returned to the original FM, and flow settings were verified to be correct. For the comparison of set to ordered flows, acceptability of results was arbitrarily set at ± 10% and ± 20% to be considered within a tolerable range of variance. Differences were calculated (ordered flow–measured flow) to determine the number of measurements outside of the ± 10% and ± 20% range. Pearson correlation and t-tests were used in the analysis. **Results:** Data was stratified for ordered flows of < 2 LPM (48%, 24/50) and ≥ 2 LPM (52%, 26/50). For ordered flows < 2 LPM, flows ranged from -0.35 to 0.49 LPM below and above the ordered set flow and 54% (13/24) and 46% (11/24) were outside the ± 10% and ± 20% range, respectively. Differences were not statistically significant (p=0.62). For ordered flows ≥ 2 LPM, flows ranged from -0.33 to 0.33 LPM below and above the ordered set flow and 23% (6/26) and 0% (0/26) were outside the ± 10% and ± 20% range, respectively. Differences were not statistically significant (p=0.63). Set vs. measured flows for the < 2 LPM group showed less correlation (R^2=0.86) compared to the ≥ 2 LPM group (R^2=0.94). **Conclusion:** Measured flows compared to set flows correlated well, however, when looking at the flows outside of the ± 10% and ± 20% range, the accuracy of personnel setting the flows was concerning, particularly in the < 2 LPM group since about half were outside of the ± 10% and ± 20% acceptability limit. Accurately set FM can help assure appropriate and consistent O_2 weaning strategies, and can assist LIPs in knowing the patient's current O_2 requirement.

Sponsored Research - None

2006529

PENDANT RESERVOIR CANNULA OFFERS ADVANTAGES OVER STANDARD CANNULA IN A MODEL OF COPD.

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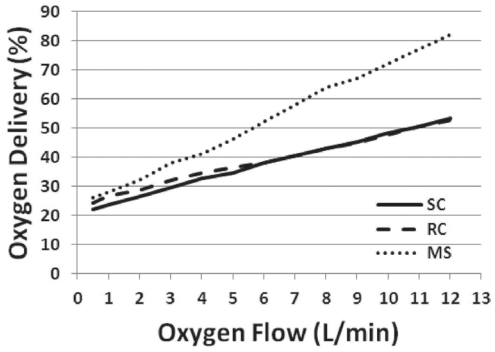
BACKGROUND Reservoir cannulas (RC) are designed to store oxygen during exhalation, deliver that oxygen during inhalation, and thus result in oxygen conservation or a higher FiO_2 for a given flow. Previously we have shown (Respir Care. 2009;54(11):1573) that elevated end expiratory flows with COPD can reduce FiO_2 from a standard cannula (SC) due to elimination of the anatomic reservoir. Thus reservoir cannulas may be less affected. We hypothesized that with simulated COPD, oxygen delivery from RC would be greater than that of SC. **METHODS** An ASL 5000 lung simulator (IngMar Medical) modeled a COPD patient with the following settings: f = 20. Rin = 12, Rout = 25, C = 66, V_T = 685, Pmax = 24.52, increase = 35%, release =2 3%, resulting in end expiratory flow = 15 L/min. A SC and model nose were connected to the simulator. Oxygen flows of 0.5 to 12 L/min were used. FiO_2 was measured with the simulator. The experiment was repeated with the Oximizer pendant RC. Mean FiO_2 for 20 breaths were compared for both cannulas using paired t-tests with P<0.05 considered significant. Manufacturer's claimed FiO_2 specifications (MS) were also compared. **RESULTS** Data are shown in the Figure. The RC produced significantly higher FiO_2s with oxygen flow < 6 L/min (mean difference 2%). However, the MS overestimated the RC FiO_2 for all flows (range 2 – 29%). **CONSLUSION** The RC may offer a small advantage over SC, either in terms of oxygen conservation or higher FiO_2 for COPD patients. Caution should be used when interpreting MS because the data were generated using an arbitrary normal lung model rather than an evidence based COPD model. These results suggest the need for human studies.

Sponsored Research - None



2013198

THE USE OF HIGH FLOW NASAL CANNULA IN OBESE PATIENT POST CARDIOTHORACIC SURGERY.

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Background: Obesity has been linked with obstructive sleep apnea, which can lead to prolonged mechanical ventilation after cardiovascular surgery. Prolonged mechanical ventilation post cardiovascular surgery is a known complication. High flow nasal cannula (HFNC) has been proven to decrease respiratory rate, decrease work of breathing, and increase lung volumes post cardiovascular surgery. The goal being a decrease in mechanical ventilation time and preventing re-intubation or use of BiPAP. IRB approval was obtained prior to the start of the study. Method: Patients who were identified with a BMI > 30 kg/m2 or PaO2 > 59 mm Hg but < 80 mm Hg, were extubated to high flow nasal cannula, and remained on HFNC for at least 24 hours at an FiO2 of .50 and flow of 50 LPM. Post 24 hours, the FiO2 and flow were weaned based on the patient's needs. Data obtained on each patient include: PaO2 pre and post extubation, BMI, extubation time, time of transition from HFNC to nasal cannula, chest x-ray results pre and post operatively, and the surgical procedure performed. Results: Forty patients were enrolled in the study. Sixteen of those patients were excluded because they were on HFNC for <24 hours. The remaining 24 patients were followed for this study. The average BMI was 34.7 kg/m2. One patient was re-intubated due to a paralyzed diaphragm; patient was subsequently trached and transferred to a long term acute care facility. Of the study population, 83% had a BMI > 30 kg/m2. With the use of HFNC, 45% of the study population, who would not have been extubated because of a low PaO2, were extubated. Of the study population, 17% showed an improved chest x-ray after 24 hours on HFNC. Conclusion: For obese patients, BMI > 30 kg/m2, or hypoxic patients, HFNC may be an option for decreasing mechanical ventilation times and preventing re-intubation.

Sponsored Research - None

2020035

COMPARISON OF RIGHT AND LEFT PRONG OXYGEN FLOW RATE ON FIVE DIFFERENT NASAL CANNULA ADJUNCTS.

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Background: The delivery of low-flow oxygen to patients is commonly given via nasal cannula, which consists of two nasal prongs connected to a single oxygen tubing source. However, there is a lack of literature describing the actual flow of oxygen delivered through each nasal cannula prong separately. The null hypothesis states there is no significant difference in the oxygen flow rate between the right and left prongs of nasal cannulas. Methods: This IRB exempt bench-top study evaluated five different nasal cannulas from different manufacturers. The nasal cannula manufacturers evaluated included Westmed, Salter Labs, CareFusion, Hudson RCI, and Medline with 7 foot tubing. Two factory calibrated thermal mass flowmeters were simultaneously connected to each nasal cannula prong and the flow rate from each nasal cannula prong was measured while delivering a set flow rate of 0.5-6 Liters per minute oxygen in 0.5 Liter per minute increments via a calibrated Thorpe tube style flow meter. Flow rate settings on the Thorpe tube style flow meter was verified using the thermal mass flow meter. The paired t-test and Manova statistical methods were utilized to analyze data at an alpha level of 0.05. Results: Table 1 displays the mean flow rate and standard deviation for the nasal cannula prongs at each delivered oxygen flow rate. The paired t-test demonstrated a significant difference between the flow rates from the right and left nasal cannula prong with a p value of <0.01. The Manova statistical method did not demonstrate a significant difference in flow rates of each nasal cannula prong between the studied nasal cannulas of the different manufacturers with a p value of 0.07. Conclusions: While a statistical significant difference was found between the mean oxygen flow rates delivered from the right and left nasal cannula prongs, the difference was no larger than 0.26 Liters per minute. The authors believe this difference is not clinically significant and would not impact the delivery of oxygen and patient care. There was no statistically significant difference found between nasal cannulas of different nasal cannula manufacturers. Disclosures: The authors have no relations with industry.

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Table 1. The mean flow rate and standard deviation for the nasal cannula prongs at each delivered oxygen flow rate.

	Mean Flow Rate ± SD (Lpm)	
Oxygen Flow Rate (Lpm)	Right Prong	Left Prong
0.5	0.25±0.03	0.2±0.02
1	0.52±0.03	0.43±0.02
1.5	0.75±0.03	0.64±0.02
2	1±0.09	0.89±0.12
2.5	1.22±0.08	1.11±0.08
3	1.47±0.11	1.36±0.08
3.5	1.71±0.19	1.62±0.19
4	1.99±0.08	1.93±0.1
4.5	2.14±0.12	1.88±0.18
5	2.5±0.2	2.7±0.18
5.5	2.67±0.15	2.65±0.22
6	2.89±0.09	2.85±0.21

2022459

PERFORMANCE OF OXYGEN CONCENTRATORS AT ALTITUDE AND TEMPERATURE EXTREMES.

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BACKGROUND: Oxygen is commonly used to prevent and/or correct hypoxemia. Compressed gas and liquid oxygen systems are currently used during transport, but the oxygen supply is finite and presents hazards in an austere environment. Oxygen concentrators have been proposed as an adjunct. METHODS: We evaluated three commercially available portable oxygen concentrators (Eclipse 3 and Saros, Sequal Technologies, and iGo, Devilbiss Healthcare) at altitude and temperature extremes in a laboratory setting. Altitude testing was performed in an altitude chamber at sea level and 8,000, 16,000, and 22,000 feet. The devices were also stored at 60oC and -35oC for 24 hours and then operated at room temperature at sea level. The concentrators were tested in continuous flow mode at 1, 2, and 3 lpm and a range of volumes in bolus mode. RESULTS: In continuous flow mode the FIO2 range was 0.94-0.95 and 0.93-0.97 in bolus mode at sea level and all altitudes with the Eclipse 3. The Saros FIO2 was 0.94-0.96 in continuous flow mode and 0.95-0.97 in bolus mode at sea level and all altitudes. The FIO2 range with the iGo in continuous flow mode was 0.87-0.91 at sea level, 8000, and 16000 feet. In bolus mode the FIO2 range was 0.93-0.94 at 8000 feet and sea level respectively. The Eclipse 3 FIO2 across the test range was significantly lower (p<0.001) after 60oC storage (range 0.81-0.95, mean 0.88 ± 0.5) and after -35oC storage (range 0.81-0.95, mean 0.88 ± 0.5) compared to room temperature FIO2 (range 0.89-0.96, mean 0.93 ± 0.2. The FIO2 from the Saros after 60oC storage was not statistically different (p=0.07) from room temperature measurements. The range and mean was 0.89-0.96 (0.94 ± 0.2) compared to room temperature FIO2 (range 0.9-0.97, mean 0.95 ± 0.2). The FIO2 after -35oC storage was statistically different (p=0.3). The range and mean was 0.92-0.97 (0.95 ± 0.1). The FIO2 from the iGo after 60oC storage was not statistically different (p=0.3) from room temperature FIO2. The range and mean was 0.89-0.95 (0.93 ± 0.2) compared to room temperature FIO2 (range 0.9-0.95, mean 0.93 ± 0.1). The FIO2 after -35oC storage was statistically different (p<0.001). The mean and range was 0.69-0.91 (0.86 ± 0.7). The iGo ceased operating at 16,000 feet. CONCLUSIONS: The iGo ceased to operate at 16,000 feet in bolus mode. The Eclipse 3 produced stable FIO2 at all altitudes tested. Oxygen delivery from all devices was affected by high respiratory rates and temperature extremes.

Sponsored Research - None

2022480

PERFORMANCE OF CHEMICAL OXYGEN GENERATORS AT ALTITUDE AND TEMPERATURE EXTREMES.

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BACKGROUND: Oxygen delivery may be life-saving following traumatic injury. Cylinders are heavy and present a number of hazards, and liquid oxygen is too heavy and cumbersome to be used in far forward and remote locations. Chemical oxygen generators (COG) are used in commercial air flight and can be used in an austere environment. Alterations in oxygen production and delivery with increasing altitude and temperature extremes must be evaluated and understood. METHODS: We evaluated three COG (emOx BUDI, Green Dot Systems; Traumaid, Habco Industries; O2Pak, Pacific Precision Products) at altitude and at temperature extremes in a laboratory setting. Studies were conducted in a man-rated altitude chamber at Wright-Patterson Air Force Base or an altitude/environmental chamber at the University of Cincinnati. Altitude testing was done at sea level and 8,000, 16,000, and 22,000 feet. Temperature extreme testing was performed after device storage at 60oC and 35oC for 24 hours. RESULTS: Oxygen flow, duration of operation, and total oxygen volume varied between devices and between the same device types. Mean oxygen flow rate increased with all devices with increased altitude. At sea level the range was 0.6-3.4 lpm (mean 1.9 ± 0.4) with the BUDI, 4.4-6.7 lpm (mean 5.7 ± 2.7) with the Traumaid, and 7.0-7.2 lpm (mean 7.1 ± 2.5) with the O2Pak. At 22,000 feet the range was 1.7-4.6 lpm (mean 3.5 ± 1.3) with the BUDI, 7.9-9.8 lpm (mean 9.0 ±) with the Traumaid, and 13.9-14.7 lpm (mean 14.5 ± 5.0) with the O2PaK. After 60oC and -35oC storage, flow output with the BUDI did not significantly change (p=0.28 and p=0.9 respectively) The range was 1.6-2.0 lpm (mean 1.8 ± 1.2 and 1.6 ± 0.7 respectively). After 60oC and -35oCstorage, output from the Traumaid was not significantly different from output at room temperature (p=0.39 and p=0.42 respectively). The range and mean was 6.2-7.0 lpm (6.6 ± 3.4) and 3.4-4.0 lpm (3.7 ± 2.6) respectively. After 60oC storage, flow output with the O2Pak output did not significantly differ (p=0.5) from room temperature output. The range and mean were 7.5-8.4 lpm (7.9 ± 2.9). Although after -35oC storage the output was significantly lower (p=0.02). The range and mean were 5.3-5.7 lpm (5.5 ± 1.6). CONCLUSIONS: This study showed differences in flow output between devices and within the same type of device at altitude and temperature extremes. Clinicians must understand the performance characteristics of devices in all potential environments.

Sponsored Research - None

2022696

EVALUATION OF OXYGEN USE IN THE ACUTE CARE SETTING OF A TEACHING COMMUNITY HOSPITAL - A PILOT PROJECT.

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Background: Oxygen is prescribed for many hospital inpatients for a variety of indications and diagnoses. In our institution, we observed that at times oxygen was being prescribed inappropriately or continued without a clear need. This leads to a waste of resources and adds additional cost to patient care. Oxygen may be deleterious to some patients. We therefore performed a quality improvement project to further evaluate these practices at our institution. Methods: Patients admitted to the medical and telemetry floors of a large community teaching hospital over a two week period were evaluated for oxygen use within 24 hours of admission. Patients who were on oxygen by nasal cannula were included in the current project. The AARC guidelines for oxygen therapy were used to determine need for oxygen use in these patients. Patient charts were reviewed for active oxygen orders. In addition, determination of need was made based on the AARC guidelines. If need was appropriate, then the records were analyzed for documentation of the reason for the oxygen order. All data were analyzed using SPSS. Results are reported using descriptive statistics. Results: Over the study period, 363 patients were screened; 102 (28%) of these patients were on oxygen therapy by nasal cannula. Of the 102 patients on oxygen, 38 (37.3%) had no active order in the chart; 30 patients (29.4%) who were on oxygen did not meet AARC criteria for oxygen use. Of the 72 patients who did meet AARC criteria for oxygen use, 51 (71%) did not have documentation in the chart to justify oxygen usage. Conclusions: The results suggest that oxygen therapy is inappropriately utilized and the documentation for its use is lacking in a significant number of patients. These practices lead to misappropriation of the already limited resources available. It also leads to unnecessary costs to the healthcare system. House staff and hospitalists need to be educated further regarding the appropriate use of oxygen therapy. The above data has led our institution to develop new oxygen utilization guidelines which include limiting duration of orders for oxygen, which is easily implemented when an electronic EMR is in place. We have instituted more frequent assessments of patients' needs for oxygen therapy by the pulmonary and respiratory staff. In addition, multidepartmental meetings have been held to re-educate staff who are involved in patient care. Disclosures: All the authors have nothing to disclose.

Sponsored Research - None

2023002

THE EFFECTS OF NASAL CYCLING ON INSPIRED FIO2 BY NASAL CANNULA IN AN ADULT MODEL.

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Background: The nasal cannula (NC) is a common method for delivering low flow oxygen. Previous literature demonstrates equal airflow through a patient's right and left nare can be significantly hindered due to nasal cycling, which is the unilateral alternation of congestion and decongestion of nasal mucosa. How is oxygen delivery by NC affected if one nare is completely obstructed due to nasal cycling? The null hypothesis is there is no significant difference in the inspired FiO2 administered by a NC if one nare is completely obstructed compared to the inspired FiO2 administered by a NC with patent nares. Methods: This IRB exempt bench-top study utilized the AirSim Advance manakin head, which has an anatomically correct upper airway, connected to a QuickLung Breather test lung with settings of Vt 500 mL, frequency 15 breaths per minute, and an I:E ratio of 1:2. The tidal volumes were verified using a Wright's Respirometer and the manikin head was arranged to be at a 30-degree angle to mimic a comfortable patient position. A polarographic oxygen analyzer calibrated per manufacturer recommendations was placed inline between the manikin and the test lung. A NC was placed on the manikin head with oxygen delivery increased from 0.5-6 Liters per minute in 0.5 Liter per minute increments using a calibrated Thorpe tube style flow meter. Each oxygen flow rate was verified using a thermal mass flow meter. Inspired FiO2 was measured using the polarographic oxygen analyzer with both manikin nares patent, then with the right nare occluded, and finally with the left nare occluded, sequentially. Data was analyzed using the One-Way Repeated Measures ANOVA and Bonferroni post hoc statistical methods at an alpha level of 0.05. Results: Table 1 displays the measured inspired FiO2 for each measured oxygen flow rate and nare patency. The Repeated Measures ANOVA demonstrated significant differences for inspired FiO2 with a p value <0.01. The Bonferroni post hoc statistical method demonstrated significant differences between patent nares and the left nare occluded at a p value <0.01 and between patent nares and the right nare occluded at a p value <0.01. Conclusions: The occurrence of complete left or right nare occlusion due to nasal cycling could have an impact on oxygen delivery by reducing the inspired FiO2 a patient receives. This effect has a greater impact on inspired FiO2 at higher NC oxygen flow rates. Disclosures: The authors have no relations with industry.

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Table 1. The inspired FiO2 for each measured flow rate and nare patency.

0.5	24.7	24.3	
1	27.7	27.2	
1.5	30.4	29.5	
2	33.8	30.5	
2.5	36.1	31.9	
3	38	34.3	
3.5	40.4	34.6	
4	40.7	35.4	
4.5	44.2	35.8	
5	45.1	35.8	

2021242

COMPARISON OF TWO CLINICALLY ACCEPTED METHODS OF METERED DOSE INHALER ALBUTEROL DELIVERY IN MECHANICALLY VENTILATED INFANTS WITH SEVERE BRONCHOPULMONARY DYSPLASIA.

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BACKGROUND: A quality improvement initiative examining the efficacy of metered dose inhaler (MDI) albuterol delivery was completed on a sample of orally intubated, mechanically ventilated infants with severe bronchopulmonary dysplasia (BPD). The objective was to evaluate outcomes on two clinically accepted methods of albuterol delivery by MDI. METHODS: The IRB at Nationwide Children's Hospital made the determination that this study did not meet the definition of human subjects research. Method 1 delivery utilized a MDI with an AeroChamber HC MV (Monaghan Medical Corporation, Plattsburgh, NY) device and a self-inflating manual resuscitation bag (Mercury Medical, Clearwater, FL). Method 2 utilized an AirLife MiniSpacer (CareFusion, Yorba Linda, CA) dual spray inline device placed between the patient endotracheal tube (ETT) and the ventilator circuit Y-connector. Heart rate (HR), peak expiratory flow rate (PEFR), expired minute ventilation (Ve) and percent air leak were recorded pre and post albuterol treatment from an IntelliVue Patient Monitor (Philips Healthcare, Andover, MA) and an Avea (CareFusion, Yorba Linda, CA) ventilator equipped with a proximal hot wire flow sensor. Data were evaluated using ANOVA and t-tests. RESULTS: Twenty four (24) pre and post measurements were obtained (n=12 by Method 1 and n=12 by Method 2) on 7 intubated infants with severe BPD. Significant differences were found in mean pre to post treatment HR (12.8% vs. 3.4%; p=0.006) and PEFR (41.7% vs. -1.0%; p=0.008) for Method 1 versus Method 2 respectively. There was also a trend toward an increase in pre to post treatment mean expired Ve for Method 1 versus Method 2 (28.7% vs. -9.0%; p=0.054). There were no significant differences in means for Method 1 pre versus post air leak (18.6% vs. 18.2%; p=0.955), Method 2 pre versus post air leak (27.1% vs. 28.8%; p=0.890) Method 1 pre versus Method 2 pre air leak (18.6% vs. 27.1%; p=0.390), and Method 1 post versus Method 2 post air leak (18.2% vs. 28.8%; p=0.372). CONCLUSIONS: These preliminary results suggest that an AeroChamber HC MV device and a manual resuscitation bag may be a more efficacious approach for the delivery of albuterol by MDI compared to an AirLife MiniSpacer dual spray inline device in intubated infants with severe BPD. Additional formal studies will need to be performed to verify these unblinded but provocative findings.

Sponsored Research - None

2021287

EFFECT OF TIDAL VOLUME AND VIBRATING MESH NEBULIZER POSITION ON AEROSOL DELIVERY IN A PEDIATRIC MECHANICAL VENTILATION MODEL.

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Introduction Children undergoing mechanical ventilation frequently receive nebulized therapy. Data generated with adult models previously reported an increase in aerosol delivery with increasing tidal volume. Position of the nebulizer has been proven to be critical in optimizing aerosol delivery. We speculate that increasing tidal volume does not increase aerosol delivery and that moving a vibrating mesh nebulizer from the Y-piece to the ventilator does. Methods 4 units of a disposable vibrating mesh nebulizer (VM) (Solo®, Aerogen) were filled with albuterol (2.5mg/3ml) and studied when placed at the Y-piece (Y), and at the ventilator before the humidifier (V) in a pediatric ventilator model (Servo-*i*, PRVC mode, RR 20, PEEP 5 cm H2O, FiO2 0.4, IT 0.75 seconds). Tidal volumes of 100, 150, 200, and 300 ml. were studied. The circuit was connected in series to a 5.5 cuffed ETT, deposition filter and a lung model. Albuterol concentration was measured with spectrophotometry at 276 nm. Coefficient of variation were calculated for each position-tidal volume (CV=SD/mean). Statistical analysis done with analysis of variance followed by Tukey test for tidal volumes and t-test for nebulizer position. Results (expressed as % of nominal dose and as mean ± SD of 4 runs) Aerosol delivery did not change with tidal volumes in the 150-300 ml range. Moving the nebulizer from Y-piece to the ventilator increased drug delivery by 2.7-3.1-fold for tidal volumes 150-300 ml. The coefficient of variation was 1-4-3.5-fold with the nebulizer at the ventilator compared to placement at the Y-piece. Conclusions Increasing tidal volume does not increase aerosol delivery from VM in a pediatric mechanical ventilation model. Placement of a VM between ventilator and humidifier increased aerosol delivery except for 100 ml tidal volume scenario.

Sponsored Research - None

	100 ml	150 ml	200 ml	300 ml
Y-piece	7.3 ±1.1*	4.8 ± 1.1	4.9 ± 0.7	4.7 ± 0.8
Ventilator	9.5 ±5.1#	14.7 ±5.2	13 ± 3.9	12.8 ±3.1
P value Y vs. V	0.46	0.03	0.02	0.01

*p < 0.02 when compared to other tidal volumes.
p = 0.44 when compared to other tidal volumes.

2021446

EFFECTS OF BLEED-IN METHOD AND VOLUME VENTILATION ON NITRIC OXIDE DELIVERY DURING MRI.

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BACKGROUND: Patients may require inhaled nitric oxide (iNO) during Magnetic Resonance Imaging (MRI) testing. Due to incompatibility, equipment for iNO delivery: iNO Max DS ir (Ikaria, Hampton, NJ) requires the unit to remain outside the MRI suite during testing. The purpose of this study was to determine if the iNO Max DS ir delivers desired iNO ppm to the patient using volume ventilation during MRI. METHODS: A MRI compatible ventilator, GE iVent 201 (GE Healthcare, Waukesha, WI), was set to volume control ventilation (SIMV) at a respiratory rate 20 bpm, set tidal volumes (Vt) of 50cc and 400cc, pressure support 5cmH2O, PEEP 5cmH2O and FiO2 100%. The iNO Max DS ir injector module was placed in the inspiratory limb of the circuit and set at 20ppm. For baseline measurements, a 10ft sample line was place proximal to the patient in the inspiratory limb. iNO samples were taken with the injector module out of line using 2 liters per minute at 25 ppm and 80ppm nitric oxide bled in from the iNO Max DS ir blender. iNO gas was added into the inspiratory limb of a ventilator circuit from the iNO blender using a bleed-in method, a pressure line adaptor and 42 feet of oxygen tubing. iNO and NO2 were measured at six points along the 42 feet of oxygen bleed-in tubing. RESULTS: There was no statistically significant difference in measured iNO or fluctuations in NO2 through a prolonged delivery route and volume ventilation through the ventilator circuit (p<0.0001). Mean values and standard deviations for iNO and NO2 are displayed in the table below. CONCLUSION: The iNO Max DS ir bleed-in method delivers desired iNO and maintains stable NO2 levels with delivery and sample line extension tubing during MRI. Set tidal volume affects the amount of iNO required to achieve desired iNO concentrations.

Sponsored Research - None

Analyzed iNO and NO2 ppm

Bleed-in Amount	2lpm of 25ppm (50cc Vt)	2lpm of 25ppm (50cc Vt)	2lpm of 80ppm (400cc Vt)	2lpm of 80ppm (400cc Vt)
Analyzed Location	iNO (ppm) mean (StDev)	NO2 (ppm) mean (StDev)	iNO (ppm) mean (StDev)	NO2 (ppm) mean (StDev)
Bleed-in Only	19.00 (0.00)	0.60 (0.00)	20.00 (0.00)	0.30 (0.00)
Injector Only	20.20 (0.41)	0.41 (0.04)	21.00 (0.00)	0.20 (0.00)
At vent circuit	19.20 (0.41)	0.30 (0.00)	61.97 (0.25)	1.10 (0.00)
7ft from circuit	19.90 (0.31)	0.22 (0.04)	61.00 (0.00)	1.10 (0.00)
14ft from circuit	19.90 (0.31)	0.20 (0.00)	61.07 (0.25)	1.04 (0.05)
21ft from circuit	19.97 (0.18)	0.20 (0.00)	60.93 (0.25)	0.99 (0.03)
28ft from circuit	19.90 (0.31)	0.20 (0.00)	61.00 (0.00)	0.90 (0.00)
35ft from circuit	19.93 (0.25)	0.20 (0.00)	61.00 (0.00)	0.89 (0.03)

2022444

COMPARISON OF AEROSOL DRUG DEPOSITION BETWEEN AEROSOL MASKS AND MOUTHPIECE USING A VIBRATING MESH NEBULIZER IN A SPONTANEOUSLY BREATHING LUNG MODEL.

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BACKGROUND: Vibrating mesh nebulizers are commonly used in the clinical setting. There is little to no data available regarding drug delivery using various interfaces. The purpose of this comparison was to determine if there is a difference in the amount of aerosolized drug delivered using a vibrating mesh nebulizer with various interfaces (three different aerosol masks and mouthpiece) in an in-vitro, spontaneously breathing, adult lung model. METHOD: An adult upper airway manikin (Laerdal, Stavenger, Norway) was attached to a training test lung (TTL) (Michigan Instruments, Grand Rapids, Michigan) with both bronchi attached to a collecting filter (Carefusion, San Diego, California) to determine dose deposition. A conventional mechanical ventilator was used to drive the TTL to simulate an adult asthmatic breathing pattern (flow 60 L/min, tidal volume 500 mL, respiratory rate 25 bpm, I:E ratio 1:3, sinusoidal waveform). Albuterol sulfate (2.5 mg/ 3 mL) was administered with a vibrating mesh nebulizer (Aerosol Solo, Aerogen, Galway, Ireland) at air flow rates of 0,2,4,8 and 10 L/min via 4 airway interfaces applied to the adult manikin. These interfaces are the mouthpiece, AirlifeTM Aerosol Mask (Carefusion, San Diego, California), OxyMulti Mask™, and OxymaskTM Aerosol (Southmedic, Barrie, Ontario, Canada). Each treatment was run until completion, sputter or 10 minutes, whichever occurred first. Deposited drug was eluted (0.01% NaOH) from each filter and analyzed by spectrophotometry (276mm). Each unique case was repeated three times with a 20% or less agreement between each run. RESULTS: There was not any significant (p<0.05) differences in the mean amount of drug delivered using the vibrating mesh nebulizer at no flow or 2,4,8 and 10 L/min through the nebulizer's t-piece with all interfaces combined. The mean drug (μg) delivered using the mouthpiece (716 ± 271) was significantly (p<0.05) higher than the mean drug delivered through the AirlifeTM Aerosol Mask (266 ± 59), OxyMulti Mask™ (325 ± 42), and OxymaskTM Aerosol (400 ± 24). See Figure 1. CONCLUSION: Overall, the mouthpiece resulted in a higher aerosol drug delivery compared to aerosol masks using a vibrating mesh nebulizer. Drug delivery with vibrating mesh nebulizer was not affect by the air flow rates through the adapter up to 10 L/min. Further testing is needed to determine if there are any differences in aerosol drug delivery at various flow rates using the mouthpiece.

Sponsored Research - This data was collected as part of a funded research project by Southmedic, Ontario, Canada

2022524

INFLUENCE OF PATIENT INTERFACE AND GAS COMPOSITION ON ALBUTEROL DELIVERY IN A SPONTANEOUSLY BREATHING INFANT AND CHILD MODELS: A BENCH STUDY.

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INTRODUCTION: Pediatric aerosol therapy is frequently administered with an aerosol facemask. Those patients requiring other forms of respiratory support, such as heated high flow nasal cannula (HHFNC) or heliox (HeO2), the optimal method of aerosol delivery is unclear. We investigated albuterol delivered through facemask and HHFNC with and without heliox in spontaneously breathing infant and pediatric lung models. We hypothesized that there would be no differences in the absolute mass of Albuterol between different airway delivery devices and gas composition. METHODS: A test lung (Ingmar, PA) was programmed to simulate spontaneous breathing in a seven month old and a five year old patient. An Aeroneb Solo (Aerogen, Galeway IR) was placed proximal to the age-appropriate nasal cannula or face mask distal to the oxygen tubing or HFNC circuit (Fisher & Paykel, Auckland NZ). Flow was set at 3 and 8 L/min for the infant and small pediatric models, respectively. The airway interfaces were attached to the airway/lung models and Albuterol (5 mg) was nebulized first using 40% FiO2 and then again using HeO2 (60/40%) for the respective devices and simulated patients. Humidity, temperature, and flow were measured prior to nebulization. Drug was collected using a filter attached to lung model and quantified using high performance liquid chromatography. Differences were compared using ANOVA with Tukey post-hoc tests. Significance was determined as $p<0.05$.RESULTS: The infant facemask resulted in greater drug delivery than HHFNC for both the infant and pediatric models ($p<0.01$). The use of HeO2 gas resulted in less drug delivery in all of the lung model conditions ($p<0.05$) but the infant facemask ($p=0.85$). In the HHFNC, excessive fluid formed on the walls of the infant cannula and was aspirated into the nasal airway model; whereas, only minimal fluid was observed in the small child model. DISCUSSION/CONCLUSIONS: Based on these findings, heliox appears to be a poor gas medium for delivering bronchodilators in pediatrics. We feel that infants should be given bronchodilators using an aerosol facemask, not only because drug delivery was low (<2%) with HHFNC but also because of potential safety concerns from excessive fluid accumulation. Although facemask provided greater drug deposition in the small child model, HHFNC provided acceptable drug delivery without excessive fluid. We believe that this may due to the specialized material used with the Optiflow cannula.

Sponsored Research - None

2022906

BENCH EVALUATION OF EZPAP: NEBULIZER EFFICIENCY AND POSITIVE AIRWAY PRESSURE GENERATION.

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Background: The EzPAP is a simple device designed to deliver positive airway pressure that has replaced IPPB as a treatment for atelectasis in some hospitals. In clinical observation, it has been noted that a puddle forms on the expiratory side of the device when a nebulizer is run in-line with EzPAP, leading to the question of how much drug is delivered to the patient. There has been little research conducted on the performance of EzPAP, both in pressures generated at different liter flows and in drug delivery with an in-line nebulizer. We hypothesized that EzPAP would deliver positive pressure on expiration only and that the EzPAP would reduce drug delivery from the nebulizer to the patient. Method: A two-chambered test lung powered by a ventilator was used to simulate spontaneous breathing on 4 different experimental setups: jet nebulizer alone running at 8 LPM, nebulizer with EzPAP running at 6, 10, and 12 LPM. Inhaled albuterol (2.5 mg/ 3ml nominal dose) aerosol traveled through a model "throat," consisting of a 90° elbow and a 20 cm length of clear vinyl tubing (allowing visualization of the aerosol), and finally deposited on a filter. The patient dose was the mass of albuterol delivered to the filter and was determined by eluting the drug from the filters and analyzing the solution by spectrophotometry (276nm). Airway pressures were monitored with a manometer attached to the sampling port on the EzPAP device. The patient dose results were compared by a one-way analysis of variance (ANOVA) and further evaluated by the Tukey test. Results: Contrary to our hypothesis, the patient dose of albuterol increased with the use of a nebulizer with EzPAP and further increased with increasing EzPAP flow (Figure 1). The patient dose results (as percent of nominal dose) for each group from nebulizer alone to nebulizer with EzPAP at 12LPM are as follows: 7.6%, 14.1%, 21.5%, 25.8%. The difference in patient dose between each group was statistically significant ($p<0.05$). The EzPAP delivered a set of 3 distinct pressures through 3 phases of the respiration cycle: peak expiration/resting expiration/inspiration. The resulting pressures during the respiration cycle delivered at 6, 10, and 12 LPM were as follows: 13/5/1cmH2O; 17/10/5cmH2O; 20/13/7cmH2O. Conclusion: In our simple model, the EzPAP and nebulizer combination delivered a higher patient dose than a nebulizer alone and was capable of delivering significant positive airway pressures in the therapeutic range.

Sponsored Research - None

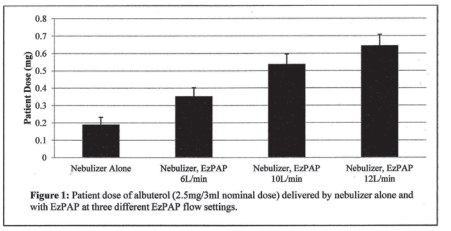

Figure 1: Patient dose of albuterol (2.5mg/3ml nominal dose) delivered by nebulizer alone and with EzPAP at three different EzPAP flow settings.

2022990

FOLLOW THE ARROW: AN EVALUATION OF THE AERONEB® SOLO ADULT T-PIECE DIRECTION ON DOSE DELIVERY IN AN IN-VITRO MODEL.

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Background: The Aeroneb® Solo nebulizer t-piece enables delivery with an aerosol mask in spontaneously breathing patients. The arrow on the adapter is designed to point towards the patient in all delivery modes. The adapter can easily be set-up with the arrow pointing away from the patient and aerosol still be delivered. The objective of this study was to evaluate the amount of drug delivered to an in-vitro, adult model using three aerosol masks with the adapter arrow pointing towards and away from the model. Methods: An adult upper airway manikin (Laerdal, Stavenger, Norway) was attached to a training test lung (TTL) (Michigan Instruments, Grand Rapids, Michigan) with both bronchi attached to a collecting filter (Carefusion, San Diego, California). A conventional mechanical ventilator was used to drive the TTL to simulated an adult asthmatic breathing pattern (flow 60 L/min, tidal volume 500 mL, respiratory rate 25 bpm, I:E ratio 1:3, sinusoidal waveform). Albuterol sulfate (2.5 mg/ 3 mL) was administered with a vibrating mesh nebulizer (Aeroneb® Solo, Aerogen, Galway, Ireland) at 0 L/min via 3 aerosol masks. The masks included the AirlifeTM Aerosol Mask (Carefusion, San Diego, California), Prototype OxyMulti Mask and OxymaskTM Aerosol (Southmedic, Barrie, Ontario, Canada). Each treatment was run until completion, sputter or 10 minutes, whichever occurred first, with each mask three times. Deposited drug was eluted (0.01% NaOH) from each filter and analyzed by spectrophotometry (276mm) to determine deposition. Results: This study was conducted to examine whether there was a difference in drug deposition when using the Aeroneb® Solo nebulizer with the provided t-piece pointing in two different directions; arrow toward the model (n=9) and arrow away from the mode (n=9). Data analyzed using a Mann-Whitney U test revealed a significant difference in drug deposition between the arrow pointed toward the model (mdn 316, IQR: 217, 398 µg) and away from the model (mdn 58, IQR: 42, 66 µg) as depicted in figure 1. U= 0.0, z= -3.6, $p<0.001$. Conclusions: When using the Aeroneb Solo Nebulizer to deliver treatments via aerosol mask, median drug deposition is significantly greater when the t-piece arrow is pointing towards the patient. Disclosure: This data was collected as part of a funded research project by Southmedic, Ontario, Canada.

Sponsored Research - This data was collected as part of a funded research project by Southmedic, Ontario, Canada.

2022906 (continued)

AEROSOL MASKS VERSUS MOUTHPIECE: THE INFLUENCE OF AEROSOL INTERFACES ON DRUG DEPOSITION IN A SPONTANEOUSLY BREATHING MODEL.

Hemali Brahmbhatt, Meagan N. Dubosky, David L. Vines; Respiratory Care, Rush University, Chicago, IL

Background: Limited data is available on the quantity of aerosol delivered using various patient interfaces, including standard and hybrid aerosol masks compared to a mouthpiece in adults. The primary objective of this study was to evaluate the amount of drug delivered to an in-vitro, adult model using three different aerosol masks and a mouthpiece. Methods: An adult upper airway manikin (Laerdal, Stavenger, Norway) was attached to a training test lung (TTL) (Michigan Instruments, Grand Rapids, Michigan) with both bronchi attached to a collecting filter (Carefusion, San Diego, California). A conventional mechanical ventilator was used to drive the TTL to simulate an adult asthmatic breathing pattern (flow 60 L/min, tidal volume 500 mL, respiratory rate 25 bpm, I:E ratio 1:3, sinusoidal waveform). Albuterol sulfate (2.5 mg/ 3 mL) was administered with two jet nebulizers, Uni-HeartR (Westmed, Tucson, Arizona) at 2 and 4 L/min and Misty Max 10TM (Carefusion, San Diego, California) at 8 and 10 L/min., and a vibrating mesh nebulizer (Aerosol Solo, Aerogen, Galway, Ireland) at 0, 2, 4, 8 and 10 L/min via 4 airway interfaces. These interfaces include the mouthpiece, AirlifeTM Aerosol Mask (Carefusion, San Diego, California), OxyMulti MaskTM and OxymaskTM Aerosol (Southmedic, Barrie, Ontario, Canada). Each treatment was run until completion, sputter or 10 minutes, whichever occurred first, with each interface and nebulizer three times. Deposited drug was eluted (0.01% NaOH) from each filter and analyzed by spectrophotometry (276mm) to determine deposition. Results: See Table 1 for means, standard deviations (SD), and significant differences. Conclusions: Mean drug deposition was highest with the mouthpiece compared to the aerosol masks at flow rates of 8 and 10 L/min. When flow rates were 4 or less there were no significant differences in mean drug deposition for these airway interfaces. When appropriate, the mouthpiece appears to deliver the highest concentration of Albuterol. Disclosure: This data was collected as part of a funded research project by Southmedic, Ontario, Canada.

Sponsored Research - This data was collected as part of a funded research project by Southmedic, Ontario, Canada

Means and standard deviations for each aerosol interface at varying flows.

Flow (L/min)	Aerosol Interfaces (n)	Mean Drug Deposition + SD (µg)
0, 2, 4	OxyMulti MaskTM (15)	267.57 + 115.23
	AirlifeTM Aerosol Mask (15)	188.41 + 133.08
	Mouthpiece (15)	358.25 + 247.62
	OxymaskTM Aerosol (15)	286.05 + 156.81
8, 10	OxyMulti MaskTM (12)	270.68 + 22.25
	AirlifeTM Aerosol Mask (12)	237.17 + 26.09
	Mouthpiece (12)	641.68 + 383.05**
	OxymaskTM Aerosol (12)	383.00 + 19.23

**Mean difference is significant at the p = 0.05 level

2014876

2014 UTAH SOCIETY FOR RESPIRATORY CARE AARC/USRC MEMBERSHIP SURVEY

Kimberly J. Bennion[1], Kelly J. Rose[2]; [1]Corporate Respiratory Care, Intermountain Healthcare, Salt Lake City, UT; [2]Respiratory Care Program, Stevens Henager, Murray, UT

Background: The AARC's 2015 & Beyond reports, 2013 AARC Membership Drive & Utah's flat membership gain led the USRC Board to conduct a survey to determine baseline knowledge, attitudes & feedback regarding AARC/USRC membership. **Method**: A 10-question survey using Survey Monkey® was distributed to current AARC/USRC members & reviewed at the annual USRC conference. The survey was sent to RT managers for distribution to reach non-AARC/USRC members. The Utah Division of Professional Licensing (DOPL) currently licenses 1,316 Respiratory Care Practitioners, but denied requests to distribute the survey to all Utah RTs. The AARC reported Utah's membership rate as 24.5% at the time of this abstract. **Results**: Only 95 RTs returned the survey. When asked if interested in attending the USRC monthly meetings, respondents reported: 15 (16%) definitely not interested, 40 (42%) somewhat interested, 27 (28%) probably would attend & 13 (14%) definitely would attend. Survey results are reported in Table One. **Conclusion**: It is our impression the limited number of surveys returned may have been due to: 1) a non-distribution of the survey by managers, or 2) a general lack of knowledge regarding the benefits of membership, AARC/USRC activities or national initiatives. This may contribute to some element of apathy. Managers were sent 4 email reminders & the survey due date was extended to allow the capture of 11 additional participants. Generally, seasoned RTs felt less need for professional membership as they are not required to maintain CRCE credits. RTs requested web-conferencing of meetings, personal face-to-face communication with Board members, more social events at convenient regional locations, a more updated webpage, regular distribution of upcoming events & a greater need to capture/retain student memberships. Requests were made for more CRCE credits, lower membership fees & legislative activities to increase pay. USRC Board/committee chairs are performing hospital site visits to distribute fliers & posters regarding membership benefits for posting in departments. They are discussing USRC Board legislative initiatives & the AARC 2015 & Beyond reports. The site visits allow increased face-time with Board /committee chairs as well as opportunities for open discussions. At the time of this abstract's creation, the USRC is developing a strategic plan for moving forward to accomplish the 2014 AARC membership goal for Utah to increase membership by at least 14%.

Sponsored Research - None

Table One: 2014 USRC Membership Survey Results

Question	Yes # (%)	No # (%)
Are you a member of the AARC/USRC?	57 (60)	**38 (40)**
Were you aware your USRC membership is included in your AARC membership dues?	**60 (63)**	35 (37)
Were you aware the monthly USRC meetings were open to all members?	47 (49.5)	**48 (50.5)**
Were you aware the USRC has a web and Facebook page?	41 (43)	**4 (57)**
Total Surveys Returned = 95 (100%)		

2015112

IMPROVING COMPLIANCE WITH A NEW PRODUCTIVITY PROCESS IN A LARGE PEDIATRIC RESPIRATORY CARE DIVISION.

Angela M. Saunders, Thomas Cahill, Cynthia C. White; Respiratory Care Division, Cincinnati Children's Hospital Medical Center, Cincinnati, OH

Introduction: The ability to quantify and track productivity work units continues to increase in importance as a management process for Respiratory Care Departments. More pressure exists to justify FTE, make more efficient staffing decisions, and gain support for evolving Respiratory Therapy value added practice that directly impacts patients. As part of our division's global aim to develop proactive systems for consistency and sustainability, we implemented a quality improvement process to track our current and predictive productivity this past year. Initial barriers have delayed our ability to build the system into the EMR at our facility. This has resulted in temporary use of a program developed on a Share Point site where each Respiratory Therapist (RT) directly enters their predictive and current data for the shift. In order for this data to be reliable and timely information for staffing decisions, the predictive data for the next shift must be entered into the share point system by 0500 or 1700 respectively. An RT taskforce was formed to map out the process, discuss barriers, and develop a smart aim to increase compliance with RT's entering predictive productivity on time into share point from 0 to 95% by July 1, 2014. Methods: All cumulative productivity data was downloaded from share point into an excel spreadsheet. Weekly compliance with RT's entering the data by 0500 and 1700 was calculated and placed into a control chart to be trended for both night shift and day shift. A total of twelve interventions were implemented during the time frame of October 2013 to May 2014. Results: See attached run chart for results. Conclusions: RT's entering am predictive data have already achieved 95% compliance with entering information into share point by 0500. Compliance with entry of PM predictive data remains overall below 60% by 1700. The variation in this practice indicates that there may need to be a heightened level of awareness, engagement, and accountability surrounding the importance of productivity for RT's. The success and failure modes will need to be more closely analyzed and evaluated to identify root causes and implement new interventions to overcome the barriers to achieving successful data capture

Sponsored Research - None

2015963

UTILIZING A PILOT STAFFING MODEL TO DRIVE PATIENT OUTCOMES IN A PEDIATRIC INTENSIVE CARE UNIT.

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Background: During the past five years our facility has encountered a number of challenges in adequately staffing the pediatric intensive care unit (PICU). Some of these challenges included: increased bed capacity, unpredictable patient volumes, and variable patient complexity. The PICU staffing model was based on Relative Value Units (RVU), with a goal of each therapist taking approximately 30-40 RVUs each in a 12 hour shift. This resulted in an average of a staff of two therapists per shift, but in many cases this model required each therapist to carry more than the target number of RVUs. Method: In quarter one (Q1) of 2014 we implemented a zone-staffing pilot with one therapist assigned between six to eight contiguous occupied beds, resulting in an average target of four therapists per shift. The intent of the zone-staffing model was to promote more timely response to clinical changes, to provide additional support to nurses with overall patient cares, to enhance communication among the health care team, and to improve overall patient outcomes. Pre- and post-metrics were collected Q1 of 2013 and 2014 including: unplanned extubations per 100 ventilator days, family perception of healthcare teamwork, and pressure ulcer (stage 3 or 4) injuries per 100 non-invasive ventilator (NIV) days. Nurses, providers, and respiratory therapists were also surveyed with regard to their overall perception of the care provided by the respiratory therapists. Results: Unplanned extubations fell from 0.74/100 to 0.38/100 ventilator days, pressure ulcer injuries related to NIV devices slightly increased from 0/100 to 1.0/100 NIV days, survey results around overall perception of the respiratory therapists improved from 3.08 overall to 3.61, and family perception of healthcare teamwork improved from 60.5% to 72.0% of excellent. It should be noted that during Q1 of 2014 there was a 30% increase in total NIV days, an increase in total bed capacity from 26 to 32 beds, and the average number of therapists was four per shift. Conclusions: There were several challenges including changing the therapists focus from an RVU based assignment to a zone-staffing model, resulting in an inconsistent adoption of the zone-staffing model. However, this model does show promise in improving patient outcomes and should be further evaluated for potential implementation in other units.

Sponsored Research - None

COMPARISON OF QUALITY MEASURES Q1 2013 TO Q1 2014

Unplanned Extubations per 100 Ventilator Days		Pressure Ulcers per 100 Non-Invasive Ventilator Days		Patient Satisfaction Survey % of Excellent		Survey of Healthcare Providers	
2013	2014	2013	2014	2013	2014	Pre-Pilot	Post-Pilot
0.74	0.38	0	1.0	60.5	72.0	3.08	3.61

2016703

A QUALITY IMPROVEMENT PROJECT TO REDUCE THE NUMBER OF THIRTEEN HOUR SHIFTS IN THE RESPIRATORY CARE DIVISION.

Elizabeth A. Cooper, Kathleen Sparks, Jack Horn, Cynthia White; Respiratory Care, Cincinnati Childrens Medical Center, Cincinnati, OH

Introduction: Several recent studies focusing on nursing revealed that nurses were at higher risk for making errors when working longer shifts (12.5 hours or more compared to eight hour shifts). The employees in the longer shift group also were at higher risk for needle stick injuries, musculoskeletal injuries, drowsy driving, sleep deprivation, and fatigue. Respiratory Therapists (RT's), also tend to work twelve hour shifts on a routine basis and have similar schedules and patient care responsibilities as nursing. When factoring in extra time for end of shift report, and staying late for meetings and councils, a 12.5 hour shift can very quickly turn into a shift that is thirteen hours or longer. We initiated a quality improvement project in the Respiratory Care Division at our facility with a SMART AIM to decrease the number of thirteen hour shifts to a total of less than 273 by July 31, 2014. Methods: Data reporting shift times greater than twelve hours were recorded biweekly from our timekeeping system and recorded in an excel spreadsheet. Specific personnel information was broken down by patient care areas and sent to Respiratory Care Managers for verification. Several interventions were initiated in attempt to decrease the need for RT's to work shifts greater than 12.5 hours to attend meetings, participate in shared governance councils, and complete shift work. After realizing the long shifts worked by RT's on the transport team was mostly beyond our control, we separated the long shifts worked by the transport team RT's into a separate data line on our bi-weekly control chart. The number of long shifts were evaluated pre and post PDSA interventions. Results: See attached run chart for results. The average number of shifts worked by RT's in the Respiratory Care Division not including the transport team was 8.44 (+/- 4.88) per pay period prior to the PDSA's and 2.22 (+/- 1.31) per pay period after the interventions. Discussion: By using Rapid Cycle Quality Improvement Methodology we were able to decrease the number thirteen hour shifts worked by RT's in the Respiratory Care Division this year. This effort appears to be sustainable, and the project did not require a lot of effort following the initial PDSA's targeted at a heightened level of awareness, engagement, and accountability. More overall outcomes data needs to be correlated looking at the reduction of shifts greater than 12.5 hours and the impact on RT Health and Patient Safety.

Sponsored Research - None

2016829

JUST CULTURE: A KEY ELEMENT TO IMPROVING PATIENT SAFETY.

Joyce Baker, Matthew Vitaska, William Thompson; Children's Hospital Colorado, Aurora, CO

Background: In a punitive environment, healthcare workers typically only report errors they cannot hide. As a result, vital information needed to identify system and process failures to improve patient safety may be limited. Just Culture encourages people to report system and process failures without fear of punishment; and recognizes that even competent individuals make mistakes because it is difficult, if not impossible, to design a system that will produce perfect results. Method: Effective implementation of a Just Culture relies on developing competencies of front line managers to investigate the behavior that led to an error and to hold their team members accountable for appropriate behaviors. The intent is to create a learning culture to help design and redesign systems to be safer. Expectations of staff must include looking for risks in the environment, reporting errors or hazards, and making safe choices aligning with organizational values, while ultimately intending to improve patient safety. Training around the principles of Just Culture theory was provided by a Patient Safety Manager and Human Resource Client Service Manager to respiratory department leadership. A Just Culture algorithm was developed to standardize situational assessment and guide action to be taken by leadership. Results: Baseline and follow up metrics were established from 2011 and 2013 from cultural assessments and quality and safety reporting tool. There was a 58% increase in the number of quality and safety reports submitted by front line staff. In many incidences staff felt safe to report concerns or issues impacting patients. The AHRQ survey of favorable in the non-punitive response to error domain increased by 14%. A significant 0.83 increase was noted with in the employee opinion survey 0.83 under the category of "I can report medical errors without fear of reprisal". Conclusion:Implementation of a Just Culture methodology decreased front-line staff perception of a punitive environment and increased confidence of front-line staff's commitment to organizational safety and quality. One can argue that a long term benefit of implementing Just Culture will improve patient outcomes as a result of staff feeling more comfortable in openly bringing process and quality improvement opportunities forward to management.

Sponsored Research - None

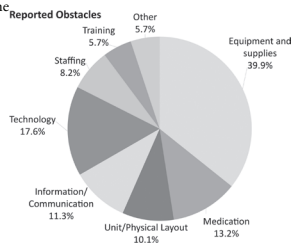
2017934

TRACKING SYSTEM OBSTACLES TO IMPROVE RESPIRATORY THERAPISTS WORKFLOW AND OVERALL QUALITY OF PATIENT CARE.

Elise Miller[1], Joyce Baker[1], Collin Miller[2]; [1]Children's Hospital Colorado, Aurora, CO; [2]St. Louis University, St. Louis, MO

BACKGROUND: Respiratory Therapists (RT's) have an intimate knowledge of their patient care system and its obstacles. Most adverse events in health care derive from small process and system failures common enough to take for granted. In many incidences workarounds become standard practice despite not being the best way to get the job done and address the ongoing system challenges. The basis for this improvement project includes staff empowerment, team collaboration, and operational aspects to improve workflow and quality of care. METHODS: Initially an anonymous online, 5 question, 5 point Likert scale survey was sent out to RT's to evaluate perception of patient safety within the organization. An anonymous, pocket size card was disseminated asking to track shift specifics; number of operational obstacles; number of incidents with each obstacle; description of the obstacles; and time spent overcoming the obstacle in minutes. The card offered seven different recorded obstacles: equipment and supplies, medication, unit/physical layout, information/communication, technology, staffing, and training. The information was gathered over a three-week period. RESULTS: The survey showed the perception of patient safety had an average of 3.19. A total of 159 cards were collected, of those cards 34% reported no obstacles; 37.1% of the cards reported one obstacle; and 29% reported 2-4 obstacles. The average time spent overcoming one obstacle was 30.26 min. When a card reported 4 obstacles the mean time spent resolving the obstacles was 142 min. Of the seven reported categories equipment and supplies was the highest reported obstacle at 39.9% with a mean time spent of 29.84 min to resolve the obstacle. The combined mean time for all reported obstacles in the 3-week collection period was 5395 min (89.9 Hours). This extrapolated over a year's time to one full time employee. CONCLUSION: Information gathered from the recorded obstacle descriptions will further assist in identifying barriers impeding efficiency or delay in patient care. The survey will be repeated in 6-9 months to re-evaluate perception of patient safety within the organization. Nursing completed a similar study and a comparative analysis is planned to establish common system barriers. Overall, this project has potential to decrease inefficiencies and improve patient outcomes.

Sponsored Research - None



2018457

WORKPLACE BULLYING AMONG RESPIRATORY THERAPY MANAGERS AND SUPERVISORS IN OHIO.

Sarah M. Varekojis, Erica Chen, Krystal Kaiser, Emily Monks, Tiara Washington, Tyler Wolpert; The Ohio State University, Columbus, OH

Introduction: There have been many studies conducted regarding the prevalence and effects of workplace bullying in the nursing field. These studies have shown that workplace bullying affects self-esteem, job satisfaction and patient care. Respiratory therapists have similar working conditions to nurses. There has been little research conducted on the subject of workplace bullying among respiratory therapists. The purpose of this study is to establish the prevalence of workplace bullying experienced by respiratory therapy managers, supervisors and clinical leaders in Ohio. Methods: We used the Negative Acts Questionnaire-Revised (NAQ-R) survey instrument to measure the prevalence of workplace bullying. The instrument includes a 5-point weighted Likert-scale and several additional demographic questions, including gender, credentials, years of work, hospital size and type. Institutional IRB approval was obtained. A link to the electronic survey was emailed to all licensed respiratory therapists in the State of Ohio (n=6,205) using the Ohio Society for Respiratory Care (OSRC) database. Participants who indicated that their main role was manager, supervisor or clinical leader continued on to the NAQ-R survey. Results: We received 750 (12.1%) responses and 169 (22.5%) indicated their current role was manager, supervisor or clinical leader. 35 (25.5%) participants experienced bullying (daily or weekly experience of 2 or more NAQ-R items). Teaching hospitals (p=0.022) and respondents with less than 15 years of experience (p=0.001) were victims of bullying more frequently. The mean NAQ-R summary score was significantly higher of those who were bullied (498.7) verse those who were not (23.06) (p=0.000). 55.1% of respondents did not perceive they were bullied and were not actually bullied while 5.9% perceived they were not bullied and were actually bullied at work. Conclusion: Respiratory Therapy managers do experience workplace bullying at a rate similar to that reported in both nursing and respiratory staff literature. The vast difference in the mean NAQ-R scores between those who were bullied and those who were not indicates that when it does exist, it exists to a severe degree. Further research regarding the consequences for the hospital concerning managerial retention and turnover as well as the overall costs and impact on patient care associated with workplace bullying is warranted. Disclosures: None.

Sponsored Research - None

PROTOCOL BASED RESPIRATORY CARE SERVICES - STILL NOT NECESSARILY THE EXPECTED RESULTS?

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Background: Implementation of The Affordable Care Act (ACA) has become reality, with both mandated and anticipated changes to healthcare provision and reimbursement in abundance. Readmission penalties for respiratory-related conditions are soon to become a fact of hospital life. Medical Necessity (MN) is a key component of ACA, with Recovery Audit Contractors (RAC) reviewing and denying claims based on lack of MN. Protocol Based Respiratory Care Services (PBRCS) may assist in ensuring MN, but were initially enacted to improve utilization of Respiratory Care Services (RCS), as has been proven in peer-reviewed literature (1,2). Our RC Department implemented PBRCS and reported preliminary data at Open Forum 2013. We have continued to collect data and are now reporting as a follow-up. Methodology: Ongoing retrospective data review of workload statistics. Our facility converted to PBRCS in October of 2012, and has systematically collected Quality Assurance data both pre and post implementation. We previously reported data for the same 6 month time period of two consecutive years. We now are now reporting data for the past 22 months. Findings: The total procedure count has decreased by 6% since implementing PBRCS, and does not indicate statistical significance overall. However, when considering RC Services by category, different results appear to be unfolding. Scheduled Medicated Aerosol Therapy has decreased by 73%, While Volume Expansion Therapy has increased by 16%. Both of these values indicate statistical significance ($p<.05$). Oxygen Therapy and Secretion Clearance Therapy have remained relatively flat, with less than 5% change overall. Conclusions: Our data indicates that we have made significant impact on workload type through the use of PBRCS, a finding which was not supported early on. Our data also indicates that in spite of this, the overall workload has not been significantly impacted. We also hypothesize that our data may may indicate greater adherence to Medical Necessity guidelines. We can also now fully support a finding that indicates at least some degree of previous misallocation of resources, as others have reported. We intend to analyze our data an implement further changes as ACA continues to evolve, and will continue to collect and report this data as part of our ongoing Quality Assurance Program. 1 Respir Care, March 2013 58:3, 431-437 2 Respir Care, July 2004 49:7, 761-765

Sponsored Research - None

2019748

USE OF A STAFFING TOOL TO MEET HOSPITAL PRODUCTIVITY THRESHOLDS.

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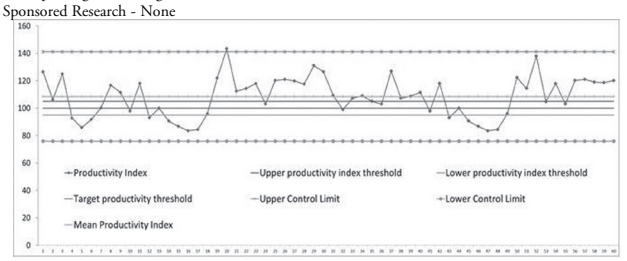
BACKGROUND: Hospital administrators base staff reductions and/ or position replacement on productivity metrics. At our institution, a productivity index, is used to determine approvals for new or replacement positions. Predictive staffing tools may assist respiratory team leaders (TL) adjust respiratory therapist (RT) daily staffing to meet the target productivity index within acceptable tolerance intervals. The purpose of this study was to evaluate the percent of time that our staffing tool was able to meet a productivity standard of 100% ± 5%. **METHODS:** An Excel spreadsheet was pre-programed with a list of respiratory procedures and their associated relative value units, as specified in the American Association for Respiratory Care's Uniform Reporting Manual. Twice daily the TL calculated the number of variable staff required by entering in actual workload volumes based on respiratory orders. Every 4 hours, fixed and variable RT hours were evaluated to determine the approximate number of RTs needed to provide ordered care. The TL adjusted RT worked hours, based on staffing tool predictions, by increasing or decreasing RT scheduled hours. Productivity index was calculated as (budgeted worked hours/budgeted volumes) divided by (actual worked hours/actual volumes). The daily productivity index and the ability to meet the index was recorded from 3/1/14 - 4/30/14. Mean daily productivity index and 95% confidence limits were calculated. The percent of time productivity standards met, exceeded or fell below the standard of 100% ± 5% were calculated. **RESULTS:** The mean productivity for the 2 month study period was 108.5%. Calculated limits yielded a control range wider than the hospital specified range (upper control limit 141, lower limit 76). Using the staffing tool to adjust worked hours, the TL met or exceeded the productivity standard 23% and 55% of the time, respectively, see Figure. **CONCLUSIONS:**Hospital control limits were more restrictive than statistically based limits. Use of the staffing tool kept productivity at or above required limits 78% of the time. These data provide a benchmark for comparison with other departments and for improving the staffing tool.

Sponsored Research - None



2019807

KBMA: ACHIEVE AND SUSTAIN MAXIMUM POSSIBLE COMPLIANCE.

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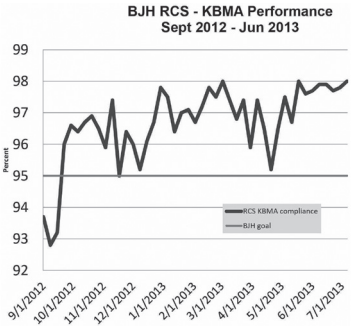
Background: Administering the right medication to the right patient is a Safety-Quality non-negotiable. BJH has a goal of 95% scanning compliance for KBMA –Knowledge-Based Medication Administration. In spite of numerous and major efforts to increase training, awareness and discipline; every week the Department's score is erratic, unpredictable and barely compliant. Methods: Respiratory Care Services began to track KBMA compliance each week using MDI (Managing for Daily Improvement). RCS posted weekly individual compliance scores starting in September 2012. Team members with perfect compliance were identified, recognized and studied. Successes were shared with individuals that were not meeting 95% compliance. Throughout the effort, therapists mastered the ability to identify and tackle problems quickly. In late April, Pharmacy introduced new labels that were difficult to scan. RCS Leadership intervened to improve the labels to enhance scanning ability and achieve greater patient safety. Results: The graph below shows weekly compliance during and after intervention. Notice how performance increases and the range narrows down. In 2013, YTD performance was sustained -now bringing up the overall BJH YTD average. As of late July 2013 the Department can practically predict performance –and now the only issues that get it out of its 'common variation range' are system disruptions (e.g., implementation of 'Follow Me Desktop', IT breakdowns, etc.); these are noted and reviewed every time they happen. Conclusion: Therapists have better discipline and awareness of the importance of delivering the right medication to the right patient, everyone has better data, leaders are able (both with data and skills) to take prompt action using facts and sound tools.

Sponsored Research - None



2021741

DECREASING SEROUS HARM WITH QUALITY IMPROVEMENT IN A PEDIATRIC INTENSIVE CARE UNIT.

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Background: At the end of FY 13, our PICU had more events of serious harm (SH) than other units in the hospital. SH is defined as VAP, CAUTI, CLABSI, ADE, never events, and serious pressure ulcers, falls, and PIV infiltrates. In FY 13, there were 27 events of SH in the PICU. Our team set an aggressive goal to reduce the number of SH events from 27 to <14 events by the end of FY 14. Method: The leadership team implemented leadership safety rounds, which are comprised of having unit leaders observing practice by interacting with patients, families, and staff. We set out to change our culture, moving to a proactive approach. Everyone on the team owned this and had to feel comfortable with feedback. In parallel to safety rounds, the unit sent a team of clinicians to Rapid Cycle Quality Improvement training. By using the 'Ask Why 5 Times' tool, the team was able to identify that a root cause of SH was the lack of awareness that patients were at risk for harm. Critically ill patients with lines, drains, and airways were the norm in the PICU. There was a lack of recognition that the very same things that were saving the lives of these patients were also putting them at risk. An intervention to improve SH recognition was to have the leadership team ask the bedside caregivers if their patients were at risk for SH and if so, was there a mitigation plan in place to prevent the harm. Over the course of the project and with the implementation of real time coaching, the staff began to accurately identify SH with a plan >90% of the time (starting at 10%). Trends were recognized that required interventions to improve compliance with our prevention standards. With the VAP bundle it was noted that the compliance for having the oral suction device properly stored in a non-sealed container for patients on invasive mechanical ventilation was 25%. The method for storing the device was not effective and when a new device was implemented, compliance increased to >80% in 4 months. Compliance is now >95%. Results: With a month to go in FY 14, there have been 10 events of SH and we are on track to surpass the goal. Conclusions: The implementation of safety rounds and SH recognition and mitigation was an effective means to reduce serious harm in the PICU. One of the most significant improvements was the reduction of VAP in our unit, going from 7 to 1 event this FY. We also shifted our mean for the first time in the reduction of all ventilator associated infections (VAP & VAT).

Sponsored Research - None

2022627

ASSESSMENT OF MORAL DISTRESS IN RESPIRATORY THERAPISTS.

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Background: Moral distress (Md) is the psychological disequilibrium experienced when one perceives the right moral action to take but is constrained from taking that action. Only one study has focused specifically on Md among respiratory therapists (RTs). Research demonstrates a correlation between Md and perception of workplace ethical climate (PEC). It is important to study this problem in all health care workers (HCWs) because, left unaddressed, Md may result in adverse emotional and physical symptoms, increased risk of burnout, and loss of HCWs from the workforce. Existing surveys may underestimate Md in non-nursing HCWs. Research questions: 1) Do RTs experience moral distress with a comparable frequency and intensity to that reported in RNs? 2) Is there a significant difference in RTs' moral distress measured using the MDS-R alone vs w/ MDS-R + RT-specific survey items? 3) Are the survey items developed for this study reliable and valid? Methods: Five RT-specific survey items were designed for and administered to RTs along with a validated Md instrument (MDS-R) that has been utilized in nursing research. Survey reliability was assessed with calculation of Cronbach's alpha. Statistical analyses were performed on 1) moral distress index (MdI) measured with and without RT-specific survey items; 2) MdI in RTs who had left or considered leaving a clinical position because of Md versus RTs who had not done so; and 3) the relationship between Md and the PEC. Results: Cronbach's alpha was 0.898. Two of the five RT-specific Md survey items demonstrated construct validity with two recent studies in RTs. The MdI measured using the revised survey was significantly higher than that from the MDS-R alone ($r = .982$, $p < 0.001$). The MdI was significantly higher in RTs who had ever left or considered leaving a position because of their Md than in those who had never done so ($p < .021$); and among those currently planning versus not planning to leave a position ($p < 0.001$). There was a negative correlation ($r = -0.423$, $p < .001$) between Md and PEC. Conclusions: The data supported the hypothesis that augmenting a generic survey with a limited number of discipline-specific items optimized Md assessment in RTs. Correlations reported elsewhere of job attrition and PEC with Md are replicated in this study. Validation of new survey items should continue.

Sponsored Research - None

2028603

SURVEY OF PROLONGED MECHANICAL VENTILATION IN INTENSIVE CARE UNITS IN MAINLAND CHINA: A PROSPECTIVE MULTICENTER STUDY.

Jie Li[1], Qingyuan Zhan[2], Chen Wang[3], Chinese PMV Study Group Chinese PMV Study Group[1]; [1]Respiratory Intensive Care Unit, Beijing Institute of Respiratory Medicine, Beijing Chaoyang Hospital-Affiliate of Capital Medical University, Beijing, China; [2]ICU, Beijing China-Japan Friendship Hospital, beijing, China; [3]Beijing Hospital, Ministry of Health, beijing, China

BACKGROUND: In mainland China there are no special care centers for patients requiring prolonged mechanical ventilation, burdingin the ICUs. Our goals was to characterize and understand the incidence and outcome of prolonged mechanical ventilated (PMV; defined as ventilation≥21days) in typical units across China. METHODS: A prospective one-day prevalence study was performed at 55 ICUs, with 28-day follow-up between Jul 10th and Aug 7th, 2007. RESULTS: On July 10th, 622 adult patients occupied ICU beds, with 302 patients receiving invasive ventilation enrolled, of which 109 (36.1%) PMV patients had been ventilated for more than 21 days (median 51, 21-3419) in ICU. PMV incidence varied by type of ICU: Respiratory/Medical ICU (51.4%), General ICU (36.9%), Surgical ICU (23.7%), Emergency ICU (40.0%). 28 days later, 157 in 302 patients became PMV. Of 60 patients who admitted ICU on July 10th, only 3 patients (5%) became PMV. For the 157 PMV patients, 31(19.7%) died in hospital, 10(6.4%) discharged hospital on request of the patient or their surrogates with unknown outcome, 42(26.8%) were successfully weaned, and the reminder 74 continued ventilation in the ICU. CONCLUSIONS: The ratio of PMV patients was surprisingly high in this cross section of Chinese ICUs, especially respiratory/ medical ICU. In the following 28 ICU days, only a small proportion of PMV patients were weaned. The optimal venue for care of PMV patients needs to be investigated.

Sponsored Research - None

Patients' outcomes on different day of admitting ICU

Date admit ICU	PMV# or not	Discharged from ICU in good condition	Discharged with unknown outcome	Died in ICU	Still in ICU but weaned	Still in ICU received IMV*
On study day	PMV (3)	0	0	1	1	1
	Non-PMV (57)	48	5	4	0	0
Before study day	Had been PMV (109)	19	4	25	2	59
	Became PMV during 28 days' follow-up (45)	12	5	5	2	21
	Non-PMV (88)	41	12	31	4	0

#PMV= prolonged mechanical ventilation, *IMV= invasive mechanical ventilation

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PHASE III OF A MULTI-PHASE INTERDISCIPLINARY STUDY AIMED AT REDUCING ENDOTRACHEAL TUBE DEVICE-RELATED HOSPITAL ACQUIRED PRESSURE ULCERS IN ICU AND CVICU.

Charez Norris, Debra Beauchaine; Respiratory Therapy, John C. Lincoln- North Mountain, Phoenix, AZ

Background: A phase II study using a commercial adjustable ETT stabilizer improved, but did not eliminate, the incidence of facial/mucosal HAPUs from ETT. We continued to study ETT stabilization methodology in our network hospital Level 1 Trauma ICU and CVICU. Purpose of study included: 1) To decrease incidence of device-related hospital-acquired pressure ulcers (HAPUs) in ICU/CVICU by standardizing the re-taping process for endotracheal tubes (ETT), and 2) to identify attitudes of Registered Nurses, (RN's) and Respiratory Therapists (RT's) regarding tape vs. a commercial ETT stabilizer. Method: Study proposal was presented to hospital's research committee to determine if IRB was needed to be obtained. Committee determined study was a process improvement project. An anonymous six question semi-structured qualitative survey using survey monkey was designed and sent to every ICU/CVICU RN and RT prior to study intervention. Next, education about a new standard work process for taping and/or using a commercial stabilizer for ETT was provided. The RT educator audited the process for 4 weeks post intervention. The same survey was distributed post intervention. Results: 109 patients were audited over four weeks. Tape was used on 107 patients; commercial stabilizers on 2 patients, both had beards. 11 patients, using tape, developed blanchable redness on the face. RT's notified RN's of skin alterations as part of the standard work process. There were zero HAPUs during the audit and also during the next quarterly prevalence study. The majority of survey respondents were nurses. (RN = 28; RT = 13.). 68% of respondents agreed tape is a causative factor in the development of facial/mucosal HAPUs, and 55% agreed commercial stabilizers facilitated easer tube repositioning and inspection than tape. But only 39% respondents agreed a commercial ETT stabilizer is effective in prevention of HAPUs. Conclusion: Tape is a causative factor in the development of facial/mucosal HAPUs but commercial ETT stabilizers are not necessarily more effective in preventing HAPUs. A standardized re-taping process for ETT was effective in prevention of HAPUs associated with ETT stabilization.

Sponsored Research - None

2012334

IMPACT OF A FOCUSED TRACHEOSTOMY ALGORITHM AND TRAINING ON RT MANAGEMENT OF POST-OPERATIVE TRACHEOSTOMIES.

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Background: Accidental dislodgement of pediatric post-operative tracheostomies in the ICU, particularly in the first week, is a potentially life threatening complication. Two sentinel events at our institutions encouraged us to improve management and expertise at the bedside. Methods: We created a multidisciplinary task force including respiratory therapists (RT), intensivist physicians, ENT and pediatric surgeons, and nurses to identify opportunities for improved fresh post-operative care and education. The team created recommendations for standardized OR care, sedation management, and bedside management. We also created an Emergency Tracheostomy Dislodgement Algorithm (ETDA). We developed mandatory staff education and simulation for our ICU RTs. Training included an hour didactic session on types, signs and risk factors for dislodgement, the new task force recommendations, ETDA and simulation. Simulation included a dislodgement scenario in which the RT had to use the ETDA to determine the type of tracheostomy dislodgement, pull the stay sutures and replace the tracheostomy. Every therapist was to demonstrate how to properly pull stay sutures and insert a new tracheostomy tube. Correct demonstration of use of stay sutures, tracheostomy insertion, and a correct post-training competency test were required to complete the class. We hypothesized that ICU RT confidence in tracheostomy management and specific techniques was low, and that institution of a focused tracheostomy training program would improve comfort and confidence. Prior to the class an anonymous electronic survey was sent to all ICU RTs with 4 questions on level of confidence with fresh post-operative tracheostomies (Likert Scale: 1= strongly disagree, 5=strongly agree). A similar survey was sent out at the end of the education program. Statistical analysis was performed. Results:Initial survey response pre-training was 76% (100/132), and post-training was 100% (132/132); no difference was seen in years of ICU RT experience pre- or post-training. Survey results are seen in Table 1. Staff confidence significantly improved post-education in knowledge of stay sutures and risk factors in dislodgement ($p<0.001$), and in confidence of ability to manage dislodgement ($p<0.001$). Conclusion: Implementation of focused tracheostomy education, including a directed ETDA with simulation can improve ICU RT confidence and expertise in managing potential complications of fresh post-op tracheostomies.

Sponsored Research - None

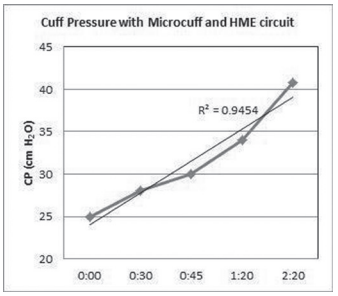
2015287

PRESSURE CHANGES IN HME CIRCUIT USING CUFFED POLYURETHANE ENDOTRACHEAL TUBE.

William R. Howard, Paul F. Nuccio; Respiratory Care, Brigham and Women's Hospital, Boston, MA

BACKGROUND: According to the Microcuff™ ETT manufacturer, (Kimberly Clark, Irving, TX), the polyurethane cuff material is permeable to humidified air. This allows water molecules to migrate into the cuff which humidifies the air inside. In addition, temperature difference between air within the cuff and the ventilation gas flowing through the main ETT shaft causes air inside the cuff to condense or "rainout". With an HME circuit, air passing over the cuff may contribute to temperature differences during inspiration compared to exhalation. We wanted to know if the result of these variables was sufficient to have an effect on cuff pressure (CP). METHODS: A Puritan Bennett 840 ventilator, (Covidien, Mansfield, MA), with an Airlife OY1778 unheated patient circuit and Airlife 3003 hygroscopic humidifier, (Airlife Carefusion, San Diego, CA) was connected to an 8.0 Microcuff ETT. The ETT was intubated into an artificial trachea (aerosol tubing) and connected to a Hamilton 279206 breathing bag, (Hamilton Medical, Reno, NV). To simulate body temperature, the bottom of the breathing bag was cut and a 2 L/m continuous O2 flow connected. Temperature was set for 37 degrees Celsius from a Fisher & Paykel model 850 heater, (Fisher & Paykel Healthcare, Irvine CA), using an Airlife RT-219 single limb circuit. Ventilator settings were VT 500 mL, RR 14 BPM, and PEEP 5 cm H2O and baseline CP 25cm H2O. CP values and elapsed time were recorded and analyzed with ANOVA and for Pearson correlation. RESULTS: CP mean difference from baseline (± SD) was 12.3 cm H2O (± 7.76), ($p = 0.05$) and the elapsed time was 1.9 hours. Pearson Correlation was 0.98. CONCLUSIONS: The combination of a passive humidified circuit with the Microcuff ETT increases CP that quickly exceeds recommended guidelines for maintaining CP between 20-30 cm H2O. SUMMARY: Considering the infrequency of the routine "cuff check", additional surveillance and monitoring to prevent the undetected rise in CP when using passive humidification type circuits is warranted.

Sponsored Research - None



2015375

IMPACT OF CONTINUOUS CUFF REGULATION - QUALITY IMPROVEMENT INITIATIVE.

William R. Howard, Mark Bouthot, Paul F. Nuccio; Respiratory Care, Brigham and Women's Hospital, Boston, MA

BACKGROUND: Although we have practiced standard preventative "vent-bundle" interventions with a high percentage of compliance for several years, our VAP rate has continued to trend upward through 2013. Our rate, as reported by the infectious diseases department was 4.19 infection-related ventilator associated complications per 1,000 ventilator days (IVAC) in 2009. This rate continued increasing to a high of 6.62 for 2013. Recently, continuous cuff regulation (CCR) has been reported to have a favorable impact in lowering the occurrence of ventilator associated pneumonia.(1,2) We conducted a quality improvement initiative to determine if our recent intervention for implementing CCR had an impact on our IVAC rate. METHODS: In December, 2013 routine cuff checks guided by manometry and scheduled to be performed every 12-hours were discontinued. Standard vent-bundle measures continued to be practiced and monitored for compliance. CCR was implemented using 1 of 2 types of devices for all MV ICU patients. We used Hamilton Intellicuff™, (Hamilton Medical, Reno, NV), an option installed on 12-Hamilton G5 ventilators. CuffSentry™, (Outcome Solutions, Mocksville, NC), was used with all Puritan Bennett 840 ventilators, (Covidien, Carlsbad, CA), and the G5 ventilators not having the Intellicuff™ option installed. The goal was to maintain consistent cuff pressure (CP) targeting our standard of 30 cm H2O. IVACs continued to be monitored through April, 2014. The data were analyzed using independent t-test with $p < 0.05$ considered significant. RESULTS: Four months post-CCR intervention the IVAC rate was 4.44 per 1,000 ventilator days which decreased 33% from 2013; $p = 0.04$. DISCUSSION: Vent-bundle compliance remained at pre-CCR intervention levels suggesting that CCR intervention may have an important role in the avoidance of IVAC. Numerous evidence-based articles recommend maintaining CP between 20-30 cm H2O. Two recent articles suggest that CCR maintaining CP in this range lowered the rate of VAP. The result of our single intervention with CCR indicates agreement with the published evidence. 1. Lorente L, et.al. Continuous endotracheal tube cuff pressure control system protects against ventilator-associated pneumonia. Critical Care 2014, 18:R77. http://ccforum.com/content/18/2/R77. 2. Nseir S, et.al. Continuous control of tracheal cuff pressure and microaspiration of gastric contents in critically ill patients. Am J Respir Crit Care Med, 2011;184:1041–1047.

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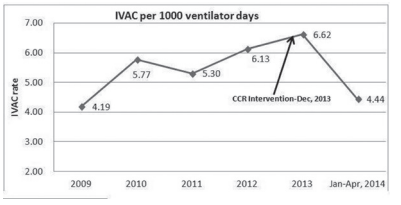


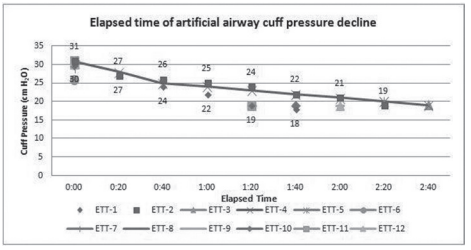
2015384

WHAT HAPPENS TO CUFF PRESSURE AFTER THE ROUTINE CHECK?

William R. Howard, Paul F. Nuccio; Respiratory Care, Brigham and Women's Hospital, Boston, MA

BACKGROUND: Cuff pressure below 20 cm H2O allows contaminated oral and gastric secretions, precursors to ventilator associated pneumonia, to be aspirated into the lungs. Routine cuff pressure (CP) checks expected to guard against this consequence are typically performed once per 12-hour shift. We wanted to know if this frequency adequately maintained CP within the recommended range of 20-30 cm H2O until the next scheduled check is performed - several hours later. METHODS: A 6 inch section of artificial trachea (ribbed aerosol tubing) was separately intubated with 12 new and cuffed artificial airways including 6 -Teleflex 8.0 and 9.0 mm I.D. ETTs, (Research Triangle Park, NC), 3 - Shiley D.I.C. 5.0, 7.6, and 6.4 mm I.D. tracheostomy tubes, (Covidien, Mansfield, MA), and 3 - Portex D.I.C. 6.0, 7.0, and 8.0 mm I.D. tracheostomy tubes, Smiths Medical, Keene, NH). The airways were connected to a Hamilton G5 ventilator, (Hamilton Medical, Reno, NV) using an Airlife RT-210 patient circuit, (CareFusion, San Diego, CA), and Fisher & Paykel model 850 heater (Fisher & Paykel Healthcare, Inc, Irvine, CA). The artificial trachea was attached to an ASL-5000 breathing simulator, (IngMar Medical, Ltd, Pittsburgh, PA), at 30 ml/cm H2O compliance and 20 cm H2O/L/sec resistance. The ventilator settings: VT 400 mL, RR 14 BPM, PEEP 5 cm H2O, and FIO2 0.6. A 3-way stopcock connected a cuff inflation syringe and the pilot balloon to a certified TSI-4080 FA-Plus pressure analyzer, (Shoreview, MN). The cuff was inflated to a baseline CP of 30 cm H2O and the elapsed time until CP readings fell to 19 cm H2O was recorded. ANOVA and paired t-tests was performed ($p \leq 0.05$). RESULTS: The mean difference from baseline until CP fell below 20 cm H2O was1.92 hours at a rate of 4.3 cm H2O/hour (± 2.01), ($p < 0.05$). DISCUSSION: This series of tests demonstrates that CP decreases over time which is suggestive that intervention between routine cuff checks is necessary. Had we started at a lower CP than the initial baseline of 30 cm H2O, violation of our clinically acceptable minimum 20 cm H2O threshold would likely have occurred sooner than these results. CONCLUSION: Considering that scheduled checks are typically 12 or more hours apart, the minimal threshold of 20 cm H2O will likely be violated before the next scheduled check.

Sponsored Research - None



2020591

COMPARISON OF THE TRACHEAL WALL PRESSURE EXERTED BY FIVE ENDOTRACHEAL TUBE CUFFS: A BENCH EVALUATION.

Christopher T. Chenelle[1], Taiga Itagaki[1,2], Daniel Fisher[1], Lorenzo Berra[1,2], Robert M. Kacmarek[1,2]; [1]Department of Respiratory Care, Massachusetts General Hospital, Boston, MA; [2]Department of Anesthesia, Critical Care, and Pain Medicine, Massachusetts General Hospital, Boston, MA

Background: The PneuX ETT (Venner Medical) uses a novel low-volume silicone cuff that in preliminary studies has been shown to provide superior leak prevention at equivalent tracheal wall pressures (TWP) to HVLP cuffs when inflated to its target intracuff pressure (ICP) of 80 cmH2O, but these claims have not been independently verified. The goal of this study was to determine the TWP exerted by the PneuX ETT and other commercially available ETTs. Methods: The ETTs included were the Mallinckrodt Hi-Lo, TaperGuard, and SealGuard, the Kimberly-Clark Microcuff, and the Venner Medical PneuX. For each ETT, TWP was determined by measuring the ability of the cuff to support a column of water. This was done by inserting and securing an ETT into a rigid tracheal model, a 2.2 cm ID polycarbonate tube, clamped in a stationary vertical position. The ETT cuff was inflated to 20 cmH2O above its recommended pressure (45 cmH2O for HVLP cuffs and 100 cmH2O for the PneuX ETT). ICP was continuously recorded using WINDAQ software. A dyed-water column of height 20, 25, 30, 35, or 40 cm, performed in randomized order, was established above the cuff, then ICP was slowly decreased at a steady rate. The ICP at which leak first began and at which it became an uninterrupted flow between the cuff and tracheal wall ("flow leak") were recorded, with the latter point indicating a TWP equal to the height of the water column. This was done for each column height for each tube, with and without CPAP (10 cmH2O) and lubrication (20 runs total for each tube), and for three tubes of each type. Results: For water column heights of 20, 25, 30, 35, and 40 cm, flow leak was first observed at ICPs of 19.64±1.42, 24.66±1.41, 29.45±1.41, 34.47±1.71, and 39.88±1.88 cmH2O, respectively, for all HVLP cuffs. No difference was seen between HVLP tube types. The respective ICPs for the PneuX were 74.17±5.78, 78.92±5.33, 83.62±5.93, 87.01±5.07, and 90.03±5.27 cmH2O. Neither CPAP nor lubrication affected TWP. Conclusions: Our findings support the manufacturer's claim that, when inflated to its target ICP of 80 cmH2O, the PneuX ETT, on average, exerts TWPs within the acceptable range of 20-30 cmH2O, though variability was seen between individual tubes. For HVLP cuffs, we found that ICP is approximately equivalent to TWP, which is consistent with previous studies.

Sponsored Research - This study was partially funded by a grant from Venner Medical.

2020593

COMPARISON OF THE ABILITY OF FIVE ENDOTRACHEAL TUBE CUFFS TO PREVENT LEAK: A BENCH EVALUATION.

Taiga Itagaki[1,2], Christopher T. Chenelle[1], Daniel Fisher[1], Lorenzo Berra[1,2], Robert M. Kacmarek[1,2]; [1]Department of Respiratory Care, Massachusetts General Hospital, Boston, MA; [2]Department of Anesthesia, Critical Care and Pain Medicine, Massachusetts General Hospital, Boston, MA

Background: Leak past the ETT cuff is a risk factor of VAP. Previous studies show that cuff design significantly influences leak. The PneuX (Venner Medical) is an ETT with a low-volume silicone cuff minimizing leak by eliminating the longitudinal folds seen with high-volume low-pressure (HVLP) cuffs. The low-volume design of the PneuX requires higher intracuff pressure (ICP) (80cmH2O) to seal the trachea, though tracheal wall pressures are equivalent to HVLP cuffs. In this study, we evaluate the PneuX and four ETTs with HVLP cuffs ability to prevent leak in a tracheal model. Method: The five ETTs tested included were the Mallinckrodt Hi-Lo (polyvinyl chloride (PVC)), TaperGuard (PVC) and SealGuard (polyurethane (PU)), the Kimberly-Clark Microcuff (PU) and PneuX. Each tube was placed without lubrication inside the silicone tracheal model (2.3 cm internal diameter) attached to a test lung and ventilator circuit. In four HVLP-ETTs, ICP was controlled at 20, 25 and 30 cmH2O by the Intellicuff (Hamilton Medical). In the PneuX, ICP was controlled by the Tracheal Seal Monitor (Venner Medical) to keep estimated tracheal wall pressures (eTWP) of 10 and 20 mmHg. After the cuff was inflated, 35 mL of colored water was placed above the cuff. Once the height of the fluid was established, mechanical ventilation was initiated with a respiratory rate of 20 bpm and PIP of 15 cmH2O without PEEP. Each run was 30 minutes. The initial and final heights of the fluid were measured and the total leak volume was calculated. This procedure was repeated with three new ETTs of each type and the results were averaged. Results: For the PneuX, no leak was seen at an eTWP of 20 mmHg though leak occurred at 10 mmHg with large variation between individual tubes (15.1±18.8 mL). The PneuX at 20 mmHg outperformed all other tubes at ICP of 20 cmH2O (all $p<0.05$) and outperformed the TaperGuard and Hi-Lo at all tested ICPs (all $p<0.005$). The Microcuff (leak volumes at 20, 25, 30 cmH2O; 9.1±0.9, 5.0±4.2, 5.0±4.1 mL) and SealGuard (10.1±5.3, 2.2±2.1, 3.6±3.1 mL) significantly outperformed the Hi-Lo (32.1±1.5, 28.3±1.5, 28.1±2.6 mL) and TaperGuard (27.2±3.6, 18.5±14.0, 11.8±6.7 mL) (all $p<0.05$). Conclusions: The PneuX, with an eTWP of 20 mmHg, is the only tested condition able to completely prevent leak. Additionally, PU cuffs are significantly better at preventing leak than PVC cuffs at all tested ICPs.

Sponsored Research - This study was partially funded by a grant from Venner Medical.

2020678

EBC PH AND PERSONAL AIR POLLUTION EXPOSURE.

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Cristiane Mayumi Kazama1,2, Michael Denning Davis3, Eduardo Riyoiti Tatebe1, Andreas Rembert Koczulla4, Pieter S Hiemstra5, Ubiratan de Paula Santos6, Maria Lucia Bueno-Garcia7, Paulo de Andre1, Carmen Diva Saldiva de André8, Paulo Hilario Nascimento Saldiva1, Naomi Kondo Nakagawa1,2 Background: Exhaled breath condensate (EBC) pH can be used to monitor occupational exposure to air pollution. Lower EBC pH has been associated with airways and lung inflammation. We aimed to determine a threshold for EBC pH with sensitivity and specificity by ROC curve analysis to identify personal high-exposure to air pollution among subjects with three different occupational activities. Methods: 52 male nonsmoking healthy subjects (14 forest-workers, 20 taxi-drivers and 18 traffic-controllers) were examined for EBC pH after agreement with written informed consent. This observational study was approved by the Ethical Committee of Clinics Hospital University of Sao Paulo Medical School (CAPPesq 0565/07). We performed EBC pH measurements after gas-standardization with ultrapure argon gas. We used 24-hrs active personal air pollution monitoring system for analysis of particulate matter (PM2.5). ROC analyses and Spearman Coefficient Correlation were performed using SPSS 15 software. Results: EBC pH was decreased in high-exposed subjects ($p<0.001$). We found an EBC pH threshold of 7.82 for screening with 67% of sensitivity and a specificity of 85%. EBC pH negatively correlated with PM2.5 measurements ($r=-0.40$ and $p=0.004$). Conclusion: For air pollution exposure assessments, the EBC pH threshold that rendered higher accuracy was 7.82. Lower EBC pH below the threshold is not a sole indicator of adverse effects of air pollution, but in combination with high levels of air pollution may help to identify those that may be most susceptible to the adverse health effects.

Sponsored Research - Fundacao de Amparo a Pesquisa no Estado de Sao Paulo (FAPESP 07/51605-9) and Conselho Nacional de Pesquisa (CNPq 555.223/06-6)

2021440

DOES ENDOTRACHEAL TUBE CLAMPING MAINTAIN AIRWAY PRESSURE? A BENCH EVALUATION.

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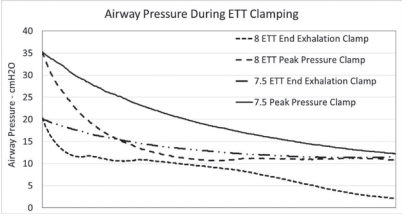
BACKGROUND: Endotracheal tube clamping is commonly recommended when a hypoxemic patient is on high PEEP and requires a quick disconnect from mechanical ventilation. We wanted to determine if clamping the endotracheal tube (ETT) actually maintains airway pressure for a short disconnection. METHODS: A test lung was ventilated on pressure assist controlled ventilation with PIP = 35 cmH2O, PEEP = 20 cmH2O. An ETT was placed between the ventilator circuit and the test lung. The environment around the endotracheal tube was heated to body temperature to have clinically realistic pliability of the ETT being clamped. A NICO NM3 (Respironics) monitored flow and pressure with an adult flow sensor placed between the ETT and the test lung. A 7.5 and 8.0 ETT were tested at two clamping time points in the ventilation cycle: at end exhalation (at PEEP of 20 cmH2O) and at peak inspiration (35 cmH2O). Five trials were performed with each of the ETTs at both clamping time points. There were no circuit leaks and the ETT was directly connected to the test lung, with no potential for cuff leak. Optimum clamping technique was tested with a 10 second clamp for each trial. RESULTS: With PEEP set to 20 cmH2O and PIP set to 35 cmH2O: 7.5 ETT Clamped at End Exhalation maintained 11.1 +/- 0.4 cmH2O 8.0 ETT Clamped at End Exhalation maintained 2.5 +/- 2.7 cmH2O 7.5 ETT Clamped at Peak Pressure maintained 11.1 +/- 1.4 cmH2O 8.0 ETT Clamped at Peak Pressure maintained 10.7 +/- 1.1 cmH2O See graphic for airway pressure drop over time during the clamping of the ETT. CONCLUSIONS: For both of the ETTs tested and at both points of clamping, only 2.5 to 11.1 of the 20 cmH2O PEEP was maintained. Our initial examination of ETT clamping shows that airway pressure is not well maintained during clamping. Clamping the ETT may not be as effective as assumed in protecting patients from de-recruitment during short disconnections. Greater loss of PEEP than we experienced could occur clinically if there is leakage in the ventilator circuit or the ETT cuff.

Sponsored Research - None



Representative airway pressure graphic shown during an ETT clamp and disconnection for 7.5 and 8.0 ETT when clamped at end exhalation or at peak pressure.

2021773

ENDOTRACHEAL TUBE CUFF INFLATION VOLUME AND RESULTANT CUFF PRESSURE: A MANIKIN STUDY.

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Background: Numerous studies have demonstrated dangerously high cuff pressures (CPs) in endotracheal tubes (ETTs) placed in the prehospital environment. There is no evidence to suggest that prehospital providers are deviating from standard practice for cuff inflation, thus it is reasonable to suspect the problem is associated with the conventional prehospital cuff inflation technique (i.e. generic use of 5-10 mL). The purpose of this study was to identify an optimal cuff inflation volume (CIV) to achieve a safe CP using airway manikins. This is particularly important in the prehospital environment, where manometers are not commonplace and ambient noise may preclude the effective use of traditional CP optimization techniques (e.g. minimal occluding volume). **Methods:** This observational study utilized three common manikins, each of which was intubated with ETTs ranging from 6.0-8.0 mm. Each size ETT was inflated with air at volumes of 3 mL through 10 mL in 1 mL increments. CP was measured for each of the 120 possible combinations of ETT size, CIV, and manikin. This process was repeated two additional times, with measurements recorded by a total of three independent raters. **Results:** We recorded 360 individual CP measurements (r_{icc}=0.95, 95% CI 0.94-0.97, M=75.82, SD=47.17). Only 5% (n=18) of all CP measurements were within an optimal range (20-30 cmH_2O). Multiple linear regression analysis indicated that ETT size and CIV accounted for 59.3% of the variance in CP, while manikin differences accounted for an additional 2.9% of the variance (R^2=0.622, F(4, 243)=100.06, p<.01). After controlling for manikin differences, ETT size significantly predicted CP (β=0.42, p<.01), as did CIV (β=0.81, p<.01). [Fig. 1] **Conclusion:** An optimal CIV to achieve a safe CP could not be established in this study due to an insufficient number of recorded measurements in the optimal range. Nonetheless, the results of this study demonstrate a potential flaw in the conventional prehospital approach to ETT cuff inflation. Despite the potential limitations associated with manikin use, the findings of this study are consistent with the reported findings of elevated CP in human subjects within this setting. A reduction of recommended CIV for prehospital endotracheal intubation might be warranted. **Disclosures:** None

Sponsored Research - None

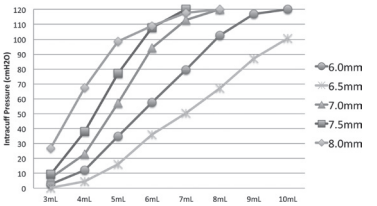

Figure 1: Relationship Between Cuff Inflation Volume and Intracuff Pressure for Each Size Endotracheal Tube

2022602

TITLE: DOES SUCTIONING DURING HFOV EFFECT THE AIRWAY PRESSURE AND FLOW? A BENCH EVALUATION.

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BACKGROUND: Routine suctioning through the endotracheal tube during HFOV is not commonly recommended. It is often thought that the potential to de-recruit the lung is a high risk when suctioning a patient on HFOV. We wanted to determine if suctioning through the endotracheal tube (ETT) while on HFOV has any effect on the mean airway pressure and flow. METHODS: A test lung was ventilated on HFOV with MAP = 28cmH2O, POWER =5.5, HZ = 4 % I TIME = 33. An ETT was placed between the ventilator circuit and the test lung. A NICO NM3 (Respironics) monitored flow and pressure with an adult flow sensor placed between the ETT and the test lung. A 7.5 and 8.0 ETT were tested with a 14 Fr. In-line suction catheter. Three trials were performed with each of the ETTs. Flow and pressure measurements were obtained for each trial before introduction of the suction catheter, after introduction of the suction catheter, and during intermittent suctioning. Flow and pressure measurements were obtained for each phase for 5 seconds. Standard suction pressures were maintained and suction attempts were limited to 10 seconds. There were no circuit leaks and the ETT was directly connected to the test lung, with no potential for cuff leak. RESULTS: (see table) CONCLUSIONS: For both of the ETTs tested it was noted that the MAP was maintained during the introduction of the suction catheter. There was a noticeable decrease in both inspiratory and expiratory flow when the suction catheter was introduced. When intermittent suction was applied both MAP and flow rates decreased. Suctioning during HFOV using an in-line catheter decreases the MAP as well as flow when intermittent suction is applied.

Sponsored Research - None

	8.0 ETT			7.5 ETT		
	MAP cmH2O	Insp Flow L/min	Exp Flow L/min	MAP cm H2O	Insp Flow L/min	Exp Flow L/min
Before Introduction of suction catheter in the airway	28.70 +/- .03	48.25 +/-.07	88.54 +/- .31	26.16 +/- .23	47.36 +/- .17	85.56 +/- 1.44
Suction catheter deployed	26.68 +/-.41	38.51 +/- .39	65.63 +/- 3.62	25.87 +/- .20	33.65 +/- .54	58.49 +/- .75
During intermittent Suction	15.71 +/- 1.17	36.17 +/- .32	61.31 +/- 1.72	14.03 +/- .69	32.91 +/- .70	52.44 +/- 3.74

2019606

PRESSURE COMPARISON OF VDR SINGLE PATIENT PHASITRON AND TURBOHUB AND PRESSURE MEASUREMENTS OF A SINGLE PATIENT PHASITRON WITH 3.5, 5.0, AND 7.0 ENDOTRACHEAL TUBES.

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BACKGROUND Percussionarie's (Sandpoint, Idaho) Volumetric Diffusive Respirator (VDR) is a pneumatically powered device that incorporates both a convective pressure regulated (conventional) breath and high frequency "percussive" breaths. The Turbohub contains the phasitron and is designed to allow added or improved humidity to the patient. The continued production of the Turbohub is unknown at this time. Percussionair recently provided a single patient phasitron (SPP) and circuit assembly. We wanted to know if it was possible to replace the Turbohub with the SPP. We postulated the performance of the SPP should be equal to the Turbohub with respect to PIP, MAP, and PEEP. METHOD We tested a standard Turbohub and SPP. An infant circuit (RT235 Fisher/Paykel) and humidifier (MR850 Fisher/Paykel), 3.5 ETT and infant test lung (Smart Lung Infant, IMT Medical Switzerland) R5 and C2 ml/mbar were used. Pressure measurements were made using the Certifier FA plus (TSI, Shoreview, MN) at the outlet of the Turbohub and between the ETT and test lung. We tested the SPP in the same way. VDR settings were convective rate 20, Ti 1 second, I:E 1:2, PIP 35, oscillatory CPAP 10, percussive rate 600, i:e 1:1, PSI 40. A "T" adapter added to the SPP allowed the inspiratory and expiratory circuit limbs to be attached. Air entrainment was not restricted during the testing. Additionally we tested the SPP using a 5.0 ETT and pediatric circuit (CareFusion RT509-852) and 7.0 ETT and adult circuit (F&P RT240) with a test lung (Smart Lung Adult R20 C 2ml/mbar). Pressure measurements were taken at the SPP outlet and post ETT. RESULTS The SPP demonstrated significant loss of PEEP when compared to the Turbohub at the outlet (5.1 cmH20 loss) and post ETT (2.1 cmH20 loss). The SPP also showed a significant loss of PIP post ETT (4.4 cmH20) compared to the Turbohub. The SPP also demonstrated more pronounced PIP loss with the 3.5 and 5.0 ETT when comparing outlet PIP and post ETT PIP (9.3-9.8 cmH20 loss). CONCLUSIONS The SPP for the VDR does not produce comparable PIP and PEEP as compared to the Turbohub . The Turbohub has a "red" sliding venturi while the SPP has a "green" venturi. It is unknown if the venture accounts for the pressure loss with the single patient phasitron.

Sponsored Research - None

2020455

IDENTIFYING APPROPRIATE MECHANICAL VENTILATION ALARM SETTINGS TO IMPROVE PATIENT SAFETY: A BENCH STUDY.

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BACKGROUND: Setting appropriate alarm limits is of utmost importance when providing mechanical ventilation for patients. We have identified situations where alarm settings that appear to be appropriate may not trigger as anticipated. Our goal is to help prevent potential serious safety events by bringing awareness of these situations. METHOD: A bench study was designed to collect data on the MAP readings of a high frequency oscillatory ventilator (HFOV) when connected to various sizes of unobstructed endotracheal tubes, and to determine if different sizes of EtCO2 adapters could have an effect on alarm triggering in a specific conventional ventilator. A Sensormedics 3100A HFOV (CareFusion, San Diego, CA) and a Pulmonetic Systems LTV-1200 (CareFusion, San Diego, CA) were used for this study. The HFOV was placed on the following settings: MAP 30 cm H2O, Amplitude 50 cm H2O, and Hz 12. With these settings, 12 different endotracheal tubes varying in I.D. sizes 2.5 – 8.0 mm were attached individually, and the resulting MAP readings were recorded. With the LTV-1200, two different sizes of Philips FilterLine H set EtCO2 adapters (Philips, Andover, MA) were placed at the end of the circuit wye and attached to a test lung. The two sizes used were adult/pediatric and infant/neonate. Each size was individually tested by disconnecting from the test lung and recording the resultant alarm signals. The ventilator settings were as follows: RR 20 breaths/min, PC 20 cm H2O, PEEP 5 cm H2O, I-time 1 sec, and a low pressure alarm of 5 cm H2O. RESULTS: There was a consistently increased drop in MAP observed with each increase in endotracheal tube size on the oscillator; however, at no point did the MAP decrease below 3 cm H2O. The MAP didn't decrease below 10 cm H2O until a 5.0 mm I.D. or larger size tube was attached. With the LTV-1200, the disconnect, low pressure, and low MV alarms all triggered when the adult/pediatric EtCO2 adapter was disconnected from the test lung. When the infant/neonate EtCO2 adapter was disconnected, the only triggered alarm was the low MV alarm. The disconnect alarm and low pressure alarm were not triggered while this size adapter remained attached to the circuit wye. CONCLUSION: Low MAP alarm settings on a HFOV should be set high enough to ensure alarm triggering in cases of unintended extubations, and it is important to set the low MV alarm on the LTV-1200 when a small ETCO2 adapter is placed in line. Sponsored Research - None

Sponsored Research - None

2021448

THE IMPACT OF ENDOTRACHEAL TUBE LENGTH TO DELIVERED TIDAL VOLUME IN AN INFANT BENCH MODEL.

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BACKGROUND: Previous studies have been conducted regarding how endotracheal tube length and decreasing diameter increases resistance (Wall, 1980). Manczur et al. (2000) also showed that a small endotracheal tube diameter can significantly increase work of breathing. However, there are no studies that have demonstrated how endotracheal tube length and size interacts with mechanical ventilators and affects delivered tidal volumes. Our objective was to determine how delivered mechanical tidal volumes, in an infant bench model is affected by the size and length of the endotracheal tube, and its interactions with two different types of ventilators. METHODOLOGY: Two ventilators, the Avea and Servo-I, were equipped with infant heated wire circuits (Evaqua), calibrated according to manufacturer standards and connected to a Michigan Instruments Infant Test Lung (Compliance 0.002L/cmH2O) using standardized infant ventilator settings. The ventilator settings were: Assist Control Mode, Rate=24, PIP=24, PEEP=4, Insp. Time=0.4 seconds, and Fi02=0.30. Mallinckrodt endotracheal tubes were tested ranging in size from 2.5 mm to 3.0 mm in diameter. Each endotracheal tube was shortened four times by 1/8 (12.5%) increments. With each new shortened length, the ventilator was allowed to deliver 10 breaths and the average of the exhaled tidal volumes was measured. Tidal volumes were measured using a pressure differential pneumotach (NICO). RESULTS: There was a statistically significant increase in delivered mechanical tidal volumes as the length of the tubes was shortened. (Paired t test, p< 0.05A 3.9% to 10.2% increase in tidal volume delivery was seen with the 2.5 ETT and a 2.67% to 6.03% volume increase with the size 3.0 ETT with the Servo-i. A 1.32% to 5.12% increase in tidal volume was seen with the 2.5 ETT, and a 1.10% to 6.61% increase in tidal volume was seen with the 3.0 ETT in the Avea. The Avea appeared to compensate more effectively for the changes in ETT length. CONCLUSION: Endotracheal tube length has a direct effect on delivered mechanical tidal volumes. The shorter endotracheal tubes allow for more effective volume delivery.

Sponsored Research - None

Average Tidal Volume (ml) with Servo i Ventilator						
ETT Size/Length	Uncut	1/8 cut	2/8 cut	3/8 cut	4/8 cut	% Increase
2.5	24.75	25.75	26.77	27.37	27.56	3.9 to 10.2
3.0	27.42	28.15	28.69	28.83	29.18	2.67 to 6.03
Average Tidal Volume (ml) with Avea Ventilator						
ETT Size/Length	Uncut	1/8 cut	2/8 cut	3/8 cut	4/8 cut	% Increase
2.5	27.15	27.51	27.72	27.63	28.54	1.32 to 5.12
3.0	29.94	30.27	30.81	31.44	31.92	1.10 to 6.61

2021582

EFFECTIVNESS OF TIDAL VOLUME DELIVERY IN THE TRANSPORT ENVIRONMENT WITH NASAL CANNULA IMV: A BENCH STUDY IN AN INFANT MODEL.

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Background: Nasal Cannula IMV is becoming a more common approach to provide NIPPV in the infant population. Transporting critically ill infants while on Nasal Cannula IMV can be challenging. Using a transport ventilator may be a feasible way of delivering regulated NIPPV to infants through a nasal cannula. We performed a bench evaluation in an infant model to determine whether tidal volumes delivered from a transport ventilator and an ICU ventilator were comparable when using Nasal Cannula IMV at leak percentages that are typically seen in our ICUs. Methodology: A Servo-i ventilator and three transport ventilators (HT-70+, LTV 1000, and IC-2A) were setup and calibrated according to manufacturer standards. Each ventilator used an infant circuit with the exception of the LTV1000 which used the smallest available pediatric circuit. Each ventilator was connected to a Michigan Instruments Infant Test Lung using a RAM Infant Nasal Cannula. Size 3.0 ETT adaptors connected each nasal prong to a wye and three-way stop cock which was adjusted to vary the percent leak in the system. Leaks were tested at 60%, 75%, and 90%. A pressure differential pneumotachometer (NICO) was placed proximal to the infant test lung (Compliance: 0.002 L/cm H2O) to measure tidal volumes. Measurements were obtained on Noninvasive Pressure Control mode for the Servo-i, and Assist Control Pressure Control mode for the transport ventilators. The following ventilator settings were used for all ventilators: RR 40 BPM; PIP of 30, 25, 20, and 15 cmH20; PEEP 5 cmH20; FiO2 0.30; and I- time 0.6 seconds. Results: The average tidal volume delivered through each ventilator across varying leak percentages is as follows: Servo i - 22.41 ml, HT-70+ - 21.64 ml, LTV1000 – 19.73 ml, IC-2A – 21.51 ml. Each transport ventilator delivered less tidal volume than the Servo-i, but this decrease was statistically insignificant (Paired t-test, p > .05). As leak percentage increased, each ventilator had a significant decrease in tidal volume (See table). Conclusion: When compared to the Servo-i ventilator, each transport ventilator was able to deliver effective tidal volumes during Nasal Cannula IMV in the infant model. The transport ventilators delivered tidal volumes as effectively as the Servo-i with increasing leak conditions.

Sponsored Research - None

	60% Leak	75% Leak	90% Leak
Servo i	27.85 ml	23.75 ml	15.63 ml
HT-70+	27.85 ml	22.56 ml	16.53 ml
LTV-1000	23.58 ml	20.93 ml	14.68 ml
IC-2A	26.73 ml	22.82 ml	15.12 ml

2021583

UNPLANNED EXTUBATION RATE AND OUTCOMES IN THE ADULT INTENSIVE CARE UNIT.

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BACKGROUND: Data describing frequency and outcomes of unplanned extubation (UE) in adult intensive care units (ICU) are limited. UE is a safety risk which may impact mortality, time on the ventilator and time in the hospital. There is currently no benchmark for UE in the adult population. Our sedation practice and restraint use has changed with efforts to balance UE and efficient liberation. We wanted to determine the unplanned extubation rate and the associated outcomes in our adult ICUs to assess the need for performance improvement efforts. METHODS: We retrospectively reviewed all ventilator patients in our adult ICUs from October 2011 (discrete data was added in the Respiratory Care documentation for UE) to May 2014. We collected number of ventilator patients, ventilator days, hospital days, planned or unplanned extubation, re-intubation, gender and disposition outcome. Rate of UE is displayed as #UE per 100 endotracheal tube days. RESULTS: 8542 ventilator patients were identified in our adult ICUs since October 2011 with 42,279 ventilator days. 243 UE were identified. Rate of UE was 0.76 events per 100 endotracheal tube days. 35% of UE occurred on dayshift, 38% on evening shift and 27% on mid-night shift. 8% of UE required re-intubation. 57% of all ventilator patients were male, 56% of patient with UE were male. See table for information about the overall ventilator patients compared to UE and UE with re-intubations. CONCLUSIONS: Despite changes in sedation practice and restraint use, UE's occur at a very low frequency. When they do occur, UE's are associated with prolonged increased ventilator days, hospital LOS and mortality, which was more pronounced in those that required eventual re-intubation. It is not clear if UE's are independently associated with adverse outcomes. Since only 8% of UE events require re-intubation, more aggressive liberation efforts may have been possible.

Sponsored Research - None

	All Ventilator Patients (8542)	All Unplanned Extubation Patients (243)	Unplanned Extubation Patients Requiring Re-Intubation (20)
Mean Ventilator Days	4.9	8.1	11.7
Mean Hospital Days	12.6	17.7	20.3
Mortality (%)	18.8%	13.0%	25.0%

2022564

THE IMPACT OF CLINICAL TRIALS: A SURVEY ON THE USE OF HFOV: A ONE YEAR FOLLOW-UP.

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Background: To evaluate the impact of the 2013 OSCILLATE3 and OSCAR4 trials published in the New England Journal of Medicine, a survey was sent to 200 respiratory therapists to examine the practice of High Frequency Oscillatory Ventilation (HFOV) for the treatment of refractory hypoxemia in the past year. These results suggested that both studies may have impacted the use of HFOV to some extent. The results also revealed a concurrent increase in the use of APRV, ECMO and prone positioning. The purpose of this study was to evaluate any additional changes to HFOV practice one year later. Methods: The identical survey tool used in the previous study was emailed to the original 200 respiratory therapists initially contacted. Only 1 participant per institution was allowed. Results: The response rate was 32%, down from 44%. The results from both the 2013 and the 2014 survey are depicted on Table 1. In the opinion of those surveyed, 6% believe the utilization of HFOV in the institution will increase, 40% expect a decrease, and 60% think utilization will stay the same due to the OSCILLATE and OSCAR trial results. Conclusions: This survey mirrors the trends found in the previous survey and suggests that the OSCILLATE and OSCAR trials may have impacted the use of HFOV for treatment of refractory hypoxemia. The concurrent increase in the use of APRV, ECMO and prone positioning is also consistent with the previous study, but has increased to a greater extent. The increase in prone positioning and ECMO may be attributed to randomized controlled trials on these topics. 3. Ferguson ND, Cook DJ, Guyatt GH, et al. High-frequency oscillation in early acute respiratory distress syndrome. N Engl J Med 2013;368:795-805. 4. Young D, Lamb SE, Shah S, et al. High-frequency oscillation for acute respiratory distress syndrome. N Engl J Med 2013;368:806-13.

Sponsored Research - None

Table 1. Clinical practice changes post OSCILLATE/OSCAR

	HFOV (2013)	HFOV (2014)	APRV (2013)	APRV (2014)	iNO (2013)	iNO (2014)	Prone (2013)	Prone (2014)	ECMO (2013)	ECMO (2014)
Increased	2%	6%	10%	24%	5%	10%	8%	35%	10%	38%
Unchanged	76%	56%	87%	73%	88%	84%	91%	58%	89%	62%
Decreased	23%	37%	3%	3%	8%	7%	2%	7%	2%	0%

2022647

VENTILATOR MANAGEMENT OF PULMONARY ALVEOLAR PROTEINOSIS POST-LUNG LAVAGE.

Lindsey Kreisher, John Davies, MacIntyre Neil, Piantadosi Claude; Duke Medical Center, Durham, NC

Background: Pulmonary alveolar proteinosis (PAP) is a diffuse lung disease characterized by the accumulation of lipoproteinaceous material in the distal airspaces from impaired clearance of surfactant by macrophages. In most cases, PAP is idiopathic, but it can also be caused by inhalation of mineral dusts such as silica, titanium oxide, aluminum, indium-tin oxide, insecticides and, rarely, by hematologic malignancies. Whole lung lavage remains the most widely used therapy for PAP and is reserved for patients with significant symptoms and hypoxemia. Our institutional approach has been to perform sequential lavage of both lungs under anesthesia in our hyperbaric chamber. Because of their unique diffuse lung injury, we were interested in knowing if we could provide them with ventilatory support in accordance with our lung protective ventilator management protocol. Method: After IRB approval, a retrospective review was performed of patients with PAP admitted to the medical intensive care unit post-lung lavage between July, 2002 and October, 2013. The following data were obtained: total inspiratory pressure (Ptotal), PEEP, FiO2, respiratory rate, tidal volume, ventilator mode, time to extubation, and FiO2 delivery device post-extubation. Results: 39 patients were reviewed with 38 initially ventilated in pressure assist control and 1 in volume assist control. All were ventilated with our institutional lung-protective ventilator protocol focused on limiting Ptotal to <30 cm H2O and providing tidal volumes of 4-8 ml/kg (IBW). The median length of ventilation post-procedure was 7 hours. The mean initial total pressure was 27.8 ±7.4 cm H2O with a mean initial PEEP of 9.82 ± 2.06 cm H2O. The initial FiO2 was 1.0 for all patients. The mean initial respiratory rate was 16.8 ± 6.1 bpm. 30 patients were extubated to FiO2 < 0.50. 8 were extubated to FiO2 ≥ 0.50, and 1 patient failed to wean. This specific patient was trached after a failed extubation due to respiratory muscle weakness and transferred to a hospital closer to her home. There were no???? complications from while on the ventilator. Conclusion: Although PAP is a very rare disease it is still important to use proper strategies for the ventilator management post-whole lung lavage. In our experience we were able to ventilate our PAP patients using our standard lung protective ventilator protocol without any complications during the mechanical ventilation phase of these patients' clinical course.

Sponsored Research - None

2022822

DOES OUR PRACTICE CHANGE WHEN PRESENTED WITH EVIDENCE? RESULTS OF FOLLOW UP STUDY ON VENTILATOR ALARM SELECTION IN A MEDICAL-SURGICAL ICU.

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BACKGROUND: Ventilator alarm selection is one of the aspects of the day-to-day practice in the ICU that has been poorly studied. We have previously reported in 2013 that alarms are set very loosely probably due too the high number of false alarms and the fatigue they generate on the clinician. The results showing a high discrepancy between the alarm settings and the patient parameter in 2013 were sent via email by the director of the RT department to all RTs responsible for setting up ventilators in the medical and surgical ICUs. The goal of this study was to evaluate if the practice was affected a month after the results of the previous study were communicated. METHODS: A retrospective review of medical records of patients admitted to a medical-surgical ICU during the last week of May of 2014 was conducted. The alarm settings selected for analysis were high respiratory rate (HI RR), high peak inspiratory pressure (HI PIP), and high and low minute volume (HI MV, LO MV), as they represent the most frequently documented alarms. SPSS 22.0 was used for data analysis. Means and standard deviations were calculated. A t-test was used to compare groups and statistically significant difference was set at a $p<0.05$. RESULTS: Recorded ventilator parameters and alarm settings of 22 mechanically ventilated patients admitted to six ICUs at a university-affiliated, 496-bed hospital, in San Antonio, Texas. A total of 49 ventilator checks were recorded. Patients monitored parameters were not significantly different between 2013 and 2014 [RR 19.6 vs. 19.8 +/- 6.1 b/min); MV 10.3 vs. 8.1 +/- 3.9 L/min); PIP 22.7 vs. 20.6 +/- 7.3 cm H20); p=0.11]. The selected alarm settings deviated from patient parameters in a range similar to the previous year (67% to 155% in 2013 vs. 61% to 159% +/- 46.6% in 2014). In 2014, there was a significantly higher difference between the alarm and the patient setting for the HI PIP ($p<0.001$) and the HI MV ($p=0.009$), while no significant changes in selection occurred for the other 2 parameters evaluated [HI RR ($p=0.06$); LO MV ($p=0.29$)]. Only three out of the 49 (6.1%) of the alarms appeared to be consistent what the recommended limits. CONCLUSIONS: Our results suggest that despite being presented with evidence of mismanaged alarm limit selection, this practice is rooted and poorly individualized to patient clinical parameters. The recurrent "one parameter fits all" when selecting these limits could potentially compromise patient safety.

Sponsored Research - None

2022823

USE OF CONTINUOUS PHYSIOLOGIC AND MECHANICAL VENTILATION DATA TO PREDICT DEVICE UTILIZATION FOLLOWING EXTUBATION IN A PEDIATRIC COHORT.

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Background: The decision to liberate a patient from mechanical ventilation depends heavily on clinical judgment without well-established measurements of pre-extubation respiratory mechanics. Although overall device utilization rates are relatively low, device use is significantly higher for more complex patients. Continuous data acquisition, storage, and subsequent analysis provide ample opportunity to study the relationship of proven indicators of liberation. Historically, patient information was obtained from the physiologic and mechanical ventilation monitors at the point of care. HCPs are left to manually filter, document, and communicate vital information in a timely fashion. Advancements in physiologic monitoring and ventilation technology provide the capability to stream information in a digital data format. This has enabled the coupling of high frequency physiologic and ventilation data sampling for real-time display and interaction. Methods: In a prospective and random assignment, patients anticipated to require mechanical ventilation for longer than 3 hours were selected to have their ventilator and physiologic monitors connected to our hospital-developed web based tracking, trajectory, and triggering decisions platform - dubbed T3. This platform is designed for real-time capture, display, storage, and analysis of data. Patients were separated into 3 categories: no device, noninvasive ventilation, and reintubation. Patients who were never extubated were excluded. Data collected 3 hours prior to extubation were analyzed and compared to device utilization. Results: 57 mechanically ventilated patients aged 1 day to 32 years (mean 6.6) were enrolled. 31 (53%) patients were extubated without requiring any supportive device other than simple oxygen therapy, 14 (25%) patients required noninvasive ventilation, and 5 (8%) required reintubation. Two extubation indices were developed from parameters that were statically significant or clinically relevant and compared. See figure 1 for details. Conclusion: The use of continuous physiologic and pulmonary mechanics data prior to extubation may delineate subtle differences in those who will require support. Parameters such as dynamic compliance or the extubation indices we have described may allow for the development of future computer aided decision support. We anticipate that further application of these indices will allow refinement of a useful extubation readiness tool.

Sponsored Research - None

1991836

MAINTAINING ADEQUATE CO2 CLEARANCE DURING AIRWAY PRESSURE RELEASE VENTILATION (APRV) WITH THE ABSENCE OF SPONTANEOUS BREATHING.

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INTRODUCTION APRV is often described as CPAP with a brief release which facilitates carbon dioxide (CO2) removal. In APRV the CO2 clearance may be achieved through both diffusive and convective gas exchange. A perceived contraindication of APRV in the absence of spontaneous breathing is the inability to effectively maintain adequate CO2 clearance. There is a misconception that an acceptable CO2 level cannot be achieved without spontaneous breathing. However, this validated method utilizes the combination of P High and T High ("diffusive" CPAP phase) to establish alveolar stability and promote diffusive gas exchange simultaneously with a pressure time profile (PTP) of 90% CPAP. This PTP is typically achieved in adults with a T High not less than 5 seconds. In addition, the combination of lower pressure (P Low) and T Low ("convective" release phase) is regulated by terminating the expiratory flow to 75% of the peak expiratory flow rate. CASE SUMMARY A 22 year old female S/P hanging was hypotensive and in shock as evidenced by a lactate of 5.1 mg/dL and progressive acute lung injury with a P/F ratio of 128. She was initially placed on SIMV/PRVC/PS where she was spontaneously breathing. However, due to her decreased compliance and poor ABGs, she was transitioned to APRV where she continued to spontaneously breathe (Table 1). Within 3 hours, her CXR and ABG showed improvement and the ventilator settings were weaned accordingly. However, she began deteriorating neurologically with the cessation of spontaneous breathing. Further evaluation determined anoxic brain injury and she was subsequently declared brain dead where the CO2 level was maintained within normal parameters. Although, the total minute ventilation and set frequency of APRV were lower than conventional ventilation APRV provided alveolar stability and more efficient diffusive and convective gas exchange resulting in improved oxygenation, alveolar ventilation and regulation of CO2 when the lung was properly recruited. DISCUSSION There isn't literature that discusses that APRV can be used with non-spontaneous breathing patients and able to maintain normal PACO2. CONCLUSION Spontaneous breathing in APRV has demonstrated many benefits and is encouraged. However, this case demonstrated that APRV can be used on patients that are not spontaneously breathing while effectively oxygenating and ventilating.

Sponsored Research - None

2006727

CASE REPORT FOR CHEST CUIRASS IN TODDLER WITH DIAPHRAGM WEAKNESS POST HEART TRANSPLANT.

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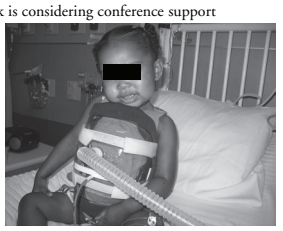
Introduction: Diaphragm weakness/paralysis can occur in patients using the Berlin Heart. The Berlin heart is used to assist the heart in maintaining adequate cardiac output or if it cannot adequately provide oxygenated blood to vital organs. The insertion of the device requires the cannulas to be placed through the diaphragms to get to the heart which can lead to diaphragm weakness/paralysis after removal. It is intended to provide cardiac support to the heart for patients awaiting heart transplant. Biphasic Cuirass Ventilation (BCV) is the ideal mode of ventilation for patients suffering muscle weakness. It is a noninvasive way to actively control both phases of the respiratory cycle. It can actually improve and redevelop the respiratory muscles weakened due to respiratory failure. IRB determination was that this case was not research and therefore not subject to IRB review. Case Summary: The patient was a 2 year old with a complex history that began with viral myocarditis. The patient underwent VA ECMO and was placed on a Berlin heart until time of heart transplant. The patient suffered from diaphragm weakness due to previous Berlin heart placement. The patient had several admissions for recurring pneumonia and chronic hypercarbia that required multiple intubations. It was decided to place the child on Biphasic Cuirass Ventilation via the Hayek RTX Ventilator prior to extubation. The initial settings were control mode rate of 20, -12/+3 while sleeping and CNEP-8 cm while awake. The patient received CPAP with Pressure Support via conventional ventilator. After several hours and comfort achieved on the Chest Cuirass the patient was extubated. The secretion clearance mode was also used on this patient to help generate a cough and maintain lung clearance. The patient remained on the chest cuirass for several months as an inpatient. During this time the patient transitioned to up to 4 hours a day off the device and discharged home on 14, -14/+3 settings. Discussion: Biphasic Cuirass Ventilation (BCV) can be a lower cost and noninvasive alternative to tracheostomy for some patients. Compared to other types of noninvasive ventilators BCV is easily fitted to small children and does not require sedation. More information and education is needed concerning the availability of the device as an alternative to tracheostomy in some patients. Disclosures: Conference support pending from Hayek Medical Devices.

Sponsored Research - Hayek is considering conference support



2007192

ECMO AND HIGH FREQUENCY JET VENTILATION FOR NECROTIZING PNEUMONIA COMPLICATED BY BRONCHOPLEURAL FISTULA IN A PEDIATRIC PATIENT

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Introduction: Severe and rapid decompensation can occur in patients presenting with necrotizing pneumonia caused by methicillin sensitive Staphylococcus *aureus* (MSSA). This case illustrates the course of a previously healthy 6 week old female with MSSA and strategies implemented for her recovery. **Case Summary:** This infant presented to an outside hospital after being found minimally responsive by her parents. The patient was intubated for respiratory failure, placed on conventional ventilation (CV), and transferred to our center. Chest x-ray (CXR) revealed complete right lung consolidation and tension pneumothorax. A chest tube was placed. Pleural fluid and a bronchioalveolar lavage (BAL) were obtained, cultured, and found positive for MSSA. Serial CXR noted pneumatoceles in the right lung, and development of a bronchopleural fistula (BPF) while on CV. On day 2, respiratory status deteriorated requiring VA-ECMO. Lung protective strategy utilizing PEEP (15 cmH_2O) and left mainstem intubation was performed to allow resolution of the BPF. She was transitioned to High Frequency Jet Ventilation (HFJV) to improve lung recruitment and minimize air leak. On day 3, the ETT was pulled back to allow for recruitment of the right lung. Despite HFJV, she continued with significant air leak, but remained stable on VA-ECMO. On day 11 she transitioned to CV without incident. On day 15, chest CT showed fluid surrounding the right lung and necrotic areas within both lungs. ECMO was successfully discontinued on day 17. After transition to CV in PRVC mode, BPF reoccurred. On day 23, her respiratory status declined and nitric oxide (iNO) was started. On day 25, she improved by being placed prone. iNO was weaned and prone positioning was continued. iNO was discontinued on day 29. Her respiratory status improved and on day 32 she transitioned to volume support, with successful extubation on day 35 to 8 LPM high flow nasal cannula (HFNC) at 100% F_iO_2. The chest tube was removed on hospital day 36. HFNC was discontinued on day 48 with hospital discharge on day 65. **Discussion:** Necrotizing pneumonia caused by MSSA can be lethal in the pediatric population. This case illustrates three important points: 1) Infection with MSSA can cause rapid deterioration in respiratory status requiring ECMO, 2) HFJV can aid in lung recruitment and potentially minimize persistent air leak caused by BPF, and 3) Other strategies including iNO and prone positioning can facilitate ventilatory improvement.

Sponsored Research - None

2011010

A CASE SERIES OF FOUR TECHNOLOGY DEPENDENT INFANTS WITH COMPLICATIONS DURING NEBULIZER THERAPY.

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Introduction: Adding flow into neonatal and pediatric ventilator circuits during nebulizer therapy has always been a concern in this population. Previous bench and clinical evaluations have identified complications with both patient ventilator synchrony and impact on ventilator parameters when additional flow is added into the circuitry. Recent advances in technology such as vibrating mesh nebulizers (VMN) have eliminated or reduced the need to add additional flow into ventilator circuits during nebulizer therapy. These technologies have not yet entered the home care market secondary to barriers related to access, expense, and reimbursement. In this case series, we are reporting the incidence of four infants with chronic lung disease (CLD) who all developed respiratory distress while receiving SVNs in line with sub acute ventilators. Case Series: All four patients in this case series were being ventilated in pressure ventilation on a Trilogy ventilator (Phillips Respironics, Carlsbad, CA) with a 22 mm passive circuit and a disposable exhalation valve. Sensitivity on three of the patients was set on a flow trigger or 1 and the fourth was set on autotrak (sensitive). Each patient was less than twelve months of age and weighed less than 10 kg. Immediately after the start of nebulizer therapy, all four infants developed increased work of breathing, retractions, and desaturation. All of the treatments were administered by an AirLife®MistyFinity®Nebulizer SVN (Carefusion, Yorba Linda, CA) that was powered by the Respironics Inspiration compressor (Phillips Respironics,Carlsbad, CA). Discussion: The above care series reveals that ventilator dependent infants under 10kg with CLD may be at risk for developing respiratory distress during nebulizer therapy with via a standard SVN. Patients in the homecare setting are at higher risk secondary to having limited control over the L flow with a compressor to power the SVN. Screening ventilator dependent infants prior to discharge or in pulmonary clinic setting may be necessary to assess the need to switch patients at risk to MDI's or alternative therapies.

Sponsored Research - None

2013907

INDEPENDENT LUNG VENTILATION UTILIZING HIGH FREQUENCY JET VENTILATION IN A TWO MONTH OLD WITH CONGENITAL PULMONARY AIRWAY MALFORMATION.

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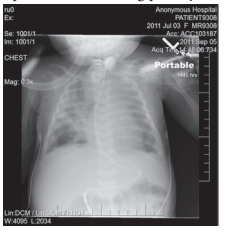
Introduction: Independent lung ventilation (ILV) is a strategy used for patients with non-homogenous lung disease. This is a 2 month old female ventilated with ILV and HFJV that was being considered for lung transplant. Case Summary: A term infant presented with tachypnea, hypoxia, and persistent left lower lobe atelectasis. CT scan showed Left CPAM and grossly abnormal lung development. CPAM was surgically removed on day 10 of life. Post-op she required HFOV due to high ventilating pressures and respiratory acidosis. A tracheostomy tube was placed at one month of age. Throughout her NICU course, she continued to have: persistent left lung atelectasis, persistent extreme hyperinflation of the right lung, and severe respiratory acidosis. Her PaCO2 ranged from 45-130mmHg throughout the next month. The decision was made to trial ILV and ventilate her right lung via HFJV. To initiate this we made the following interventions: fiberoptically intubated her left bronchus through her tracheostomy stoma with a 3.5 cuffed ETT, orally intubated her trachea with a 3.0 ETT to ventilate her right lung. The left lung was ventilated via conventional ventilation (PC/AC Rate 40 PIP 40 PEEP 3 Ti 0.35 FiO2 100%) to achieve 4 ml/kg Vte. The right lung was ventilated with HFJV via the oral tube. Initial HFJV settings were: PIP25 Rate420 Ti.02s; the CMV was set at Rate2 PIP18 PEEP5 Ti0.35 FiO2 100%. ABG prior to initiation was: pH 7.32/PaCO2 102/PaO2 171/HCO3 53. ABG 2 hours after initiation: pH 7.47/PaCO2 72/PaO2 62/HCO3 48. CXR three hours after initiation showed markedly improved aeration of left lung and markedly reduced hyperinflation of the right lung. This strategy continued for two days uneventfully with PaCO2 67-80 and pH 7.30-7.45. On day three, transient respiratory acidosis developed due to left lung ETT leak. On day 5 ILV was aborted and conventional ventilation was initiated through her tracheostomy tube to facilitate better secretion clearance and prepare for transport. Discussion: Initiating ILV in an infant can be logistically difficult, but the presence of a tracheostomy can be beneficial. Our greatest challenge during this process was maintaining the airways in correct position and assuring patency of each. Disclosures: none.

Sponsored Research - None



3 hours after initiating ILV+HFJV. Left sided endobronchial tube. Oral endotracheal tube. Markedly decreased hyperinflation of right lung. Markedly increased aeration of left lung.

2016232

NOVEL USE OF FIBEROPTIC BRONCHOSCOPY TO TREAT PERSISTENT LOBAR CONSOLIDATION.

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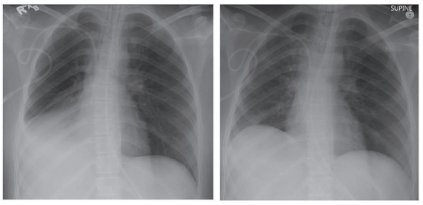
INTRODUCTION: We describe an innovative therapeutic intervention using equipment and personnel available in most children's hospitals to manage persistent lobar collapse. CASE REPORT: A 14 year-old female with acute lymphocytic leukemia status post bone marrow transplant was transferred to the PICU for management of multi-organ (hepatic, renal, cardiac, respiratory) failure. She was intubated and placed on high frequency oscillatory ventilation due to poor lung compliance and refractory hypoxemia. The patient's condition improved over the next nine days, enabling transition to conventional mechanical ventilation. As she clinically improved she was noted to have a persistent right lower lobe (RLL) consolidation. Initial fiberoptic bronchoscopy revealed tenacious secretions in the RLL bronchus, which could not be suctioned through the bronchoscope's narrow channel. When no improvement was noted two days after the initial bronchoscopy, the Attending Pulmonologist used a 2.2 OD fiberoptic bronchoscope as a stylet to guide a 12 French suction catheter into the RLL bronchus. The internal diameter of this catheter is 2.25 times greater than that of the suction channel of the 3.8mm OD pediatric bronchoscope used in the first procedure. The suction catheter was cut at the proximal end so that it could slip over the bronchoscope. Special attention was paid to lubrication to facilitate removal of the scope from the suction catheter once proper position in the RLL bronchus was achieved. The bronchoscope/suction catheter was then inserted into the 6.0 endotracheal tube and advanced into the RLL. Once the bronchoscope was removed, with the suction catheter remaining in place, 40 ml of 0.9% saline was instilled through the catheter, and then a large amount of thick, purulent secretions was suctioned out. The patient tolerated this well. The initial post-procedure CXR showed some improvement, and two days after the second procedure there was markedly improved aeration of the RLL. Four days after the procedure, the patient was successfully extubated. DISCUSSION: It is feasible to use a small flexible bronchoscope to safely guide a large 12 French suction catheter into a bronchus to facilitate removal of thick secretions from the airways.

Sponsored Research - None



Pre Intervention x-ray Post Intervention x-ray

2016799

THE IMPACT OF AIRWAY RESISTANCE ON VENTILATOR ALARMS IN PEDIATRIC PATIENTS.

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Background: To improve patient safety, JCAHO issued a National Patient Safety Goal (NPSG) focused on alarm management. Expectations will be for organizations to improve their systems by finding a balance between prioritizing safety alarms, and preventing nuisance alarms that may result in alarm fatigue. Disconnect alarms on mechanical ventilators are an example of a high priority alarm that needs to occur to ensure patient safety. Alarm settings are impacted by patient size, ventilator settings, operational features of each vent type, and circuit configuration type (active vs. passive). The following case series highlights complications with occurrence of a circuit disconnect alarm when a size infant ETCO2 adapter was added to the ventilator circuit configuration. Case Series: Both patients in this case series were patients in our Transitional Care Center (TCC), who required long term ventilator support using a Trilogy 202 (Phillips Respironics, Carlsbad, CA) ventilator with a passive circuit in SIMV PC mode. Both were under the age of 6 m/o, weighed < 10kg, and had Neo Extend Connect tracheostomy tubes (Smith Medical, Dublin OH). Patient #1 had a size 3.5 x 34. Patient #2 had a 3.0 x 32. Both patients did not have a circuit disconnect alarm occur with the purple size Ped/Infant ETCO2 monitor (Phillips Respironics, Carlsbad, CA) in line with vent circuit. When the purple adapter was removed, the alarm occurred reliably. Both patients had low minute ventilation alarms occur within 10 seconds as long as the low minute ventilation alarm was set within a high enough percent of tidal volume. We discovered we were able to place a clear Adult/Ped ETCO2 monitor in line while getting the disconnect alarm with more consistency. An NM3 monitor was placed in line to compare the impact of changes in ventilation with each of these adapters compared to no adapter. See attached graph for data comparison. WOB was not impacted with either of the ETCO2 adapters. Discussion: Chronic pediatric patients have historically been ventilated in pressure ventilation with low minute ventilation being the only reliable ventilator disconnect alarm. The addition of specific disconnect alarms are valuable safety features for home ventilators. This case series highlights the need to consider the impact of additional monitors that may be added to the vent circuit when designing disconnect alarms. The concept of timed versus average alarms may also be worthwhile for patients with leaks.

Sponsored Research - None

2021213

THE VENTIALTOR MANAGEMENT OF A CONGENITAL DIAPHRAGMATIC HERNIA IN A NEONATE: A CASE REPORT.

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INTRODUCTION: Patients diagnosed with congenital diaphragmatic hernia require ventilatory assistance before and after surgical repair secondary to respiratory distress, pulmonary hypertension and pulmonary hypoplasia. We present a case of a diaphragmatic hernia in which NAVA was used to facilitate liberation after surgical repair of a diaphragmatic hernia with a complicated medical course. **CASE REPORT:** A term male infant born by caesarian section with an in utero diagnosis of congenital diaphragmatic hernia had Apgars of 4 and 7. Delivery room resuscitation included intubation, mechanical ventilation, fluid resuscitation, and temperature regulation. Pulmonary hypertension, confirmed by echocardiogram, was treated with paralytics, sedation, pressure control ventilation and inhaled nitric oxide for 8 days. Diaphragmatic surgical repair was performed on day of life (DOL) 9. The postoperative course was complicated by pneumo-pericardium/mediastinum and recurrent pleural effusions requiring bilateral chest tubes, extracorporeal membrane oxygenation and high frequency oscillation ventilation with nitric oxide titration for lung recovery. On DOL 18, the patient transitioned to pressure control ventilation with a inspiratory pressure 22 H_2O, f 48/minute, T_i

2022018

THE UNIQUE APPLICATION OF NEGATIVE PRESSURE CUIRASS VENTILATION IN A PEDIATRIC PATIENT.

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Abstract Body: Until the mid-1950s, negative-pressure ventilation (NPV) was commonly used in patients requiring mechanical ventilation. Currently, NPV is enjoying resurgence in use in many patient populations utilizing the cuirass (clam shell device over the chest, upper abdomen). We describe the unique application of NPV, Biphasic Cuirass Ventilation (BCV, United Hayek, United Kingdom), in a 3 year old boy with paraplegia from spinal cord injury at thoracic vertebra T3 to cervical vertebra C5. BCV is a unique mode of NPV most significantly using an active expiratory cycle and varying modes/sensitivities. Case Summary: The child had a tracheostomy since 1 year of age, and was actively weaned from the ventilator. However, he had a chronic history of insomnia and restlessness in sleep. He had need for frequent pulmonary toilet for secretion management. He was admitted and managed for respiratory distress, hypoxemia, pneumonia and chronic atelectasis. He was managed with Positive Pressure Ventilation (PPV), aggressive and frequent airway clearance, mucolytics and frequent bronchoscopy. Atelectasis was recurrent and persistent with notable mucus plugging. Clinically, this patient was observed to have marked mid thoracic dysynchrony, in that his superior thorax was still supported by neck muscles, but his lower appeared to be a flail chest due to his lower cervical spine injury. BCV was initiated in an effort to improve his pulmonary toilet. Initial settings: Ipress -24, Epress +3 and a rate of 20. He was easily ventilated and oxygenated at these settings, and there was rapid, complete radiographic clearing of atelectasis. The patient tolerated BCV well and over time was allowed to window off PPV and BCV for 30 minutes with a speaking valve. His windows off support and on his speaking valve were gradually extended to a maximum of 2-3 hours a few times daily. Discussion: BCV use proved successful in maintaining adequate ventilation and, secretion clearance, with resolution of atelectasis in this patient with paraplegia and a lower cervical spinal cord injury. It was easily applied, well tolerated, and free of complications. Technical complications with the device and inadequate reimbursement precluded transitioning this patient home with this form of negative pressure ventilation. We believe that negative pressure ventilation may still be a viable option for this population in the future.

Sponsored Research - None

2022960

THE RESULTS OF IMPLEMENTING A HIGH-FLOW NASAL CANNULA WEANING PROTOCOL IN A PEDIATRIC ICU.

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INTRODUCTION: The use of high flow nasal cannula (HFNC) therapy as a means of providing noninvasive respiratory support for infants and children has dramatically increased at our institution since its introduction in 2004. In the current study, we assessed the impact of a weaning protocol on therapy utilization in the Pediatric Intensive Care Unit (PICU). CASE SUMMARY: In order to help facilitate weaning patients off of HFNC more efficiently, we implemented a weaning protocol in conjunction with an assessment tool. The assessment tool was based on the patient's respiratory rate according to age along with Silverman's work of breathing (WOB) tool. The tool's severity score ranged from 0 (least severe) to 12 (most severe). The flow rates were not weaned for a severity score of 8 or more. A score of 7 or 8, flows were lowered to half the current flow. A score of 6 or less, the flow was lowered to conventional nasal cannula (C-NC) flows as determined by the patient's age. If flows were weaned to C-NC, the patient's severity score was reassessed after 20 minutes. Post assessment, if the score increased to 7 or 8 the flow was put to half the initial HFNC flow, if the score was 8 or higher the patient was placed back on the initial HFNC flow. Patients in which the score meet criteria for the flow to be halved or did not meet weaning criteria were reassessed for weaning every 12 hours until the criteria to be placed on C-NC flows was reached. From August 2013 through March 2014, 130 patients were assessed for a total of 136 encounters and 346 assessments. 75(55%) were male and 61(45%) were female. Age range was 2 weeks to 21 yrs. (mean: 2yrs 8mos) (median: 15mos). Their diagnosis was 75(55%) viral, 35(26%) non-viral and 26(19%) post-extubation. 84(62%) patients successfully weaned to a C-NC setting upon first assessment. 34(25%) patients failed their initial weaning to C-NC flow, 23(18%) took 1 addition wean and 11 (8%) took 2 or more attempts. 18(13%) patients failed weaning trials due to a sustained progression in care beyond the inclusion criteria. DISCUSSION: Based on our preliminary results it appears our assessment tool and weaning strategy are effective in helping facilitate successful weaning from HFNC to C-NC flows.

Sponsored Research - None

2022116

IMPACT OF PAID CLINICAL INSTRUCTORS ON RRT PASS RATE

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Background: Many RT programs use unpaid clinical instructors to facilitate the completion of practicum courses. Does the type of clinical instructors utilized significantly affect RRT pass rates of BSRT graduates? I hypothesized that there is no significant difference between the RRT pass rates of BSRT program graduates who had paid clinical, unpaid clinical, or a combination of paid and unpaid clinical instructors. **Methods**: This study is a retrospective observational study. An IRB waiver was obtained. After pilot testing and revising the questions, a link to the electronic survey was e-mailed to program directors of 47 accredited RT programs that offer a BSRT as first professional degree. Respondents reported their program affiliation. Survey responses were compared to RRT pass rates. Programs that changed the type of clinical instructors used during any portion of the three-year CoARC cohort of January 1, 2009, to December 31, 2011, were excluded from instructor-specific data. A Kruskal-Wallis test with an alpha level of .05 was used to evaluate differences in RRT pass rates across the three instructor types. Spearman Rank Order correlations were used to evaluate the relationship between RRT pass rates and clinical hours, and student to instructor ratios. **Results**: Twenty-five BSRT program directors (53%) responded to the survey. Respondents had a mean RRT pass rate of 80.76 ± 15.95 and nonrespondents a mean of 74.23 ± 19.88. Four programs changed clinical instructor types during the cohort; the remaining programs had 873 graduates. A Kruskal-Wallis Test revealed no significant difference in RRT pass rates across the three types of instructors (Paid, Unpaid, Combo), $P = .93$. There was a small correlation, rho = .19, $P = .40$, between pass rates and total clinical hours. There was a medium, negative correlation, rho = -.37, $P = .07$, between pass rates and student to instructor ratios. **Conclusion**: Whether BSRT program graduates received training from paid, unpaid, or a combination of paid and unpaid clinical instructors, their RRT pass rates were not significantly different. Further study is needed to determine if factors such as instructor training or hours of paid instruction account for outcomes on RRT examinations.

Sponsored Research - None

RRT Pass Rate

Type of Clinical Instructors	Graduates	Median
Paid	302	81.00
Unpaid	121	75.00
Combo of paid and unpaid	450	86.00
Total	873	85.00

2022379

KNOWLEDGE, PERCEPTIONS, AND AWARENESS OF ELECTRONIC CIGARETTES AMONG HEALTHCARE PROVIDERS AND IN-PATIENTS.

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Electronic cigarettes (e-cigarettes) are battery powered inhalation devices that turn nicotine into vapor. E- cigarettes contain complex mixtures of chemicals, the safety of which is unknown and are not FDA approved. However, the e-cigarette market is evolving rapidly and the use of e-cigarettes has increased exponentially. As the use of e-cigarettes rises, healthcare providers should be prepared to provide consistent evidence-based advice to their patients regarding this emerging issue. OBJECTIVE: The purpose of the study was to investigate the knowledge, perceptions, and awareness of e-cigarettes among the in-patients, nurses, physicians, mid-level providers, and respiratory therapists at The Ohio State University Wexner Medical Center. An understanding of the deficits in knowledge and misperceptions will inform future healthcare interactions surrounding e-cigarette use. METHODS: After obtaining IRB approval, this descriptive pilot study utilized an online survey instrument that was sent out to over 900 healthcare providers. Additionally, in-patient smokers at the institution completed a survey about their knowledge and perceptions of e-cigarette use and safety. In-patients were recruited from a list obtained by the Patient Education and Evaluation Program (PEEP) team, a group of RTs who educate and advise patients during brief tobacco counseling sessions at OSUWMC. These participants were recruited from self-reported past or current smoking history. RESULTS: A total of 306 HCPs and 24 in-patients were surveyed. HCPs reported receiving questions from patients about e-cigarettes but rated their confidence in providing information as low. Final results indicate that there is a gap in the knowledge and misperceptions regarding the utility and use of both the healthcare providers and the in-patients surveyed. Opportunities for HCP training and the dissemination of advice regarding e-cigarette should be initiated. CONCLUSION: More research and education needs to be conducted to address the safety and efficacy of using e-cigarettes to provide consistent evidence-based advice for patients.

Sponsored Research - None

2022654

IDAHO PHARMACY PRACTICES AS RELATED TO METERED DOSE INHALERS AND SPACERS.

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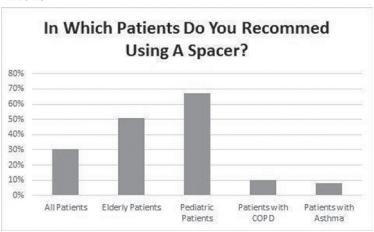
Background: Literature has shown that the use of a spacer with an MDI enhances effectiveness; however, pharmacists do not always include a spacer when dispensing an MDI. The purpose of this pilot study is to determine the percentage of time, and to which patients, pharmacists dispense spacers with an MDI. Method: IRB approval was obtained prior to the anonymous, online survey to Idaho pharmacists. The 100 licensed pharmacists who responded were asked for their opinions concerning spacers and the frequency that they dispense them. Additionally, they were asked the setting in which they work, when they recommend spacers, if they think spacers are effective in improving medication deposition and if they think spacers are effective in the management of specific diseases. Results: At independently owned pharmacies, 92% of pharmacists dispense a spacer with an MDI ≤10% of the time. In a retail chain pharmacy setting, 84% of the pharmacists dispense a spacer with an MDI ≤10% of the time. In the hospital pharmacy setting, 63% of the pharmacists dispense a spacer with an MDI ≤10% of the time. When asked if they think spacers are an effective way to improve deposition of medication, 86% say yes. When asked if they would recommend using a spacer with an MDI, 77% would recommend their usage only in some patients, 18% would recommend spacers for all patients and 5% wouldn't recommend them at all. Concerning the patient characteristics for whom they would recommend spacer usage: 66% said pediatric patients should use one; 50% would recommend a spacer for an elderly person; 30% would recommend a spacer to every patient. Interestingly, only 10% of the pharmacists would recommend a spacer for a patient with COPD and only 8% would recommend a spacer for a patient with asthma. Conclusion: This study demonstrates that even though a large percentage of pharmacists recommend spacer usage for pediatric and elderly patients, only a small percentage recommend it for disease states such as asthma or for COPD where a large majority of the patients are between the age of 64-75 years. Additionally, even though a large majority of the pharmacists agree that a spacer improves medication deposition, only a small percentage stated they would recommend a spacer to all of their patients. Through these findings we may conclude that there is a need for further education of pharmacists related to the importance of using a spacer with an MDI.

Sponsored Research - None



2022733

EXAMINING THE IMPACT OF AFTER SCHOOL HEALTH EDUCATION PROGRAM DESIGNED BY UNDERGRADUATE STUDENTS FOR ELEMENTARY-AGE CHILDREN.

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Background: Approximately 10% of students under the age of 17 have allergies and 1 out of every 10 has asthma. Asthma and allergy exacerbations impact attendance and academic performance. Poor school Indoor Air Quality (IAQ) is strongly associated with absenteeism and may lead to asthma exacerbations or respiratory infections. Elementary students are often affected by respiratory infections when not using appropriate hand hygiene. Children with asthma who participate in exercise programs improve physical fitness and have a lower risk for exacerbations. The goal of this program was to determine if the students' knowledge improves after the indoor air quality and asthma after school program. Methods: Majority of the students were Hispanic (80.8%), 94.2% are economically disadvantaged and the school offers a two-way bilingual program. The program used five interactive hands on stations; Tobacco avoidance, recognize common environmental risk factors and strategies to avoid them, best hand hygiene practices the importance of exercise and sights and sounds of asthma. Students completed a pre and post knowledge survey. Results: The participants consisted of 125 children, ages five to ten years. Only 30% of students returned the survey. There was a 53.4% improvement in the mean knowledge scores after the program (pre: 1.76; post 3.7). Conclusion: The results of this study indicate that an IAQ and asthma awareness program can significantly improve the understanding of IAQ and asthma in elementary school students. References: 1. National Academy on An Aging Society. Chronic conditions: A challenge for the 21st century. 1999. 2. van Veldhoven N, Vermeer A, Boggard J, et al. Children with asthma and physical exercise: Effects of an exercise programme. Clinical Rehabilitation. 2001;15(4):360-70. 3. Thompson S, Po M, Reeves J, Roach K, Wade L. Examining the impact of After School health education programming designed by undergraduates for elementary age children. Journal of Nutritional Disorders & Therapy. 2013;3:126. 4. Environmental Protection Agency. An introduction to indoor air quality (IAQ). http://www.epa.gov/iaq/ia-intro.html. Updated 2013. Accessed May 30, 2014. 5. The Texas Tribune. Public schools explorer: The Texas tribune's go to source for public education data. http://www.texastribune.org/public-ed/explore/north-east-isd/walzem-elementary-school/. Updated 2013. Accessed May 30, 2014.

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2022852

CHILD ASTHMA CONTROL TEST USED TO ASSESS ELEMENTARY SCHOOL CHILDREN WHO HAVE BEEN DIAGNOSED WITH ASTHMA.

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Introduction: Asthma Control in children can be assessed using the Child Asthma Control Test. (C-ACT). The C-ACT was developed to assess asthma control in children 4 – 11 years of age. The survey has 8 items, 5 student items and 3 parent items. It is designed to be self-administered to combine input from both child and parent to capture the current state of asthma control. The C-ACT correlates the meaning of asthma control and has good predictive properties for assessing asthma control. A score less than 19 indicate asthma is not controlled. Methods: The CACT was assessed during an asthma education and intervention program at several elementary schools in a local school district. There were 92 participants between the ages of 5-10 years, who were previously diagnosed with asthma per the campus nurse. Students participating in the asthma after school program completed the CACT. The students were between the ages of 5 – 12 years of age. The student and parent completed the ACT at the after school program. Results: CACT was completed by 50% of the parent and child participants and 37% scored below 19. The mean CACT score for the group was 20 (range:11-26). Conclusion: Our results indicate that 37% (17) of our students had uncontrolled asthma as indicated by the CACT. This finding could significantly impact the risk for exacerbations on these children.

Sponsored Research - The project is supported by two grants; One from the Chest Foundation with the American College of Chest Physicians and the Unviersity of Texas Health Science Center at San Antonio Center for Ethics and Humanities Community Service Learning Grant.

2023205

KNOWLEDGE RETENTION OF DIFFERENT INHALER DEVICES BETWEEN RESPIRATORY THERAPISTS AND REGISTERED NURSES.

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The current variety of medication inhaler devices can be confusing to patients due to the many different delivery systems. Many healthcare professionals who prescribe these devices are not educated enough in their proper administration technique. The purpose of this study is to evaluate various healthcare providers' knowledge of and ability to teach specific inhaler devices, and to assess their ability to retain this knowledge for a minimum of three months. Methods: We included healthcare providers who regularly educate and administer inhalation devices to patients. Respiratory Therapists (RT), and Nurses (RN), were included. Subjects underwent a baseline assessment to evaluate their knowledge and ability to use four common inhaler devices: tiotropium bromide (Dry Powder Inhaler- Handihaler), fluticasone propionate/salmeterol (Diskus), albuterol sulfate (Metered Dose Inhaler) and budesonide inhalation powder (Dry Powder Inhaler). The subject's first task was to demonstrate proper inhalation technique using placebo devices. Then, they answered 20 clinically relevant questions about the use and maintenance of each device. Finally, they watched an instructional video that explained the proper administration techniques for each. Subjects were asked to return for a follow up visit after a minimum of 3 months. During re-testing, subjects underwent the same process excluding the instructional video. Results: Thirty healthcare professionals (20 RT and 10 RN) completed baseline and follow-up testing. The mean score for the RT questionnaire at baseline testing was 70% ±10.95. Follow-up scores for the RT written questionnaire was 72.25% ± 7.66. RT practicum test results at baseline testing was 79.08% ± 11.87 and follow up practicum test results were 67.37% ± 15.03. RN result for the written questionnaire at baseline testing was 60.50% ± 13.31 and follow-up testing results were 63.50% ± 12.05. RN practicum test results at baseline was 83.42% ± 10.53 and at follow-up testing was 72.11% ± 11.30. Conclusion In this preliminary data there is a sub-optimal level in knowledge retention of inhalation devices among RTs and RNs at a tertiary care center. Additionally, instructional video training did not improve the ability to perform such tasks.

Sponsored Research - None

2023113

INTERPROFESSIONAL LAB: LOMA LINDA UNIVERSITY'S INCLUSIVE INTERPROFESSIONAL EDUCATION EXPERIENCE.

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Background: Interprofessionalism is an important aspect of health professional education. Loma Linda University houses a rich diversity of health professions and state-of-the-art Medical Simulation Center. This led to the development of the Interprofessional Lab (IPL), which is a four-hour experience facilitated by an interprofessional team of faculty and staff. The IPL provides an opportunity for cross-disciplinary interaction, exposure to functional scope of practice and team-building/communication exercises. TeamSTEPPS (Team Strategies and Tools to Enhance Performance and Patient Safety) was employed as a foundation for module development. We report the effectiveness of the IPL to increase understanding of professional scope of practice, improve communication strategies, and encourage healthcare provider role appreciation. Methods: The introduction consists of an overview of IPL, discussion of roles in practice, and an overview of communication strategies. Icebreaker exercises followed, exposing participants to truths and false perceptions of respective disciplines. A review session was conducted to discuss the use of TeamSTEPPS concepts with various professions. This also included mechanisms by which TeamSTEPPS could be employed to improve patient outcomes identified by "root cause analysis". Multi-disciplinary teams were immersed into interactive patient scenarios using mannequins and/or actors that required problem-solving. Lastly, students met for debriefing, interview, and post-survey. To improve the potential for interdisciplinary exposure, participates were given questions to ask members of their team related to specifics that may not have been addressed during the IPL. Results:Comments were analyzed using Grounded Theory, Phenomenology and triangulation. Three major themes emerged as a result of IPL: process of socialization, appreciation of health care provider roles, and enculturation of the medical setting. Likert Scale survey data were analyzed using Chi-square and Mann-Whitney U ($P < 0.5$). Significant improvements were: knowledge of other health care provider roles, respect, team effectives, patient benefit, and recognition of self-limitations. Conclusion: The IPL experience provides the opportunity for exposure to scope, function and culture of various health care professions. The IPL proved beneficial in improving overall mutual respect, communication and collaboration among hospital disciplines.

Sponsored Research - None

2018999

IMPROVED INCIDENCE OF UNPLANNED EXTUBATIONS THROUGH PROCESS IMPROVEMENT IN A LEVEL IV NICU.

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Background: Unplanned extubation (UE) in mechanically ventilated neonates is defined as an unexpected removal of the endotracheal tube (ETT). In neonates, the reported incidence of UE ranges from 0.72 to 5.3/100 ventilator days (vent days). UE poses an increased risk to patient safety such as trauma to the airway, need for cardiopulmonary resuscitation (CPR), and oxygen desaturation. Therefore, it is important to determine incidence, risk factors and population at highest risk in order to improve patient safety and quality of care. Method: Data was collected prospectively from May 2011 to March 2014. Immediately following a UE, staff recorded date/time of the incident, birth weight, gestational age, chronological age, ETT securing method, factors contributing to UE and need for reintubation. Data was processed and analyzed using Minitab software. Institutional review board approval was obtained. A previously reported 7 month UE profile was expanded to 29 months. A quality improvement measure addressing ETT security was implemented and data was collected for an additional 6 months. Results: The overall UE incidence decreased from 1.6 to 1.0/100 vent days. From May 2011 through September 2013, there were 152 UEs and 9315 vent days for a baseline incidence of 1.6/100 vent days. Endotracheal tube security mostly consisted of cloth tape. UEs occurred more frequently in infants greater than one week of age. In October 2013, a commercial NeoBar ETT holder was added on intubated infants over one week of age. UE incidence decreased to 1.0/100 vent days (21 UEs and 1941 vent days) and 57% of the UEs (12/21) had endotracheal tubes secured with tape only. Overall, the most common factors contributing to UE were patient movement (38%), excessive secretions (18%), and patient repositioning (13%). The reintubation rate was 79% (137/173). None of the UEs resulted in the need for CPR. Unplanned extubations were most frequently observed in infants less than 30 weeks gestation (65%) with the highest incidence at 4 weeks of age. Conclusions: The incidence of UEs was at the lower end of the reported range. As expected, the reintubation rate after UE was high. Adding NeoBar ETT holder to cloth tape reduced UE incidence. Additional process improvement measures related to endotracheal tube security should be explored on all intubated infants to further reduce UE incidence and complications.

Sponsored Research - None

2019698

IS THERE AN INCREASE IN EXPIRATORY RESISTANCE WITH GREATER BIAS FLOWS USING THE HIGH FREQUENCY OSCILLATOR?

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Purpose: It has been asserted that flows set at higher liters per minute (Lpm) within the CareFusion (San Diego, CA) High Frequency Oscillatory Ventilator (HFOV) 3100A circuit can increase a patient's work of breathing. This study is to determine if higher bias flows increase the expiratory resistance while using a spontaneously breathing test lung. **Method:** A performance checked and calibrated HFOV was set to a MAP of 10 cmH2O with a flow of 10Lpm. The HFOV was attached to the test lung. The test lung was set at 10bpm and delivered tidal volume (Vt) of 15mL. Four endotracheal tube (ETT) sizes were used (2.5, 3.0, 3.5, and 4.0). The pressure changes in the lung were recorded along with flows entering and exiting the lung with a TSI Certifier FA Plus System (Shoreview, MN). The initial bias flow was at 10 lpm, and increased by 5Lpm until reaching 25Lpm. The MAP was maintained at 10cmH2O. The test lungs pressure and flows were recorded after incremental changes. The testing was conducted with the circuit pressurized with oscillations stopped. **Finding:** No increase in the Peak Expiratory Pressure (PEP) within the Lung model was noted for the various ETT sizes tested when the bias flows were increased. It was noted that the Negative Inspiratory Pressures (NIP) did increase -1cmH2O with larger bias flows in all ETT sizes except the 4.0 ETT, which increased -2 cmH2O. Peak Inspiratory Flows (PIF) into the lung was decreased by 0.2 lpm on average with increases bias flow. Increases in the Peak Expiratory Flow (PEF) were noted as the bias flows increased on average by 0.25Lpm. (Tables 1, 2) **Conclusion:** In this model there was no increase in expiratory resistance detected with increased Bias flows. The measurements within the test lung showed increases in bias flow displayed a consistent PEP and the NIP was greater with a decreased PIF. The results demonstrate there is an increase inspiratory resistance, rather than expiratory resistance as a result of increased bias flow. The presence of inspiratory resistance is contrary to the anticipated results of this test and may provide information related to the laminar flow pattern at the circuit wye. This pattern may increase work of breathing if excessive Bias flows are used. Additional testing is needed to better understand the potential implications on increased PIR.

Sponsored Research - None

2020468

VALIDATION OF THE MODIFIED INSURE METHOD AND EVALUATION OF ITS EFFECT ON INTUBATED DAYS AND REINTUBATION RATES.

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BACKGROUND: The use of the InSurE method (IM), consisting of intubation, surfactant administration and immediate extubation to non-invasive ventilation (NIV) has been reported to reduce intubated days. We developed a modified version of the InSurE method (MIM) by including a standardized extubation-readiness scoring system which determined eligibility for extubation based on sequential, objective, timed assessments. The purpose of this study is to validate this scoring system and to determine if use of MIM would reduce the number of intubated days and unplanned re-intubations. **METHODS:** Demographics, timing of surfactant administration, number of intubated days and number of unplanned re-intubations after elective extubation were retrospectively collected for infants receiving surfactant administration by IM in our Level 3 NICU from 1/1/2012-10/31/2012. Data were prospectively collected for infants receiving surfactant by the MIM from 10/30/2013-4/8/2014. Welch's T-test was used to compare demographic differences between groups. Fisher's Exact test was used to examine potential differences in proportions of re-intubations. Wilcoxon Rank Sum Test was used to examine potential differences in time to first dose of surfactant and total ventilator days. Spearman Rank correlation was used to examine existence of potential relationships between 30/60 minute "Score" and "Outcome". Kruskal-Wallis Rank Sum Test was used to analyze differences among outcome for the levels of score, at the 30 and 60 minute marks to assess validity of scoring method. Statistical significance was interpreted at an $\alpha = 0.05$. **RESULTS:** Gestational age and weight were not statistically significantly different, while time to first dose was (p=0.03), Table 1. Statistically significant correlation was found for both the 30 and 60 minute scores and outcome (p=0.01 and p=0.03 respectively). **CONCLUSIONS:** The MIM exhibits improved timeliness to first surfactant dose (6.9 vs. 14.7) which may have resulted from increased physician awareness. The MIM provided a reliable method for determining the need for ventilatory assistance and extubation readiness. Scoring methods used in the MIM group provided a valid measure of determining extubation readiness and did not lead to increased ventilator days or a higher re-intubation rate.

Sponsored Research - None

Table 1

	Insure Method (IM)	Modified Insure Method (MIM)	p Value
Number of patients	18	18	-
Gestational Age in weeks : Mean (±SD)	33.1 (2.5)	33.1 (2.8)	0.99
Weight in grams: Mean (±SD)	1977 (585.2)	2065 (750.2)	0.07
Time to first surfactant dose (hrs): Mean (±SD)	14.7 (11.7)	6.9 (7.9)	0.03
Number of intubated days: Mean (±SD)	2.6 (2.6)	1.7 (1.0)	0.78
Unplanned reintubation: n (%)	6 (33.3)	5 (27.8)	1.0

2020594

CONTINUOUS HIGH FREQUENCY OSCILLATION THERAPY IN MECHANICALLY VENTILATED PATIENTS IN THE PEDIATRIC INTENSIVE CARE UNIT.

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Background: Continuous high frequency oscillation (CHFO) creates a pressure gradient in the small airways that accelerates expiratory flow. The intended use of CHFO therapy is to facilitate secretion removal and treat atelectasis. Our objective was to assess the feasibility, safety, and efficacy of CHFO in the mechanically ventilated pediatric population. Method: After IRB approval, we retrospectively reviewed medical records of mechanically ventilated children treated with CHFO (The MetaNeb® System; Hill-Rom) at our institution from July 1, 2007 through August 31, 2012. Patients receiving ECMO support were excluded. We evaluated changes in ventilator settings in patients with ventilator data documented within six hours pre- and post-treatment. We also evaluated arterial blood gas (ABG) results for individual treatments, comparing ABG results within eight hours pre-therapy to ABG results within three hours post treatment. Oxygen index (OI) and PaO2/FiO2 ratio were calculated. Demographic data, blood pressure, heart rate, and development of new air leak while being treated with CHFO were recorded. Pre- and post-CHFO measures were compared using Wilcoxon Sign Rank testing. Results: Our cohort included 59 invasively ventilated patients. Median age was 2 years (range: 1 month-19 years) and median weight 14 kg (2-81 kg). We evaluated data on 528 total treatments (range per patient: 1-39 treatments). More than 75% of patients received less than 10 total treatments. Gas exchange and ventilator parameter data are displayed in the table. There was no significant change in systolic blood pressure, diastolic blood pressure, or heart rate following treatment with CHFO. One (2%) patient developed a small pneumothorax during CHFO. Conclusions: CHFO is feasible and seems safe in our cohort of mechanically ventilated pediatric patients. The rate of pneumothorax is consistent with that seen in similar PICU populations. Peak inspiratory pressure significantly decreased with CHFO; while other parameters, including PCO2 and respiratory rate, remained clinically stable. These preliminary results suggest CHFO may be beneficial by improving lung compliance in pediatric patients with secretion-induced atelectasis. Prospective clinical studies are needed to further evaluate the clinical efficacy and safety of CHFO in children receiving invasive mechanical ventilation.

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2020798

COMPARISON OF AMPLITUDE AND LUNG COMPLIANCE DURING HIGH FREQUENCY OSCILLATORY VENTILATION.

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Background: High frequency oscillatory ventilation (HFOV) is used to provide respiratory support to critically ill infants and children with respiratory failure. However indications of changes in pulmonary mechanics are lacking during HFOV and patients often require temporarily transitioning to conventional ventilation to assess compliance, which may result in inadvertent airway collapse. Since amplitude is a measured parameter during HFOV, we sought to describe the relationship between changes in compliance and associated changes in amplitude in a pediatric lung model. Methods: The Carefusion 3100A (Carefusion, Yorba Linda, CA) ventilator was calibrated according to manufacturer's specifications and used for all testing. The experiment of conducted with the HFOV set to a power of 7, frequency of 10 Hz, mPAW of 30 cmH2O, bias flow of 20L/min, and inspiratory time 33%. The Quicklung Jr. (Ingmar, Pittsburg, PA) was used to simulate various patient conditions. Compliance was adjusted in a stepwise fashion and amplitude was recorded after each change. This procedure was repeated for 3 distinct airway resistance settings: with 5, 20, and 50 cmH_2O/L/sec. Data was transcribed and then analyzed using non-linear regression model to determine the relationship between compliance and changes in observed amplitude. Results: At lower resistance levels the amplitude had larger fluctuations with changes in compliance. At a resistance of 5cmH_2O/L/sec and a compliance increase from 1.0 to 3.0, 5.5, 13.2mL/cmH_2O the amplitude decreased by 3, 5, and 9cmH_2O respectively (Figure-1). At a resistance of 20cmH_2O/L/sec and a compliance increase from 1.0 to 3.0, 5.5, 13.2mL/cmH_2O the amplitude decreased by 2, 3, and 5cmH_2O respectively (Figure-2). There were no changes in amplitude at any level of compliance at a resistance of 50cmH_2O/L/sec. Non-linear regression revealed a statistically significant relationship between changes in amplitude and compliance (resistance 5, P =0.009, resistance 20, P =0.002) Conclusion: We found a statistically significant non-linear relationship between compliance changes and fluctuations in amplitude at lower resistance levels. Clearly, large changes in compliance can be detected by assessing the measured amplitude values. However, endotracheal tube and ventilator circuit leaks may confound these findings and should be considered carefully.

Sponsored Research - None

2020935

THE INTRODUCTION OF A NOVEL NEWBORN RESUSCITATION TRAINING PROGRAM AT AN INEXPERIENCED LEVEL II BIRTHING HOSPITAL SIGNIFICANTLY REDUCED ERRORS IN NEWBORN RESUSCITATIONS.

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Introduction: The introduction of a novel newborn resuscitation training program at an inexperienced Level II birthing hospital significantly reduced errors in newborn resuscitations. This hospital's resuscitation teams are comprised of RNs and Respiratory Therapists (RRT). Newborn resuscitation-skilled MDs/LIPs are not on site. Both the RRTs and RN's are trained annually with the AAP newborn resuscitation program (NRP). 30 resuscitation errors were identified in 2012. They involved RN skills, equipment, NRP sequencing, and RRT availability. Four of these errors resulted in serious infant compromise. To reduce the errors a novel QI program was then designed and introduced in 2013. Case Summary: Four areas of training were designed; increased RRT knowledge, RRT availability, equipment availability, and RN skills. The QI program: 1) the RRTs were tested monthly on 102 selected NRP skills 2) a new process for timely communications to assure RRTs are at 100% of the deliveries 3) all O2 blenders, suction set-ups, meconium aspirators, hand resuscitators, and pulse oximeters were at the ready, and documented, before each delivery. 4) All RNs (45) participated in two NRP simulations monthly. The simulations were done during their shifts and were unannounced (all nurses were to perform 20 key NRP components each month. These results were scored for accuracy. Added training occurred for RNs that developed test failure trends). All QI process results were documented, graphed, and reviewed monthly. There were 1230 births in 2012. The 30 errors in 2012 equated to 2.4% of the total births. Of the 30 errors, 4 needed formal peer review. 12 months after the new program was started (in 2013) errors dropped to 6 events (0.5% of 1195 births). Of those 6 errors, zero needed peer review. This is an 80% reduction of resuscitation errors within similar birthing demographics. And a100% reduction of errors that warranted peer review. Discussion: Inexperienced practitioners seem to produce errors in newborn resuscitation at a higher level when their training is based only on the traditional NRP held every 1-2 years. When training is increased to monthly, with focused targets and with feedback programs, errors can be significantly reduced. We believe that this approach has significant value to inexperienced caregivers who provide newborn resuscitations in the delivery room. Risks can be reduced, errors are fewer and outcomes may be better. And it can be done with minimal expense.

Sponsored Research - None

2021078

NITROGEN DIOXIDE (NO2) MEASUREMENTS OBTAINED FROM DIFFERENT SAMPLING LOCATIONS IN THE PATIENT CIRCUIT USING TWO INFANT VENTILATORS DURING NITRIC OXIDE (NO) ADMINISTRATION.

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BACKGROUND: Gas sampling has traditionally been measured within six inches of the patient-wye during inhaled NO (iNO) therapy. Clinicians have asked if accurate gas sampling can be achieved by placing the sampling port on the dry side of the humidifier to avoid humidity and aerosols from occluding the sampling line. We designed studies to test the hypothesis that there were no differences in NO2 measurements between different sampling locations in the patient circuit using different NO levels and ventilators. METHODS: A Servo-I (Maquet, Solna Sweden) and VN500 (Draeger, Lubeck, Germany) ventilator was set with VT 24 mL, RR 30, TI 0.4 s, FiO2 1.0, and PEEP 5 was attached to an infant test lung with a permanganate/charcoal filter to eliminate NO and NO2 from the lung model. An iNOvent DSir was placed in series with the ventilator circuit. Gas sampling was alternated, using a three-way stop-cock, between three circuit locations; (1) prior to the humidifier, (2) six inches from patient-wye and (3) at patient-wye. NO2 was measured and recorded at 5, 20, 40 and 60 ppm iNO at each location. Following these tests, a non-heated, six inch isolette inspiratory extension tubing was removed and measurements were obtained at the patient-wye. ANOVA was used to compare differences between different locations and NO settings. RESULTS: There were differences in NO2 measurement at each sample location at the respective iNO levels in all testing conditions (Figure; $p<0.05$), except the Servo-I at 5 ppm. There were disparities in NO2 levels between the humidifier and patient-wye that became more pronounced at NO >5 ppm. NO2 measurements obtained from the dry side of the humidifier underestimated the delivered NO2 in most cases but was most pronounced with the Servo-I ventilator at iNO >40 ppm. Removing the isolette tubing resulted in lower NO2 accumulation. DISCUSSION/CONCLUSION NO2 levels can vary from one ventilator to another based on sampling location, bias flow, and dwell time for NO to combine with O2 in the inspiratory limb of the circuit. Differences in NO2 production are best explained by the lower bias flow of the Servo-I (0.5 L/min) compared to the VN500 (6 L/min), thus making the inspiratory circuit and extension tubing more likely for NO2 accumulation. Based on these findings, sampling NO2 at the dry side of the humidifier appears to be safe in the VN500 but should be monitored as close to the patient as possible with the Servo-I at iNO >20 ppm.

Sponsored Research - None

2021262

THE EFFECT OF CIRCUIT SIZE ON WORK OF BREATHING, TIDAL VOLUME ACCURACY, AND GRAPHICS QUALITY DURING SIMULATED PEDIATRIC VENTILATION.

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BACKGROUND: The Evaqua II heated wire ventilator circuit (Fisher Paykel, Auckland New Zealand) is available in two sizes; Infant, and Pediatric/Adult. We previously used 3 circuit sizes in our institution prior to our switch to the F&P MR850 humidification system. The manufacturer recommends switching from infant to pediatric tubing when the tidal volume exceeds 100 mL, but we do not always know what tidal volume will be needed on admission to the Pediatric Intensive Care Unit (PICU). For this reason we felt that we could not rely on tidal volume alone to guide our choice for circuit size. We set out to evaluate work of breathing (WOB), optimal graphic quality, and acceptable tidal volume accuracy between the two different circuit sizes in order to make an educated decision about which circuit size should be used for our patients in the Pediatric Intensive Care Unit (PICU). METHODS: All testing was done using a spontaneously breathing test lung (ASL 5000, Ingmar Medical) and a Draeger Infinity V500 ventilator (Draeger Medical, Lubeck Germany) with settings of: Mode PC-AC/VG, RR 20 bpm, TI 65, tidal volume 100 mL, PEEP 5, FIO2 50%. The lung model was configured for two separate testing conditions; 1) study one (Active: RR 25, C 7 mL/cmH20, Resistance 60 cmH20/L/s, Pes 5 (20/10/50 cmH20) to evaluate WOB, imposed resistance, and response time. 2) study two (Passive: RR 0, Compliance 7 mL/cmH20, Resistance 60 cmH20/L/s, PES 0 cmH20) for volume accuracy which was calculated using the following equation % Error= (lung model VT-Displayed VT)/Displayed VT* 100). Measurements were taken under each study condition using both infant and pediatric/adult circuits. RESULTS: The results from our bench study informed us that a pediatric/adult circuit could be used safely in patients >10 kg, and < 100 mL tidal volume with clinically acceptable graphics quality, response time, WOB, and tidal volume accuracy. However, there is one caveat, in patients >10 kg with tidal volumes <100 mL and a Cdyn <2 mL/cmH2O, a proximal flow sensor must be used to assure accurate tidal volumes. See figure 1. A & B. CONCLUSION: Based on the data collected we developed a reference chart for our staff with circuit size recommendations for the Evaqua II based on weight. We have implemented this practice in our PICU with great success and no problems to date.

Sponsored Research - None

2021580

RATE OF UNPLANNED EXTUBATION AND ASSOCIATED OUTCOMES IN THE NEONATAL INTENSIVE CARE UNIT.

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BACKGROUND: Data describing frequency and outcomes of unplanned extubation (UE) in the neonatal intensive care unit (NICU) are limited. It is assumed that UE is a safety risk and may impact mortality, time on the ventilator and time in the hospital. There is no benchmark for UE in the NICU. We wanted to determine the rate of unplanned extubation and the associated outcomes in our NICU for possible performance improvement efforts. METHODS: We retrospectively reviewed all ventilator patients in our NICU from October 2011 (discrete data was added in the Respiratory Care documentation for UE) to May 2014. We collected number of ventilator patients, ventilator days, hospital days, planned or unplanned extubation, re-intubation, gender and disposition outcome. Rate of UE is displayed as #UE per 100 ventilator days. RESULTS: 626 six ventilator patients were identified in our NICU since October 2011 with 5718 ventilator days. 99 UE were identified. Rate of UE was 1.73 events per 100 ventilator days. 43% of UE occurred on dayshift, 27% on evening shift and 30% on mid-night shift. 18% percent of the UE required re-intubation. See table for information about the overall ventilator patients compared to UE and UE with re-intubations. CONCLUSIONS: Less than 2 UE events occurred for every 100 ventilator days in our NICU. UE with and without re-intubation were associated with longer length of time on the ventilator and in the hospital. It is not clear if UE causes or is an indicator for patients with increased hospital and ventilator time. UE with and without re-intubation is not associated with increased mortality rate in our NICU. Less than one fifth of patients with UE require re-intubation, therefore more aggressive liberation efforts may have been possible for those patients.

Sponsored Research - None

	All Ventilator Patients (626)	All Unplanned Extubation Patients (99)	Unplanned Extubation Patients Requiring Re-Intubation (18)
% Male	57%	57%	64%
Mean Ventilator Days	9.1	20.9	20.5
Mean Hospital Days	32.4	47.4	44.2
Mortality (%)	8.8%	4.3%	7.0%

2022129

EVALUATION OF THE RELATIONSHIP BETWEEN HEMATOCRIT AND FIO2 IN PRETERM INFANTS.

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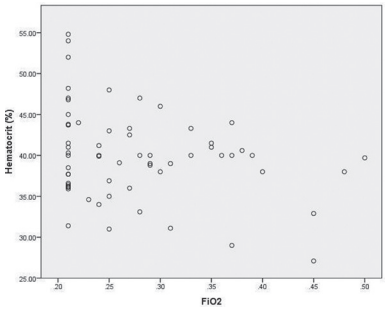
Background: Maintaining an optimal hematocrit is beneficial to oxygen transport. Anemia in the neonatal population is common in the intensive care setting and is often associated with iatrogenic blood loss, nutritional deficiencies, diminished red blood cell life span and procedures performed on the patient. Does hematocrit have an effect on FIO2 in preterm infants? I hypothesized that there is no correlation between hematocrit and FIO2 in preterm infants. Methods: IRB approval was obtained for this study. Between January 2011 and March 2013, the charts of 62 subjects 25-38 weeks gestational age were retrospectively reviewed. All subjects were born <32 weeks gestational age, diagnosed with RDS and were intubated >72 hours. Those subjects with major congenital malformations were excluded. Hematocrit values within 24 hours of extubation and the lowest documented FIO2 1 hour prior to extubation were recorded. The data were recorded, analyzed, and reported by Pearson correlation coefficient using SPSS 21 (IBM, Chicago, IL). Results: The magnitude of the hematocrit (Hct) was weakly negative correlated with the FIO2 (correlation coefficient of r= -.29, p<.01). The null hypothesis was rejected. Conclusions: Hematocrit has a slight correlation with FIO2 in the preterm infant. The weak association shows a negative slope, as hematocrit decreases, the FIO2 increases. This study is limited by its retrospective nature and the variability of fluctuations FIO2 used in this population; though, FIO2 is not often increased at extubation and is generally stable at that time. Another limitation is the length of time between hematocrit sample obtained and the documented FIO2. This factor is minimized since none of the subjects received blood products after the hematocrit was drawn. Randomized prospective research is needed to evaluate the relationship between hematocrit and FIO2 in preterm infants and to determine if blood transfusions are necessary in preterm infants requiring a high FIO2 .

Sponsored Research - None



2022554

PROSPECTIVE RANDOMIZED CROSSOVER STUDY TO EVALUATE PHYSIOLOGIC RESPONSE WITH TWO SUBACUTE CARE VENTILATORS IN TRACHEOTOMIZED INFANTS WITH CHRONIC LUNG DISEASE.

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BACKGROUND: Infants with chronic lung disease (CLD) require prolonged ventilation extending beyond the ICU setting. Many of these infants have difficulty transitioning to subacute ventilators possibly related to the inability to effectively trigger breaths. Recent advances in subacute ventilators have sought to overcome this limitation. We hypothesized there would be no differences in gas exchange, indices of work of breathing, and triggering in infants between the Trilogy 202 (Philips Healthcare, Andover, MA), and LTV model 1200 (Carefusion, Yorba Linda, CA). METHODS: Five tracheotomized infants were instrumented with an esophageal balloon catheter, airway pressure and flow sensors, SpO2, and PETCO2. Infants were then randomized in a crossover design to receive support for 20 minutes with both the LTV 1200 and Trilogy 202 ventilators at identical settings as the ICU ventilator. Noninvasive gas exchange, pressures, flow, and heart rate were recorded sfter 15 mins. Data were reduced and delta-Pes, pressure-rate product (RR*delta-PES), response times and % triggered-patient breaths (total breath number/total number of patient efforts that corresponded with a supported breath) were calculated and compared using a paired T-Test. Significance was determined a priori as p< 0.05. RESULTS:There were no differences in HR (p=0.67), RR (p=0.16), SpO2 (p=0.37), PETCO2 (p=0.16), % patient-triggered breaths (p=0.35), or PRP (p=0.06) between the two ventilators. The Trilogy 202 resulted in lower delta-Pes and faster response times in patients than the LTV 1200 (p< 0.05, Figure). All infants were able to be transitioned successfully from the NICU to the general care floors on the Trilogy 202 ventilator. CONCLUSION/DISCUSSION: Based on these data, the Trilogy 202 may extend the capabilities of subacute care ventilators and provide a more seamless transition from intensive care ventilators so that patients can progress from the NICU in a timely fashion. We believe the improved patient comfort observed with the Trilogy may have resulted from advances in triggering algorithms and lower bias flow than that used in the LTV 1200.

Sponsored Research - None

2021032

EVALUATION OF PROXIMAL VERSUS DISTAL AIRWAY PRESSURE ON THE METANEB.

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Introduction: The Metaneb ® System (Hillrom, St Paul, Minnesota) is an airway clearance device that facilitates secretion mobilization utilizing continuous high frequency oscillation (CHFO) and CPEP. Two frequencies and three resistance settings are available during CHFO. There is minimal observed pressure variation noted on the Metaneb manometer during treatment; making it difficult to determine the amount of pressure delivered to the patient. The purpose of this study is to identify distal and proximal airway pressures delivered by the Metaneb®. Methods: The Metaneb handset was connected to a BC Biomedical LS-20001 Infant Lung Simulator (St Louis, MO) with a lung compliance settings of 2, 3 and 5 ml/cmH2O and resistance at 5L/s. A calibrated Paux airway pressure line was attached to the Engstrom GE Carestation ventilator (Little Chalfont, United Kingdom) at the proximal end of the handset. The Metaneb® was cycled on for 1 minute at each of the three resistance and two frequency settings. Distal pressure readings were obtained from the Metaneb® manometer and the proximal Paux line simultaneously. Mean values and standard deviations for proximal and distal pressures are displayed in the table below. Values were analyzed using the post test 2-way ANOVA test with a statistical significance set at $p<0.05$. Results: There was a statistically significant difference between proximal and distal pressure measurements. Proximal pressures consistently measured two times greater than the distal readings at all three resistance settings and frequencies. Conclusion: Observed minimal distal pressure variation on the face of the Metaneb manometer does not reflect pressure delivered proximally to the patient.

Sponsored Research - None

		Compliance 5 ml/cm H2O			Compliance 3 ml/cmH2O				Compliance 2 ml/cm H2O			
	Low Frequency		High Frequency		Low Frequency		High Frequency		Low Frequency		High Frequency	
1 Bar Resistance	MetaNeb	Paux	MetaNeb	Paux	MetaNeb	Paux	MetaNeb	Paux	MetaNeb	Paux	MetaNeb	Paux
Mean	7	14	9	19	8	17	10	24	9	18	13	26
SD	0.316	0.000	0.316	0.000	0.516	0.527	0.000	0.943	0.483	0.000	0.483	0.422
2 Bar Resistance	MetaNeb	Paux	MetaNeb	Paux	MetaNeb	Paux	MetaNeb	Paux	MetaNeb	Paux	MetaNeb	Paux
Mean	4	7	5	10	4	9	5	12	5	9	7	13
SD	4.655	9.899	6.070	13.435	5.009	11.295	7.071	16.304	6.235	12.728	8.639	18.228
3 Bar Resistance	MetaNeb	Paux	MetaNeb Paux	Paux	MetaNeb	Paux	MetaNeb	Paux	MetaNeb	Paux	MetaNeb	Paux
Mean	4	8	5	11	5	10	6	14	6	11	8	16
SD	0.741	2.050	1.033	2.782	0.672	1.967	1.454	2.710	0.950	2.636	1.448	3.477

2021360

ACCURACY OF ETCO2 MEASUREMENTS USING A SIDE-STREAM DEVICE ON A SIMULATED PATIENT VIA HIGH-FLOW AEROSOL TEE-PIECE.

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Background: End tidal carbon dioxide (EtCO2) monitoring has become an important tool in monitoring patients receiving mechanical ventilation in our ICU setting. There is a subset of these patients that require placement of a tracheostomy tube after liberation from mechanical ventilation, due to continuing airway issues. Once liberated from mechanical ventilation these patients require supplemental high flow oxygen and hydration. There was a concern that turbulence of high airway flow rates at the tee-piece connection to the tracheostomy tube may alter the accuracy of measuring EtCO2. Our study investigated the measurement accuracy of EtCO2 utilizing a system simulating a spontaneously breathing patient breathing via a high flow tee-piece. The model replicated a realistic CO2 waveform in all cases. Methods: Testing was done in the lab setting with a continuous high flow nebulizer (dry) setup via tee-piece with the EtCO2 monitor sampling adaptor placed between the tee-piece and the endotracheal tube adaptor. The production of respired CO2 was simulated with a ventilator driving an enclosed bellows. CO2 was bled into the enclosed bellows at an adequate liter flow to achieve an end tidal value of 35mmHg at the end of the endotracheal tube. We used a side stream CO2 monitor (Oridian Medical, MicroCap). Four different respiratory rates and two different total flow rates were tested. Results: With variable respiratory rates of 12, 15, 17, and 22 with total flows of 53LPM and 40LPM, the CO2 deviation from baseline ranged from +1 mmHg to +5 mmHg. Conclusions: Within the design of limitations of the model, we could not determine any error trends with the different respiratory rates or flow rates tested. Based on our findings, there is reason to suspect significant error under these conditions.

Sponsored Research - None

2022034

EFFECTIVENESS OF MUFFLED 2-IN-1 ADAPTER AT DECREASING AMBIENT SOUND LEVEL AND EFFECT ON FLOW OUTPUT.

Charline Don, Theodore Vallejos, John Newhart; Respiratory Care, UC San Diego Heath System, San Diego, CA

Background: Use of high flow oxygen systems has increased in popularity significantly over the last several years. One of the drawbacks to its use is the increase noise level generated by the high flow gas exiting the flowmeter. In recognition of the importance of minimizing noise in the patient environment, we elected to evaluate the effectiveness of a commercially available device. The "Muffled 2-in-1" Adapter manufactured by Maxtec attempts to minimize this problem by providing a "muffler" that attaches directly to the outlet of the flowmeter. Methods: We bench- tested the device at flow rates from 10-60 LPM measuring sound levels in decibels (db). Decibel levels were measured using a smart phone app (deciBel BSB Mobile Solutions). We validated set vs. measured flow rate using a TSI Certifier. This was done both with and without the muffler in place. Results: The muffler decreased the sound by 21 db at the lower flow of 10 LPM and 8db at 60 LPM. The average decrease in sound was 12.8db. The indicated versus measured flow were all within 2 LPM of each other. Conclusions: The un-muffled sound levels from 10-60 LPM remained constant at 88db. The sound level was significantly decreased under all flow rates; the greatest differences were at the lower flow rates. The set versus measured flow rate was minimal.

Sponsored Research - None

2022261

PULSE OXIMETRY SENSORS: ONE SIZE FITS ALL?

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Background: Nellcor® OxiMax MAX-N is the most frequently used pulse oximetry sensors within the institution. Staff prefer a bandage sensor that secures to the initial site & then easily re-locates & secures to another site. Staff does not follow the weight based manufacturer recommendations for use of pulse oximetry sensors. The mechanism of action of pulse oximetry is for an infrared reading to travel from one diode to another through the selected appendage. When the sensor is placed the diodes must be lined up directly across from one another. Weight based recommendations are so the diodes can be properly aligned at the application site. If the diodes are misaligned the pulse oximetry reading may be inaccurate. A trial was designed to determine if the use of one pulse oximetry sensor for all patients, although outside of weight recommendations, has any bearing on accuracy of probe function &/or reading. Method: Manufacturer recommendations for the Nellcor® OxiMax pulse oximetry sensors used in the trial are: MAX-I (3kg – 20kg), MAX-N (< 3kg or > 40kg), and MAX-P (10 – 50kg). Oximetry readings for the following sensors & weight ranges were compared: MAX-P to MAX-N for weight range 10 kg-40kg & MAX-I to MAX-N for weight range 3kg – 20kg. It was not necessary to compare MAX-P to MAX-I for weight range 10 kg -20kg since this information was covered by the manufacturer guidelines. A total of 12 patients were chosen: 3 patients, that do not have the same weight, from each of the following weight ranges: 3kg-10kg, 10kg-20kg, 20kg-30kg, and 30kg-40kg. Each patient received one oximetry reading from each sensor. The sensor was placed on the same site & remained in place until the reading was deemed accurate via waveform & strength of signal indicator. The monitoring system used was GE Medical Solar Monitor. The examiners noted any perceived difficulties in alignment of diodes for sensors used outside of manufacturer recommendations. Data points collected were: patient weight, sensor site, sensors tested & average oximetry reading for each sensor. Results: see table. Conclusions: All but one oximetry reading comparison was within the accuracy of the GE monitoring system for Nellcor® pulse oximetry. No difficulty in alignment of diodes for sensors used outside of manufacturer recommendations was noted. Recommendations for weight are a guideline, not an absolute, for pulse oximetry sensor selection. Staff can safely use the sensor which is best for the patient.

Sponsored Research - None

Results Data

Weight	Sensors	Site	Oximetry Reading	Oximetry Reading
6.6 kg	N & I	R great toe	N: 85%	I: 77%
7.2 kg	N & I	L great toe	N: 93%	I: 93%
7.6 kg	N & I	R great toe	N: 98%	I: 95%
14.8 kg	N & I	R thumb	N: 99%	I: 99%
16.6 kg	N & I	L great toe	N: 95%	I: 94%
19.2 kg	N & I	R great toe	N: 94%	I: 92%
20.2 kg	N & P	L thumb	N: 95%	P: 93%
20.6 kg	N & P	L great toe	N: 96%	P: 97%
21.8 kg	N & P	R great toe	N: 99%	P: 98%
32.0 kg	N & P	L middle finger	N: 93%	P: 93%
37.9 kg	N & P	R third toe	N: 965	P: 98%
39.5%	N & P	L index finger	N: 100%	P: 98%

2022798

TIDAL VOLUME DELIVERY WITH MASK TRIGGERED VENTILATION DURING PEDIATRIC RESUSCITATION: A BENCH STUDY.

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Introduction: During pediatric resuscitation, Pediatric Advanced Life Support (PALS) guidelines advise clinicians to avoid excessive ventilation as it may compromise cardiac output, increase the incidence of aspiration or result in air trapping.1 Manual ventilation with a mask-triggered resuscitator provides consistent pressure during resuscitation. While constant pressure may prevent unanticipated complications, appropriate tidal volume delivery prevents over-ventilation. The purpose of this study was to evaluate the effects of delivering a consistent pressure on measured tidal volumes (Vt) with mask-triggered ventilation during pediatric resuscitation. Methods: The Ispira Emergency Pulmonary Resuscitation Device (Neoforce, Ivyland, PA) is a system that incorporates a manual trigger switch within the resuscitation mask that when depressed, initiates a manual breath at a target pressure level. Pediatric small (size 2) and large (size 3) resuscitation masks were independently strapped to a pediatric/small adult mannequin face model. The mannequin's internal mouth opening was attached to a 7 inch large bore tubing, an adult flow sensor connected to a NICO 2 Respiratory Profile Monitor (Philips Respironics, Andover MA) monitor for volume and pressure measurement and a BC Biomedical LS-20001 Infant Lung Simulator (compliance of 2 and 5 ml/cm H2O). The Ispira was set to suggested flow rates and pressures for pediatric masks: 4 lpm (size 2) and 5 lpm (size 3). The resuscitator was cycled on 90 times with a pressure set at 18 cm H20 and a Ti of 1.0 second. Tidal volumes were recorded in mL on every third breath for each circuit/mask for a total of 30 values per mask and compliance. Mean values and standard deviations for Vt were compared for each size mask (at a constant flow and pressure) using a t-test with the statistical significance set at $p<0.05$. Results In the face of a changing compliance, there was a statistically significant difference in measured tidal volumes using consistent pressures during mask-triggered ventilation. Conclusion Although consistent pressure is provided during resuscitation, tidal volume delivery during pediatric mask triggered ventilation changes with lung compliance and may require adjustments in pressure or flow to accomplish desired results. 1 http://www.circ.ahajournals.org/content/102/suppl_1/I-291.full

Sponsored Research - None

Measured Tidal Volumes with PIP 18 cm H20 During Resuscitation

	Measured Vt (mL) C=2 mL/cm H20	Measured Vt (ml) C= 5 mL/cm H20
Size 2 (p<.0001)	108 (7.812)	133 (8.3)
Size 3 (p=<.0002)	167 (11.51)	182 (16.7)

2022885

EVALUATION OF HUMIDIFICATION SETTINGS IN THREE NEW ICUS USING HEATED-WIRES: AN OBSERVATIONAL STUDY.

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BACKGROUND: Although heated humidifiers (HH) are highly efficient on providing humidification to ventilates patients they can also dry out secretions. An increase in inlet chamber temperature induced by high ambient temperatures reduces the performance of HH and can increase the risk of ETT occlusion. Thus, the presence of condensate may not be a reliable clinical marker for adequate humidification under these conditions. The goal of this study was to evaluate humidification settings in three new medical-surgical-trauma ICUs where heated wires are routinely used. METHODS: This observational study was conducted in a brand new tower of a university-affiliated hospital in San Antonio, TX. Recording of humidification settings (Y-piece and inlet chamber temperatures) were obtained from a ConchaTherm® Neptune® (Teleflex) connected to a heated-wired ventilator circuit (ISO-Gard® Circuit; Teleflex). Room temperature, indoor humidity % were measured using an AcuRite Digital Humidity and Temperature Monitor. The presence of "beading" in the circuit and the artificial airway were also recorded. Excessive water accumulation in the inspiratory limb near the patient's airway was also documented to establish potential risk for aspiration. Data are reported as mean +/- SD. RESULTS: Data was collected from 20 mechanically ventilated patients (13 medical ICU; 5 trauma ICU; 2 neuro ICU). The mean room temperature was 25.1 +/- 0.86 degrees Celsius (C) and the indoor humidity level was 50 +/- 3.81%. The mean airway temp was 39.2 +/- 1.33 C while the mean inlet chamber temp was 37.1 +/- 0.47 C (temp gradient 2.1C). The presence of "beading" was confirmed in the inspiratory limb of all patients' circuits and the artificial airways (15 ETT; 5 trachs). Excessive condensate was found in the inspiratory limb 6 inches from the wye adapter in 11 patients (55%). CONCLUSIONS: While the mean ambient temperature is slightly above 22-24C, it is not considered high (28-30C as defined by Lellouche et al). Therefore, the presence of "beading" in these group of patients may be interpreted as a good surrogate for adequate humidification performance. The presence of excessive accumulation near the Y-piece may require additional precautions to reduce the risk of aspiration of condensate.REFERENCE: Lellouche F, et al. Am J Respir Crit Care Med. 2004;170:1073-79.

Sponsored Research - None

2022887

A DISPOSABLE, BEDSIDE SYSTEM TO SUPERSATURATE LIQUIDS WITH DISSOLVED OXYGEN FOR TREATMENT OF CLOSTRIDIUM DIFFICILE INFECTION.

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Background: The CDC has reported that Clostridium difficile infections are at record high levels for incidence, deaths, and treatment costs[1]. Clostridium difficile is an anaerobic, spore-forming, bacillus that can cause pseudomembranous colitis, toxic megacolon, sepsis, and death[2]. Hyperbaric oxygen therapy has been shown to be effective in the treatment of Clostridia infections because the microbe lacks oxygen free-radical degrading enzymes. Van Unnik has shown that a PO2 tension of 250 mm. Hg may stop alpha-toxin formation, and this gas tension was found to be bacteriostatic both in vivo and in vitro3. The purpose of this study was to determine the dissolved oxygen tensions created at the bedside by a novel, disposable, bedside tonometer system. **Methods**: A disposable bedside tonometer system mixed oxygen gas and sterile water for twenty minutes under 2 groups of conditions (1) equilibration with 100% oxygen at 37 degrees C (n = 15), and (2) equilibration with 100% oxygen at 17 degrees C (n =15). The pO2 of the supersaturated sterile water solution was immediately analyzed following equilibration. A Radiometer ABL 330 blood gas analyzer was used for analysis of all tonometered fluid samples. All samples were analyzed under normobaric conditions of BTPS. Descriptive statistics and a t-test (alpha = 0.05) were calculated for dissolved oxygen tensions for both experimental groups above. **Results**: Following equilibration with 100% oxygen at 37 degrees C, the mean pO2 was 613 mm. Hg (n=14, sd = 12.4). When sterile water was equilibrated with 100% oxygen at 17 degrees C (63 degrees F), the mean pO2 increased to 977 mm. Hg. (n = 14, sd = 11.6). Statistically significant increases in dissolved oxygen tension were found between fluid tonometered with 100% oxygen at 37 degrees C and at 17 degrees C ($p < .001$). **Conclusions**: This study has shown that the tonometer system created dissolved oxygen tensions which may be sufficient for inactivation of alpha-toxin formation, and may be bactericidal for Clostridium difficile. Because C diff is extremely sensitive to oxygen, high levels of dissolved oxygen in liquids may be useful in the treatment Clostridium difficile infection; either by drinking the liquid or infusion through an NG, NJ tube, or endoscope. Additional research is necessary to determine the safety and efficacy of this technology in augmenting the treatment of Clostridium difficile infections.

Sponsored Research - None

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2023013

ACCURACY OF TIDAL VOLUME DELIVERY IN 2 COMMONLY USED PEDIATRIC VENTILATORS: A BLAND-ALTMAN COMPARISON.

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Bradley A. Kuch MHA, RRT-NPS, FAARC; Al Saville RRT; Jessica Semenko-Meli RRT*; Thomas Monahan RRT; Shekhar Venkataraman MD BACKGROUND: It is critical during pediatric ventilation there is no discernible bias between set and actual tidal volume (Vt). Inaccurate Vt delivery may increase the risk of volutrauma and/or hypoventilation resulting in pulmonary morbidity and increased length of stay. It has been reported that accuracy of Vt is dependent on the site of measurement and ventilator displayed values are a misleading indicator of true Vt.1 We sought to evaluate Vt accuracy of two commonly used pediatric ventilators. We hypothesize bias exist between the 2 evaluated ventilator. We further hypothesize bias and 95% limits of agreement (95% LOA) increase with larger Vt.2 METHODS: Bench model evaluating Servo-I (Si) and Avea (AV) ventilators at varying VT. Tidal volumes were measured concurrently using the Respironics NM3 evaluating the difference between set Vt and actual Vt. Breaths were delivered in volume control at a rate of 20 bpm, 1 second inspiratory time, FiO2 of 0.21, and ZEEP. Tidal volumes of 300, 400, and 500 mL were evaluated. Measurements were obtained during 1 respiratory cycle of 20 breaths with a NM3 pediatric adaptor. Bland-Altman analysis was used to assess bias and 95% LOA (Mean ± 1.96STD). Difference between groups determined using the Student T test. Alpha level < 0.5 was considered statistically significant. RESULTS: Si and AV measures demonstrated strong correlation through all Vt ($r2 = 0.99$; $p <0.0001$ & $r2 = 0.98$; $p <0.0001$) (Figure 1). Bland-Altman analysis of all measures revealed AV had greater bias than Si (28.3±19.7 vs. -5.3±19.7; $p <0.001$). AV Bias and 95% LOA increased with larger Vt, 300 (20.2±1.8), 400 (28.3±3.4), and 500 mL (37.7±3.4). Si demonstrated similar results, Vt, 300 (-4.6±2.1), 400 (-6.8±2.0), and 500 mL (-12.1±7.5), although not to the same magnitude. CONCLUSIONS: Our model revealed increasing bias with larger Vt. These data suggest Vt should be monitored at the ventilator wye to enhance measurement accuracy and safety. References: 1 Castle, R.A., et al. Accuracy of displayed values of tidal volume in the pediatric intensive care unit. Crit Care Med. 2002 Nov; 30(11): 2566-74 2 Bland, J. M. & Altman, D. G. Measuring agreement in method comparison studies. Stat Meth in Med Res 1999; 8: 135-60.

Sponsored Research - None

2006956

A RETROSPECTIVE EVALUATION OF RECRUITMENT MANEUVERS IN A PEDIATRIC CARDIAC INTENSIVE CARE UNIT.

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Background: Managing patients with atelectasis can be challenging. Despite a lack of evidence supporting specific interventions to reverse atelectasis, there is increasing interest in utilization of Recruitment Maneuvers (RM's) in the clinical setting. Although atelectasis is common in children after congenital heart surgery, there has been apprehension for using recruitment strategies in this population secondary to the impact on cardiopulmonary interactions and limiting venous return. We hypothesized that RMs are a safe and effective modality for children with heart disease who develop atelectasis. Method: An evidence based protocol for performing 2 different types of RM strategies was implemented in our Cardiac Intensive Care Unit (CICU). We conducted a retrospective chart review of all patients who received RMs while on mechanical ventilation in the CICU from November 2013- March 2014. Approval was obtained from the IRB. Hemodynamics and pulmonary mechanics were recorded from the GE Solar and Philips NM3 monitors. These values were collected pre and post RM. Wilcoxin Ranked Sign test was utilized to evaluate differences in pre and post RM outcome variables (SPSS version 20). Results: There were a total of 20 patients in this retrospective review with 204 individual RMs. 80% of the patients were less than 1y/o, with a median age of 5 months. Hemodynamic variables did not change after RMs, but pulmonary mechanics improved (See figure 1) VCO2 (p=.01), Vte (p=.07), alveolar VT (p=.02), and dynamic compliance (p=.01) all increased post RM. A small pneumothorax was detected on routine CXR in one patient, but it is unknown if the pneumothorax was related to RM. Conclusions: RMs were performed safely in a group of pediatric patients with congenital heart disease. RM's may be an effective modality to facilitate lung recruitment in these patients, especially after congenital heart surgery. In this cohort of patients, RM's increased dynamic compliance, alveolar tidal volume, and VCO2, without altering hemodynamic status. More rigorous studies are warranted in this unique population to evaluate the impact of RM's on outcome variables such as time on mechanical ventilation, ICU LOS, overall and hospital LOS.

Sponsored Research - None

2014115

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

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Background: An occasional practice in our institution is to place neonatal patients on high flow nasal cannulas (HFNC) via ventilator, post extubation. A study was performed to compare circuit pressure, flow, and cannula interface pressure using 2 brands of HFNC and 2 ventilator systems. **Methods:** This was a comparative in-vitro study using 2 ventilators (Servo *i* and Drager VN500) and 2 pediatric HFNC (Fisher/Paykel Salter [F/PS] and Ram [RA]). In phase 1, CPAP levels were set at 6, 8, and 10 cmH_2O for both HFNC and ventilators. In phase 2, CPAP levels were set as in phase 1 with rate and peak inspiratory pressure (PIP) added. Ventilator rate was held constant at 20 breaths per minute for all settings. PIP's of 18, 20, and 22 cmH_2O were used corresponding to the CPAP levels of 6, 8, and 10 cmH_2O, resulting in a ΔP of 12 cmH_2O. Three cannulas of each brand were used. Data were collected at 37°C and F_IO_2 1.0. Measurements of flow and pressure were acquired using the Biopac MP-100 System. The Fisher/Paykel MR850 was used to maintain humidification. Two 0-35 LPM pneumotachographs were used for evaluations: the first was placed at the large bore tubing connected to the HFNC, and the second was connected directly to the portion of the HFNC that would be inserted in the nares. Data were collected for 60 seconds. Results are presented as mean ± SD. Comparisons between HFNC brands for mean circuit pressure, circuit flow, HFNC flow, and cannula interface pressure were made using t-tests with significance set at $p<0.05$. **Results:** Circuit and HFNC flow was significantly higher in RA compared to F/PS ($p<0.001$) in all configurations. Circuit pressure was not significantly different between the 2 HFNC regardless of ventilator or with and without a rate and PIP. Although pressure at the cannula interface was minimal, it was significantly higher for the RA than the F/PS utilizing the Servo *i* with and without a rate and PIP ($p<0.001$); and utilizing the VN500 with no rate or PIP ($p=0.024$). However, when a rate and PIP were added, there was no difference at the cannula interface between the F/PS and RA ($p=0.859$). **Conclusion:** Higher flow was required to generate similar pressure within the circuit for the RA compared to the F/PS regardless of ventilator brand. Pressure was minimal at the nasal cannula interface, which may be concerning since the ventilators were set to specific CPAP and PIP levels, and were displayed as such, but were not translated at the cannula interface.

Sponsored Research - None

2016361

DOES HFOV BIAS CHANGES EFFECT VENTILATION?

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Introduction: The study was completed to determine the effects of CareFusion (San Diego, Ca) 3100A High Frequency Oscillatory Ventilator (HFOV) Bias flow (Bias) changes on ventilation. The goal is to see if CO2 gasses within a test lung (LCO2) are affected with the Bias being manipulated. **Method:** A calibrated / performance checked HFOV was connected to a 310mL semi rigid test lung with a compliance factor of 0.62ml/cmH2O with a 3.5 ETT. The test lung with 4 additional ports allow for injecting blended Air/CO2 (2) and sampling LCO2 (2). The injection and sampling flow rates were balanced at 0.3Lpm. A MAP of 12 was maintained throughout all testing. The ventilator was started at 6 HTZ, Amplitude (Amp) of 15, and Bias of 10 Lpm. A steady state LCO2 target of approximately 60torr was achieved. The Bias was increased in increments of 5 Lpm to a maximum of 25 Lpm. After each Bias change the LCO2 was allowed to stabilize and the LCO2 recorded. After the Bias of 25 lpm had been tested it was decreased to 10 lpm, Amp was increased by 5cmH2O, and previous Bias flow increase series repeated. This process would be repeated until an Amp of 35 had been tested. The HTZ was then increased by 1, Amp reset to 15, and Bias was decreased to 10 lpm. The above methodical series tests were repeated until 12 HTZ had been tested (table 1). **Findings/Conclusion:** It was found that increasing the Bias on the HFOV did change ventilation in this lung model. The percent of change varied widely depending upon the ventilator parameters. In most cases there was a decrease in the LCO2 post increase in the Bias suggesting increased ventilation. The most significant changes in ventilation were with the Bias of 20 lpm when compared with 10 lpm (Table1). It was also noted that when the Bias was increased, the power setting needed to be increased in order to maintain the same amplitude (table 2). The observation of Bias increases requiring increased power setting suggests that power changes may be the basis for LCO2 changes, instead of Bias Flow. Further investigation of these effects is needed.

Sponsored Research - None

2017082

A META-ANALYSIS OF NIPPV VS. NCPAP FOR PRETERM INFANT WITH RESPIRATORY DISTRESS SYNDROME.

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Background: NIPPV can reduce intubation rate (failure to nasal support), apnea, and post extubation failure rate but there were no significant difference in the prevalence of pneumothorax, BPD, and mortality. Who will benefit most with nasal intermittent positive pressure ventilation (IPPV) for Respiratory Distress Syndrome premature baby? This study was aim to compared the pulmonary outcome of nasal IPPV with nasal CPAP (continuous positive airway pressure) for Preterm Infants with Respiratory Distress Syndrome. We hypothesis the nasal IPPV is more effective in preterm infants with respiratory distress syndrome (RDS) than nasal CPAP in reducing the rate of failure of nasal support, pneumothorax, bronchopulmonary dysplasia (BPD) and death. Method: We searched articles of published between Jan. 1, 1990, and Dec. 31, 2013 of the databases with randomized trial of NIPPV versus NCPAP for preterm infants with RDS were sought and data were extracted and analyzed independently by the authors using the standard methodology of the Cochrane Collaboration. This meta-analysis was conducted according to the concept of the Cochrane Handbook for Systematic Reviews of Interventions, and reporting was done following the guidelines of PRISMA (preferred reporting items for systematic reviews and meta-analyses). Pooled effects of NIPPV and NCPAP were presented as risk ratios (RRs) with 95% confidence intervals (CIs). Results: There were four studies enrolled 470 preterm infants with RDS compared the efficacy of pulmonary outcomes between NIPPV and NCPAP. NIPPV was more effective than NCPAP in preventing failure of nasal support [pooled RR (95% CI)] was 1.77(1.32, 2.36).Four studies compared NIPPV versus NCPAP for the prevention of BPD and three studies compared the incidence of pneumothrax and death; all without significant difference. Conclusions: NIPPV was more effective than NCPAP in the preventing of failure of nasal support but no effective on the incidence of pneumothorax BPD and death. Further study should enrolled adequate sample size and state all the confounding factors to clearly the effective of NIPPV. Further study should focus on those birth weight >1000g or gestation age >30wks with RDS with adequate sample size and state the confounding factors clearly to testify the effective of NIPPV. Disclosures: The authors have no conflicts of interest to disclose.

2017899

A BENCH EVALUATION OF NITRIC OXIDE DELIVERY WITH THE PERCUSSIONAIRE VDR

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Background: Primary Children's Hospital (PCH) purchased and began using VDR ventilators. Currently there is no approved delivery method for Nitric 0xide (NO). Previous studies involved the Sinusoidal Bronchotron showed that 14lpm of flow introduced into TurboHub was required to achieve an analyzed concentration equal to set concentration of NO. A study was commenced to determine delivered NO concentrations with the VDR. **Method:** The Percussionaire VDR 4 was used. Circuits tested were the discontinued TurboHub Phasitron/RT 235 Neonatal Circuit combination and disposable Universal Phasitron/RT 240 Adult Circuit. The VDR ventilator was adjusted until the parameters read the following: PIP 35, Peep 10, Convective Rate 20, Convective I:E ratio 1:2.0, I-Time 1.0 sec., E-Time 2.0 sec., Percussive Rate 600, High Frequency i:e 1:1. For TurboHub testing the injector module was placed at inspiratory gas outlet. Flow rates of 0 and 6-14 liters were bled into inspiratory fail-safe valve. The Universal Phasitron was tested with injector module in two positions. First position the injector module on dry side of humidifier. The second position injector module was adapted into white "Phasitron" driving line. The Nebulizer flow was used. Measurements were taken between Phasitron outlet or Neonatal circuit outlet and test lung. The test lung was a Smart Lung Infant with settings R 5, C 2ml/cmH2O. The INO device was an Ikaria INO-Max DSir set to deliver a 20-PPM. All devices passed manufacturer pre-use checks. **Results:** Universal with injector in neb flow performed the worst with a delivered NO value of 1.3 ppm. Universal setup with injector in white line delivered a NO value of 8.5ppm. TurboHub with no additional flow delivered a NO value of 42ppm. TurboHub with added flow delivered a NO value 27 ppm at 6lpm, 24 PPM at 7lpm, 23 ppm at 10lpm, and 21 ppm at 14lpm. **Conclusion:** Current Methods of NO delivery with the Universal circuit do not achieve 50% of set versus measured ppm and may significantly impact effective delivery of NO. The TurboHub setup with a flow of 7 was required to achieve a 20% tolerance of set versus measured ppm. Higher flows achieved closer set versus measured NO ppm. Doubling the flow decreased the measured gap from 24 to 21 PPM. Adding flow there is a potential effect of increased pressure. If nitric is added to the VDR, adjustments may need to be made to maintain set pressures.

Sponsored Research - None

2018128

COMPARISON OF BREATH TRIGGERING IN THREE VENTILATORS AVAILABLE FOR TRANSITION FROM CRITICAL CARE TO HOME IN PEDIATRIC PATIENTS

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Background: As acutely ill pediatric patients with tracheotomies become more stable, transitioning to a long-term acute care ventilator can be challenging due to the size and physiology of a growing child. In our hospital, overall we have been successful with the LTV (Carefusion), except with those patients that are often smaller and/or have more severe lung disease. Often the issues in these cases are related to patient triggering. Characteristics of other available ventilators may alleviate these issues. Herein, we compared breath sensitivity and triggering performance of the LTV 1200, Revel (Carefusion), and Trilogy 202 (Philips Respironics) ventilators. **Method:** A dual chamber Michigan test lung was set to mimic a spontaneously breathing patient using a clip placed between chambers. The first chamber was set for a compliance of 4 ml/cmH_2O and airway resistance of 50 cm$H_2$0/L/s. A Philips NM3 monitor sidestream adapter was placed between the first chamber and each test ventilator patient circuit (active circuit used for the Trilogy). The second chamber was connected to a driving ventilator which was set on PRVC mode, rate = 25 b/min, and 3 different tidal volumes for flows to mimic low, medium, and high patient demand = 64, 80, and 112 mls (approximate flows were 15, 20, and 30 L/min). The T_i and PEEP were adjusted as needed for triggering. Each ventilator was tested in Pressure Support (PS) mode at settings of 5, 10, and 15 cmH_2O above PEEP of 5 cmH_2O at the 3 demand levels for a total of 9 conditions for each ventilator. Sensitivity was adjusted when necessary. For each test condition we evaluated the number of breaths missed, auto-triggered, and synchronized as a percentage of the total breaths in two minutes after stabilization. Two-way ANOVA results are shown. **Results:** Each ventilator performed well during the high demand conditions. The Revel had the most missed triggers, with almost no breaths triggered at low demand. The LTV had fewer missed triggers than the Revel, but greater auto-triggering. The Trilogy had 100% synchrony in all but two conditions and no auto-triggering. Significance was determined between all conditions ($p<0.001$). See Figure for synchrony comparison. **Conclusion:** The Revel was most problematic for the test conditions studied, even with the ability to adjust bias flow and trigger sensitivity. The Trilogy performed best in all test conditions, showing that it may be a better option for patients with issues involving synchrony.

Sponsored Research - None

2018479

FLOW/PRESSURE RELATIONSHIP OF VARIOUS RAM CANNULA SIZES.

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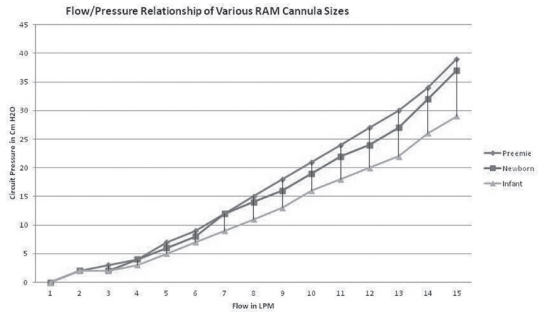
Background: The RAM cannula (Neotech) is a relatively new interface to deliver NPPV in neonates. Several studies have demonstrated it's efficacy including decreased reintubation rates and a reduction of skin breakdown with NPPV in this patient population. Bench studies have evaluated pressure propagation, Vt delivery and flow rates on various ventilators. Here we look at the flow/pressure relationship with three sizes of RAM cannulas. Method: Flows were generated through the inspiratory limb of an infant RT236 Evaqua circuit (Fisher Paykel). A fifty PSI gas source was used and flows were measured with a compensated thorp tube. Pressures were measured between the inspiratory limb and the RAM cannula interface connection using a magnehelic pressure gage (Dwyer Instruments). Measurements were made from 0 to 15LPM using the Preemie, Newborn, and Infant size cannulas respectively. Each pressure measurement was done in triplicate at each liter flow and demonstrated reproducible values. Results: We measured pressures ranging from zero PSI on 1LPM to 39 PSI on 15LPM depending on the cannula size. These results demonstrate a linear relationship between liter flow and pressure with a higher delta P as flow is increased. Higher pressures were seen as the internal diameter of each cannula decreased. Conclusion: While the linear relationship between flow and pressure is not surprising, the change in the corresponding delta P at higher flows was interesting. The measurement of higher pressures with smaller cannula size is most likely due to higher resistance with a smaller internal diameter. The manufacturer of the RAM cannula recommends maintaining a 60 to 80% occlusion at the patient nares which we were unable to duplicate in this study. Further studies are needed to assess the actual pressure delivered at the nares.

Sponsored Research - None



2019389

NEONATAL INTENSIVE CARE EVACUATION DRILL: A PERFORMANCE IMPROVEMENT PROJECT.

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INTRODUCTION: Emergency preparedness has become an important topic at hospital roundtables worldwide. Evacuating any patient from a healthcare facility is an arduous and intense proposition which poses many risks and requires a plan, personnel and resources. In addition complete evacuation of a busy Neonatal Intensive Care (NICU) and Continuing Care Units (CCN) with the hospital's smallest most fragile patient population who require specialized needs increases complexity of the task. We theorized that simulation training with real time evacuation drills could improve the efficiency, identify areas for improvement and improve patient safety. METHOD: Our NICU/CCN Disaster Preparedness Committee brought together a multi-disciplinary team consisting of hospital staff and the City of Springfield's Emergency Preparedness Team, to create a detailed evacuation plan of the NICU/CCN. This plan included the utilization of the Hospital Incident Command System, individualized job-action cards and specialized evacuation equipment, for transfer within the hospital. Training for the drill utilized both table top exercises and a full-scale, real-time drill. RESULTS: The full-scale drill utilized fifteen infant manikins representing patients. Each manikin was connected to respiratory equipment including: high flow nasal cannulas, CPAP, nasal cannulas, NIMV and the oscillator. A backpack containing paperwork for charting and basic supplies for transport was located at each bedside. The infant manikins were wrapped in blankets, placed in the evacuation basket along with IV bags and patient identifiers. Clinical staff, volunteers and security worked together to transport the infants across the hospital to their new location in the PACU without incident. CONCLUSIONS: Through the full scale drill, many positive aspects were identified as well as opportunities for improvement. We determined that the use of a hands-free evacuation basket proved to be more valuable than other products. Pre-training of the staff with power point presentations, device in-services and hand-outs helped to streamline the process. The drill also helped us develop a more efficient communication system between the NICU Satellite Command Center and the Emergency Operation Command Center. In conclusion use of simulation trainings such as our performance improvement evacuation drill supported the theory that evacuation of a busy NICU can be done efficiently and safely.

Sponsored Research - We received Homeland Grant from Homeland Security (a government grant)

2020769

PEDIATRIC NON-INVASIVE VENTILATION: ANALYSIS OF USAGE FOR CAPACITY PLANNING DURING HIGH VOLUME SEASON.

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Background: There is increasing use of non-invasive ventilation (NIV) as a means for respiratory support in the pediatric population. Traditionally, in our hospital setting all patients requiring NIV are admitted to the Pediatric Intensive Care Unit (PICU) or Pulmonary unit for resource management and support. Skills competency is maintained by grouping this patient population in these areas. We set out to evaluate the possibility of expanding our coverage to other medical units to decompress the PICU and Pulmonary unit in times of high census and acuity. Diagnoses and acuity level of patients receiving NIV were analyzed. Methods: Retrospective chart reviews were completed on all patients who were admitted to the PICU and Pulmonary unit from December 2013 through March 2014. Initially we looked at diagnosis and reason for use. Three main categories were identified: Obstructive Sleep Apnea (OSA), Thoracic Insufficiency/Neuromuscular (TI/NM), and Respiratory Distress (RD). They were further broken down into 3 subcategories: Chronic, Acute, or Acute-on-Chronic. Patients in the Cardiac Intensive Care Unit and Neonatal Intensive Care unit were excluded due to their unique disposition within the context of our hospital standards. Results:150 patients met criteria for the purposes of this analysis. OSA accounted for 28% (42/150), TI/NM 18% (28/150), and RD 54% (81/150). The subcategories revealed: chronic 25% (37/150), acute 42% (63/150), and acute-on-chronic 34% (51/150). As expected most OSA fell into the chronic category, many of TI/NM were acute-on-chronic and most of the acute use of NIV was due to respiratory distress. Further focus revealed chronic use for OSA accounted for 175 NIV days making a viable option for alternate medical unit placement in times of high capacity planning. Conclusion: NIV is a growing means of respiratory support in the pediatric population. The management and care of these patients requires resources and competency training to provide safe and effective care. Understanding the dynamics of pediatric NIV use can help the planning process during times of high volume and acuity

Sponsored Research - None

2020961

MULTIDISCIPLINARY PROTOCOL FOR HIGH FLOW NASAL CANNULA (HFNC) THERAPY IN GENERAL CARE REDUCED DELAY IN HFNC INITIATION AND NEED FOR CPAP IN INFANTS WITH BRONCHIOLITIS

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Background: HFNC can reduce work of breathing and prevent fatigue in infants with viral bronchiolitis. In winter 2012-13, HFNC required PICU admission at Dayton Children's Hospital. Clinical staff perceived that there were significant delays in both Pediatric Intensive Care Unit (PICU) transfer and HFNC initiation. In summer 2013, a multidisciplinary team reviewed all bronchiolitic infants transferred to PICU for HFNC and found delays due to multiple variables, i.e., unit high census, need for additional supportive care before transfer (IV, increased oxygen, etc.) and physician judgment for transfer. Methods: The team elected to developed criteria for initiation of HFNC on the general pediatric unit, understanding that the HFNC patients would transfer to PICU as soon as beds were available. Inclusion Criteria: Infant with viral bronchiolitis, IV fluids, respiratory distress that does not improve with aerosol trial and suctioning plus: Oxygen requirement of > 1 lpm in infants < 4 mos. of age, or >1.5 lpm for > 4 mos. of age; Bronchiolitis score of > 8 for more than one assessment; PCO2>50 mm Hg per CBG. Staff were educated in this protocol prior to winter 2013-14. Results: All patients initiated on HFNC in winter 2012-13 and 2013-14 were reviewed. The time from when the infant met criteria to the initiation of HFNC was calculated for each patient. The highest level of respiratory support required was also noted for each patient (HFNC, CPAP or mechanical ventilation). Results: Season 2012-13 2013-14 HFNC patients 26 22 Time from criteria to HFNC initiation Mean 7' 1" 57" Median 4' 55" Range 65" to 28' 14" 1" to 2' 27" HFNC 12/26 (46.2%) 15/22 (68.2%) CPAP 7/26 (26.9%) 2/22 (9.1%) Mechanical Ventilation 7/26 (26.9%) 5/22 (22.7%) Conclusion: Implementation of a HFNC protocol reduced the time delay from when the patient met criteria to the time HFNC was initiated. Earlier initiation of HFNC increased the percent of patients managed on HFNC and reduced the percent of patients advancing to CPAP.

Sponsored Research - None

2021151

DOES CIRCUIT SIZE AFFECT DELIVERED TIDAL VOLUME ON THE TRILOGY VENTILATOR.

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Introduction: Infants often transition to the Trilogy Ventilator for chronic respiratory support utilizing a Passive ventilator circuit. Disposable Pediatric and Adult heated wire passive circuits can be used for all patient populations despite size of patient. The purpose of this study is to evaluate if circuit size affects delivered tidal volumes in smaller patients. Methods: A Philips Respironics 15 mm diameter, 1.8 m pediatric heated wire circuit and a Fisher & Paykel 202 (Fisher & Paykel Halthcare Ltd, Auckland, New Zealand) single limb 22 mm diameter,1.8 m circuit was connected to the Philips Respironics Trilogy 202 Ventilator Fisher & Paykel MR290 humidifier chamber and a Swivel II Whisper Valve. The circuit was connected to a BC Biomedical LS-20001 Infant Lung Simulator with set lung compliance of 2 ml/cmH2O and resistance at 5L/s, at settings: PC-SIMV, frequency 20/minute, Pressure Control 22 cm H20, PEEP 4 cm H20 (PIP 26), Ti 0.8 sec and FiO2 21%. Tidal volumes were recorded from the Trilogy display and the NICO® Philips Respironics (Andover, MA) adult flow sensor placed proximal to the patient connect at one minute intervals for 10 minutes on each circuit. Mean values and standard deviations for distal and proximal tidal volumes were compared using a two way ANOVA with statistical significance set at $p<0.05$. Results: There was a statistically significant difference in tidal volume delivery between pediatric and adult circuits. Ventilator-displayed tidal volumes (without consideration of lost compressible gas volume) demonstrated a greater difference in delivered versus measured tidal volumes Conclusion: Circuit size affects tidal volume delivery and may represent a clinically important difference when low delivered tidal volumes are expected to be used in smaller patients.

Sponsored Research - None

Vol/Flow Trilogy Vent with Ped/Adult Circuits

Lung Compliance 2ml/cm H2O Resistance 5bar/L/s	Ped Circuit				Adult Circuit			
	Ped Trilogy Volume	Ped NICO Volume	Ped Trilogy Flow	Ped NICO Flow	Adult Trilogy Volume	Adult NICO Volume	Adult Trilogy Flow	Adult NICO Flow
Mean	25.3	14.3	12.53	7.8	32.9	15.3	14.54	8.6
Var	0.233	0.456	0.036	0.178	1.656	0.678	0.072	0.267
SD	0.483	0.675	0.189	0.422	1.287	0.823	0.267	0.516

2021172

EVALUATION OF INTERFACE TYPE WITH BUBBLE CPAP DELIVERY.

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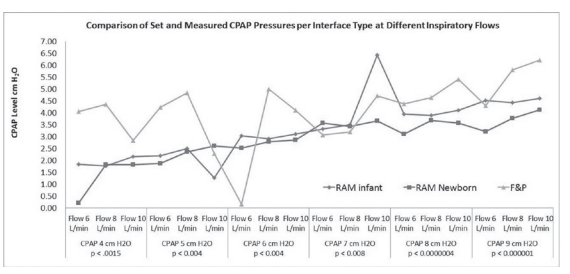
Background: Bubble continuous positive airway pressure (CPAP) is commonly used for spontaneous breathing infants with lung disease to avoid intubation or for post-extubation support. Bubble CPAP can be delivered with different interface types. The objective of the study was to evaluate the ability to maintain CPAP levels with two CPAP interfaces, specifically nasal prongs (Fisher & Paykel) and RAM cannula (Neotech, Inc.). We hypothesized there would be no significant difference between set and measured levels with each interface using the Babi (B&B) bubble CPAP system. **Methods:** A validated preterm infant nasal airway model was attached to the ASL-5000 (IngMar Medical) simulator. The ASL 5000 was programed to deliver active breathing of a surfactant deficient infant at a RR 70 per minute, Ti: 0.30 sec, Resistance: 150 cm H_2O /L/s, Compliance: O.5 mL/cm H_2O, V_T: 5 mL, and P_{es}:-10 cm H_20. The Fisher Paykel prong size 4030, Newborn and Infant RAM cannulas were each connected to the nasal airway model and the Babi Bubble CPAP system. CPAP levels were set @ 4,5,6,7,8, & 9 cm H_2O with flow rates of 6, 8, and 10 L/min, respectively. Two minute measurements were recorded after one minute of stabilization. ANOVA was used to compare set with measured values across the range of flows for each respective CPAP level. Statistical significance was established at $p < 0.05$. **Results:** Lower CPAP Levels, 4 – 6 cm H2O, the measured CPAP level precipitously dropped with the 10 L/min flow setting. At high CPAP Levels, 7 – 9 cm H_2O there was a concomitant increase in measured CPAP levels with the highest flow setting. There was a statistically significant difference in set and measured CPAP levels for all devices across all CPAP levels with measure CPAP less than set, Figure 1. **Conclusion:** Flow setting had profound effect on measured CPAP level. The concomitant drop in measured pressure with high and low flows could be attributed to increased resistance to spontaneous breathing or insufficient flow to meet inspiratory demand. Clinicians need to be aware of the effect not only of the interface, but of flow on CPAP delivery.

Sponsored Research - None



2022169

UP SIDE DOWN - HOW IS A TRANSFER INTO PRONE POSITIONING PERFORMED SAFELY IN CHILDREN WITH ARDS IN ECMO THERAPY?

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BACKGROUND: Can the practice of intermittend prone positioning and semi-prone positioning (135° degree angle prone position) used safely in children receiving Extracorporal Membrane Oxygenation (ECMO) for Acute Respiratory Distress Syndrome (ARDS)? INDRODUCTION: In the treatment of ARDS the prone position plays an important role to improve the ventilation-perfusion ratio. Children who received ECMO, represent a special challenge in terms of positioning. Severe complications such as dislocation of the ECMO cannulas, as well as the accidental extubation are potentially life-threatening complication. METHODS: Retrospective analysis of pediatric ECMO patients, with a data collection period from 01/11 till 07/13 on our interdisciplinary PICU Ward. Here all patients who were treated due to an acute respiratory failure with a veno-venous or veno-arterious ECMO, and were positioned in the sequences into the prone position or semi-prone position, are included in the analysis Exclusion criteria were transthoracic position of the cannulas or non closed thorax after heart surgery. The hemodynamic stability was measured before (VIS_0) and 30min after (VIS_30) change of position with the modified inotropic score by GAIES et al. Furthermore, the change of position were divided into low risk an high risk changes. RESULTS: In total 35 patients were treated with ECMO whereas 11 of them were treated with ECMO due to Acute Respiratory Failure. As a result of the exclusion criteria, the prone position could only be performed in 4 children. A total of 87 position changes in prone position or semi-prone position were documented. There were no serious complications such as accidental extubation, dislocation of the ECMO cannulas, arterial pressure line or central venous catheter, and desaturations did not occur. During the change of positions most patients did not show any relevant hemodynamic instabilities. ($p \geq 0.05$) While beeing in the prone position, there occured complications such as pressure ulcers on the forehead (2) and edema of the cornea (1) CONCLUSION: The final change of positions into the complete prone position can be performed safely and without major complications. There is no significant increase in potentially life-threatening events, for example bleeding from the cannulas, than without positioning in prone position. The operation of prone postioning in children under ECMO therapy requires a well trained and entusiastic PICU Team.

Sponsored Research - None

	Low risk change of position		High risk change of position	
	Nursing staff	Time (min)	Nursing staff	Time (min)
Median	1	10	2	15
Min	1	5	1	5
Max	1	30	3	45

Chart 1: Staff and workload

2022764

EVALUATION OF LEAK CHARACTERISTICS DURING NIMV WITH THE NEOTECH RAM NASAL CANNULA.

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Background: Noninvasive nasal intermittent mandatory ventilation (NIMV) use in the pediatric population has increased. The RAM cannula interface is often used in neonates due to ease of application, and patient tolerance. The system design incorporates a constant leak. The effects of leak on cannula system performance is difficult to evaluate. The purpose of this study is to determine if degree of leak adversely affects delivered pressures. Methods: The 15mm connection on a newborn, infant, and premie sized RAM cannula (Neotech,Valencia,CA) was independently attached to a Drager XL (Drager Medical,Telford,PA) ventilator set in a pediatric noninvasive mode. The RAM prongs were attached to a neonatal lung model with a compliance of 2 ml/cm H2O with fixed leak settings (Ingmar Medical, Pittsburgh,PA). Drager settings: rate 40 bpm, Ti 0.5, PIP/PEEP 15/6, 20/8, 26/10, 30/12. System pressures and flow were displayed on the Drager XL while proximal pressures were measured at the test lung by a pressure sensor on a GE CareStation(GE Healthcare,Madison,WI). All three sizes of RAM were applied to the model and connected to the test lung. Pressures were evaluated at 0%, 20%, and 40% leak. Results: Air leak in this bench model was measured at each pressure setting and flow rate for each cannula size. The average leak was 4.4 lpm with the 40% leak setting (SD 0.6, p=0.03), 2.4 lpm with the 20% leak setting (SD 0.1, p=0.001), and 0.13 lpm at 0% leak setting (SD 0.04, p=0.10) which we attribute to limitations in the model. However, the 20% and 40% leak settings, the actual leak remained unchanged as pressure settings were adjusted. Pressure loss was measured across all leak and pressure settings. The 40% leak setting resulted in an average pressure loss of 42.10% across all pressure settings (p=0.16), the 20% leak setting resulted in an average pressure loss of 16.31% (p=0.07), and the 0% leak setting had no pressure loss. Values were evaluated using the ANOVA test. Conclusion: Leak remained constant in the model even as pressure settings were increased. The degree of pressure loss changed as pressures were increased, but the degree of change does not appear to be clinically significant. Rather, pressure loss was largely determined by the degree of leak. Finally, we found that all three cannula sizes performed similarly and the size did not affect leak or pressure changes. Knowing the degree of leak will guide clinicians in determining a therapeutic level of pressures.

Sponsored Research - None

2022768

THE EFFECT OF INSPIRATORY TIME ON TIDAL VOLUME DELIVERY USING THE T-PIECE RESUSCITATOR.

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Introduction The t-piece resuscitator is a commonly used device for assisting ventilation in neonates. It incorporates features that enhance patient safety during manual ventilation by limiting the amount of pressure delivered. Conversely, the t-piece also has inherent limitations which include user variance in the control of ventilation rate and inspiratory time.The ease of inadvertently delivering a prolonged inspiratory time is one of them. This concern stems from, in part, the size of the subsequent tidal volume that may result. The purpose of this study is to evaluate the effect that user-controlled inspiratory time has on tidal volume when manually ventilating with the t-piece resuscitator. Methods A bench model was designed using the NeoPuff Infant Resuscitator (Fisher and Paykel, Auckland NZ). It was equipped with a standard circuit (Fisher and Paykel) and the driving flow was set and maintained at 10 Lpm. The t-piece was connected to a neonatal test lung with a known compliance of 2 mL/cmH2O (IngMar Medical, Pittsburgh PA). The investigators manually ventilated the test lung while tidal volumes were measured by the NICO2 respiratory monitor (Philips Respironics, Murrysville PA) and inspiratory times were measured by the Cor-M Breath Tracker (Precision Instruments,West Newton, MA). Three inspiratory times were targeted (0.5, 1.0, and 1.5 sec) at three different pressure settings (15/5, 20/5, 25/5 cmH2O). Twenty breaths were observed and recorded at each combination of time and pressure. For each pressure setting, the tidal volumes were averaged by group according to the inspiratory time setting and were then compared using the ANOVA test. Results Average manual inspiratory times of 0.51, 0.96, and 1.44 were observed for each targeted category. Across all tested inspiratory times, average delivered tidal volumes were 14.4mL (SD 0.7), 21.0mL (SD 0.76), and 25.4mL (SD 0.62) for each respective pressure setting. Thus, tidal volumes increase with corresponding pressure increases but there was no difference in delivered tidal volume as inspiratory time was adjusted ($p<0.01$). Conclusion It appears that as peak inspiratory pressure is reached, excess inspiratory flow is effectively diverted to an exhaust port on the t-piece resuscitator. While adjustments to inspiratory time had no impact on delivered tidal volume in this model, caution should still be used to avoid using prolonged inspiratory time unless supported by evidence.

Sponsored Research - None

2000291

THE DEVELOPMENT OF PROLONGED WEANING GUIDELINES TO FACILITATE VENTILATORY LIBERATION.

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Introduction: Unsuccessful ventilator liberation is associated with increased morbidity and financial burden. This has become more evident as acceptance to long-term weaning facilities become more restrictive and limited. Historically, the ICU clinical team was responsible to wean all ventilator patients regardless of etiologies or ventilator duration. To address this issue, our institution developed prolonged weaning guidelines. Method: A multidisciplinary team was assembled to develop a strategic methodology to facilitate the weaning of patients who had failed traditional weaning or were deemed difficult to wean, defined as failure of > 3 spontaneous breathing trials. Clinical experiences and review of the literature were used to develop a systematic approach utilizing three weaning strategies based on the clinical status of the patient. Option A: a quicker more aggressive weaning plan, Option B: a more conservative weaning approach and Option C: a very conservative weaning process.(Image 1) All options allowed weaning via conventional or high flow oxygen and included hyper –inflation therapy every four hours. Ambulation was encouraged along with nursing, physical therapy and nutritional support. Results: 24 patients were placed on the prolonged weaning guidelines from July1 -Dec 31 2013. The mean ventilatory duration was 22.3 days and the mean age was 63.2. All the patients were admitted to MSICU for respiratory failure. The most common etiologies were pneumonia and exacerbation of COPD. 18 were liberated from ventilator support, defined as assisted breathing absent of mechanical ventilation for greater than 48 hours. The average time until ventilator liberation for this group was 8.8 days. 4 patients were transferred to an outside weaning facility and two were deemed not able to wean secondary to neuromuscular weakness. Since historically, this category of patient population would have transferred to weaning centers it was not possible to compare this process with past outcomes. Conclusion: The prolonged weaning guidelines are a systematic method to wean patients at different levels of ventilator failure. By utilizing the guidelines there is a target progression used to determine ventilator settings in addition to assessing the clinical status of the patient as a monitor of progression or failure. In our patient population it produced a 75% success rate in patients difficult to wean.

Sponsored Research - None

2006191

LEAK COMPENSATION OF THE SERVO-I IN NIV MODE COMPARD TO THE RESPIRONICS V60: A LUNG MODEL STUDY.

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BACKGROUND: The non-invasive ventilation (NIV) of the Servo-I critical care ventilator has been compared to devices specifically designed for non-invasive ventilation in the past, but only one study has compared the Servo-I NIV mode to the Respironics V60 non-invasive ventilator. The Respironics V60 is a dedicated NIV ventilator designed to better provide NIV to an endotracheal tube. We compared the performance of the two ventilators in the presence of three controlled leak conditions at three levels of pressure support. METHODS: During 15 trials at each of three leak conditions of 5, 10, and 20 LPM for each pressure support setting of 5, 10, and 15 cmH2O, we measured trigger responsiveness (TT), time to inspiratory pressure (TP) and time to termination of inspiration for each ventilator when connected to a test lung. RESULTS- The Servo-I had significantly shorter trigger times (TT) and required significantly less time to achieve inspiratory pressure (TP). the Respironics V60 had a significant shorter time to termination of inspiration (TC). CONCLUSION- Modifying a NIV ventilator to accommodate a potentially low leak condition decreased trigger responsiveness and delayed achieving inspiratory pressure in the spontaneous breathing mode of pressure support. Modifying a critical care ventilator to accommodate potentially high leak conditions sacrifices adequate termination of inspiration. The trade-offs may contribute to patient- ventilator asynchrony.

Sponsored Research - None

2009258

REINTUBATION RATES AND DURATION OF MECHANICAL VENTILATION ACROSS THREE CLINICAL SERVICE LINES, 2011-2013.

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Background: A review of intubation data from 2011-2013 identified a statistically significant decrease (6.8% to 3.0%, P<0.001) in reintubation rates. We wanted to see if the decrease in reintubation rates was influenced by duration of mechanical ventilation (MV). At MMC, MV is managed by three distinct service lines: surgical trauma patients by the White surgical service, medicine patients by Pulmonary / Critical Care, and cardiothoracic (CT) surgery patients by CT surgeons and PAs. Respiratory Therapists (RT) float among all adult ICUs and manage ventilators by protocol. Surgical and medicine patients are managed by the same protocols; CT surgery follows a distinct post-operative protocol. Method: IRB approval was granted. Data was split into service line cohorts and analyzed independently. Highly skewed non-normal distributions of MV duration were compared by Wilcoxon rank-sum test; proportions assessed via chi-square. Results: Data reviewed from 2011-2013 for CT surgery showed a significant decrease in reintubation rates from 3.5% (n=832) to 1.9% (n=829, P=0.05) along with a statistically highly significant decrease in duration of MV from 1.2 to 0.75 days (P<0.001). The medicine service realized the largest drop in reintubation rate, from 9.5% (n=678) to 3.3% (n=668, P<0.001) with a slight decrease in average ventilation duration (4.0 to 3.8 days, P=0.7). The surgical service, with a drop in reintubation rates from 9.3% (n=344) to 5.6% (n=258, P=0.1), demonstrated a trend toward longer duration of MV from 5.6 to 6 days (P=0.1). Conclusions: We have seen an overall reduction in reintubation rates without a significant increase in duration of MV across all service lines. During the interval no practice changes were made to the care of extubated patients care in the Medical and Surgical service lines, but two significant changes for CT Surgery patients were made: In 2011, to address atelectasis caused by surgery and aid with fluid shifts, the MV protocol was modified for higher initial PEEP levels based on a RT-selected tidal volume. The second change, from 4/2012, provided a dedicated RT assigned to the CT surgery step down unit weekdays from 11am to 11pm. Using a standardized scoring system, this RT assessed all CT cases, making recommendations for therapy. The institution, based on the results of the CT surgery practice changes, would continue to benefit from a standard RT assessment and treatment algorithm for all patient populations.

Sponsored Research - None

2012972

CHARACTERIZATIZING THE FREQUENCY, DURATION, AND FUNCTIONALITY OF MECHANICAL VENTILATOR ALARMS.

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BACKGROUND: Alarm fatigue is a serious safety concern, as highlighted by JCAHO's NPSG 06.01.01 on alarm safety. Despite their contributions to alarm fatigue, there is insufficient evidence to guide clinicians in managing mechanical ventilator (MV) alarms. Before making recommendations, it is first necessary to characterize the current state. The purpose of this study was to evaluate the frequency and duration of MV alarms, and determine if the duration of an alarm might influence a practitioner's likelihood of responding. METHODS: Our study received approval from the Johns Hopkins Medicine IRB. Through integration with a secondary notification system and associated middleware, we extracted data on the number and durations of ventilator alarms in 3 adult ICUs over a 10 week period. With this information, we calculated the mean and median number of alarms/MV/day, the mean and median alarm duration, and the proportion of MV alarms with durations of < 5 seconds. Using contact information from the UHC, a survey asking respiratory therapists to identify their likelihood of responding to MV alarms lasting less than 5 seconds was distributed, with 541 responses received. RESULTS: Data from analysis of ventilator alarm attributes is summarized in Table 1. Survey results (n = 541) found that 50% of participants were "not likely" to respond to MV alarms lasting less than 5 seconds, and 30% only "somewhat likely." CONCLUSION: Most striking from our analysis was the finding that 64.03% of the 27,607 alarms had durations of less than 5 seconds. The duration of an alarm appears to influence its level of functionality, according to our survey results. If MV alarms with durations of less than 5 seconds were eliminated in this study, the total number of alarms over the 10 week period would have been reduced by 17,677, which would equate to a decrease in the number of alarms/MV/day from 16.15 to 5.81; this reduction in MV alarms could have a significant impact on reducing noise and alarm fatigue. Unfortunately, the data analyzed in this study did not include information specifying each alarm condition (e.g. High Pressure), and further research is needed to determine the utility of specific ventilator alarm conditions. The results of this and future studies should be shared with MV manufacturers to support a multidisciplinary approach to MV alarm management.

Sponsored Research - None

Total MV Alarms/10 Weeks	Frequency of MV Alarms/Vent/Day		Alarm Duration		
	Mean	Median	Mean (s)	Median (s)	< 5 s (%)
27,607	16.15	15.85	6.62	3.97	64.03

2014684

COMPARISON OF THE TUBING COMPLIANCE OF THREE DIFFERENT NEONATAL VENTILATOR CIRCUITS.

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INTRODUCTION: Studies have shown that ventilator circuit compliance is an important factor in determining the actual delivered tidal volume to the lungs of premature infants. Volume loss due to tubing compliance may be equal to the desired tidal volume for these infants. This study was done to compare the tubing compliance of three commonly used neonatal ventilator circuits. METHODS: IRB approval for this study was not required. Three different neonatal ventilator circuits were used - (Fisher & Paykel® (RT235), and Hudson RCI® (780-10), and (780-07). Each circuit was attached to the Drager (Evita XL®) ventilator without filters or humidifier. Ventilator settings were CMV-volume control, f = 12/min, I-time 0.5 sec, PEEP of 0 cm H2O and repeated at 5 cm H2O. The high pressure limit was set to maximum (120 cm H2O) and the patient wye of the circuit was fully occluded. The exhaled tidal volume and peak inspiratory pressure were recorded. The procedure was performed using set tidal volumes of 20 mL, 30 mL, 40 mL, 50 mL, and 60 mL for each circuit. The tubing compliance was calculated by dividing the exhaled volume by the measured peak inspiratory pressure. The data recorded were analyzed with the ANOVA and Tukey post-hoc tests. RESULTS: Table 1 summarizes the calculated compliance of 3 neonatal ventilator circuits at 5 different VT with 0 cm H2O and 5 cm H2O of PEEP. ANOVA test shows significant differences in circuit compliance between without-PEEP groups. For the with-PEEP groups, the Tukey post-hoc test shows significantly different in all within group means with the exception of Hudson 780-10 and 780-07. CONCLUSIONS: Hudson RCI 780-10 offers the lowest tubing compliance among ventilator circuits tested in this study. When 5 cm H2O of PEEP is applied, the circuit compliance results of Hudson RCI 780-07 and 780-10 are statistically insignificant.

Sponsored Research - None

Table 1. Compliance of 3 neonatal circuits at different VT with no PEEP and 5 cm H2O of PEEP

VT mL)	Fisher & Paykel (RT 235) Compliance (mL/cm H2O) with No PEEP and (5 cm H2O PEEP)	Hudson RCI (780-10) Compliance (mL/cm H2O) with No PEEP and (5 cm H2O PEEP)	Hudson RCI (780-07) Compliance (mL/cm H2C with No PEEP (5 cm H2O PEE
20	0.382 (0.350)	0.270 (0.260)	0.290 (0.282)
30	0.375 (0.351)	0.260 (0.250)	0.281 (0.271)
40	0.351 (0.330)	0.260 (0.250)	0.281 (0.271)
50	0.351 (0.340)	0.208 (0.198)	0.281 (0.271)
60	0.364 (0.340)	0.215 (0.187)	0.281 (0.226)

2015261

COMPARING CARBON DIOXIDE ELIMINATION USING NON-INVASIVE TO CRITICAL CARE VENTILATORS.

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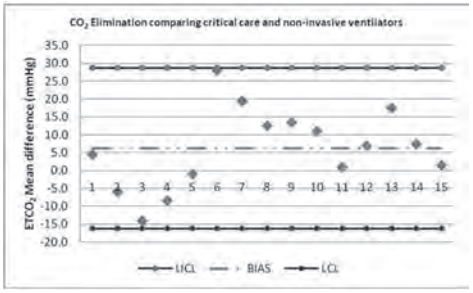
BACKGROUND: The availability of critical care ventilators (CCV) may prompt a clinician to consider using a non-invasive ventilator (NIV) that is FDA approved for managing selected patients having an artificial airway. Qualifying patients should be capable of both triggering the ventilator and spontaneous ventilation. We wanted to know if the Phillips Respironics V60 and Vision NIVs, (Carlsbad, CA), can effectively eliminate CO2 comparable to a CCV. METHODS: We compared the Vision and V60 to a Hamilton G5, (Reno, NV), and Puritan Bennett 840, (Covidien, Mansfield, MA), for CO2 removal. A Microstream N-85 sidestream capnograph, (Covidien, Mansfield, MA), was attached in-line to the patient circuit to measure and display EtCO2. The patient circuits included a single limb Airlife RT-219, (CareFusion, San Diego, CA), for both the V60 and Vision and dual-limb Airlife RT-210 for CCV. Separately these were connected to an ASL 5000 breathing simulator, (IngMar Medical, Ltd, Pittsburgh, PA) at compliance of 20 and 40 mL/cm H2O. Initial settings for each ventilator were PCV mode for the CCV and ST mode for the NIV, peak inflation pressure 20 cm H2O, PEEP 4 cm H2O, RR 14 BPM, inspiratory time 0.8 sec. 100% CO2 gas was connected inline prior to the breathing simulator at a flowrate of 0.25 L/m. Mean difference of EtCO2 of the critical care and noninvasive ventilators (± SD) was compared using one-way ANOVA and limits of agreement analysis. RESULTS: The analysis of agreement graph below illustrates ETCO2 bias and precision (± SD) between critical care and non-invasive ventilators which was 3.7 mmHg (± 24.7). CO2 elimination using a single limb NIV was not significantly different (p = 0.44) compared to a dual limb critical care ventilator. CONCLUSION: Institutions presented with barriers for obtaining critical care ventilators may have a reasonable option to effectively ventilate their patients with a NIV attached directly to an artificial airway.

Sponsored Research - None



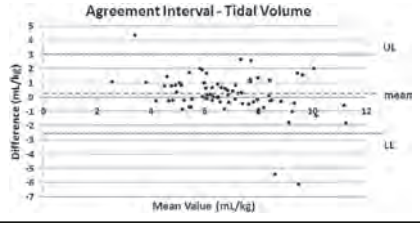
2017974

ACCURACY OF MANUALLY ENTERED DATA IN THE ELECTRONIC HEALTH RECORD: TIDAL VOLUME DURING PRESSURE CONTROL VENTILATION.

Carla Wollens, Robert L. Chatburn, Madhu Sasidhar; Respiratory Institute, Cleveland Clinic, Cleveland, OH

Errors may be introduced into the electronic health record (EHR) when values are manually entered to represent measurements that vary randomly. Furthermore, interpretations of data mined from EHR may differ depending on whether data are considered to represent a population or individuals. When populations are considered, significant variations in individual data are missed. On the other hand, if alerts are based on data for individuals, significant false alerts are possible. The purpose of this study was to examine these effects based on manually entered data during ventilator checks. **METHODS:** This study was deemed a quality improvement project by our Institutional Review Board. Patients in MICU were observed during pressure control modes of ventilation. An observer recorded tidal volumes for 50 breaths during ventilator checks when a therapist recorded a single value. The mean of 50 breaths was considered the true value. Limits of agreement and percentiles were calculated. **RESULTS:** For 75 observations, single data points manually entered for tidal volume resulted in an average error of only 0.2 mL/kg (6%) but error (documented value minus mean value) for individuals could be up to 3 mL/kg (see upper and lower limits of agreement in Figure). Positive error (overestimation of true tidal volume) was greater than 1 mL/kg 50% of the time. Negative error (underestimation of true tidal volume) occurred 15% of the time. **DISCUSSION:** The current study suggests a bias towards overestimation of true tidal volume when results are manually entered into the EHR. Retrospective studies have suggested risk for mortality and development of ARDS/ALI that is proportional to tidal volume [1-3]. However, studies that evaluate manually entered data should be interpreted with caution since there is a bias towards overestimation. Strategies that involve automated alerts based on EHR data [4] should take into account potential bias in manually abstracted clinical data. Automatically importing continuous data (eg, ventilator output) into the EHR may improve data usability and should be investigated. These results also argue for the creation of smart alarms vs simple alarm thresholds currently available on ventilators. 1. Crit. Care Med 2004;32,1817–1824. 2. Intensive Care Med 2005;31,922–926. 3. Critical Care 2010;14,R14. 4. Critical Care Medicine 2011;39,34–39. **DISCLOSURE:** Chatburn consults for IngMar Inc, Invacare Inc and Hamilton Medical.

Sponsored Research - None



2017986

OPTIMUM VENTILATION FOR LUNG DONORS.

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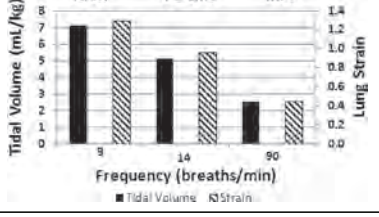
Lung donors are a unique subset of the population of ventilated patients because (a) they typically have normal lungs (those with lung disease are usually excluded from the donor program) and (b) they are often passive, ie, not able to trigger the ventilator (due to brain death). Mascia et al suggest a lung protective strategy using a pressure control (PC) mode [JAMA 2010;304(23):2620-2627]. Others [Arch Surg 2011;146(3):325-328] specifically suggest Airway Pressure Release Ventilation (APRV). The purpose of our study was to compare the potential lung protective value of three different PC modes: Pressure Control Continuous Mandatory Ventilation (PC-CMV), APRV, and Mid Frequency Ventilation [MFV; Resp Care 2008;53(12):1669-1677]. We hypothesized that the mode with the highest frequency would result in the lowest V_T and the highest potential for lung protection. **METHOD:** A passive patient was modeled (ALS 5000 lung simulator ImgMar Medical) using published parameters for normal ventilated humans: resistance = 15 cm H_2O/L/s, compliance = 39 mL/H_2O. Targets: minute alveolar ventilation (MV_A) = 2.5 L/min, totalPEEP = 8 cm H_2O. Ventilator settings were derived from published studies. PC-CMV: f =14/min, inspiratory pressure above PEEP (IP) = 9 cm H_2O, PEEP = 8 cm H_2O, T_I = 1 s. APRV f = 9/min, IP 18 cm H_2O, PEEP = 0 cm H_2O, T-low = 0.7 s. MFV: f = 90/min IP = 17 cm H_2O, PEEP = 1 cm H_2O, I:E = 1:1. For MFV, optimum frequency was determined by increasing the frequency and decreasing the set PEEP to maintain the target totalPEEP until the set PEEP reached 0 or no further V_T reduction was observed. Volume measurements were made with the ASL 5000. Mean V_Ts were compared with ANOVA ($P < 0.05$ considered significant). **RESULTS:** Actual MV_A was APRV = 2.7 L/min, PC-CMV = 2.5 L/min, MFV = 2.3 L/min. MV_A error for APRV due to interaction of autoPEEP and V_T; for MFV error due to inability to set fractional IP, necessary at high frequencies. MFV had the lowest V_T ($P = 0.001$; see Figure). Mean airway pressures (cm H_2O) were: APRV = 18, PC-CMV = 10, MFV = 11. Strain (V_T/end expiratory volume) for each mode was: APRV = 1.29, PC-IMV = 0.96, MFV = 0.44. **CONCLUSION:** This model study confirms that maximizing ventilatory frequency results in the lowest V_T and hence the highest potential for lung protection. **DISCLOSURES:** Chatburn consults for Hamilton, Invacare, and IngMar. Chatburn and Mireles-Cabodevila hold patent for MFV.

Sponsored Research - None



2019825

NON-INVASIVE BUNDLES: AN APPROACH TO PREVENT INFECTIONS AND MINIMIZE HOSPITAL ACQUIRED PRESSURE ULCERS.

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Background: Bundling care for ventilated patients in an effort to minimize the risk for developing a VAP/VAE, has been well established. For the year 2012, NHSN facilities reported more than 3,957 VAPs & the incidence for various types of hospital units ranged from 0.0-4.4 per 1,000 ventilator days. (1) Now many organizations, including our own, have achieved prolonged near 0 rates of VAE. As a next step, our VAE/Central Line Infection Prevention (VCLIP) Committee started focusing attention on providing that similar level of care to our NPPV patients. Non-invasive positive pressure ventilation (NPPV) has increasingly become a 1st line of defense in preventing tracheal intubation for COPD exacerbation or cardiogenic pulmonary edema.(2,3) While the resulting positive outcomes are staggering, that success has not come without a new host of problems. Good oral care becomes difficult to accomplish with any consistency & the incidence of hospital acquired pressure ulcers (HAPU) related to NPPV masks were found to be more problamatic than previously thought. A VCLIP Committee workgroup was established to review outcomes data & standardize current practice within the organization. Method: Utilizing Epic®, we were able to run a retrospective report on HAPU's from 1-1-14 to 2-28-14. This report included age, Braden Scale score, & other demographic information. Some retrospective chart review was performed to determine device type & length of time on NPPV. All data is recorded & tracked in an excel spreadsheet & reported to our HAU committee bi-weekly. Results: Within this data range there were a total of 1,904 NPPV days. From that 10 patients (a rate of 5.25/1000 NPPV days) were identified as having developed a HAPU related to a NPPV mask. Based on these findings the workgroup developed a NPPV bundle that includes the following components: HOB, Oral Care, Mask Size & Fit, System Leak, & Wound Care. The focus was on both HAPU & Infection prevention measures. The second step was to create a "High Risk Assessment Tool", to ensure prevention efforts were utilized appropriately. Conclusions: We discovered issues with HAPU's related to NPPV to be surprisingly bigger than suspected. Our team decided to initiate a NPPV practice standard bundle to standardize practice across the organization & implement prevention standards for reducing HAPU's. Our next step after implementation will be to validate these standards & implement a validated "High Risk Assessment Tool".

Sponsored Research - None

High Risk Assessment

Age >60	Braden Score >18	NPPV Duration Criteria
67	16	yes
56	13	no
66	12	yes
70	13	no
90	n/a	yes
77	n/a	no
60	n/a	no
50	n/a	no
69	n/a	yes
57	n/a	no
Results		
70%	0%	40%

2021645

DERIVATION AND CLINICAL VALIDATION OF A SIMPLE MATHEMATICAL FORMULA TO PREDICT CHANGES IN BLOOD PACO2 AND PH VALUES.

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BACKGROUND: Blood gas analysis is a common test used to monitor oxygenation and ventilation. During mechanical ventilation, ventilation is controlled, most commonly, via changes in respiratory rate. Several equations have been proposed to estimate changes in blood gas parameters as a result of ventilator setting adjustments. Henderson-Hasselbalch equation was developed to calculate pH for a buffer solution. The use of this equation at the bed-side is not practical as the equation contains advanced mathematical expressions. Another common equation used to estimate respiratory rate change to achieve a desired change in PaCO2 is (New Rate = (known Rate x known PaCO2)/ desired PaCO2). This formula was criticized for using PaCO2, rather than pH, as a target parameter. The objective of this study was to propose and test validity of a simple mathematical derivation of Henderson-Hasselbalch equation to estimate change in respiratory rate necessary to achieve specific pH values. METHODS: We used Henderson-Hasselbalch Equation to solve for PaCO2 at any given pH value. At any pH value, PaCO2= HCO3 x factor, where factor is the proportionality number. Then, using the common formula to predict changes in respiratory rate to achieve desired PaCO2, we replaced PaCO2 with formula above, obtaining the new proposed formula. Ethical approval was obtained. We collected retrospective data of 34 arterial blood gas samples pre and post respiratory rate changes. The desired rate was calculated using the new equation targeting pH value of post RR change. Calculated RR values were compared to the actual post RR for agreement level. Agreement between the actual post RR and the calculated RR was assessed by Bland-Altman plot and Passing-Bablok regression analysis. RESULTS: Mean Bias was -0.5, 95% LA was 1.6 to -2.6. No evidence of Fixed Bias as indicated by low mean difference (-0.5). Intercept of the regression line was 0.88 (95% CI -2.18 to 0.95) indicating no significant fixed bias. Slope of the regression line was 1.01 (95% CI 0.90 to 1.10) indicating no significant proportional bias. Regression line is not significantly different from identity line. CONCLUSIONS: The proposed formula showed sufficient accuracy to predict respiratory rate changes necessary to achieve specific pH values. It is expected that the use of this formal will reduce number of blood gas sampling, reducing harm to patients and cost of care.

Sponsored Research - None

2021726

RESPIRATORY CARE STUDENTS' EVALUATION OF NUMASK INTRA ORAL MASK AND ORAL PHARYNGEAL AIRWAY WITH BAG-VALVE-MASK AND ORAL PHARYNGEAL AIRWAY FOR MANIKIN VENTILATION.

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BACKGROUND: Bag valve mask ventilation (BVMV) is an accepted method for the respiratory care practitioner (RCP) to provide manual ventilation. ACLS guidelines for appropriate BVMV are to use the E-C technique to hold the mask to the face (creating a "C" with the thumb and forefinger) while lifting the jaw along the bony portion of the mandible with the last three fingers of the same hand (these fingers make the "E"). The RCP keeps the airway open with head tilt and use of oral pharyngeal airway when necessary. The NuMask design requires the RCP to insert an intraoral mask and a seal is maintained with one hand occlusion of mouth and nose. An oral pharyngeal airway is used when necessary. The hypothesis for this study was that students would prefer the NuMask device to traditional BVMV when ventilating a manikin. METHODS: The Institutional Review Board of Youngstown State University approved this study. Respiratory Care students were instructed in the technique for manual ventilation of a manikin with the NuMask and were reinstructed in the BVMV technique for manual ventilation of a manikin to ensure adequate demonstration of both methods. After manikin ventilation using both methods, the students completed a questionnaire. RESULTS: Eighteen respiratory care students participated in this study. Sixty-six percent of the students agreed that that the NuMask device was easier to seal on the manikin's facial area than the bag valve mask unit while thirty-three percent agreed that BVMV was easier to seal on the manikin's facial area than the NuMask device. Seventy-two percent agreed that the NuMask device provided adequate chest rise and sixty- six percent agreed that adequate chest rise was obtained with BVMV. Overall, 55% of the students stated that they would choose the NuMask for manual ventilation over BVMV. Comments provided by fifteen respondents were reviewed and common themes identified. Dislikes related to maintaining a seal were more frequently specified for BVMV (53%) than for NuMask (20%). Dislikes related to application of the device were reported equally for BVMV and NuMask (40%). CONCLUSIONS: Results indicated that the majority of students prefer the NuMask method to obtain an adequate seal and would select it over BVMV. The researchers suggest that further evaluation of the NuMask device with experienced RCP's, would be beneficial to determine if the NuMask is preferred over BVMV.

Sponsored Research - None

2021789

EFFECTS OF RISE TIME ON PEAK INSPIRATORY PRESSURE OF TWO SUBACUTE/HOME CARE VENTILATORS IN A SIMULATED NEONATE/ INFANT MODEL.

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BACKGROUND: Rise time is typically set/adjusted based on patient age, demand or work of breathing and not necessarily as a component contributing to the achievement of peak inspiratory pressure (PIP). In our institution, we have observed variances between two subacute/home care ventilators and their ability to deliver a set (PIP) based on set rise times. We conducted tests of two brands of home care ventilators used in our hospital. Our aim was to evaluate the effects of rise times on delivered PIPs. We hypothesized the LTV 1200 (Carefusion, Yorba Linda, CA) and the Trilogy 202 (Phillips Healthcare, Andover, MA) when using each manufacturers' proprietary active circuits, would accurately achieve set PIPs; but when using the Trilogy 202's passive circuit PIPs would not be achieved with slower rise times. METHODS: The Trilogy 202 and LTV 1200 vent/circuit configurations were attached to a test lung (Ingmar ASL 5000) using the neonate/apneic model. Ventilator settings used were: PC-SIMV mode, PIP 15 cmH2O, PEEP 5 cmH20, RR 20 breaths/min, Ti .5, leak compensation "on", and were constant throughout the test. Rise times were varied from 1-6. Delivered PIPs were recorded for 10 consecutive vent breaths, at each rise time, using the ASL 5000. RESULTS: The LTV 1200 increasingly overshot set PIP by 5-21% as rise times/settings decreased, with a rise setting of 6 PIP's were accurately delivered. The Trilogy 202 with active circuit under-delivered set PIP by 4-27% with rise settings of 2-6, PIP was accurate with a rise setting of 1. The Trilogy with passive circuit under-delivered set PIP by 7-33% with all rise settings. As hypothesized the Trilogy with passive circuit did not delivery set PIP at slow rise times, but we did not expect PIP's wouldn't be achieved at any rise setting. We were surprised the Trilogy 202 with active circuit under-delivered set PIP's. We also did not expect the LTV 1200 to over-deliver set PIPs. Conclusion: Performance of ventilators vary and manufactures have different proprietary algorithms for the adjustment of rise time. Based on these data, clinicians should be conscience of the effects of rise time settings during pressure ventilation and the possibility of over or under ventilating patients, especially when switching between the LTV 1200 and Trilogy 202.

Sponsored Research - None

Ventilators	Rise Setting 1		Rise Setting 2		Rise Setting 3		Rise Setting 4		Rise Setting 5		Rise Setting 6	
	Average PIP	% diff from set PIP of 15	Average PIP	% diff from set PIP of 15	Average PIP	% diff from set PIP of 15	Average PIP	% diff from set PIP of 15	Average PIP	% diff from set PIP of 15	Average PIP	% diff from set PIP of 15
LTV 1200	18.2	21%	17.6	17%	17.1	14%	16.6	10%	15.7	5%	14.8	-1%
Trilogy 202 Active Circuit	15.0	0%	14.4	-4%	13.5	-10%	12.5	-17%	11.6	-22%	11.0	-27%
Trilogy202 Passive Circuit	14.0	-7%	13.6	-9%	12.3	-18%	11.5	-23%	10.8	-28%	10.1	-33%

2022008

PREDICTIVE ACCURACY OF EXPIRATORY FLOW TERMINATION AS A DETERMINATE FOR ESTIMATION OF AIR TRAPPING DURING AIRWAY PRESSURE RELEASE VENTILATION.

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Background: Airway Pressure Release Ventilation (APRV) can be described as an open lung concept mode of mechanical ventilation that relies on a release time (Tlow) to enhance Co2 removal and create intentional auto-PEEP that prevents cyclic opening and closing of alveoli. Recommendations have been proposed to set the Tlow in APRV to target 25%-75% of peak expiratory flow during the release phase. The setting of Tlow is a key determinate of expiratory flow termination, although lung and chest wall compliance and expiratory flow resistance may have an unseen contribution. Solely targeting a range of peak expiratory flow rate, for expiratory phase termination, may not apply to some more complicating lung and chest wall compliance characteristics and does not take into account absolute expired and residual lung volumes. We hypothesize that using an alternate approach of transpulmonary PEEP (Ptp PEEP) measurements, rather than simply Tlow and expiratory flow %, may be beneficial in the determination of the optimal peak expiratory flow release phase termination point to avoid alveolar derecruitment. Method:We used a standard test lung and placed it in a water basin along with an esophageal catheter (balloon). We produced a stable pleural pressure environment by adding water sufficient to produce a pleural pressure of 15 cmH2O. We also reduced the water level to produce a control environment of a pleural pressure equal to 5 cmH2O. We tested 3 Phigh settings (20, 25 and 30 cmH2O), all at a Plow of 0 and 5 cmH2O. The Thigh remained at 5.0 seconds throughout the study. We tested 5 different Tlow settings (0.3, 0.4, 0.5, 0.6 and 0.7 seconds). At each of the Tlow settings we recorded five parameters; Ptp PEEP, % of Peak Expiratory Flow, Tidal Volume, Expiratory Resistance and Auto PEEP. Results:Of the 30 Ptp PEEP measurements collected in the pleural pressure environment of 15 cmH2O, 26 resulted in a negative Ptp PEEP. Of these measurements, there were 10 negative Ptp PEEP recordings that had a % of PEFR ≥ 25%. The control environment of a pleural pressure of 5 cmH2O resulted in only one negative Ptp PEEP recording (table 1). Conclusions: Arbitrarily adjusting APRV Tlow settings simply by convention to target expiatory flow termination of 25-75% without consideration to lung or chest wall compliance, and specifically lung and pleural pressure gradients, may result in inaccurate assessment of residual lung volume and affective transpulmonary pressures.

Sponsored Research - None

Pleural Pressure environment of 15 cm H_2O											
Settings	Phigh	20	25	25	30	30	20	25	25	30	30
	Plow	0	0	0	0	0	5	5	5	5	5
	Thigh	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
	Tlow	0.3	0.5	0.4	0.4	0.5	0.3	0.4	0.5	0.5	0.6
Results	Ptp PEEP	-8	-2	-5	-1	-4	-2	-2	-4	-2	-3
	Auto-PEEP	7	14	10	14	11	13	13	11	13	12
	% PEFR	41.0	49	40	41.5	35.6	67	48.2	24.8	40.2	29.5
	Exp Resistance	8.8	7.7	8.5	8.3	8.5	13.3	17.4	12.8	11.4	11.2
	VI	250	310	360	420	470	230	320	350	430	470

2022160

CAN THE USE OF A FAST TRACK PROTOCOL INCREASE THE NUMBER OF OPEN HEART SURGERY PATIENTS EXTUBATED IN 6 HOURS?

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Background: Our 2012 data for the number of patients extubated within 6 hours, had decreased to 52%. We brought a multidisciplinary team together to develop a plan to help us improve. We hypothesized that the use of a Fast Track protocol will show no significant difference in the number of postoperative open-heart patients extubated within 6 hours than not using a protocol. Methods: We had an exemption from IRB review. After review of the literature and discussion of our barriers, we developed a Fast Track Protocol to be used on appropriate patients. The protocol used specific criteria to determine which patients could be on the protocol. Criteria included a review of vital signs, hemodynamic, blood loss and how complicated the surgery was. The surgeon made the call to place the patient on the protocol. The protocol included communication, posting the goal time for extubation and a huddle at 4 hours to review why the patient was not yet extubated. The protocol included a checklist to help guide the team through the process. We educated the team in the use of the protocol. We compared the percentage of all patients extubated within 6 hours from 2012 to 2013 after the implementation of the protocol. We included all open-heart surgery patients; this was a process improvement project to develop a new clinical process for our patients. We used the Chi-Square statistic, SPSS software, Chicago, IL, to test for goodness of fit and Excel, Microsoft, Redmond, WA. Results: We reviewed 458 patients from 4/1/2012 through 3/31/2013; 63% of our patients were extubated within 6 hours. We reviewed 453 patients from 4/1/2013 through 3/31/2014; 80% of our patients were extubated within 6 hours. The Chi-Square test had a p value of less than 0.01 and therefore the difference was significant. Conclusions: The use of a multidisciplinary team to develop an evidence based protocol to improve our process to extubate patients appropriately as quickly as their conditions allowed is an excellent method for quality improvement. We found that education of the process, the use of a checklist, excellent communication and the inclusion of a goal time for extubation worked well to increase the percentage of patients extubated within 6 hours. Disclosures: Nothing to disclose.

Sponsored Research - None

2022262

BEHAVIOR OF END-EXPIRATORY LUNG VOLUME DURING EXPIRATORY POSITIVE AIRWAY PRESSURE DETECTED BY ELECTRICAL IMPEDANCE TOMOGRAPHY.

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BACKGROUND: The technique Expiratory Positive Airway Pressure (EPAP) consists the application of a resistance to the expiratory phase of the respiratory cycle, with purpose to promote lung expansion. However, there is a lack in the description of the effects inside the lung. The aim of this study was to evaluate the behavior of end-expiratory lung volume (EELV) and the regional lung ventilation during EPAP detected by Electrical Impedance Tomography. METHODS: This is an observational study with 10 healthy subjects. Inclusion criteria was: BMI 18.5 to 29.9, no cardiopulmonary disease and no smokers. Changes in EELV were represented of change in the end-expiratory lung impedance (EELI) and tidal variation through the impedance change (ΔZ). Thereby, the EELI and ΔZ were measured before, during and after the technique through the EIT monitor, using a belt with 32 electrodes around de upper chest wall. An electric current was applied with 5mA at a frame rate of 50 images/second. EPAP were performed by a spring load valve set at 10 cmH2O, during 5 minutes. The study was approved by the local Research Ethics Committee (n.:15037913.0.0000.5208). RESULTS: During the first minute of EPAP there was an increase in EELI compared to baseline (-13.62 vs 37.67) and in the ΔZ (31.46 vs 68.92) (figure 1), remaining higher after interruption. After the first minute of EPAP, the EELI was not kept in the same range, reducing through the final 4 minutes. In contrast, the ΔZ has always maintained highest throughout the EPAP technique. CONCLUSIONS: While using the EPAP, the end-expiratory lung volume not remained constant, showing a greater effect during the first minute. As for the regional lung ventilation, the increased during EPAP was maintenance probably due to the need for greater effort to open the inspiratory valve

Sponsored Research - None

Variation of electrical impedance before, during and after EPAP technique

Variable	Mean	CI (95%)
ΔZ before	31.46	20.12 - 42.80
EELI before	-13.62	-19.74 - 7.49
ΔZ 1 min	68.92	16.24 - 121.60
EELI 1 min	37.67	7.16 - 68.18
ΔZ 2 min	59.00	30.43 - 87.56
EELI 2 min	19.86	-0.25 - 39.97
ΔZ 3	58.14	43.64 - 72.64
EELI 3 min	18.48	-5.49 - 42.45
ΔZ 4	60.58	42.06 - 79.10
EELI 4 min	15.85	-10.55 - 42.26
ΔZ 5	62.58	49.18 - 75.97
EELI 5 min	6.53	-21.96 - 35.03
ΔZ after	43.74	-31.36 - 56.12
EELI after	-1.8	-15.67 - 11.89

EELI: end-expiratory lung impedance; ΔZ: impedance change

2022443

PERFORMANCE OF PORTABLE VENTILATORS AT TEMPERATURE EXTREMES.

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BACKGROUND: In the current theater of military operation and in disaster situations, medical devices are often shipped and stored at ambient conditions. These devices are often put into use after a minimal time to acclimate to room temperature. The effect of storage at both hot and cold temperature extremes on ventilator performance is unknown. METHODS: We evaluated three portable ventilators currently in use or being evaluated for use by the Department of Defense (731, Impact Instrumentation; T1, Hamilton Medical; and Revel, CareFusion) at temperature extremes in a laboratory setting. The study was conducted in an environmental chamber at the University of Cincinnati. The ventilators were stored at temperatures of 60o C and -35o C for 24 hours and were allowed to acclimate to room temperature for 30 minutes prior to evaluation. The devices were attached to a test lung with a pneumotachograph and fast oxygen analyzer in-line and operated at a number of combinations of FIO2, tidal volume (VT), respiratory rate, and PEEP. Flow, volume, and pressure signals were continuously recorded for later analysis. RESULTS: Using the 500 mL setting as an example, mean VT difference with the 731 was statistically significant (p=0.005) comparing room temperature measurements and after 60oC storage. The range at room temperature was 483–500 mL (mean 494 ± 3). The range after 60o storage was 436-462 mL (mean 451 ± 2). VT range after -35oC storage was 495-522 mL (mean 507 ± 2). The difference was not statistically significant (p=0.12). The VT range for the T1 at room temperature was 501-528 (mean 514 mL ± 3) was significantly different (p=0.02) than the VT after 60oC storage (range 418-435 mL, mean 473 ± 1) but was not significantly different after -35oC storage (range 449-552 mL, mean 498 ± 1). Although the Revel VT after 60oC storage (range 418-435 mL, mean 427 ± 2) and -35oC (range 397-418, mean 408 ± 2) did not differ significantly (p=0.31, p=0.99 respectively)from room temperature measurements (range 383-429 mL, mean 409 ± 2), all the VT were < the ASTM standards. CONCLUSIONS: Storage at extreme temperatures did affect the performance of the portable ventilators tested. Additional time to acclimate to room temperature may help to minimize any temperature effect. Caregivers must be aware of the potential alterations in ventilator performance after storage at extreme temperature.

Sponsored Research - None

2022488

WORK OF BREATHING DURING CPAP: COMPARISON OF CONTINUOUS FLOW AND DEMAND FLOW VENTILATORS.

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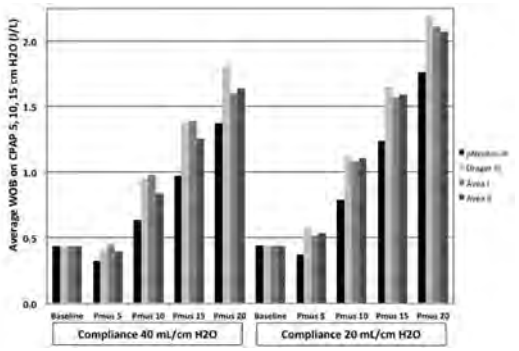
Background: Work of breathing (WOB) on a ventilator is dependent on inspiratory and expiratory valve performance, and patient muscle effort We compared WOB on varying levels of CPAP during breathing simulation at different inspiratory efforts (Pmus) and lung compliance settings. Testing was performed on the pNeuton A ventilator continuous flow CPAP and the Drager XL, Avea (Avea I), and upgraded Avea (Avea II) ventilators with demand flow CPAP. Method: An ASL 5000 advance breathing simulator was used set to a frequency of 30/min, sinusoidal breath configuration, rise time 20%, inspiratory hold 0%, release time 30%, resistance 5 cm H2O/L/sec, compliance 40 and 20 mL/cm H2O, and Pmus of 5, 10, 15, and 20 cm H2O. Baseline measurements were recorded with a Pmus setting of 5 cm H2O with no ventilator connected. Ventilators were tested at CPAP settings of 5, 10, and 15 cm H2O at each compliance and Pmus setting. Inspiratory and expiratory WOB, and total WOB in Joules/Liter (J/L) were recorded and calculated at each test setting by the ASL 5000. The total WOB at all CPAP levels was averaged for each ventilator. Results: Total WOB increased on each ventilator as Pmus increased and lung compliance decreased. WOB was lowest on the pNeuton A ventilator during all test conditions. WOB was highest on the Drager XL at all Pmus settings with a lung compliance of 20 mL/cm H2O. Conclusion: This data confirms that WOB is lower on continuous flow CPAP versus demand flow CPAP systems.

Sponsored Research - None



2022546

THE WHO AND HOW VENTILATOR SETTINGS AND ALARMS ARE SELECTED IN LATIN AMERICA: RESULTS OF A MULTINATIONAL SURVEY.

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Background: Ventilator alarms have been designed to improve safety in patients undergoing mechanical ventilation. They are typically selected by RTs in most ICUs around the US. The newly founded SOLACUR (Sociedad Latino Americana de Cuidado Respiratorio) is trying to assess practices of respiratory care in Latin America. Since only 8 of the 20 Latin American countries offer academic degrees in respiratory care, the specific objective of this study was to determine who and how ventilator alarms are selected in these particular countries. Methods: A 10-item questionnaire was created in Spanish using survey monkey and distributed by SOLACUR to 88 Latin American healthcare providers of the 8 countries mentioned above responsible of patient care in the ICU. The survey was designed to identify who orders ventilator parameters, who selects the ventilator alarms, how alarms are selected, and if alarms were perceived as disruptive of patient care. SPSS 22.0 (IBM, Chicago, 2013) was used to analyze the descriptive data. Results: The response rate was 65.9% (n=58). The country with the largest number of respondents was Colombia (n=35), followed by Chile (n=9), and Argentina (n=7). Most respondents were RTs (41.4%), followed by kinesiologists (22.4%), and RNs (13.8%). The healthcare provider most often responsible for selecting the ventilator parameters and set the alarms was the RT (67.2% and 87.9%, respectively). Intensivists (29.3%) selected the ventilator settings but seldom (6.9%) selected the alarm parameters. The most important parameter to determine selection of specific alarms was a protocol (48.3%), followed by policy and procedures (25.9%) and personal preference (22.4%). Half of the respondents considered alarms to be disruptive of patient care. Conclusion: While a greater sample will be necessary to generalize our findings, this initial assessment of the ventilator management selection revealed that the RT has an important role in selecting ventilator parameters and alarms in Latin American ICUs. The perception of alarms as nuisance by the majority of the respondents should be further investigated as it may determine how alarm parameters are selected.

Sponsored Research - None

	Intensivist	Resident/Fellow	RT	RN
Who selects VENTILATOR parameters?	29.3%	3.4%	67.2%	0%
Who selects ALARM parameters?	6.9%	0%	87.9%	5.2%

2022695

DETERMINATION OF OPTIMAL PRESSURE LOW SETTING IN AIRWAY PRESSURE RELEASE VENTILATION.

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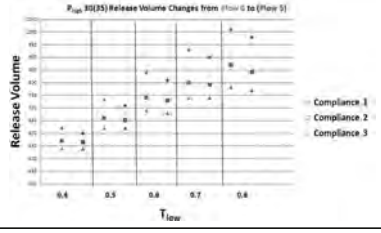
Background: Airway Pressure Release Ventilation (APRV) has become a more widely accepted mode of mechanical ventilation and has shown benefit in some patients with respiratory failure, ARDS and trauma. Published recommendations provide baseline guidance for initial APRV settings. However, limited data exists regarding release volumes resulting from the transition from the Phigh to Plow settings under variable conditions. It has been suggested that a Plow setting of 0 cmH2O allows for minimal resistance to expiratory flow, maximizing the potential for release volumes and co2 elimination. The purpose of this study was to determine if there is a difference in PEFR and release volumes when applying a Plow of 0 cmH2O versus a Plow of 5 cmH2O. Methods: An Adult/Pediatric Demonstration Lung Model was used which allows our APRV settings on two ventilators, (Drager XL and AVEA) to be tested at three different compliance settings. At each compliance setting, data on 3 sets of Phigh/Plow (Delta P) settings were collected (20/5 vs 25/5, 25/0 vs 30/5 and 30/0 vs 35/5). A Tlow of 0.4, 0.5, 0.6, 0.7 and 0.8 seconds were applied to all Delta P settings. At each Phigh/Plow setting, data on the release volume, PEFR and expiratory resistance was recorded. Results: Analysis of the data showed a trend of little difference in release volumes when the same Delta P was compared (figure 1). The differences in release volume were minimal at low compliance settings and longer Tlow (0.7 and 0.8) settings on both ventilators. The Avea ventilator displayed a noticeable difference in expiratory flow resistance resulting in a greater resistance with a Plow of 5 when compared to a Plow of 0. Despite the clear difference in expiratory flow resistance at the 30/0 vs 35/5, there was a minimal difference in release volumes and PEFR with a Plow of 5 when compared to a Plow of 0. Discussion: The literature recommends the setting of Plow of 0 in APRV. The rationale for such a convention is to minimize resistance to expiratory flow and maximize release volume potential. Our data suggests that caution should be followed when arbitrarily setting a Plow of 0. Certain lung and chest wall conditions may be prone to inadvertent zero flow and alveolar de-recruiting conditions. Setting a Plow of 5 may be as effective in release volume delivery, while maintaining auto-PEEP. Further study is required to determine if there is a statistically significant difference in the setting of Plow 0 vs a Plow of 5.

Sponsored Research - None



2007960

PERIOPERATIVE TRANSPORT OF THE PATIENT ON INHALED AEROSOLIZED EPOPROSTENOL; THE ROLE OF RESPIRATORY CARE.

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BACKGROUND: There is a subset of complex cardiac surgery patients who are at risk for intraoperative right heart dysfunction. Evidence suggests that epoprostenol (Flolan®, GlaxoSmithKline, NC) is less expensive than nitric oxide and has similar efficiency for decreasing pulmonary vascular resistance. METHODS: Peri-operatively, both anesthesia and respiratory care (RC) require specialized training regarding the use of aerosolized Flolan (PGE2) with the anesthesia ventilator (AV) and intra hospital transport. PGE2 is started as cardiopulmonary bypass is withdrawn. An Aerogen® (Danger, Galway Ireland) (ANB) nebulizer is connected to the inspiratory port of the AV. PGE2 is started at 20.000ng/mL, 8cc/hr via infusion pump (IV). The ANB control unit (CU) is set-up in the continuous mode (CM). After starting PGE2, administration should not be interrupted. Before transport, check battery power levels for ANB CU and IV pump, and verify that there is enough PGE2 solution in the IV bag for a 30 minute transport. For transport, a cylinder containing 100% oxygen (O2), a Mercury® (Clearwater, FL) resuscitation bag (MB), with PEEP valve and pressure manometer attachment. The O2 tubing is connected to the MB and O2 gas flow set at 10L/min. The MB is connected to a bacteria filter, and ANB elbow adapter, connected to a two stag adapter, connected to a double swivel elbow with 9mm port that is connected to the endotracheal tube. During transport, PEEP valve is set for the level maintained on AV, the patient is ventilated at 20 cm H2O, RR - 12 breaths/min. The IV pump and ANB CU will automatically switch over to battery power once the power cord is disconnected. RESULTS: Peri-operatively, we have performed >50 transports of patients on PGE2 between the operating room and intensive care at The University of Chicago Medicine. There are no alarms to alert staff of problems. The team must pay attention to vital signs: heart rate, MAP and SaO2, during transport. There have been no reports of adverse events. After transport is completed, RC must check that the ANB CU is plugged back into an electrical outlet, reset ANB CU back into CM or CU will automatically turn off after 30 minutes. CONCLUSION: Respiratory Care is an essential member for the safe administration and transport of patients being maintained on PGE2. There have been no reports of adverse events. More prospective study is needed to determine the best optimal strategy for patient transport with PGE2.

Sponsored Research - None

2019418

EXHALED AEROSOL APPLIED ON THE LUNG DISEASES DETECTION: A NOVEL METHOD.

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Background In recent years, a new type of lung diagnosis device that uses the exhaled breath is being developed. It has long been known that breath contains clues to many diseases. One critical limitation of the gas-signature based approaches is that they only measure the presence and concentration of exhaled gas chemicals. They cannot provide any information about the location where these chemicals are produced (i.e., the carcinogens site) or the level of the airway remodeling, both of which are crucial in cancer treatment planning. Any alternative that can locate the malignant sites in a safer and less expensive way would be highly desirable. Method A physiologically accurate airway model is the necessary first step for reliable analysis of breath testing. To prepare the airway models, medical images of different airway sections will be segmented in MIMICS to convert the raw image data into a set of cross-sectional contours that define the nasal airway. Based on these contours, an internal nasal surface geometry will be constructed in Gambit 2.3 (Ansys, Inc.). ANSYS ICEM 10 (Ansys, Inc.) will be used for meshing once the surface model is ready. To resolve the multiple flow regimes, the approach of large eddy simulation (LES) is used, which separates the velocity into a resolved part and a sub-grid part. The resolved part of the field represents the 'large' eddies which are solved directly, while the subgrid part of the velocity represents the 'small scales' whose effect on the resolved field is included through the subgrid-scale (SGS) model. Result A simple lung model which extends from the mouth to the bronchial bifurcation G6 was established. Apparent discrepancies in exhaled aerosol distributions are observed among the four models. More specifically, each abnormality gives a unique aerosol pattern that is clearly suggestive of the disease location and extent. For any given disease, this pattern persists for different particle sizes considered (0.4 – 5 μm), even though the detailed distributions might vary. Conclusion Exhaled aerosol can be used to detect the lung diseases as a novel method.

Sponsored Research - None

2021606

AN IN-VITRO COMPARISON OF AEROSOL EMITTED DOSE DELIVERED BY AEROECLIPSE NEBULIZER WITH AEROBIKA, ACAPELLA AND RC-CORNET.

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BACKGROUND: The development of Oscillatory Positive Expiratory Pressure therapy (OPEP), first took place in Switzerland as adjunct or supplement to airway clearance methods. OPEP therapies are administered intermittently with the goal of clearing secretions. OPEP can be used to treat individuals with asthma, bronchiectasis and chronic obstructive pulmonary disease. The combination of oscillations with a medicated aerosol is thought to provide an added secretion clearance benefit. The research question for this study is: what is the emitted aerosol dose when combining the AeroEclipse nebulizer with AerobiKA, the Acapella and RC-Cornet in a lung model? METHODS: The materials used included, the AeroEclipse nebulizer together with Aerobika, Acapella OPEP and RC-Cornet. A pneumatically-powered lung simulator was connected to a test lung. One side of the test lung was inflated by the other by a connection between the two sides of the test lung. Each of the OPEP devices was connected to the test lung via a filter before the test lung. Five trials at two resistance settings each were used to determine emitted dose. The emitted dose was determined by measuring the filter weight before and after nebulization. Means and standard deviations for each trial was calculated. One-way ANOVA and Tukey's HSD was used. Significance was set at $P \leq 0.05$. RESULTS: The combination of the nebulizer and the AerobiKA emitted the highest emitted dose (0.6635g ±0.019026). The second highest emitted dose was from RC-Cornet (0.59596g ±0.029782), and the least emitted dose was with the Acapella (0.17328g ±0.070396). CONCLUSION: OPEP devices are used for airway clearance. This study shows that AerobiKA addition to the Monaghan Breath Actuated Nebulizer had the highest emitted dosage as compared with other combinations.

Sponsored Research - None

2022092

PATTERN OF LUNG DEPOSITION OF RADIOAEROSOL IN OBESE WOMEN.

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BACKGROUND: A difference in particle deposition throughout the lung is related to factors that influence ventilation. In obese women the increase in abdominal volume modifies the curvature of the diaphragm, the zone of apposition and the increase in adipose tissue reducing the space for lung expansion. The aim of this study was to assess the radio-aerosol pulmonary deposition in obese woman, using scintigraphy. METHODS: In this controlled trial, 20 adult women were divided into two groups, 10 control group (CG; BMI=21.75±1.73 kg/m2) and 10 obese group (OG; BMI≥30 mean 35.60±4.77kg/m2). All subjects inhaled 99mTc - DTPA (technetium labeled dietilnotriaminopentacético acid) with an activity of 1 mCi with normal saline to a total dose volume of 0,2(ml) using a vibrating mesh nebulizer. After nebulization particles were counted with a scintillation camera to analyze regions of interest (ROIs) in a seated position at 5min in each position. The statistical tests used for compare differences between control and obese groups was Mann–Whitney Test. For intragroup comparison of horizontal and vertical gradient Kruskal-Wallis and Duncan post hoc tests were applied. All tests were conducted at a 95% confidence level and significance level of $p < 0.05$. The study was approved by the local Research Ethics Committee. RESULTS: The groups showed differences: Body Fat (CG=29.00±4.37%; OG=44.68±7.00%, p=0.001) and Trunk (CG=31.54±2.53%; OG=45.82±4.93%, p=0.001). Differences between groups in the radio-aerosol pulmonary deposition (CG=62.73±8.47%; OG=4356±9.13%, p=0.000), and the inhaled (CG=71.16±8.07%; OG=55.43±9.82%, p=0.001) and in the cartridge (CG=25.32±7.54%; OG=37.76±4.30%, p=0.001). The intragroup comparison in pulmonary deposition of the horizontal gradient (upper, middle, lower third) control group showed lower counts in the upper third than in middle and lower third (p=0.0001), whereas in the obese group only upper third is less than the middle third (p= 0.0263). In vertical gradient (central, intermediate and peripheral) the deposition in the central was lower than in the peripheral and intermediate areas in the CG (p=0001) and OG (p=0.009). In the intergroup analysis vertical and horizontal gradient was different (figure1) CONCLUSIONS: Obese women had reduced in radio-aerosol pulmonary deposition and the inhaled deposition compared to control, with change in the pattern of distribution of particles in the horizontal gradient.

Sponsored Research - None

2007459

THE IMPACT OF A MULTI-DISCIPLINARY COPD AND PNEUMONIA READMISSION REDUCTION PROGRAM ACROSS THE HEALTH CARE CONTINUUM.

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Introduction: In October 2012, the Centers for Medicare and Medicaid Services (CMS) implemented the Hospital Readmissions Reduction Program focusing on the three most expensive diagnoses among beneficiaries: Acute MI, Congestive Heart Failure, and Pneumonia. In 2014, the program expanded to include two additional diagnoses of Chronic Obstructive Pulmonary Disease (COPD) and Acute Ischemic Stroke. In 2012, Carolinas Medical Center, using an evidence-based approach, began a multi-disciplinary initiative targeting readmissions among patients admitted with pneumonia. In 2013, the multi-disciplinary team utilized best practice items from the pneumonia initiative to develop a plan for COPD. Using guidelines from The Joint Commission and the International COPD GOLD guidelines, a consistent model of evidence-based care for COPD and Pneumonia was developed and implemented across the healthcare continuum. The goal of the program was to reduce readmissions among patients admitted with COPD and Pneumonia by 10% from baseline data. Case Summary: The COPD and Pneumonia Initiative Multi-disciplinary Team reviewed evidence-based standards for COPD and Pneumonia to develop a comprehensive patient pathway. Baseline 2013 data collected for COPD showed an inconsistent pattern due to the lack of consistent evidence-based care. Since the program's implementation, COPD readmission rates have dropped from 14.5% in December 2013 to 8.9% in March 2014. Pneumonia readmissions dropped from 14.47% in 2011 to 11.03% by the end of 2013. Interventions throughout the continuum are expanding to include the formation of a Respiratory Service Line to address the need for streamlined, consistent interventions and evidence-based care for this patient population. Discussion: System-wide (Carolinas Healthcare System) coordinated COPD and Pneumonia inpatient and outpatient care has expanded the current model to help create a consistent pathway of interventions for all patients impacted within the system, which encompasses approximately 30 hospitals throughout the Carolinas in addition to outpatient facilities, physician practices, and rehabilitation centers. By coordinating a system-wide continuum effort, consistent evidence-based care is delivered to a larger population of patients, thus impacting readmission rates for a large pool of hospitals. This, in turn, helps to strengthen the focus on outpatient follow-up and continued care in the medical home.

Sponsored Research - None

2008251

A CASE STUDY: THE USE OF ISOFLURANE FOR BRONCHODILATION IN A PATIENT WITH LIFE THREATNING STATUS ASTHMATICUS.

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Craig Hawkins, BS, RRT, Marnni E. Hutchins, BS, RRT, Lanny Inabnit, MS, RRT-ACCS, RRT- NPS, Dr. Ronald Hunt, MD, William Barrett, CRNA, Carolinas Medical Center University, Charlotte, North Carolina. Introduction: This case study describes the potential benefits of using Isoflurane for bronchodilation in life threatening status asthmaticus. Benefits may include: decrease in CO2, improved airway dynamics, and an increase in PaO2. In addition, the possibility of refractory bronchospasm after rapid weaning or abrupt discontinuation of Isoflurane will be discussed. Case Study: A 29-year-old male with acute asthma exacerbation was admitted to the sub-acute care floor and developed severe respiratory distress. The patient was transferred to the ICU and emergently intubated. The patient was placed on paralytic and sedative drips. Initial vent settings: PCV 26, RR 10, PEEP 4, FI02 80%. ABG: PH 6.75, PaCO2 out-of-range, PaO2 31, HCO3 missing data, SO2 26%. VT 120cc. The patient was failing conventional therapies including bronchodilation. The patient was placed on an anesthesia ventilator and Isoflurane was initiated. ETT dosage of Isoflurane was 2.2 MAC. Ventilator settings: PCV 38, RR 5, PEEP 4, FIO2 100%. ABG: PH 6.85, CO2 184, PAO2 352, HCO3 31, SO2 99.7. VT 580cc. Isoflurane was weaned to 1.2 MAC due to increased need for Epinephrine infusion. VT decreased to 200cc. An ABG was obtained before transition to heliox, and conventional ventilator. Ventilator settings: PCV 40, PEEP 4, RR 10, FIO2 60%. ABG: PH 6.88, PaCO2 115, PAO2 116, HCO3 21, SO2 96%. The patient was transitioned to PCV 30, PEEP 10, RR 10, FIO2 35% and Heliox 80/20 mixture. VT 485cc. Within 2 hours of transition the patient was noted to have decreased VT 250cc, ABG PAO2 54. Discussion: Isoflurane as a bronchodilator may be useful in patients with severe/life threatening status asthmaticus that are unresponsive to conventional therapies. Furthermore, the rapid weaning and/or discontinuation of Isoflurane may cause refractory bronchospasm. Refractory bronchospasm may be seen as a reduction in VT and PaO2 while using the pressure control mode of ventilation.

Sponsored Research - None

2012475

A COMPREHENSIVE RESPIRATORY CARE SERVICES INPATIENT COPD EDUCATION PROGRAM.

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BACKGROUND: Chronic Obstructive Pulmonary Disease (COPD) affects 12 million Americans today and with the implementation of standardized (SD) health care this number is expected to double. COPD patients have frequent hospitalizations, this has created an economic burden on society. Cost estimates range 49.9 billion dollars annually. In 2015 CMS has added COPD to the list of diseases that will incur penalties for readmissions (RA) within 30 days. At University of Chicago Respiratory Care Services (RCS) has been part of a multidisciplinary (MD) initiative to reduce COPD RA since August 2013. Implementing an RCS driven COPD inpatient education (EDU) program was one of the major components of this intervention. METHODS: A MD group created a SD care pathway that began when a patient was admitted and continued until the first post-discharge appointment. For RCS the 3 phases of this pathway were to identify appropriate COPD patients and determine logistics of the program. EDU materials were created. A core team of Respiratory therapists (RT) was identified. Training the Core RT staff consists of 4 hour sessions that covered COPD Gold Guidelines, and "Teach To Goal" (TTG) MDI training. This is followed by viewing a COPD patient receiving their EDU to ensure competency and SD. Implementation includes: 60 minutes of patient EDU with the goal for patient self-management. The first half focuses on disease process and reviewing a COPD Action Plan. The second 30 minutes consists of TTG MDI training. The modified Medical Research Council scale Breathlessness Scale (mMRC) is scored along with the TTG checklists. A patient questionnaire is also collected to gauge patient knowledge and comprehension both pre/post EDU. RESULTS: Of the 75 patients that have been referred to RCS 71% (n=53) received EDU, 4% (n=3) were unable to complete training, and 1% (n=1) refused EDU. The remaining 24% of patients were unable to be seen by RCS either because a RT was unavailable or because of process issues (i.e. no notification of patient discharge). CONCLUSION: Of the patients that received EDU, 63% (n=35) were rated on the mMRC scale and 83% (n=29) had an mMRC=4. Patient feedback from the pre/post questionnaire and MDI training checklists has shown an increase in patient knowledge and improvement in MDI technique. It is early in our data collection for tracking 30 day RA; we will continue to monitor patient RA and address comorbidities and patient self-management skills and comprehension.

Sponsored Research - None

2019408

TIME ANALYSIS OF DELAYS IN BRONCHODILATOR ADMINISTRATION BETWEEN EMERGENCY DEPARTMENT DISCHARGE AND MEDICAL/SURGICAL UNIT ADMISSION

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Introduction: Anecdotal evidence suggested occasional treatment delays during the transfer of care between the Emergency Department (ED) and admission to inpatient medical/surgical units (M/SU) for asthmatics. A retrospective review was performed on all asthmatics admitted to quantify the time period from the administration of the last bronchodilator (BD) treatment in the ED to the first BD treatment or respiratory assessment in the M/SU after admission. **Methods:** This study was not deemed human subject testing by the IRB. Data was reviewed for all asthmatics admitted to the M/SU from the ED between 5/2013 and 4/2014. Data excluded asthmatics directly admitted to intensive care units. Specific components included the time from the last BD treatment in the ED to ED discharge, the time from ED discharge to the patient assessment or BD treatment in the M/SU, and the sum of these two time periods to quantify the scope of the problem. Monthly mean times and ranges for the three parameters were recorded. Additional analysis included the number of asthmatics who received an assessment or treatment 2, 3, and 4 hours after their last BD treatment in the ED. A test of change was implemented during 5/14 in which an order was obtained for Q2PRN BD treatment while the patient was still in the ED. **Results:** Pre-test of change data on 188 asthmatics for one year were reviewed. For the study period, the average time from ED treatment to ED discharge was 2 hours (H) 28 minutes (M) (range: 1H 50M–3H 10M), and from ED discharge to assessment or BD treatment in the M/SU was 51M (range: 36M–1H 5M). The average total time from ED treatment to assessment or BD treatment in the M/S unit was 3H 19M (range: 2H 46M–4H 9M). Only 19% (35/188) were treated in the M/SU at 2 hours post ED BD treatment. At 3 hours post ED BD treatment 47% (89/188) received a BD treatment in the M/SU, and at 4 hours 73% (138/188). **Conclusion:** Delays in treatment times were demonstrated during the pre-test of change data collection period. The primary cause identified was that the responsibility for the patient became unclear when the decision was made to admit, since no active orders were in place. An intervention was undertaken where RT requested an order for Q2PRN BD therapy. When delays in the admission process occurred, the patient was still assessed and treated at a minimum of every 2 hours while in the ED. Data will be collected to determine if this intervention was successful.

Sponsored Research - None

2021408

PH AS AN INDEPENDENT PREDICTOR OF NON-INVASIVE VENTILATION FAILURE IN PATIENTS IN ACUTE HYPERCAPNIC RESPIRATORY FAILURE CAUSED BY EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE.

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Background Non-Invasive Ventilation (NIV) is considered the first-choice treatment for patients in acute hypercapnic respiratory failure caused by exacerbation of Chronic Obstructive Pulmonary Disease (COPD). Previous studies have identified severe acidosis on arterial blood gases taken at admission and after NIV initiation as part of multivariable models that predict NIV failure. We hypothesize that the pH < 7.25 at admission and pH < 7.25 at two hours post-initiation of NIV can independently predict increased risk for NIV failure. Method This study is a retrospective review of patients in acute hypercapnic respiratory failure caused by exacerbation of COPD treated with NIV. These patients were admitted to the Medical Intensive Care Unit or Medical Intermediate Care Unit in a single institution. The ventilators used were Puritan Bennett 840, Respironics BiPAP Vision and Respironics V60. Each patient was reviewed by a respiratory physician before NIV was initiated and followed until they were successfully weaned off NIV or failed NIV. NIV failure was defined as the need for endotracheal intubation. The institutional review board waived consent and approved this study. Statistical analysis was performed using the student's t test. Results From March 2012 to March 2014, 70 patients were initiated on NIV for acute hypercapnic respiratory failure caused by exacerbation of COPD. 6 patients failed NIV. At admission, 25 (35.7%) had pH < 7.25 and 45 (64.3%) had pH >7.25. Of the 6 who failed NIV, 2 had admission pH < 7.25, 4 had admission pH > 7.25 (p = 0.342). One patient was intubated one hour after initiation of NIV. Two hours after initiation of NIV, 11 (15.9%) had pH < 7.25 and 58 (84.1%) had pH >7.25. Of those who failed NIV, 2 had pH < 7.25 and 3 had pH >7.25 at two hours after NIV initiation (p = 0.232). Conclusion The possibility to predict at hospital admission or early in treatment the likelihood of NIV failure in acute hypercapnic respiratory failure caused by exacerbation of COPD would be useful in instituting earlier endotracheal intubation. The sample size of this study is too small to show statistical significance of severe acidosis at admission and 2 hours post-initiation of NIV. Further studies will be needed to identify if these variables can be used independently.

Sponsored Research - None

Subjects n	NIV Success	NIV Failure	p-value
pH at admission < 7.25	23	2	0.3423
pH at admission > 7.25	41	4	
pH after 2 hours NIV < 7.25	9	2	0.2325
pH after 2 hours NIV > 7.25	55	3	

1999969

THE EFFECTS OF AIRWAY PRESURRE RELEASE VENTILATION ON PATIENT WITH UNILATERAL PNEUMONIA: A CASE REPORT.

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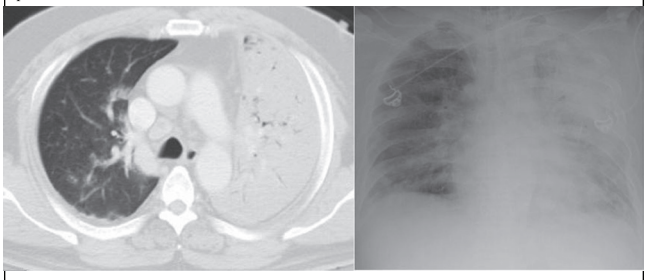
Introduction: Airway pressure release ventilation (APRV) is a safer mode that is associated with higher mean airway pressure (MAP) and lower peak pressure than conventional mechanical ventilation. Several studies demonstrate the benefits of APRV on patients with Acute Respiratory Distress Syndrome (ARDS). One of the Berlin definitions of ARDS is acute on set of bilateral infiltrates. We present a case of unilateral pneumonia that had refractory hypoxemia during conventional mechanical ventilation, which is successfully treated by APRV. Case summary: A 49 years old male was admitted within a chief complain of having fever for days. He has a smoking history of 50 pack-years without any other systemic problems. CT of chest revealed volume shrinkage with infiltrates over left lung that showed progressive change comparing to previous image. During day 3 after admission, this patient was intubated with initial ventilator settings of VCV VT 400(6mL/kg of predicted body weight), RR 20, PEEP 8 following refractory hypoxemia. Due to poor aeration of left lung and the patient's asynchrony, we switched mode to APRV within initial settings of Phigh 30, Thigh 5.0", Plow 0, Tlow 0.4". Chest x-ray post APRV initiation revealed significantly improved over left lung aeration. After 48 hours post APRV initiation, we weaned from APRV settings by "drop and stretch" method. Then, he was extubated successfully. Discussion: This unilateral pneumonia is a heterogeneous lung disease. The classic indication for APRV is usually ARDS within bilateral infiltration. We are concerned that APRV may cause barotrauma during higher mean airway pressure especially in non-dependent part of right lung. In this case, we demonstrate that the use of APRV during heterogeneous lung disease without barotrauma is the safer alternative mode and significantly improved the patient's oxygenation.
Sponsored Research - None



Chest of CT revealed left lung collapse(left). Post APRV initiation for 3 hours(right).

2001802

THE EFFECT OF INHALED NITRIC OXIDE ON PULMONARY ARTERY PRESSURE DURING BIVENTRICULAR ASSIST DEVICE SURGERY.

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Introduction: Inhaled nitric oxide (iNO) has been used therapeutically to treat severe pulmonary hypertension and selectively dilates pulmonary vessels in well-ventilated regions of the lungs. The patient in this report sustained pulmonary hypertension (PH) due to decompensated dilated cardiomyopathy (DCM) and needed to receive biventricular assist device (BiVAD) surgery. However, the hemodynamic monitor revealed relatively elevated pulmonary artery pressure (PAP) during surgery. Therefore, we supplied iNO to treat PH and reduced PAP successfully. Case Summary: A 59 year-old male sustained PH (pulmonary capillary wedge pressure: 41mmHg) due to DCM with severe mitral regurgitation (left ventricular ejection fraction: 18%). He was intubated because of dyspnea and hypoxemic respiratory failure and was waiting for cardiac transplantation in intensive care unit. The patient was supported by cardiac inotropic agents, intra aortic balloon pumping (IABP) and extracorporeal membrane oxygenation (ECMO) after the diagnosis of cardiogenic shock. Owing to rapidly progressive pulmonary edema with hemoptysis, the cardiovascular surgeon suggested that the patient should receive Bi-VAD surgery immediately. The PAP values of pre-operation and post anesthetic induction were 100/59mmHg and 125/70 mmHg. In the period of BiVAD implantation, the surgeon found the blood flow pumped from left ventricular assist device (LVAD) was inadequate due to high pulmonary vascular resistance (PVR). Therefore, we supplied iNO treatment at 20 ppm initially, PAP decreased to around 68/42mmHg in 30 minutes then iNO concentrations were set to deliver 30 ppm to keep systolic PAP around 50mmHg. The patient was weaned from iNO after completing implantation procedure with PAP: 59/35mmHg and acceptable BiVAD support status (LVAD flow around 4.0 L/min; RVAD 1.9 L/min). He received cardiac transplantation 7 days later and was extubated successfully. Discussion: It is much more common to use iNO in preterm neonates with persistent pulmonary hypertension of the newborn and adults with acute respiratory distress syndrome than patients with PH during open heart surgery. In this case, PAP decreased significantly after receiving iNO treatment during BiVAD surgery. We are making iNO treatment to be more routinely available for adults with PH during open heart surgery.
Sponsored Research - None

2006786

THE USE OF AIRWAY PRESSURE RELEASE VENTILATION (APRV) PREVENTS THE NEED FOR EXTRACORPOREAL MEMBRANE OXYGENATION (ECMO) IN A TRAUMA PATIENT.

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INTRODUCTION Airway Pressure Release Ventilation (APRV) is described as CPAP with a brief release to augment carbon dioxide (CO_2) removal. Although APRV may be applied as soon as intubation, it is still widely used as a rescue mode once respiratory failure has progressed to acute lung injury (ALI) and acute respiratory distress syndrome (ARDS). However, recent data demonstrate the early application of APRV prevents acute lung injury (ALI) and the progression to acute respiratory distress syndrome (ARDS). When respiratory failure progresses to ALI/ARDS, lung protective strategies such as low tidal ventilation, recruitment maneuvers, HFOV and (ECMO) are often implemented. This is case study illustrates the early intervention of APRV not only prevented ALI/ARDS, but also the need for ECMO. Early intervention by the respiratory therapist(s) to place this patient on restored alveolar stabilityprevented the need for ECMO. CASE SUMMARY A 23 year old male was in a high speed motor vehicle collision suffering a right tension pneumothorax, bilateral pulmonary contusions, right lung laceration, several ortohopedic injuries and a small frontal lobe hemorrhage. He was hypoxic and in shock as evidenced by a lactate level of 7.0 mg/dL. Upon admission to the trauma center, he was initially placed on PRVC (AC-VC/Autoflow) with FiO_2 100%, set rate of 22, tidal volumes of 470 mL, PEEP 14 cmH_2O and peak airway pressure of 50 cmH_2O. Because he had suffered two pulseless electrical activity (PEA) events related to refractory hypoxia, it was decided by the primary physician to place this patient on venous-venous (VV) ECMO. With the ECMO circuit set up progressing at the bedside, the primary respiratory therapist requested to transition to APRV prior to VV-ECMO. Upon transition to APRV three hours after admission using the plateau pressure on AC/VC, oxygenation and ventilation were immediately improved. Subsequent changes to the APRV settings allowed for further alveolar stability and the FIO_2 was weaned to 60% within 4 hours. This stabilization in oxygenation and ventilation allowed for an improvement in hemodynamic stability and necessary surgical interventions to be completed. DISCUSSION: In this case APRV was used early in the course of respiratory failure and prevented the need from requiring the invasive VV-ECMO therapy. Early intervention of APRV allows for alveolar stability facilitating lung recruitment that improves oxygenation and ventilation.
Sponsored Research - None

2019430

METHEMOGLOBINEMIA IN A PATIENT WITH A CHRONIC COUGH: A CASE REPORT.

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Introduction: Methemoglobin is a dysfunctional form of the oxygen-carrying protein hemoglobin. Produced by oxidation of the ferrous iron (Fe^{2+}) in a heme group to ferric iron (Fe^{3+}), it inhibits the protein from proper oxygen binding and release. Oxidative stress can increase methemoglobin levels, reducing oxygen delivery to tissues. Medications can cause oxidative stress, leading to the development of methemoglobin. Case Summary: We report on a 12 year old female with epilepsy, cerebral palsy and scoliosis who developed a case of methemoglobinemia after use of Benzocaine spray. The patient presented with a chronic cough and clear emesis at an outpatient clinic. A chest radiograph revealed a large right pleural effusion for which she was admitted for chest tube placement. Subsequent complications included an apical pneumothorax and atelectasis for which the patient eventually required intubation. After receiving a tracheotomy following several failed extubation attempts, Benzocaine spray to the upper airway was ordered PRN prior to tracheal and oral suctioning to prevent coughing and clear emesis. After 4 weeks of PRN dosing, the patient had increased oxygen requirements with desaturations between 80% and 90% via pulse oximetry, despite increases in PEEP and a FiO_2 of 100% oxygen. Co-oximetry revealed a critical methemoglobin value of 22.2%. Methylene blue 1% was administered at 1 mg/kg via IV and within a few hours improvement was noted: a methemoglobin level of 0.2%, a FiO_2 requirement of 60% to 70%, and a SpO_2 of 94% to 96%. Discussion: In addition to 20% Benzocaine, the patient was receiving acetaminophen, ciprofloxacin, clonidine, and Ativan, all of which may have contributed to her methemoglobinemia. However, over the course of 4 weeks of PRN dosing, our patient received a total of 95 doses of the Benzocaine spray where a one half-second spray is approximately a 30 mg dose. Dosing anesthetic sprays at the site of mucus membranes appears to have a more rapid onset than topical exposure. Methemoglobinemia has occurred with as little as one dose of Benzocaine. Symptoms include cyanosis, respiratory distress, and a difference in arterial oxygen saturation and pulse oximetry saturation. The gold standard to determine the presence of methemoglobin and true oxyhemoglobin saturation is co-oximetry which showed a 22.2% methemoglobin level in our patient. Treatment includes IV methylene blue dye to which our patient responded positively. Disclosures: None
Sponsored Research - None

2020582

THE USE OF COMBINED NEGATIVE AND POSITIVE PRESSURE VENTILATION IN TREATING SEVERE ARDS AND AIR LEAK SYNDROME WHILE ON ECMO.

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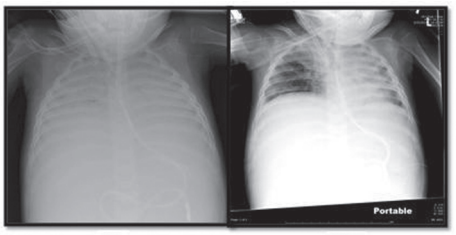
INTRODUCTION: Respiratory management of a patient with ARDS that has developed air leak syndrome is challenging because while positive pressure ventilation (PPV) is used to maintain lung function (FRC), it can also lead to iatrogenic lung trauma. We report a case of an individual with severe ARDS and a history of pneumomediastinum and pneumothorax in whom we were able to apply PPV and negative pressure ventilation (NPV) to increase aeration without promoting air leak. CASE REPORT: A 13 month old child with a recent diagnosis of acute lymphocytic leukemia (ALL) developed respiratory syncytial virus (RSV) and required venoarterial ECMO due to persistent hypoxia, hypercarbia, and air leak. After 3 weeks on ECMO, the patient continued to have complete opacification of both lung fields and persistent air leak despite total lung rest and intermittent incremental increases in positive pressures in an attempt to recruit the lungs. Continuous negative pressure (CNEP) of -25 cm H2O along with intermittent secretion clearance was added using the Hayek RTX Respirator (United Hayek) to aid in lung recruitment. Initially, the patient's VT was 3 mL and Cdyn 0.30 mL/cm H2O (see figure A). After 48 hours, aeration improved bilaterally on PC IMV: PIP 20 cm H2O, PEEP 10 cm H2O, f 14 breaths/min with CNEP -25 cm H2O (VT 20 mL; Cdyn 2.0 mL/cm H2O) with no evidence of further air leak (see figure B). After 53 days of ECMO, this patient was successfully decannulated from ECMO. DISCUSSION: Despite providing ECMO, total lung rest, and intermittent recruitment using positive pressure ventilation, adequate aeration could not be achieved without exacerbating air leak. CNEP, using an external noninvasive chest cuirass in conjunction with PPV, may have allowed for improved chest wall compliance as well as a more uniform distribution of ventilation. CNEP in conjunction with PPV may be considered as an adjunct recruitment modality for ECMO patients with complete bilateral opacification and persistent air leak.

Sponsored Research - None



2021247

POST-ICU MECHANICAL VENTILATION: OUTCOMES OF THE REVISED THERAPIST-IMPLEMENTED PATIENT-SPECIFIC (TIPS) WEANING PROTOCOL.

Glenn Payne[1], Douglas Vela[1], Meg Hassenpflug[1], David R. Nelson[1], Scott A. Sasse[1], Jillisa Steckart[1,2]; [1]Barlow Respiratory Hospital and Research Center, Los Angeles, CA; [2]VA-GLAHS, Los Angeles, CA

Introduction: Barlow Respiratory Hospital (BRH) is a 105-bed long-term acute care (LTAC) hospital network that serves as a regional weaning center, accepting chronically critically ill (CCI) patients transferred from the ICUs of hospitals in southern California. Patients have been weaned using the Therapist-Implemented Patient Specific (TIPS©) weaning protocol since 1998 (CHEST 2001; 119:236-242). Herein we report weaning outcomes after the implementation of our most recent revision of the protocol compared to outcomes of the previous calendar year. Method: An interdisciplinary task force was formed to review existing protocol and seek opportunities for improvement. Literature review was performed to update evidence base of ICU and LTAC weaning practices, stability and weaning parameters, ventilator modes, and other protocols. Input was solicited from staff pulmonologists and other key stakeholders. Protocol revisions were drafted, circulated, and discussed; expert opinion was utilized for decisions lacking a true evidence base. EHR documentation was updated to reflect protocol revisions and provide data for compliance monitoring. After training of all staff, revised protocol was applied to patients admitted from 3/3/2014 forward. Outcomes (weaned, vent-dependent, died) were scored at BRH discharge for both cohorts; weaned defined as patient being free of invasive mechanical ventilation for at least one full calendar day prior to day of discharge. Results: Two key protocol revisions were realized to "accelerate" weaning: 1) daily rapid shallow breathing index (RSBI) measurements to assess for earliest opportunity to advance to self-breathing trials, and 2) up to three daily reassessment opportunities to advance multiple steps in the protocol. From 3/3/2014-5/28/2014 33 CCI patients admitted for weaning reached outcome. These preliminary results are compared to 297 CCI patients treated by the same physicians and staff in 2013. Conclusions: These very preliminary results show a significant decrease in time to wean after implementation of revised weaning protocol incorporating additional "acceleration" steps while maintaining conservative safety and stability screens. Fewer days on mechanical ventilation may translate to less risk of ventilator-associated events/infection, enhanced rehabilitation opportunities, and shorter lengths of stay. Continued rounding, reinforcement of education, and compliance monitoring will inform these findings. Disclosures: None

Sponsored Research - None

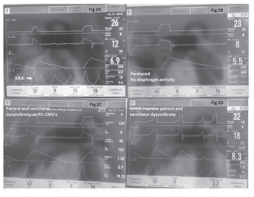
2023033

NEURALLY ADJUSTED VENTILATORY ASSIST VENTILATION (NAVA) FOR MANAGEMENT OF RESPIRATORY FAILURE IN A COPD EXACERBATION.

Justin Hoffman, Khawaja Zaki, Eduardo Mireles-Cabodevila; Cleveland Clinic Foundation, Cleveland, OH

Introduction: Mechanical ventilation (MV) has evolved since its introduction in managing patients with respiratory failure. The prognosis of critical ill patients with respiratory failure depends on their underlying etiology, and the strategy used for mechanical ventilation. Neurally adjusted ventilator assist (NAVA) is one of the newest developments in MV. It is an assisted mode of MV which uses the electrical activity of diaphragm (EAdi) to trigger the ventilator breath. This allows breath to breath assessment of ventilator assist and thus improvement of patient ventilator asynchrony. Case Report: 58 year old male with past medical history of hypertension, >40 pack yr former smoker and very severe COPD with FEV1 of 15%, admitted with acute hypercapnic respiratory failure at outside hospital requiring intubation. On presentation he was intubated and sedated remained dysynchronous with the ventilator, afebrile, BP 134/96, Pulse 84/bpm regular. Poor air entry bilateral with wheezes but no crackles or JVD Labs were significant for Hb of 10.8, HCO 31, ABG 7.31/65/107/32/97 on 40% FiO2 on ventilator. CXR showed hyperinflation. Initial ventilator settings were PC-CMV with Inspiratory pressure (IP):15, PEEP:12, Peak pressure(Ppeak):27mmHg, mean pressure(P-mean):15mmHg, AutoPEEP 15mmHg after paralysis and static compliance was 129 lit/cm H2O. He was placed on NAVA with levels between 2-5cm H2O/ µV, EAdi peak 8-18µV, PEEP +8mmHg, Ppeak 32mmHg and Pmean 13mmHg. The airway pressures didn't change significantly however; it improved patient ventilator dysynchrony and decreased work of breathing. Discussion: Patient ventilator asynchrony is common and presents in 25% of MV patients and can lead to increased need for sedation and neuromuscular blockage, barotrauma, ventilator induced lung injury and prolong need for MV. The presence of intrinsic PEEP and dynamic hyperinflation as seen in our patients with COPD can leads to ineffective triggering. NAVA utilizes EAdi signals to determine the timing and level of ventilator assist resulting in synchrony between the ventilator flow and neural respiratory cycle. Until now there are no clinical trials suggesting its role in improving outcome. However, improving asynchrony has been shown in various physiological studies in animal and healthy individuals. NAVA is a new promising tool for clinician and researchers in the field of MV. Future trials needed to evaluate its indications and effectiveness in improving outcome.

Sponsored Research - None



Synchrony waveforms

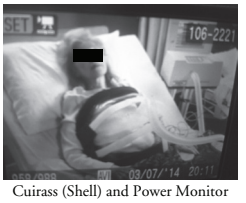
2025306

A CASE STUDY: USE OF BIPHASIC CUIRASS VENTILATION UPON DIAGNOSIS OF AMYOTROPHIC LATERAL SCLEROSIS.

Frank Austan[2,1], John D. Domanski[1,3]; [1]Geriatric Medicine, Kennedy Long-Term Care and Rehabilitation Facility, Sewell, NJ; [2]Pulmonary, PVAMC, Philadelphia, PA; [3]Sub-Acute Rehabilitation Wing, Kennedy Health Care Center, Sewell, NJ

Introduction: A 68 year old white female was admitted to a sub-acute care rehabilitation facility after undergoing spinal cervical decompression surgery. The patient achieved minimal response to rehabilitation and was admitted to a long-term care facility. Case Summary: The patient was evaluated by neurology for progressive upper limb and respiratory muscle weakness. The evaluation resulted in a diagnosis of amyotrophic lateral sclerosis (ALS), a terminal disorder of unknown origin that is complicated by gradual reduction in lung volumes, impaired cough, speech and respiratory failure the principal cause of death. Pulmonary consultation recommended Biphasic Cuirass Ventilation™ (BCV), (Hayek Medical, London, UK), a method that uses a non-invasive cuirass (shell), connected to a module which actively controls both phases of respiration cycle. BCV is designed to increase functional residual capacity, promote airway clearance and cough assistance. A didactic and hands-on competency review was provided to the nursing staff. BCV was ordered every 6 hours for duration of 15 to 30 minutes per session as tolerated and received therapy daily for a period of 52 days. Respiratory parameters were measured daily pre and post therapy for 28 days by Pulmonary Services. Parameters were averaged and percent change documented in the medical record. Discussion: In this case BCV was initiated upon diagnosis of ALS improving the patient's tidal volume (363 ml Ê 34 %), vital capacity (0.950 L Ê 19 %), decrease in respiratory rate (17 BPM Ñ 37%), improved comfort and tolerance between the equipment and patient interface. The nursing staff found BCV to be user-friendly and efficient in reducing the labor intensiveness of administering deep breathing exercise, chest physical therapy and cough assistance. We infer given the terminal nature of ALS and eventual respiratory failure, the early introduction of BCV may assist in establishing a Segway that "bridges" improvement in the patient's compliance and tolerance of the device. BCV also provided in this case greater comfort by not having to wear a full face BIPAP mask that prevents verbal communication as well as increasing the risk of facial tissue breakdown. Another added advantage is the delay BCV provides in the inevitable need for a tracheostomy and conventional mechanical ventilation. Resource: Cuirass Ventilation: A review and Update. Critical Care and Resuscitation 2004; 6: 113-122 Sponsored Research – None

Sponsored Research - None



Cuirass (Shell) and Power Monitor

2017964

HOSPITAL UTILIZATION FOR COPD PATIENTS REQUIRING NONINVASIVE POSITIVE PRESSURE VENTILATION ENROLLED IN HOME-BASED PULMONARY REHABILITATION.

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PURPOSE: To measure the impact of a home-based, respiratory therapist-led health management program on hospital utilization among patients living with chronic respiratory failure who require non-invasive positive pressure ventilation (NIPPV). METHODS: The Comprehensive Respiratory Outcome Management (CROM, Alana HealthCare) program was implemented for patients living with chronic respiratory failure and require the use of non-invasive positive pressure ventilation. The program consists of face-to-face home visits by a respiratory therapist who performs clinical assessments, intensive education, behavior modification, skill training, smoking cessation and exacerbation mitigation/management training. Home visits are supplemented with scheduled and unscheduled respiratory therapist phone interviews. Patients with a diagnosis of chronic respiratory failure, either ≥ 1 hospital admission or ≥1 emergency room visit in the past 12 months and/or for whom a BIPAP has proven to be ineffective were enrolled into the program. RESULTS: 459 patients were enrolled into the program over an 18-month period (January 2012 through June 2013) with a diagnosis of chronic respiratory failure. 211(46%) of those enrolled had a diagnosis of chronic respiratory failure and experienced a minimum of 1 hospital admission in the 12-month period prior to enrollment into the program, and 61 (13%) of those enrolled had a minimum of 1 hospital readmission (30-day) in the 12-month period prior to enrollment into the program. Following enrollment and participation in the program, patients experienced a 51% reduction in hospital admissions, a 56% reduction in days spent in the hospital and a 48% reduction in 30-day hospital readmissions. Analysis was done using equivalent time periods, pre and post start of care. CONCLUSIONS: The use of a respiratory-therapist led health management program resulted in a decrease in hospital utilization amongst patients living with chronic respiratory failure, as defined by admissions, days spent in the hospital and 30-day readmissions. CLINICAL IMPLICATIONS: Nationally, hospital utilization for patients living with chronic respiratory failure is among the highest in the nation. This respiratory health management program helps to significantly reduce admissions (51%), days spent in the hospital (56%) and hospital readmissions (48%). Significant reductions in health care related expenditures can thus be expected.

Sponsored Research - THE STUDY WAS COMPLETED BY EMPLOYEES OF ALANA HEALTHCARE.

Hospital Utilization Outcomes (Pre & Post Intervention)

	Before Start of Care	After Start of Care
Hospital Admissions	483	236
Total Days Spent in Hospital	2620	1143
Hospital Readmissions (30-Day)	122	63

459 patients were enrolled over an 18-month period (January 2012 through June 2013). Patients eligible to be included in the hospital utilization analysis required that each patient experience a minimum of 1 hospital admission and/or hospital readmission (30-day) in the 12-month period prior to enrollment in the program. Clinical exclusions applied to this analysis include terminal conditions, patients with a recent history of alcohol or drug abuse, ESRD, Cirrhosis, patients who are confined to an institutional setting, patients with recent psychiatric inpatient admissions, those living with pulmonary fibrosis, TB or neurological disorders.

211 (46%) patients qualified for the hospital admission and days spent in hospital (DSIH) analysis. 61 (13%) patients qualified for the hospital readmission analysis Patients were separated into three cohorts. Patients in category A were enrolled for more than 12 months. Patients in category B were enrolled for 9 -11 months and category C were enrolled for 6 - 8 months. Analysis was done using equivalent time periods, pre and post start of care.

2007169

A STUDY OF BODYBUILDERS PREDISPOSITON TO SLEEP DISORDERS.

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The purpose of this study was to investigate the likelihood that body builders are predisposed to sleep disorders due to their lifestyles. The prevalence of poor sleep patterns, workout schedules and Epworth Sleepiness scores (ESS) were all explored. One hypothesis was tested: Due to the numerous lifestyle factors that bodybuilders face, they are predisposed to sleep disorders and poor sleep hygiene. Methods: A 15 question survey and 8 question Epworth Sleepiness Scale gleaned data to evaluate body builder's predisposition to sleep disorders. Informed consent was obtained. The survey was distributed at the Arnold Sports Festival in Columbus, Ohio. Results: A total of twenty seven participants completed the survey. A significant correlation was made between body builders training times and Epworth sleepiness scales. Body Builders and Sponsored Athletes who train during the afternoon have a significantly lower ESS (7.6 ESS) compared to the Body Builders and Sponsored Athletes who train during the morning (13.1 ESS) or night hours (12.2 ESS). Twenty of the participants (74%) reported a neck size that puts them at risk for Obstructive Sleep Apnea. The average ESS scale among participants was 11.7 which categorize them into the medical severe risk category. Conclusions: There is a huge emphasis on the need for sleep education in today's society. Dearth amount of data is available linking sleep disorders with the body building population, however now we have a bridge connecting this specific lifestyle to sleep disorders.

Sponsored Research - None

2016411

EFFECTS OF DIFFERENT CERVICOTHORACIC SPINE POSITIONS IN THE SUPINE POSTURE ON LATERAL DEVIATION OF UPPER THORAX AND RESPIRATORY FUNCTION.

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Background Upon clinical assessment of patients on the bed, respiratory function seems to depend on the position of cervicothoracic spine (CTS). Worsening CTS position likely induces imbalance in lateral deviation of upper thorax (LD). Then, a problem occurs in the costal or abdominal breathing, relating to morbid alteration in ventilation function. Positioning on the CTS often brings about improvement of breathing activity. We here investigate the relation of LD to respiratory function when CTS is extended or flexed. Method Subjects were 9 healthy men, 25.9±2.6 yo. Respiratory function and LD were measured at three CTS positions of medium, extended and flexed at the supine posture. Using spirometer (AS-507, Minato), vital capacity were measured at each position. Using 3-D analyzer (QM-3000, Topcon), LD was measured by dividing the horizontal plane of thorax into left and right areas by the sternum center, and was assessed at following 5 conditions; the resting expiratory level at each position and the maximal inspiratory/expiratory levels at medium position. Data analysis was made by paired t test using SPSS. Approved by the Ethnic Committee of Bunkyo Gakuin University. Results Expiratory reserve volume (ERV) was significantly greater at the extended position than the flexed ($p<0.01$). Inspiratory reserve volume (IRV) and inspiratory capacity (IC) were greater at the flexed than the extended position ($p<0.01$). At the maximal expiratory level with medium position and the resting expiratory level with flexed position, the segmental area of horizontal plane of the upper thorax was bigger in the left than in the right ($p<0.01$). In contrast, at the maximal inspiratory level with medium position and the resting expiratory level with extended position, the lateral difference was diminished. Conclusions Results indicate that CTS position influences LD and respiratory function with change in alignments of CTS and ribs. At extended position, LD is similar to the maximal inspiratory level and ERV becomes high, indicating that extension makes LD close to maximal inspiratory level, thus enabling expiration from inspiratory state. At flexed position, LD is similar to the maximal expiratory level and IRV/IC becomes high, indicating that flexion makes LD close to maximal expiratory level, enabling inspiration from expiratory state. Thus improvement of respiratory function can be achieved by positioning for CTS position responsible for the patient conditions.

Sponsored Research - None

2017349

ANALYSIS OF THORACIC SHAPE DURING FORCED BREATHING - RELATIONSHIP OF THE THORACIC SHAPE AND RESPIRATORY FUNCTION -.

Tetsuro Hirayama[1,2], Tatsuya Ishizuka[3,4], Taiichi Koseki[1], Yuuki Homma[2,3], Naoya Nishida[5,6], Michie Okazaki[4,7], Tomoko Kawasaki[1,5], Hirohisa Koseki[1,8], Masahiko Izumizaki[2], Yukisato Ishida[5], Fujiyasu Kakizaki[5]; [1]Department of Rehabilitation, Hiro-o Orthopedics Clinic, Shibuya-ku,Tokyo, Japan; [2]Department of Physiology, Graduate School of Showa University, Shinagawa-ku, Tokyo, Japan; [3]Department of Rehabilitation, IMS group Itabashi chuo medical center, Itabashi-ku,Tokyo, Japan; [4]Graduate School of Tokyo Medical University, Shinjuku-ku,Tokyo, Japan; [5]Graduate School of Bunkyo Gakuin University, Bunkyo-ku,Tokyo, Japan; [6]Department of Rehabilitation, Sonoda Second Hospital, Adachi-ku,Tokyo, Japan; [7]Azabujuban Primary Medical Clinic, Minato-ku,Tokyo, Japan; [8]Touto Rehabilitation College, Shibuya-ku,Tokyo, Japan

Background During breathing parts of thorax seem to move asymmetrically. The chronic increase in the asymmetry may induce unidirectional movement in the thorax, leading to the breathing dysfunction. Intervention in the physical therapy considering the thoracic asymmetry often improves the thoracic movement and respiration. Here we investigate the lateral movement of the upper and lower thorax during breathing in relation to the breathing function. Method Subjects were 18 healthy men (25.4±3.7 yo). Using 3-D image analyzer (QM-3000, Topcon, Japan), thorax shape was captured at resting expiratory, maximal inspiratory and maximal expiratory level. Asymmetric movements of rib rotation were assessed by calculating left and right horizontal cross-sectional areas of the upper and lower thorax divided by the line between sternum middle point and spinous process. Respiratory function was measured using a spirometer (AS-507, Minato Medical Science, Japan). Data analysis was made by paired t test or Pearson correlation coefficient using SPSS. Approved by the Ethnic Committee of Bunkyo Gakuin University. Results At resting and maximal expiratory levels, the left segmental area of horizontal plane of upper thorax was significantly bigger than the right area ($p<0.01$). While, the right area of the lower thorax was bigger than the left area ($p<0.01$). At the maximal inspiratory level, the bilateral difference of cross-sectional area was reduced both in the upper and lower thorax. With respect to respiratory function, the increase in bilateral difference of upper thorax tended to correlate with the increase in tidal volume (TV) of respiration ($r = 0.40$, $P = 0.1$). A strong negative correlation was obtained between bilateral difference of the lower thorax and TV ($r = -0.71$, $P<0.05$). A moderate negative correlation was present between bilateral difference of the upper thorax and the peak expiratory flow rate ($r = -0.50$, $P<0.05$). Conclusions Results suggest that thorax is distorted as upper thorax to the left and lower thorax to the right from the maximal expiration to resting expiratory levels and that inspiration to the maximum level diminishes the distortion. TV may be reduced by a factor of lateral right-deviation of the lower thorax. The left-deviation of upper thorax may limit the expiration rate, but may relate to the increase in TV, presumably due to the reduction in the exhalation with the hyper activity of the inspiratory muscle.

Sponsored Research - None

2017404

CHANGES IN SLEEP KNOWLEDGE AND SLEEP BEHAVIOR OF COLLEGE STUDENTS AFTER COMPLETING A SLEEP EDUCATION COURSE.

Tamara Douglass-Burton[1], Devon A. Dobrosielski[2]; [1]Interprofessional Health Studies, Towson University, Towson, MD; [2]Kinesiology, Towson University, Towson, MD

BACKGROUND: College students often experience sleep deficiencies and irregular sleep patterns, which may impact academic performance, physical and mental health. Yet, efforts to promote sleep health among college students at public universities are lacking. This study will examine the effects of a sleep education course on knowledge of sleep and self reported sleep quantity of college students attending Towson University. METHODS: Men and women enrolled in a 15-week course, designed to provide an understanding of the function of sleep, the health consequences of untreated sleep disorders, including sleep deprivation, and treatments for disturbed sleep. The Dartmouth Sleep Knowledge and Attitude Survey was administered prior to and after completion of the course to evaluate knowledge in the content areas. The National Sleep Foundation 7 day sleep diary was used to record sleep data at both times. The University Review Board granted permission to use the data collected during the courses. Upon completion of the data collection period, all the data was merged into one file using Stata 12.0 and SPSS and the level of significance was <.05. An analysis of descriptive statistics were calculated for the pre and post knowledge test data, as well as measures from the pre and post diary. To measure the differences in demographics, mean sleep duration and days feeling rested, paired t-tests were used. ANOVA test were used to determine if the mean amount of sleep changed from the beginning of the semester to the end RESULTS: Sixty-five students (18.1 ± 0.7 years; 68% women) completed the course. At the start, the mean score on the sleep knowledge quiz was 73±9%. Students reported an average sleep time of 7.8 hours/day and 30% of those who enrolled in the course felt that they were getting enough sleep. After completing the course, the mean score on the sleep knowledge quiz improved to 88±9% ($p<0.01$), while self-reported sleep time increased to 8.4 hours/day ($p<0.01$). The percentage of students who felt they were getting enough sleep increased to 51% ($p<0.01$, Pearson's chi square test). CONCLUSION: College students who completed a 15-week sleep education course demonstrated improvements in learning outcomes as well as increased sleep time and better perception of sleep quantity, suggesting that sleep education may ultimately impact sleep habits in college students. No affiliations or relationship with industry for the previous 2 years by either author.

Sponsored Research - None

2019105

THE COMBINED EFFECTS OF MANUAL CHEST SQUEEZING COORDINATED EXPIRATION WITH RELAXATION POSTURES IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD).

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Background: Relaxation postures are recommended to reduce the work of breathing and dyspnea in patients with COPD.We already reported that effects of relaxation postures for COPD. However, it is not clear that the effects of the manual chest squeezing coordinated expiration with relaxation postures in patients with COPD. The purpose of this study is to clarify combined effect of the manual chest squeezing on the relaxation postures from the point of view of clinical stratification. Method: Twenty-nine stable outpatients with COPD participated in the study. We measured mouth occlusion pressure (P0.1), ventilatory parameters, and degree of relaxation used by visual analogue scale (VAS) in quiet breathing at sitting, forward-leaning sitting and semi- Fowler's position. We also measured these parameters with manual chest squeezing on lower chest in the most comfortable position in these 3 positions. All patients were measured pulmonary function, arterial blood gas analysis and respiratory muscle strength. Results: The most comfortable position was semi-Fowler's position, and forward-leaning sitting is the second, sitting is the third ($p<0.0001$). There were significantly reduced in VO2, VCO2, ETCO2, VAS after chest squeezing ($p<0.001$) .However, P0.1 and P0.1/PImax did not reduced significantly with chest squeezing. The most comfortable position was forward-leaning sitting in patients with GOLDIV, semi-Fowler's position in patients with GOLDIII ($p<0.05$). Conclusions: Manual chest squeezing with relaxation postures may be effective to reduce ventilatory parameters and dyspnea without central output in patients with COPD.

Sponsored Research - None

Table 1 Ventilatory parameters and degree of relaxation before and after chest squeezing

	ETCO2	O2	CO2	VAS
chest squeezing before	3.98±0.62	0.22±0.07	0.17±0.04	1.22±1.33
chest squeezing after	3.70±0.61	0.19±0.06	0.15±0.04	0.82±1.26

2019269

EFFECTS OF PULMONARY FUNCTION OBTAINED DURING AEROBIC EXERCISE IN LUNG CANCER PATINTS UNDERGOING CHEMOTHERAPY.

Kyoko Honda[1], Ryo Kunishi[1], Asumi Kajiwara[1], Yuki Furukawa[1], Tetsuro Nishikimoto[1], Ryujiro Sugimoto[2], Kazuhiko Kataoka[2], Shoichi Kuyama[3]; [1]Rehabilitation, National Hospital Organization Iwakuni Clinical Center, Japan, Iwakuni, Japan; [2]Thoracic Surgery, National Hospital Organization Iwakuni Clinical Center, Japan, Iwakuni, Japan; [3]Pulmonary Medicine, National Hospital Organization Iwakuni Clinical Center, Japan, Iwakuni, Japan

BACKGROUND: In 2010 Japan began cancer rehabilitation sessions due to an increase in overall cancer patients in Japan (Lung cancer: 70,619 in 2001 to 107,241 in 2010). Physicians recommend aerobic exercise such as biking, for lung cancer rehabilitation, based on evidence of exercise benefits for breast and prostate cancer patients. However, little research is available on the benefits of exercise for lung cancer patients. The Iwakuni Clinical Center had an average of 108 lung cancer chemotherapy patients per year for the past four years. We used stationary bike aerobic exercise in rehabilitation to study the pulmonary function of lung cancer patients undergoing chemotherapy. We postulate that aerobic exercise partially prevents loss of physical performance through conditioning. METHOD: We measured pulmonary function with the spirometer and the distance walked in six minutes. We also measured leg muscle strength with the isometric dynamometer. Twenty chemotherapy patients (Training Group) biked five to thirty minutes at twenty to fifty watts daily. Pedaling loads were adjusted daily to achieve the Borg scale target heart rate for each patient. Five patients in the control group did not train. All patients received lung cancer chemotherapy and were assessed within fifteen days from admission to discharge. RESULTS: In pulmonary function, the %VC and %PEmax significantly increased respectively 5.8% and 15.2% on average($P<0.05$), in the training group. Duration of neutropenia and thrombopenia decreased. The training group had fewer side effects of mucositis, constipation, nausea, and fatigue than the control group. The training group walked 34 meters further in six minutes by the time of hospital discharge. CONCLUSION: The %VC and %PExmax improved. Distance walked improved which increased the activities of daily living (ADL) of patients by improving physical and respiratory function. The duration of neutropenia and thrombopenia decreased in the training group. These results encourage continued exercise and extend ADL. The training group had less constipation, fatigue, loss of appetite resulting in more activity and dietary intake. The training group showed improvement in physical function, therefore, it is possible to maintain ADL on admission, continue chemotherapy and advance the return home. We think there is a need for further study on the effects of exercise therapy and its effectiveness on chemotherapy patients.

Sponsored Research - None

2020090

EFFECTS OF MUSIC ON EXERCISE EXPERIENCE OF CARDIAC AND PULMONARY REHABILITATION PARTICIPANTS.

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BACKGROUND Patients with heart and lung disease participate in cardiopulmonary rehabilitation programs to improve or regain the stamina lost due to sedentary lifestyles and exacerbating events. Though beneficial, exercise can be unpleasant. Music, as a form of distraction, has been used to make the activity more enjoyable. Adherence to regular exercise is related to enjoyment. This study examined the effect of favorite music on the exercise experience of cardiopulmonary rehab patients. METHODS In a crossover trial, with Institutional Review Board approval, 45 patients from cardiopulmonary rehabilitation programs were randomized to a sequence of three music and three control sessions during exercise once per week over a six-week period. The primary outcome measure was MET-minutes of exercise and secondary outcome was enjoyment measured by a visual analog scale. Percent target heart rate, rates of perceived exertion and perceived dyspnea, and steps per minute were also measured. General well-being was assessed prior to exercise sessions. RESULTS Mixed-effects model showed no statistical difference in MET-minutes for music and control sessions ($p=0.199$). Music had a significant positive effect on enjoyment of exercise ($p <.0001$) and percent target heart rate ($p=0.02$). Perceived exertion and dyspnea were not significantly different ($p =0.08$ and $p=0.16$ respectively) for music versus control sessions. There was no association between steps per minute of exercise and music tempi. Feelings of general well-being were positively associated with enjoyment. CONCLUSIONS Listening to favorite music resulted in higher levels of exercise enjoyment and percent target heart rate but did not show significant difference in MET-minutes, perceived exertion or dyspnea. DISCLOSURES This work was supported by grants from the University of Minnesota, School of Public Health and the Pulmonary Clinical Research Group at HealthPartners Institute for Education and Research. The author has no conflicts of interest to disclose.

Sponsored Research - Grants from the University of Minnesota, School of Public Health and the Pulmonary Clinical Research Group at HealthPartners Institute for Education and Research

2021293

WHOLE BODY VIBRATION (WBV) IMPROVES FUNCTIONAL CAPACITY IN PATIENTS WITH COPD: A RANDOMIZED, CONTROLLED, CROSSOVER CLINICAL TRIAL.

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RATIONALE: Exercise intolerance is a common development in patients with chronic obstructive pulmonary disease (COPD). There is little data on the use of an isolated program using a vibration platform training on the functional capacity in these patients, an area that deserves investigation. The aim of the study was to investigate the effect of whole body vibration training (WBV) of 12-week duration on functional performance and quality of life of patients with COPD. METHODS: A randomized controlled, blind, crossover clinical trial conducted with 11 patients with COPD (62.91 ± 8.82 years old, 81.8% male; forced expiratory volume in the first second - FEV1%pred = 14.63±11.14; forced vital capacity - FVC%pred = 48.84±15.21; FEV1/FVC = 47.39±11.63). We evaluated the 6-minute walk test (distance traveled [DW], duration of the walk [TW] and index of perceived exertion [IPE]), quality of life using the Saint George Respiratory Questionnaire (SGRQ) and developed a 12-week program of training on a vibrating platform. The training was adjusted monthly (1st month: f = 35 Hz, A = low 30s vibe with intervals of 60s for 10 minutes; 2nd month: F = 45Hz, A = low / high 60s with 30s intervals, for 15min, 3rd month: f = 45Hz, H = High, 60s with 30s intervals for 20min). RESULTS: The DW increased at the end of training (WBV: 413.09±101.56 m, Control: 337.82±95.62 m with a difference between groups of 75 m [95% CI = 27.98 to 122.56] $p = 0.005$). All domains of the SGRQ (total: $F = 19.647$, $df = 1$, $p = 0.001$; symptoms: $F = 8.388$, $df = 1$, $p = 0.016$; activity: $F = 5.562$, $df = 1$, $p = 0.040$; impact: $F = 4.867$, $df = 1$, $p = 0.052$)) improved at the end of training. CONCLUSION: Our results show improvement of the functional capacity in the 6MWT of patients with COPD undergoing a training program on the vibrating platform as well as in all domains of the SGRQ quality-of-life. The study was approved by the local Research Ethics Committee and registered at clinicaltrials.gov under the number NCT01649310. Supported by grants: FACEPE, CAPES and CNPq.

Sponsored Research - None

2022199

IMPROVEMENT IN THE 6-MINUTE WALKING DISTANCE BY FASTENING POSTURE STABILITY SYSTEM BELTS IN COPD PATIENTS.

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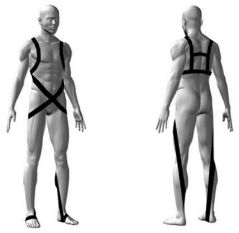
Background The breathing is affected by the posture, and the postural approach for patients with chronic obstructive pulmonary disease (COPD) alleviates dyspnea. Many kinds of taping and belt systems have been developed to improve deformed extremities or trunks. We now invent a special belt system, named as The Posture Stability System (PSS) (Figure), that is able to stabilize the posture of the trunk. Then, we have experienced fastening this PSS around the body trunk leads to the improvements of breathing, gait, and some more. Fastening PSS belt also reconstructed the breathing motion due to the improved function of abdomen and thorax. These facts we previously observed suggest that the fastening PSS belts around the trunk is beneficial for patients to better perform activities of daily living. Here we here investigate the apparent effect of PSS belts on 6-minute walking distance of COPD patients, since many COPD patients have severe breakdown in the postural control function. Method The subjects were 9 patients (mean FEV1.0, 1.38 ± 0. 4 L) with COPD. The 6-minute walk test was performed when the PSS belts is not fastened and fastened put the rest of the 30 minutes, and measured ventilation pattern, and SpO2. HR monitoring were included. Also, we measured the severity of dyspnea by Bidirectional Analogue Scale (BAS). Statistical analysis was made by paired t test. Informed consent was obtained with enough explanation and written documents of agreement for experimentation. Results The 6-minute walk distance was instantly extended in the PSS belts-fastened patients than unfastened patients without substantial training ($P<0.01$). In spite of the walk distance extension, we did not observe the exacerbation of dyspnea, oxygen desaturation, increase in heart rate under fastening the PSS belts. Conclusions Results show that wearing PSS belts safely improves the working ability of COPD patients. Presumably, PSS belts reduces superfluous contraction of the back muscle and makes the standing posture upright. Thus, PSS belts apparently brings conditions for thoracic cavity and diaphragm easy to achieve respiratory function.

Sponsored Research - None



2021916

EVALUATION OF MOLECULAR SIEVE OXYGEN CONCENTRATORS AT VARYING FLOW RATES.

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Background: Long term oxygen therapy (LTOT) for patients with hypoxic chronic bronchitis and emphysema is critically important; it has been shown to positively impact longevity and reduces repeat hospital admission rates. Correspondingly, the technical performance of each device is of great import. In this study, the authors purport to evaluate the FIO2 levels of home oxygen concentrators at various flow rates from two to five liters per minute. The accuracy of the oxygen concentrator, as compared to the manufacturer's claims, was determined. Methods: The oxygen concentrators used in this study were: Invacare Perfecto 2, Respironics Everflow, Respironics Millenium, and the Airsep VisionAire. In order to simulate inhalation and exhalation, a 2010 Hans Rudolph, Inc. Series 1101 Breathing Simulator was attached to a Laerdal VitalSim® manikin using large bore corrugated tubing and two, one-way valves for isolated input and output. A new sensor was placed in a Hudson RCL galvanic fuel cell oxygen analyzer, calibrated every 15 hours to room air and 100% oxygen to measure FIO2 delivered to the carina. One nasal cannula was connected to each of the aforementioned concentrators. Baseline respiratory values were as follows: RAW 3 cm H2O/L/sec, CST 80 mL/cm H2O, Respiratory Rate 18 breaths/minute, Percent Inhale 20%, Effort Slope 4, Amplitude 23 cm H2O; these settings resulted in a Peak Inspiratory Flowrate of 60 LPM. The FIO2 was evaluated over a period of 45 hours; the FIO2 was sampled every five minutes, for 15 hours at 2, 3.5 and 5 LPM. Results: The FIO2 for each concentrator evaluated remained consistent for each flow rate, with the standard deviation of the measurements slightly more than the resolution of the oxygen analyzer, which reported oxygen percent to 1%. The reported standard deviations were equivalent to the expected detector deviation (±0.5%) and were, thus, negligible. Measured standard deviations were all less than 0.6%. Although some minor variation around the mean output was observed, it is likely that this would be clinically negligible. Results are reported in Table 1, with values expressed as the mean with the standard deviation. Conclusion: The four measured oxygen concentrators showed clinically negligible variance of delivered FIO2. It is reasonable to assume that the in-home use of oxygen concentrators is a valuable tool for the treatment of patients requiring LTOT. Disclosures: No authors have a conflict of interest.
Sponsored Research - None

	Everflo	Visionaire 5	Invacare	Millennium Respironics
Flow Rate				
2 L/Min	27.5 ± 0.5	27.6 ± 0.6	26.5 ± 0.5	27.5 ± 0.6
3.5 L/Min	33.2 ± 0.6	33.8 ± 0.6	32.9 ± 0.6	33.0 ± 0.6
5 L/Min	39.0 ± 0.7	39.8 ± 0.5	38.6 ± 0.5	39.5 ± 0.5

2022479

HIGH FLOW OXYGEN DELIVERY USING A SIMPLY MODIFICATION TO THE HAMILTON G5 VENTILATOR CIRCUIT.

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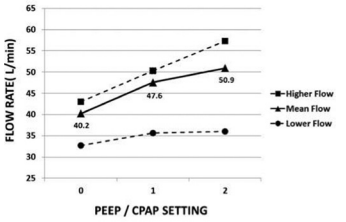
Background: The benefits of high flow oxygen therapy delivered by face mask with heated humidification are often required immediately following extubation of adult ICU patients. Using a simple modification to the Hamilton G5 ventilator circuit allows the device to be used as a high flow oxygen delivery system and eliminates the need for an additional oxygen delivery and humidification device. Method: A Fisher Pakal RT240 Evaqua ventilator circuit connected to a MR290 humidifier chamber was used with the G5 flow/pressure sensor placed at the outlet of the ventilator. All testing was performed on a single cold dry circuit. The G5 ventilator was set in the NIV mode; PEEP/CPAP settings of 0, 1, and 2 cm H2O; PS = 0; P-Ramp 25 ms; Ti-max set to 3.0 seconds; FiO2 .21 to 1.0; ETS 0.5 to 70%; Flow Trigger 0.5 to 15.0 L/min; with Low Minute Volume; Low Tidal Volume; Leak % Alarms OFF; Low Pressure Alarm = 2; Low Rate Alarm = 0; Apnea Time Alarm = 30 seconds. When configured in this manner the ventilator delivers continuous flow with brief drops in flow every 3 seconds for an average duration of 0.28 seconds at the set FiO2 with no alarms. We tested the modified system at PEEP/CPAP settings of 0, 1, and 2 cm H2O at varying FiO2, ETS %, and Flow Trigger Settings. Flow rate was measured by the ventilator flow/pressure sensor placed at the outlet of the ventilator and averaged at each PEEP/CPAP setting for all test conditions. Mean flow rate was determined by averaging the duration at the higher flow with the brief periods at the lower flow. Results: The system delivered flow rates between 32 to 43, 34 to 52, and 35 to 58 L/min at mean flow rates of 40.2, 47.6, and 50.9 L/min on PEEP/CPAP settings of 0, 1, and 2 cm H2O respectively. FiO2, ETS%, and Flow Trigger settings had minimal or no effect on the flow rates delivered. PEEP/CPAP settings above 2 cm H2O caused flow delivery to oscillate up and down which triggered low pressure and disconnect alarms. Conclusion: High flow oxygen therapy by face mask with heated humidification and adjustable FiO2 can be delivered to adult patients with this simple modification to the Hamilton G5 Ventilator in the NIV mode. Similar measurements with high flow nasal cannulas for both adult and infant applications need to be performed.
Sponsored Research - None



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2010253

PERFORMANCE OF THE SONARMED AIRWAVE IN A CONTINUOUS FLOW ENVIRONMENT: A BENCH STUDY.

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BACKGROUND: The SonarMed Airwave (SonarMed Inc, Indianapolis IN) is a device designed to provide direct, real time monitoring for displacement of an endotracheal tube (ETT), as well as monitor obstructions within the airway by utilizing acoustic reflectometry. Previous bench studies have shown this device operates as intended during conventional ventilation. It was unknown if the Airwave would function in conjunction with a non-conventional ventilator mode which utilizes high continuous flows, as seen in high frequency oscillatory ventilation (HFOV). In HFOV there is continuous bias flow of roughly 20-30 lpm. The purpose of this bench study was to see if the Airwave would operate as intended in this environment. METHOD: The Airwave monitor was placed in-line with the Sensormedics 3100B oscillator. The piston was turned off and a bias flow of 20 lpm set. Under these conditions, the Airwave monitor was unable to detect a reading. To identify specifically what flow the Airwave would cease to function, we tested it on a PB 7200 ventilator which has a user selectable bias flow rate (Flow-By). The Airwave was placed in-line with an adult circuit attached to a 7200 ventilator. This was then attached to a #8 ETT which was placed in a simulated airway made of Polyvinyl chloride and attached to a standard test lung. Initial ventilator settings were CMV, RR 12, 500 TV, PEEP 5, 40% FIO2, with flow-by turned off. The Airwave was monitored to ensure correct operation. Once this was confirmed, flow-by was turned on. We started with a flow-by base flow of 5 lpm, and increased by 1 lpm increments until the Airwave was unable to obtain a reading. RESULTS: With flow-by turned off, the device operated as designed without delays in readings. When a base flow of 5 lpm was initiated, the Airwave monitor would delay readings by 2-3 seconds, on 6 lpm it was delayed by 4 seconds, and on 7 lpm it was delayed a total of 4-8 seconds before the next reading. Once the base flow was turned to 8 lpm and above, the device would display an ongoing delay and never give a new reading. CONCLUSION: The Airwave monitoring device, with software used at the time of this testing, seems to have limitations in environments with continuous flows > 7 lpm. While most conventional ventilators that utilize continuous bias flow use flows of ≤ 2 lpm, caution should be used when a ventilator that utilizes bias flows > 7 lpm is used in conjunction with the Airwave device (Example: High Frequency Oscillator).

Sponsored Research - None

2014476

IMPACT OF SECRETION BUILD-UP WITHIN ENDOTRACHEAL TUBES ON AIRWAY RESISTANCE IN A SMALL PATIENT COHORT.

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Background: Recent studies have documented current standard of care for the removal of secretions on the inside of endotracheal tubes (ETTs) may not result in complete removal, which can lead to the build-up of secretions. The objective of this study was to determine the quantity and potential impact on airway resistance of secretion build-up on the inside of endotracheal tubes removed from patients (Test ETTs) by comparing with unused ETTs (Control ETTs). Method: Ethical considerations: The measurements conducted on the materials listed within this section were done on ETTs that had been removed from patients or on Control ETTs, and patients were not involved in study interventions or testing. A written, standardized protocol was adhered to for measurements of Test and Control ETTs. Inclusion criteria: Test ETTs were assessed if the ETT size ranged between 6.0-9.0 mm of predetermined brands, had been utilized on one type of ventilator, patient was >18 years of age, had been mechanically ventilated >24 hours, and was intubated with the same ETT >24 hours. ETTs were not utilized if they were cut shorter than the manufactured length, or if any of the inclusion criteria were not met. Measurements: The weight of secretions on the inside of ETTs was determined by weighing Test ETTs and comparing to the Control ETT weight. The difference in weight was calculated and converted to volume utilizing a standardized conversion calculation (mass/density [1.35 g/ml]=volume) to determine the volume of secretions in the Test ETT. Measurements on Test ETTs were taken within 60 minutes of extubation. Airway resistance (Raw) was calculated using the following formula: Raw (cm H2O)= (Peak Inspiratory Pressure (PIP)– Plateau Pressure (PPlat))/Flow rate L/s. Test and Control tubes were connected to one ventilator to obtain ventilator settings. Means and standard deviations are reported. Results: A total of 50 Test ETTs were analyzed and compared with 50 Control ETTs; missing data was removed from analysis. Secretion volume in Test ETTs and airway resistance for Test and Control tubes are presented in Table 1. On average, Test ETTs had 2.11 ml of secretions, and airway resistance was increased in Test ETTs. Conclusion: This small analysis of ETTs adds to the evidence that secretions on the inside of ETTs negatively impact airway resistance. Further study is needed. Disclosures: This study was supported by Sage Products, LLC. New Product Development. Sponsored Research - Disclosures: This study was supported by Sage Products, LLC. New Product Development.

Table 1. Control vs. Test ETT tube measurements

Control*	Test*	Difference
Mean weight (g) = 21.36 (SD 8.21)	Mean weight (g) = 25.21 (SD 4.49)	Mean weight of test 3.85 g heavier than control
Mean volume (ml) = 0 ml	Mean volume (ml) = 2.11	Mean volume of test 2.11 ml in excess of control
Mean PIP = 42.08 (SD 2.14)	Mean PIP= 44.12 (SD 2.89)	Mean PIP of test 2.04 greater than control
Mean PPlat = 41.14 (SD 2.30)	Mean PPlat = 41.76 (SD 5.6)	Mean PPlat of test 0.62 greater than control
Raw = 0.94 cm H20	Raw = 2.36 cm H20	Raw of test 1.42 greater than control

*In a few circumstances, electronic data entering resulted in missing data presented as a 0. Missing data were removed from the analysis.

2018220

EFFECTS OF COUGH WITH MECHANICAL ASSISTED COUGH (MAC) AND HIGH FREQUENCY CHEST WALL OSCILLATION (HFCWO) FOR AIRWAY CLEARANCE.

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Background: MAC and HFCWO are commonly used for airway clearance. We already reported that effects of cough mucus clearance on the differences of rheological property, driving pressure and frequency during HFCWO in AARC Congress 2013. In recent years, new MAC devices have been developed. The purpose of this study is to compare the effects of cough with MAC and HFCWO. Method: MAC equipment (COMFORTCOUGH™Plus,CoughAssist E70™, PEGASO™, PULSAR™) and HFCWO(SmartVest™) were compared the movement distance of the different viscoelastic mucus stimulants (MS) in tube length 1m internal diameter 1cm with varying compliance and resistance using a TTL model lung. MS were prepared using thickener 1%(purulent sputum of chronic bronchitis) and 4%(plug mucus of asthma attack). By applying a driving pressure of three 30/-30, 40/-40, 50/-50cmH2O, I time1.5sec, E time1.5sec, pause time1sec in four ways of combining 30,60 mL/cmH2O compliance, and 5,20 cmH2O/L/sec resistance. Then we measured the moving distance of MS as well as the above-mentioned method with combination of percussion mode. 20 normal subjects were also measured migration length of each MS by compressing chest strap after using 30, 40, 50 cmH2O by mask in COMFORTCOUGH™Plus and SmartVest™. Result: In the MS of 1%, the moving distance is increased as the pressure is strong in the each MAC ($p<0.05$). The COMFORTCOUGH™Plus and CoughAssist E70™, the moving distance of the MS has bought significantly greater than that of the PEGASO™ and PULSAR™($p<0.05$). The moving distance is dependent on the flow rate of the device, which are depending on resistance than compliance ($p<0.05$). On the other hand, in the MS of 4%, the moving distance was no difference due to equipment of MAC, driving pressure, the flow rate. However, the migration length was increased significantly by the combined use of percussion mode in 4% MS ($p<0.05$). The moving distance of MS in COMFORTCOUGH™Plus and SmartVest™ were significantly greater than the MAC equipment ($p<0.05$). Conclusion Moving distance of MC in the MAC equipment was dependent on airway resistance and the flow rate of the device. Not improved by increasing the flow rate and pressure to move the high sputum viscoelasticity, the combination of percussion was effective. It seemed to vibration and pressure of the rib cage during expiration was more effective than applying a negative pressure within the airway.

2018530

EFFECTS OF DIFFERENT AMOUNT OF ARTIFICIAL SECRETIONS ON THE AIRFLOW RESISTANCE OF ADULT ENDOTRACHEL TUBES.

Mufleh AlRougi, David Chang; University of South Alabama, Mobile, AL

Background: Presence of secretions in the ETT can lead to increased airway resistance and work of breathing. Clinical data are lacking regarding the relationship between amount of secretions in ETT and changes in airway resistance. The goal of this study was to measure the changes in peak inspiratory pressure (PIP) by using artificial secretions to induce airway resistance in the ETT. Methods: IRB was not required for this laboratory study. Four ETT (sizes 7, 7.5, 8 and 8.5) (KimVent®, Kimberly-Clark Health Care, Roswell, GA) were used and each ETT was connected to a Lung Model (Dual Adult TTL®, Michigan Instruments Inc., Grand Rapids, MI.) via a 7.2 inch corrugated tube and a Y-connector. All ETTs were inserted 2.5 inches into the corrugated tube, and inflated until adequate seal was achieved. The proximal end of ETTs was connected to the ventilator using an adult heated wire circuit (Hudson RCI®, Research Triangle Park, NC). The ventilator (Galileo, Hamilton Medical, Reno, NV) was calibrated and set to volume-controlled, f 12/min, VT 700 ml, FIO2 21%, and PEEP 5 cm H2O. The lung model and ventilator settings remained unchanged for all trials. All PIP readings were recorded after the ventilator delivered ten breaths. For each ETT, 4 PIP readings were recorded. The baseline reading was taken without any gel solution in the ETT. In the subsequent 3 trials, 1, 2, and 3 mL of gel solution (E-Z Lubricating Jelly, Chester Packaging, OH) were used in the ETT to mimic secretions. PIP data were obtained from the pressure manometer on the ventilator for all trials. Results: Table 1 summarizes the data collected. Conclusions: This study shows that as little as one (1) mL of secretions can have a profound effect on the airway resistance of the ETT during mechanical ventilation. Three ETT (7.5, 8, 8,5) do not show any differences in the observed PIP when no secretions are present. However, larger ETTs have the ability to mitigate the increased airway resistance due to different amounts (1, 2, and 3 mL) of secretions.

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Table 1. Peak inspiratory pressures with and without artificial secretions in 4 ETT

ETT Size	No secretions (PIP in cm H2O)	1 mL of secretions (PIP in cm H2O)	2 mL of secretions (PIP in cm H2O)	3 mL of secretions (PIP in cm H2O)	Average PIP
7	22	32	51	63	42
7.5	21	29	35	54	35
8	21	26	36	49	33
8.5	21	23	32	35	28

2018522

OPINIONS OF RESPIRATORY THERAPISTS ON THE USE OF ADHESIVE TAPE AND HOLLISTER ANCHOR FAST TUBE HOLDER FOR ETT SECUREMENT.

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BACKGROUND: Securing the endotracheal tube (ETT) is an important step following endotracheal intubation. A properly secured ETT reduces the incidence of inadvertent extubation, endobronchial intubation, airway trauma and other complications. The purpose of this study was to compare the opinions of respiratory therapists (RT) on the use of adhesive tape and the Hollister Anchor Fast tube holder for ETT securement. METHODS: Following IRB approval, an online and paper version of the survey were sent to RT to gather information on the use of adhesive tape and Hollister tube holder as ETT securement devices. The participants of this study included RT at six hospitals. At three hospitals, RT used adhesive tape to secure ETT. At the other three hospitals, the RT used Hollister Anchor Fast tube holder. The survey results were analyzed using a descriptive method. RESULTS: Fifty-four surveys (37 paper and 17 online) were received. The paper version had a response rate of 62%, and the online version had a response rate of 28%. One of the survey results showed that 75% of the RT who used Hollister tube holder were able to change the tube location (e.g., left to right) in less than 2 minutes. Among the RT using adhesive tape, 36% reported the same efficacy. Another survey result showed that 58% of the RT who used Hollister tube holder occasionally needed a second person to assist in changing the tube location. Among the RT using adhesive tape, 86% reported that they needed a second person occasionally to perform the same task. Table 1 summarizes the frequency of complications reported by RT using the Hollister tube holder and adhesive tape. CONCLUSIONS: A higher percentage of RT who used Hollister tube holder were able to change the tube location in less than 2 minutes. RT who used Hollister tube holder were less likely needing a second person to change the tube location. RT who used Hollister tube holder reported an overall lower incidence of complications than RT using the adhesive tape as the ETT securement device.

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Table 1. Frequency of complications based on the use of ETT securement device

	Adhesive tape	Hollister Anchor Fast
Skin redness	13	5
Skin break down	13	5
Lip ulceration	17	6
Unable to secure ETT due to sweaty skin	14	2
Difficulty to do mouth care due to securement device	5	2

2020074

COMPAIRISON OF ADDING A PEDIATRIC OMNI-FLEX CONNECTOR OR A SONTEK SWIVEL Y 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 (delta P). 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) or a Sontek suction safe Swivel Y (Sontek Medical, Inc, Hingham, MA) allows a degree of flexibility for circuit/patient interface. The purpose of this study was to determine if the additional of either adaptor has an effect on the delivered MAP and delta P. 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 delta P were measured with an Omni-Flex and a Swivel Y Adapter connector added to the patient circuit. MAP and delta P data was collected under three conditions: (1) without an adapter; (2) with Omni-flex in line; and (3) with a Swivel Y adapter. Mean and standard deviation were used to compare pressure differences using no adaptor versus adding the Omniflex or a Swivel adapter with a statistical significance set at $p < 0.05$. Results: There was no significant difference in proximal or distal delta P or MAP when adding an Omni-Flex adaptor or a Swivel Adapter. MAP and delta P data are represented by mean values with standard deviations and displayed in the table below: Conclusions: The addition of an Omni-flex adapter or a Swivel Y Adapter has no significant impact on measured MAP or delta P pressure.

Sponsored Research - None

Mean Pressures (SD) cm H2O	Delta P Pressures	MAP Pressures
No Adaptor	32 ± 0	15.1 ± 0.11
Omniflex Adaptor	32 ± 0	14.91 ± 0.14
Swivel Y Adaptor	32 ± 0	15.02 ± 0.03

2021833

MANUAL VERSUS MECHANICAL PERCUSSION.

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Background: Chest percussion is used to help mobilize secretions in patients who have excessive secretion production and/or secretion retention. This method can be performed mechanically or manually. The purpose of this study was to gather information related to the use and preference of the two methods from respiratory care practitioners (RCPs). Method: After receiving IRB approval, on April 17 and 18, 2014, surveys were distributed to RCPs who attended the Idaho Society for Respiratory Care Annual Educational Conference in Boise, Idaho. The host of the conference reminded each attendee to complete the survey and return it to the properly labeled receptacle by the entrance. Ninety-four RCPs attended the conference; 35 (37%) completed surveys were turned in. Results: Out of the 35 RCPs completing the survey, 30 (85%) prefer using mechanical percussion, four (11%) prefer manual percussion, and one (3%) prefers both techniques. With regards to using the two techniques in their own clinical practice, 32 (91%) report using mechanical percussion most often, two (6%) use manual percussion most often and one (3%) uses neither method more frequently than the other. Of the four RCPs who reported manual percussion being their preferred method, it is interesting to note that each of these RCPs were over the age of 50 years, have worked in the industry for more than 20 years, and three of the four were between 70-74 inches tall. The Pearson Chi Square test of independence was used to assess the potential relationship between hospital policy on manual versus mechanical percussion, therapists' preference for type of percussion, and type of percussion most frequently used. A statistically significant association was observed for all three tests ($p < .002$). There was no statistically significant association between age category, gender or years in practice and hospital policy, as well as no statistically significant difference in preference of manual versus mechanical percussion or what the person uses most in the hospital. Conclusion: RCPs, in the surrounding area, utilize and prefer to utilize mechanical percussion over manual percussion on patients who have a need for secretion mobilization. RCPs preference is likely to have driven hospital policy. Additional surveys should be completed to assess the use of mechanical versus manual percussion on a nationwide basis. Disclosures: None of the authors have a conflict of interest with industry.

Sponsored Research - None

2022305

ESTABLISHING NEW UPLANNED EXTUBATION BENCHMARK AT KING FAHAD MEDICAL CITY(KFMC).

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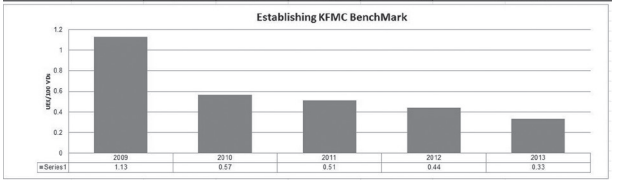
Background: Unplanned extubations (UEX) are associated with increased morbidity and even mortality in critically ill patients. A quality improvement (QI) program developed aiming to: 1) reduce the number of UEX below the international benchmark which was defined as a rate of <1 UEX per 100 ventilator days(VDs); and 2) to explore the possibility of establishing a new benchmark. Method: (Institutional review board (IRB) approval was obtained in our institution) The incidence of UEX in 6 critical care units at King Fahad Medical City (KFMC) was assessed in 384 patients with a total of 10374 VDs in 2009 and in 490 patients with a total of 13778 VDs in 2010 which revealed a significant decrease in the UEX incidence from 1.13 to 0.57 per 100 VDs (P=0.0001). Constantly, the QI program has been continued since then; the study comprised 2 periods: 1) pre-intervention (384 patients/10374 VDs; January to December 2009); and 2) post-intervention (1977 patients/55082 VDs; January to December 2010 to 2013). Results: UEX events decreased significantly from 117 (30.5% of patients) in the pre-intervention period which represent 1.13 UEX per 100 VDs to 0.57, 0.51. 0.44, and 0.33 UEX per 100 VDs in years 2010, 2011, 2012, and 2013, respectively. The lowest rate of UEX was in 2013 and the average was 0.33 UEX per 100 VDs, therefore it is considered the benchmark for UEX in our tertiary heath care institution. Conclusion: Implementation of comprehensive educational and monitoring quality improvement initiative to reduce UEX in mechanically ventilated patients at KFMC was associated with a decrease in UEX which has led to the establishment of a new benchmark at KFMC that may be shared across the globe.

Sponsored Research - None

	2009	2010	2011	2012	2013	Establishing KFMC BenchMark
	1.13	0.57	0.51	0.44	0.33	0.33UEX/100 VD



2023122

AARC ENDOTRACHEAL SUCTION CLINICAL PRACTICE GUIDELINE: IS IT IMPACTING OUR PRACTICE IN THE ICU?

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BACKGROUND: Endotracheal suctioning is considered one of the most often performed procedures in the ICU. The AARC CPG recommends adult suction pressures not to exceed -150 mmHg. We have previously reported in 2013 that this guideline is rarely followed, that suction pressures are not routinely monitored, and never documented. The results showing lack of adherence to the AARC CPG were sent via email by the director of the RT department to all RTs working in the ICU. The goal of this study was to evaluate if the practice was affected a month after the results of the previous study were communicated. METHODS: Prospective observational study at a university-affiliated hospital, in San Antonio, TX. We collected data from 18 patients admitted to the MICU and SICU who had either an endotracheal tube (ETT) or tracheostomy tube (TT) during the last week of May of 2014. We recorded the amount of negative pressure displayed in the manometer after occluding the end of the suction tubing used for airway suction. These values were compared to the recommended suction pressures and compared to the ones found the previous year. RESULTS: The mean negative pressure recorded was greater than -200 mmHg (+/- 50.3). No significant differences were observed on the suction pressure between patients with TT (p = 0.33). CONCLUSIONS: The amount of negative pressure routinely used for these patients in ICU significantly exceeded the recommended suction pressures. This practice has not significantly changed after presenting evidence of inadequate settings just few weeks ago. An educational module explaining the guidelines and reviewing all potential adverse effects of suction could potentially improve the practice of setting, monitor, and record the suction pressure used for artificial airways.

Sponsored Research - None

2016828

AN EVALUATION OF AEROSOL EXPOSURE AND OCCUPATIONAL ASTHMA IN RESPIRATORY THERAPISTS.

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BACKGROUND: Past surveys have indicated that respiratory therapists (RTs) have an increased risk of developing work-related asthma. Various theories have been investigated, but the aim of this review is to determine what contribution passive inhalation of escaped aerosol from commonly administered respiratory treatments makes to occupational asthma (OA). **METHODS:** A search of peer-reviewed articles was conducted to explore the topic. The investigation of asthma must have been physician-diagnosed after entry into the healthcare field and is referred to as reported asthma. Editorials were excluded from the search in an effort to determine what objective findings exist in current literature. Studies discussing only ribavirin or pentamidine were also excluded because of the extra precautions these known health hazards already require. **RESULTS:** The literature search yielded six articles that investigated OA in RTs. Four of these were mailed cross-sectional questionnaires conducted to determine the percentage of health care workers with OA (Table 1). Another was a review prompted by the original survey to identify potential causes of reported asthma in RTs. The author did not find enough evidence to support the claim that aerosolized bronchodilator exposure could cause asthma or bronchial hyper-responsiveness *de novo*. The other article examined plasma levels of albuterol in RTs after administration by nebulizer or metered dose inhaler. 3.7 pg/mL of *S*-albuterol could be detected after four days. Peak flow measurements remained unchanged in most participants but decreased in 3/12 subjects by an average of 30 mL. **CONCLUSIONS:** Researchers acknowledge the possibility of a relationship between chronic, low-dose aerosol exposure and development of asthma, but the mechanism is mostly thought to affect those with pre-existing asthma. Improved nebulizer designs are available that limit airborne aerosol content. However, no definitive preventative action is recommended. Still, few studies focus on this subject specifically, and more research is needed before ambient aerosol exposure is dismissed as a trivial contributor to OA among RTs. Until OA from aerosol therapy is studied more systematically, there is not enough objective evidence to support the increased unit cost of breath actuated nebulizers or expiratory filters for the delivery of aerosols not known to have health risks to the practitioner.

Sponsored Research - None

TABLE 1. Summary of findings from asthma surveys

Authors	Questionnaires Returned				Prevalence of Reported Asthma				Odds Ratio	95% CI
	RTs	*Controls*			*RTs*	*Controls*				
Kern and Frumkin, 1989	182	241 [a]	276 [b]		9.3%	1.2% [a]	1.8% [b]		4.6	2.0-10.4
Christiani and Kern, 1993	1067	684 [a]	499 [c]		7.6%	2.3% [a]	3.6% [c]		2.5	1.6-3.3
Dimich-Ward et al, 2004	275	628 [d]			6.9%	4.6% [d]			2.4	1.2-4.7
Delclos et al, 2007	879	941 [e]	968 [f]	741 [g]	5.6%	7.3% [e]	4.5% [f]	4.2% [g]	1.3	0.8-2.2

a) Physical Therapists b) Radiologic Technologists c) Physical Therapy Assistants d) Physiotherapists e) RNs f) Occupational Therapists g) MDs

2021396

CAN CARDIORESPIRATORY PERFORMANCE BE INFLUENCED BY THE LIPID PROFILE IN DIABETIC HYPERTENSIVE ELDERLY? A PARALLEL TRIAL CLINICAL STUDY.

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Background: Aging is associated with several comorbidities, including hypertension (HTN), dyslipidemia, and obesity which will increase the risk factor to develop cardiovascular disease in elderly when associated to Type 2 Diabetes Mellitus (T2DM). The aim of this study was to compare the ergospirometric test performance effects on the lipid variables from both sedentary individuals with hypertension and those with hypertension associated with T2DM. Method: It was a parallel trial clinical study, involving 40 elderly, male and female, divided into two groups: 20 sedentary hypertensive (GH; 68.50±5.85 years) and 20 sedentary diabetic-hypertensive (GDH; 68.95±6.79 years). Nutritional status; glucose and lipid controls - postprandial glucose (PPG), triglycerides (TG), total cholesterol (TC), low density lipoprotein (LDL-C), very low density lipoprotein (VLDL-C), high density lipoprotein (HDL-C), blood pressure, and cardiorespiratory performance were measured in this protocol. To statistical analysis we used the Mann-Whitney Test, Wilcoxon Test, Spearman Test and Multiple Linear Regression, considering significant $p<0.05$.The study was approved by the local Research Ethics Committee. Results: The GDH presented a lower VO2peak in comparison to GH(15.42 ±2.71 vs 19.70 ±3.44, $p<0.0001$). GDH subjects reached VO2peak in less time and this was correlated with high levels of LDL-C and diastolic blood pressure. We found correlation between VE/VCO2 and the plasma concentrations of TG, VLDL-C and HDL-C, also a lower plasma concentration of HDL-C. The Multiple Linear Regression showed that LDL and HDL cholesterol fractions were identified as the major predictors of the poor performance of these subjects. Conclusions: In this study, we found that sedentary diabetic hypertensive elderly had a poorer cardiorespiratory performance during testing. The high levels of TG, VLDL-C, and LDL-C and low HDL-C level potentiated this low performance, regardless the presence of hypertension, overweight, and sedentary lifestyle found in the whole sample studied.

Sponsored Research - None

2019356

QUALITY OF SPIROMETRY PERFORMED BY REGISTERED NURSES IN A PEDIATRIC POPULATION: EFFECTS OF AN EDUCATIONAL PROGRAM.

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Introduction: In pediatric outpatient settings, spirometry is often performed by caregivers without formal respiratory therapy or spirometry training. Consequentially, the quality of spirometry data produced is questionable and potentially lead to misinterpretation of results. The quality of spirometry data performed by registered nurses (RNs) at CCHMC outpatient satellite clinics was examined to determine the effects of an educational program focused on the proper technique of performing spirometry in a pediatric population. The quality of testing by RNs after training to respiratory therapists (RTs) experienced in pediatric spirometry was compared. Methods: From 2006–2013 all pediatric spirometry performed at CCHMC outpatient satellite clinics were examined to determine if tests met the age-adjusted criteria for acceptability and repeatability (A&R) as established by the ATS/ERS. A 6 hour educational program was developed first in 2006 and then in 2012 and provided to each RN which focused on the proper technique of performing spirometry in a pediatric population. The rates of A&R tests from RNs was determined after the completion of the educational programs and also compared to RTs who began performing spirometry at satellite clinics in 2009. Results: In 2006 prior to the educational program, 50% of spirometry performed by RNs met A&R criteria. For the ensuing two years following completion of the educational program the rate of A&R tests increased to 69% (Figure). However over the next 4 years (2008-2012) there was a steady decline in the rate of A&R spirometry to a low of 31%. After repeat education sessions in 2012, the rate of A&R spirometry increased to 56% within 1 year, before trending to rates below 50%. For all time points measured from 2009 through 2013 the percent of A&R spirometry remained higher for RTs compared to RNs with the overall average percent of A&R spirometry 80% for RTs vs. 51% for RNs. Conclusion: The percentage of spirometry meeting A&R criteria in children produced by RNs is significantly reduced compared with trained RTs. An educational intervention transiently increases the rate of A&R tests, although the percentage of tests meeting A&R criteria remains below those performed by trained RTs. These data suggest that spirometry education focused for RNs performing pediatric spirometry is effective in improving the quality of tests but likely needs to be implemented at more frequent and consistent intervals.

Sponsored Research - None

1927134

EFFECTIVENESS OF AMERICAN COLLEGE OF CHEST PHYSICIANS' INSTRUCTIONAL HANDOUT REGARDING METERED-DOSE INHALER (MDI) ON ADULT PATIENTS.

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BACKGROUND: Many patients with asthma fail to understand proper inhaler technique and frequently misuse their respiratory inhalers, indicating a need for a gold standard on education for correct inhaler technique. Training patients to properly use their inhalers could prevent emergency department visits and reduce readmission rates. However, data are necessary to demonstrate the effectiveness of educational strategies with discrete components such as inhaler technique. Thus, the purpose of this study is to determine the effectiveness of the instructional handouts for use of pMDI with or without spacer written by the American College of Chest Physicians in adult patients. METHODS: Adult patients were recruited from an urban Midwestern comprehensive allergy, asthma, and sinus outpatient clinic. Institutional review board approval was obtained. Data was collected on demographic variables, education level, MDI-technique, and inspiratory flow rates. Misuse was classified as completing < 11/14 steps correctly. Statistical analyses were performed using the chi-square test comparing pre and post misuse and inspiratory flow rates. RESULTS: A total of 24 patients were studied who used a MDI without a spacer Of these 24 patients, 9 were males, 15 were females, 12 were Caucasian, 4 were Latino, 4 were African American, 1 was Afro-Caribbean, 2 were Asian, and 1 was a Pacific Islander. The mean age was 45.1 years. There were 2 with an elementary education level; 3 with a high school degree; 2 with an associate's degree; 9 with a bachelor's degree; and 8 with a post-bachelor's degree. During pre-assessment, 11/24 misused their inhaler. After the handout was given to the patients, 4/24 misused their inhaler. None of the patients performed correct inspiratory flow rates with the InCheck DialTM on first. After receiving verbal feedback, 22/24 patients were able to perform correct inspiratory flow rates. CONCLUSION: This pilot study of adults demonstrated significant improvement in MDI technique (without a spacer), thereby, validating the effectiveness of the educational handout written by the ACCP. This study highlighted that many patients generate excessively high inspiratory flow rates when using the InCheck DialTM demonstrating the need for regular flow rate assessments. Routine assessment of inhaler technique and proper education by healthcare providers is crucial for optimum use of metered-dose inhalers.

Sponsored Research - None

2021992

EVALUATION OF A TRAINING METHOD TO IMPROVE KNOWLEDGE, SKILLS AND INCREASE THE CLINICAL USE OF PRONE POSITIONING.

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BACKGROUND Patients with acute respiratory distress syndrome (ARDS) or acute lung injury (ALI) are typically managed by mechanical ventilation. Several methods have been evaluated in an attempt to better understand best practices in the care of ARDS patients. Prone positioning may be an effective method of lung recruitment in ARDS patients. The primary aim of this study is to determine if lecture, video, and a human simulation laboratory exercises improve knowledge, confidence, and skill associated with prone positioning which may result in an increase in its clinical use. METHOD Critical care respiratory therapists, nurses, and physicians were invited to participate in pre-post test, educational interventional study that was approved by the IRB, which involved a written pre-test examination to assess knowledge and an affective evaluation to assess self-confidence administered before and after the educational intervention. The participants received instructions on prone positioning procedure through three ways: printed guideline and protocol outlining the associated policy and procedure, lecture and video demonstrating how to correctly place a patient in prone positioning, and hands-on instruction in laboratory setting using human simulation until competency is achieved. RESULTS Twenty-three subjects participated in this study. Increases were observed in written post-test scores and self-assessment confidence. The overall mean score on written pre-test was 61%. Knowledge increased following the education intervention by (37.7 %) with post-training written test score of 84%. CONCLUSION In this study, improvements in physicians, respiratory therapists, and nurses knowledge and self-confidence in human simulated prone position indicate that simulations may be an effective way to increase knowledge and confidence of health care providers.

Sponsored Research - None

2018825

PERCEPTIONS TOWARD AN INTERPROFESSIONAL EDUCATION CLINICAL ROTATION: COMPARING HEALTHCARE PROFESSION STUDENTS AND STAFF.

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Background: An interprofessional education (IPE) clinical rotation is important for healthcare profession students to be able to learn about each other's roles and responsibilities, team work and collaboration, for future clinical practice. This study captures the perceptions towards an IPE clinical rotation. Method: An IRB approved perception survey, using a 19-item Readiness for Interprofessional Learning Scale survey, was administered to 27 participants consisting of respiratory care students (n=4), nursing students (n=10), nursing staff (n=10), and respiratory care staff (n=3). Respiratory care and nursing staff were indirectly exposed to the IPE student activities, and were surveyed at the end of the student rotation. IPE clinical activities included bedside patient care, case discussion sessions, and presentations. Student surveys were completed post-IPE experiences. Staff surveys were completed at the end of all student clinical experiences. Descriptive statistical tests were used. Results: An analysis of the means across the total scale and the four sub-scales, showed various patterns. Values for the questionnaire were reverse-coded to signify 5 for strongly agree and 1 for strongly disagree. Respiratory care staff scored highest in the teamwork/collaboration (M = 4.94, SD = .111) and positive IPE perception (M = 4.92, SD = .167) subscale categories. Nursing staff data reflected the lowest means regarding teamwork/collaboration (M = 4.54, SD = .433). Nursing students showed the lowest mean score for positive IPE perception (M = 4.23, SD = .498) and self-IPE roles and responsibilities (M = 2.74, SD = .400). Respiratory care students showed the highest means related to negative IPE perception (M = 2.78, SD = 1.95), as well as having the highest mean score for self-IPE roles and responsibilities (M = 3.78, SD = 1.07) The subscales of team work/collaboration (M = 4.69, SD = .363) and positive IPE perception (M = 4.41, SD = .526) reflected highest total scores. The negative IPE perception subscale, for total (M = 1.94, SD = 1.09) was low. Conclusions: Over all, health care profession student respondents perceived interprofessional experiences as an important part of their pre-professional experience. Professional staff participants showed that teamwork and collaboration are important to clinical practice. Follow-up surveys are needed to track changes in perceptions.

Sponsored Research - None

1929482

IMPROVING THE DELIVERY OF ASTHMA EDUCATION TO PARENTS OF YOUNG CHILDREN.

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Background: Asthma education is a source of information pertinent to proper asthma management. Parental or caregiver comprehension is necessary to help utilize the education effectively and properly manage a child's asthma. In this study, parental concerns were explored in order to better engage parents in asthma education. Methods: Approval was obtained by an IRB to conduct a semi-structured interview with parents and caregivers of children with asthma at an urban youth center. Caregivers answered questions related to asthma and its management. A questionnaire was given to each participant prior to the discussion to obtain demographic information. Questions pertaining to their child's asthma were asked and the discussion was audio-recorded, transcribed, and coded into common themes. Results: Five major themes emerged from the focus group discussion: environmental triggers, asthma self-management, emotional responses to emergency situation, and education delivery. Overall there was a unanimous response of fear and anxiety during emergency situations as well as confusions about the actions of medications and the proper administration. Conclusions: Parents and caregivers in this study faced similar adversities as in prior research such as exposure to tobacco smoke, feeling fear and anxiety during an asthma related emergency, inappropriate uses of asthma medication, and not properly utilizing an asthma action plan. Awareness of these common themes can help asthma educators develop effective curricula to better educate parents of children with asthma.

Sponsored Research - None

1965626

THE UTILIZATION OF A RESOURCE ALGORITHM TO ENHANCE DEPARTMENTAL COMMUNICATIONS.

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Fluctuating workloads, changing patient acuity, and staffing patterns requires precise and proper communication. It is unrealistic to expect departmental leadership to be in-house twenty-four hours a day to address questions or alter workload assignments. Historically, staff was obligated to make front-line decisions, often without proper guidance and/or global insight. Clinical management of difficult patients would then be limited to in-house staff's clinical experiences. Often the proper resource was not contacted to assist in the problem resolution. Advanced technological interventions were delayed until departmental leadership was in-house. Equipment issues were often pushed aside until leadership was available. All of these things often led to staff frustration and confusion. To combat these issues, our department developed an on-call resource algorithm (Fig 1). Our algorithm addresses administrative, technological, and clinical management issues in order for the in-house staff to promptly contact the appropriate on-call leader. All staff charge therapists were provided education and process information on the utilization of the algorithm. Staff feedback was encouraged and questions were answered. Figure 1: Post implementation of the resource algorithm revealed that the departmental communication was enhanced for staff. Questions were directed to the appropriate departmental leadership and answered in a timely and efficient manner. Staff is now working in a more efficient manner and is less frustrated and confused. Clinical management and technological interventions are now maintained twenty-hours a day.

Sponsored Research - None

1993417

WE HAVE SO MUCH MORE TO GIVE! EXPANDING THE RESPIRATORY THERAPIST'S ROLE TO INCLUDE CLINICAL RESEARCH RESPONSIBILITIES.

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INTRODUCTION: Traditional respiratory research has been narrow-focused and limited in its scope. Innovation and adaptation is the cornerstone of respiratory care. With these tenents in mind, a unique, innovative opportunity for respiratory therapists (RT) was developed for the Pediatric Emergency Department. We developed a program encompassing two dedicated Respiratory Clinical Research Associate (CRA) positions in a program dedicated to a multidisciplinary and multi-specialty approach to research opportunities in the Emergency Room (ER). Located in the ER, these CRAs are responsible for selected clinical research study activities, and serve as a resource for research study participants, families, and other healthcare providers. CRAs assist in protocol writing, IRB submissions, Consent/Assent of subjects and data collection and management. The CRAs actively screen patients in the ER for ongoing research at our institution. This project was to see if other hospitals around the nation were utilizing respiratory therapists (RTs) in a similar fashion. **METHODS:** To evaluate the hospitals, a survey was conducted (4/10/14-5/9/14) containing 8 questions (3- Yes/No, 4- Likert Scale, 1- open ended). After administrative review, the IRB determined the project not human subject research. The study was sent to members of the Children's Hospital Association listserv as well as posted with permission on the AARConnect Management and Neonatal/Pediatrics section boards. This anonymous survey was built in the REDCap secure database. **RESULTS:** Out of 102 survey responses, only 27% (28/102) said that their institution has a RT in a specific research role, and 32% (33/102) say that RT participates in research out of the RT department. 38% (39/102) responded that they participate in IRB processes, and 29% (30/102) are a part of the Consent/Assent process in research. However, only 15.6% (16/102) state they actively screen and recruit patients from the ER. **CONCLUSION:** In these uncertain economic times, there has been discussion nationally on how to stay relevant as RTs. Institutions should consider hiring RTs to fill research roles. RTs are critical thinkers that can perform a variety of tasks outside the traditional field of Respiratory Therapy. A career in interdisciplinary research can increase RT employee satisfaction and job longevity by offering fresh and exciting opportunities for growth, and busy ERs with long wait times are perfect venues for research recruitment.

Sponsored Research - None

2005137

USE OF SECURED MEDICATION BOXES IN GENERAL CARE REDUCES RT TIME AND ENHANCES EFFICIENCY ASSOCIATED WITH BRONCHODILATOR AND INHALED CORTICOSTEROID ADMINISTRATION.

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Background: TJC requires hospitals to secure medications (meds) until ready for use. RTs and RNs access meds through Pyxis at MWHC. The number of providers needing access simultaneously can cause a delay in med withdrawal. Our goal was to study methods to enhance the efficiency of RT med administration in general care (GC) using LEAN methods for waste elimination. Methods: Data were extracted from our electronic medical record (EMR) to calculate the number of meds provided in GC the previous year, along with data on scanning rates linked to the patient medication administration record to prevent errors. We also conducted a study of RT med delivery in GC, through 100 random staff observations using the "Time Observation Sheet" to identify detailed task descriptions. Using this data, we developed a process map which revealed the sequential steps and areas of inefficient time management. We then traveled to 3 hospitals in our Solucient compare group to determine related best practices, and found the use of a secured med box. A "Value Stream Work Plan" using a secured med box carried by the RT in lieu of Pyxis access was created, with objectives for streamlining and standardizing work. This initiative was approved by pharmacy in accordance with DC regulatory requirements. The program was pilot studied on 1 GC unit with follow-up staff observations, then implemented house wide. This study qualified for an IRB waiver as it was considered process improvement. Results: Results of our observational study and process map showed the root cause of inefficiency was wait time at the Pyxis. In 2012 the GC RT made 42,000 visits/y to the Pyxis to obtain meds averaging 3.5 ± 1.2 min/visit. In addition, there were 14,000 visits to return meds, averaging 1.5 ± .6 min/visit. Total time spent at Pyxis was 2,800 h/y in GC. Following process modification, this time was reduced to 7.4 ± 1.5 s per patient which totaled 86.3 h/y. Total FTE hours at MWHC minus vacation and holidays were calculated at 1840 h, which was then divided into 2,714 h (2800-86) for a savings of 1.47 FTEs. EMR reports revealed a compliance rate of 98% for scanning the patient armband and med to prevent administration errors at the time of delivery. Anecdotally, RTs relayed less frustration with the elimination of Pyxis wait time. Conclusion: We enhanced RT efficiency in GC by improving medication access and delivery using LEAN. This change led to an equivalent hourly savings of 1.47 FTEs.

Sponsored Research - None

2006596

CREATING A TEMPORARY RESPIRATORY WORKFORCE COMPRISED OF NEW RESPIRATORY THERAPY GRADUATES: IS IT SAFE AND ARE THERE HIDDEN BENEFITS?

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Traditional temporary respiratory work pools consist of respiratory therapists of varying experience and work requirements. Staffing shortages in our hospitals were common place, resulting in potentially dangerous heavy workloads and a high utilization of overtime. A solution was to take the local respiratory school new graduates and incorporate a large percentage of them into a staffing flex pool. These respiratory therapists were hired into a hospital flex staffing pool called Meduflex and were given an 8 week orientation. Patient safety was the top concern due to the new graduates' lack of experience. The pool was created in April 2011 and included 9 initial graduates and has had a total of 31 new graduates as of this writing. Results showed no increase in sentinel events and a 40% decrease in overtime (monthly average CY 2012). Quality metrics improved in CY 2012 with a reported decrease in ventilator day utilization by 9% (measured by ventilator-dependent patient days per ventilator patients; UHC median decrease 3%). Total expense per ventilator-dependent patient days decreased by 4% from $263 to $254 (UHC median decreased 1% from $379 to $374) during CY 2012. Additional benefits for discussion included: increased scheduling creativity to increase staffing during peak workload volume period and improved employee satisfaction as the Meduflex respiratory therapists were the ones that would instead of the non-temporary employees. A positive culture change towards more unity was noted as Meduflex respiratory therapy staff frequented all 3 patient towers. There was a decrease in resources required for the orientation of full-time hires as the full-time positions were filled with the top Meduflex respiratory therapy candidates, and conversely when Meduflex staff were not meeting expectations it was not difficult to terminate the relationship. Because the Meduflex staff was new to the field, they seemed far less biased against the changing health care environment. Their adaptability also allowed them to be more open-minded to instruction and constructive criticism and assisted in their development of being a more conscientious therapist that was willing to go where needed with a positive attitude.. Conclusion: Building a temporary respiratory therapy work pool of new graduates was not only safe but successful in reducing overtime hours, improving morale, and helped the hospital's respiratory department improve quality.

Sponsored Research - None

2007075

THE RISK AND RELATED FACTORS OF MECHANICALLY VENTILATED PATIENTS READMITTED TO THE INTENSIVE CARE UNIT WITHIN SEVEN DAYS – A NATIONWIDE POPULATION-BASED COHORT STUDY.

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Background: Mechanically ventilated patients readmitted to the intensive care unit (ICU) within seven days, involved not only patient safety but also the quality of care in the ICU. This study aimed to investigate the risk and related factors of mechanically ventilated patients readmitted to the ICU within seven days. Method: By using a population-based database from Taiwan National Health Insurance Research Database (NHIRD), we analyzed the study cohort who were mechanically ventilated patients aged ^17 years and discharged from the ICU within seven days between January 1, 2005 and December 31, 2011. A total of 658,452 patients were discharged from the ICU. The logistic regression model with GEE approach was used to explore the probability and related factors of the mechanically ventilated patients readmitted to the ICU within seven days. This study was approved by the ethics committee of the Yuan's General Hospital Results: The ratio of study subjects transferred to the general ward (GW), respiratory care center (RCC), respiratory care ward (RCW), and home respiratory care (HRC) was 90.45%, 7.13%, 2.36 %, and 0.06 %, respectively. A total of 29,657 patients were readmitted to the ICU within 7 days. The total readmission rate was 4.5 %, while the GW, RCC, RCW and HRC readmission rate was 3.32%, 13.42%, 23.03%, and 5.24 %, respectively. There were 64.77% patients with the same diagnosis as before while returning to the ICU within seven days. The results of GEE logistic regression model showed that women, older age, higher comorbidity score, complications (e.g. pneumothorax, subcutaneous emphysema, pneumonia, oxygen toxicity, pulmonary embolism, pulmonary edema), ICU in private hospitals, ICU days ≥ 21 days, transferred to RCC and RCW, next turn to the regional or district hospital as well as the Central division of NHI Administration (NHIA) had a higher risk of readmission. Conclusions: Among the mechanically ventilated patients aged ^17 years and readmitted to the ICU within seven days, the risk and related factors included patient characteristics, disease status, hospital attributes, the division of NHIA, and the length of ICU stay. Therefore, the clinicians should pay attention to the higher risk patients and assess carefully before transferred or discharged from the ICU to prevent readmission. Keywords: mechanically ventilated patients, ICU, ICU readmission, respiratory care center, respiratory care ward

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2014907

RESPIRATORY THERAPISTS' PERCEPTION ON THE ADMINISTRATIVE FUNCTIONS OF THEIR JOB.

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BACKGROUND Research suggests that attempts to control healthcare costs and enhance quality may result in unintended consequences — increased administrative burden on clinicians, thereby decreased their satisfaction (Arfken, 2006; Cook, 2013; Lemak, 2003; Luzzi & Spencer, 2011). Studies of healthcare workers identify the level of administrative burden as a major predictor of provider dissatisfaction, and may compromise the quality of patient care (Mache, 2011). Through an on-line survey, this study sought to take an initial step in studying the links between changing administrative requirements, provider satisfaction and quality of patient care by examining the perceptions of changing administrative workload among respiratory therapists in New Jersey. The primary goal of this study was to explore attitudinal patterns of respiratory therapists with respect to changes in administrative duties and overall workload. The focus is to document perceived changes in documentation, indirect patient care, and organizational accommodation. The results of the study will be used to contribute to a small but growing body of knowledge about trends in administrative functions for clinicians such as respiratory therapists. MATERIALS AND METHODS An on-line survey was provided through an online link to Redcap. Redcap allowed for: secure transmission, anonymity, informed consent, other important logistics of this study. The targeted sample population was approximately 3,500 licensed respiratory therapists in the state of New Jersey. A response rate 7% or 245 survey responses were obtained. The results were analyzed using SPSS software. RESULTS 55% of respondents indicated that time spent on computerized documentation was much greater currently, than five years ago. Additionally, respondents showed a significant increase in their perception of overall time spent on all indirect patient care activities. The largest proportion of respondents "strongly disagree" that their organization has been effective in maximizing time spent with patients. This research study helps us to begin to understand changes in workload for respiratory therapists and multifaceted issues potentially associated with such changes. When combined with similar, but more robust studies, the collective results may be beneficial in optimizing clinical efficiency, effectiveness and job satisfaction.

Sponsored Research - None

2015033

SUSTAINING RESPIRATORY THERAPIST ENGAGEMENT IN ICU LIBERATION.

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Background: The Society for Critical Care Medicine (SCCM) has developed a guideline for the management of pain, agitation, and delirium in patients in the Intensive Care Unit. This guideline was based on evidence that critically ill patients are at risk for development of delirium. The Respiratory Therapy departments in our hospital system implemented an interprofessional bundle approach to reduce this adverse event. Initially the Respiratory Therapists identified barriers including workload and productivity concerns, fear of patient discomfort and asynchrony, and fear of inadvertent extubation during awakening and mobility. Once those barriers were overcome with a variety of techniques, the department had to persistently ensure that the engagement of the staff was sustained. Methods: Upon implementation of the ICU Liberation bundle work was done to overcome barriers and maintain staff engagement. To sustain the work, ongoing techniques were required to ensure bundle elements were performed daily as part of the standard work of the Respiratory Therapists. Interprofessional team education was provided to staff at the beginning of the project and the use of these skills was monitored during daily ICU rounds. We scheduled RT and nursing team leaders to monitor rounds to ensure the team utilized standardized order sets and procedures to promote best practices such as delirium assessments, correct medication selection, daily awakening and spontaneous breathing trials and early mobility. We tracked ventilator length of stay (LOS), ICU LOS, ICU mortality, 6-month post discharge mortality, ventilator LOS greater than 7 days, and all or nothing bundle compliance data. Results: Four months into full implementation, daily rounds are occurring, standardized scales are used to assess delirium and sedation levels, daily SAT and SBT's are being performed and patients who meet safety criteria are being mobilized. Patients are more awake and participating in ventilator weaning trials and mobilization. Ventilator LOS has decreased with no increase in re-intubation rate. 6-month post discharge mortality rates are reduced from 11.2% to 2.9%. Conclusion: The ICU Liberation bundle is being sustained with improved clinical outcomes. Management, informal clinical leaders and staff worked together to remove barriers, maintain staff engagement which was critical to sustaining our work. Further study is needed to assess long term outcomes and compliance with the bundle.

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2017898

PUTTING MECHANISIMS IN PLACE TO REDUCE OVERTIME.

Jenifer Graves, Tom Bell, Jessica LoneElk, Marcia Teal, Ernest Jones, Trista Kallis, Garner II Faulkner; Respiratory Care, UC San Diego Health System, San Diego, CA

BACKGROUND: UC San Diego Health System Overtime (OT) Reports showed that the Respiratory Care Departments had a total of 1880.6 hours of OT for Fiscal Year 2013 – 2014. 41% were accrued at .25 hours increments, 15% at 4 hour increments, 9% .5 hour, 3% .75 hour, 3% 1 hour, 2% 8 hour, 2% 12 hour and the remaining 25% by all other increments. We looked at ways to reduce unnecessary OT. METHOD: We created a log to track all OT and to include the reason why. Per hospital policy, staff is permitted to clock in up to 7 minutes late, 3 times in a calendar month before, they receive a tardy. So we created a way to track this "grace period late" by using our scheduling and the time keeping system. RESULTS: Using the OT log allows us to determine which employees are routinely accruing OT and need to receive feedback. We determined that a significant portion of the .25 increments were created when the oncoming shift was late receiving report thus causing the departing shift to be late clocking out. We believe the 41% of .25 hour increments of OT can be greatly reduced with feedback and counselling for late arrivals as well as for charting and time management. We have also been able to determine that the majority of our 4 hour increments of OT are from day shift staff working an additional 4 hours to help the night shift for either increased workloads or sick calls. To address this we added a 4 hour PM flex shift. Using our newest per diem employees, to work weekend shifts and PM flex shifts, will reduce the number of 4 hour increments of OT. CONCLUSIONS: The nature of our business with patient transports, trauma admits, rapid responses and code blue calls often happening at shift change OT is inevitable and can never be completely eliminated. We are showing that the mechanisms we have put in place will reduce unnecessary OT.

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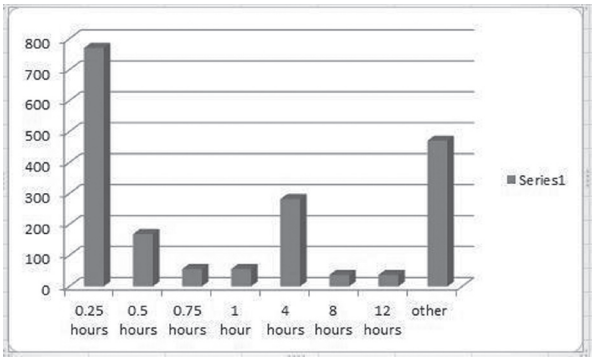

2019035

QUALITY IMPROVEMENT PROJECT MEDICAL EMERGENCY EQUIPMENT BAG EXCHANGE POLICY: CHECK-IN OR CARRY-ON?

Tammy Schultz, Nancy Back, Cory Brotzel, LuAnn Budahn, Kari Erickson, Michael Erickson, Mary Hall, Betty Knutson, Erin Nelson, Christopher Pike, Janet Weber, Grant Wilson, John Wheeler; Respiratory Care, Mayo Clinic, Rochester, MN

Background: The Medical Emergency Team (MET) within the department of Respiratory Care at the Mayo Clinic noted problems with reliable and consistent medical emergency equipment taken to Non-Intensive Care Unit (Non-ICU) emergency codes. Through quality checks the medical emergency equipment was found to have a 50% accuracy rate (23 defects throughout 8 bags/ 4 out of 8 bags were stocked correctly). Quarterly quality checks showed our medical emergency equipment bags had a number of defects when it came to expired, overstocked, and missing equipment making our most needed equipment unreliable. Method: A multidisciplinary team was formed consisting of Respiratory Assistants, Respiratory Therapists, and department Supervisors. Two quality improvement methods used were the DMAIC steps (define, measure, analyze, improve, and control) and Lean process. Meetings were held to gather diverse input from stakeholders, encourage creativity, and organize ideas. Our goal was to increase our quality level, decrease the number of defects, eliminating waste, and decrease cost in all of our Non-ICU medical emergency equipment bags. Results: The decision was made to standardize all medical emergency equipment bags. A red hard shell suitcase for easy cleaning was chosen. Contents of bags were organized into 4 smaller colored compartments depending on frequency of use. Breakable locking tabs were placed on each of the compartments and on the outside of the medical emergency equipment bag indicating the bag was ready for use. Our Respiratory Assistants radiate a diversity of skill when it comes to equipment and those strengths took over maintaining and stocking the medical emergency equipment bags from the Respiratory Therapists. We increased our number of medical emergency equipment bags to 13 allowing an opened bag to be reprocessed and exchanged promptly. A medical emergency equipment bag exchange policy was written to clarify responsibility between Respiratory Therapists and Respiratory Assistants. Conclusion: Our first quality improvement check showed an 83% accuracy rate (2 defects throughout 13 bags/ 11 out of 13 bags were stocked correctly). We were able to increase quality, reliability, and improve our medical emergency equipment bags in Non-ICU areas by using a methodology approach of DMAIC and Lean. Continuing quarterly quality checks and education will be used to sustain our progress and improve our standards.

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2019371

MANAGING FOR DAILY IMPROVEMENT: 6 SAFETY ELEMENTS FOR THE CARE OF PATIENTS WITH A TRACHEOSTOMY OR LARYNGECTOMY.

Kathleen Spihlman, Lisa M. Cracchiolo, Donna Clayton, Darnetta Clinkscale, Jason Domachowski, Mark Jackson, Robin Kidder, Ron Aboudnader, John Pace, Patty Silver, Peggy Watts, Linda Weems; Barnes Jewish Hospital, St. Louis, MO, MO

Background: Review of events and discussion with team members caring for patients with a tracheostomy or laryngectomy prompted the development of a multi-disciplinary team, which included Respiratory Care Services. This team developed a new patient safety, quality and improvement initiative. In addition, Respiratory Care Services developed an evaluation tool for monitoring and sustainment of the initiative. The design of the tool utilizes the Lean concept of Managing for Daily Improvement (MDI). Method: Based on our assessment, six elements were identified as essential for providing an environment for safe care in this patient population. A daily report was created within the electronic medical record to identify new "trach" patients within the hospital. This report captures patients admitted with a tracheostomy or laryngectomy and those patients who had these procedures within the previous 24 hour period. Per our standard work, a supervisor rounds, assesses and evaluates patients for the following 6 elements: 1. Documentation of stoma or trach type and size 2. Emergency algorithm and airway emergency signs posted at the head of the bed 3. Additional tracheostomy tubes at bedside (1 of the same size, 1 size smaller) 4. Humidified HHTC (Heated Humidified Trach Collar) 5. Resuscitation bag and mask at bedside 6. Suction equipment and supplies If any of the six elements are missing, the rounding supervisor together with the nurse retrieves and places item(s) in the room. The missing items are documented on the MDI board located in the Respiratory Care department. A Prato Chart is used to identify the missing items and the nursing divisions with occurrences. The team conducts MDI rounds every Tuesday at 11:15 to discuss defects and actions required for improvement. Results: Since the implementation of daily rounding in October 2013, there have been 2018 audits conducted. Of the 2018 audits, 141 items were identified as missing from the patient room during these inspections (total defect of 7.0%). During the first 16 weeks of audits we averaged 6 missing items per week and have reduced that to an average of 2 missing items per week with a continued goal of no missing items at bedside. Since the inception of this initiative, there has been zero safety events reported. Conclusion: The tracheostomy and laryngectomy audit has ensured safe quality care that meets this complicated patient population needs, and requires a team approach for success.

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2019515

THE KENTUCKY CHILDREN'S HOSPITAL NICU RESPIRATORY WORKGROUP: RESULTS FROM A MULTIDISCIPLINARY TEAM LED BY AN RT/ MD DYAD.

Lisa V. Wright, Hubert Ballard, Lori Shook; UK HealthCare, Kentucky Children's Hospital, Lexington, KY

Introduction: The Kentucky Children's Hospital (KCH) NICU Respiratory Workgroup (RWG) is a multidisciplinary group established in 2011 with the mission to improve the respiratory outcomes of NICU patients. The RWG is co-led by an attending and a respiratory therapy supervisor. The MD/RT dyad leadership model has been an instrumental factor in enabling this group to promote multidisciplinary standardization of care, augment RT utility in the NICU and fundamentally change unit practices with demonstrable improvement in patient outcomes. The KCH NICU has seen a 22% reduction in the rate of chronic lung disease in babies born <1500 grams over two years. Case Summary: The RWG uses Vermont Oxford data and practices of top performers to determine what directions to take to improve respiratory outcomes. Root cause analyses using a standardized form are done for all patients discharged with chronic lung disease. The group implemented numerous protocols and guidelines applicable to respiratory care in both the NICU and delivery room. Practice changes deliberately defined an enhanced scope of practice for the RT and successfully led to an increase in respiratory therapy FTE allocation for the NICU. The NICU shifted towards using more Bubble CPAP and NIPPV and away from high flow nasal cannula use (see table). Time till first extubation was reduced by 50% with an extubation success rate for all NICU patients of 86%. 23% of babies born less than 1500 grams are never intubated. Other practice changes resulted in a 50% reduction in the unplanned extubation rate. The leadership dyad maintains a scorecard for tracking project progress. The scorecard includes monthly QA/QI measures related to each of the projects the workgroup has been involved with as well as patient outcome data. Discussion: The value of multidisciplinary involvement in process and performance improvement cannot be stressed enough. The dyad leadership structure provides different spheres of influence and aids in better coordination of the multidisciplinary teams. The physician leader and the RT leader offer new perspectives not only to each other but also to the different groups on the teams. It also provides two sets of eyes on the group dynamics and allows potential problems to be averted. The mutual trust and respect that the MD and RT leaders have for each other has also been of significant importance in making a dyad leadership structure a driving force behind the success of the KCH NICU RWG.

Sponsored Research - None

2022491

THE USE OF AUTOMATED SCHEDULING SOFTWARE IMPROVES SCHEDULING INTEGRITY: MD ANDERSON DEPARTMENT OF RESPIRATORY SERVICES.

Clarence Finch, Reena Nathaniel; Respiratory, MD Anderson Cancer Center, Houston, TX

INTRODUCTION Automated scheduling allows staffing flexibility without the need of management intervention and relieves internal stresses often associated with work schedules. In September 2013 the Respiratory Department implemented OpenTempo, an automated staff scheduling system, to reduce schedule build time, increase transparency, and provide business intelligence data. CASE SUMMARY The Department of Respiratory Services consist of 80 respiratory therapists who are also part of the larger Department of Anesthesiology, which first implemented automated scheduling in spring of 2013. The department deployed a flexible staffing model in 2010 to allow staff to choose their work schedule based on a selection of management-defined rules. A basic Excel spreadsheet was used to enter workdays, followed by management's oversight to ensure the set rules were consistently applied. Likewise, this method required a large portion of time spent negotiating swaps, approving vacation time and ensuring those assigned possessed the appropriate skill level. Building a schedule while allowing a self-scheduling approach took upwards of 4 weeks to complete. Since implementing automated scheduling, schedules are now built in 3 days, with all rules easily applied and no management intervention needed to enforce them. The new method keeps a record of every request made for time off or swaps, which has increased transparency and reduced mistrust. As a result, we have seen a 20% improvement on an employee opinion survey regarding flexible scheduling. Gen X and Millennials especially like having a say in their schedule and really appreciate the flexibility. The new method also provides necessary business intelligence data. A Group Balance Report shows targeted vs. actual staffing quotas and skill mix. Providers are alerted when licenses are about to expire, and the system also aligns with Kronos so staff can see how many PTO hours they have left. DISCUSSION With automated scheduling, the department is now able to build schedules faster, free up the leadership team, and reduce staff mistrust. Staffing appropriateness has improved and trend data are able to be analyzed. Future goals include improving provider communication by implementing the mobile scheduling app.

Sponsored Research - None

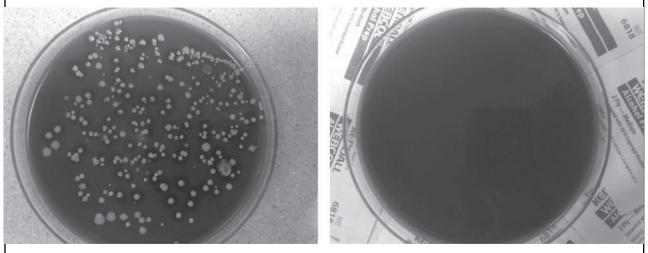
2020020

CAN A COMMON TOOL USED FOR PATIENT ASSESSMENT BE A CULPRIT FOR HEALTHCARE ASSOCIATED INFECTIONS?

Daniel S. Hujar; Respiratory Care, Rex Healthcare, Raleigh, NC

Background: Patients are at risk for infections. Stethoscopes used for patient assessment can be a cause. Method: I studied the growth of cultures from stethoscopes used by all types of healthcare workers at a community hospital. The results prompted me to do a second study comparing a simple cleaning technique. The first study was completed during a Respiratory Care Week celebration. Staff at the local hospital was asked if they would like their stethoscopes cultured for a project. Various Healthcare workers including Respiratory Therapists, Nurses and Physicians volunteered to have their scope swabbed. These swabs were plated on chocolate agar and incubated for 36 hours. Photographs were taken of the cultures. That study prompted a second study looking at a simple solution to reduce the number of organisms grown on a stethoscope. Randomly utilizing several areas of the community hospital, including the intensive care units, medical- surgical units and the emergency department, the staff was again engaged to participate by swabbing their stethoscope and then it was plated. They were instructed to clean their scope with a common 70% isopropyl alcohol swab. The scope was allowed to dry. They were swabbed again and plated. These plates were identified in pairs and incubated for 36 hours. Photographs were taken of the cultures. Comparison of the plates took place. Results: Of the initial 40 stethoscopes that were cultured, 100% of the scopes grew organisms. These cultures were not identified by Microbiology. (Microbiology was not involved with this study.) The second study compared the growth of cultures before and after cleaning. 9 of the 10 stethoscopes showed significant reduction of organisms and growth after the alcohol cleaning. A poster and power point discussion was developed and distributed throughout the hospital to encourage simple cleaning of personal stethoscopes. Conclusions: This study concludes that a simple cleaning with an alcohol swab that is readily available within the hospital to all staff members may be able to reduce the potential cross-contamination or Health Care Associated infections that pose risks to our patients. Limitations: Low sample size.

Sponsored Research - None



Subject 5. Study 2 - after 70% Isopropyl Alcohol

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