UTILIZATION OF ANCHOR FAST ORAL ENDOTRACHEAL TUBE FASTENER TO REDUCE THE INCIDENCE OF LIP ULCERS.

Kenneth J. Miller, Linda Cornman, Chris Fenstermaker, Angela Lutz, Diane Limoge, Georigiann Morgan, Hungarter Donna; Respiratory care, LVHN, Allentown, PA

Introduction: Endotracheal intubation is a common clinical intervention in the critical care environment. Unfortunately, endotracheal intubation is not without complications, even when instituted with expertise and diligently maintained. One of the complications of endotracheal intubation is the development of lip ulcerations secondary to maintaining a patent and secure airway. The development of a lip ulcers has been identified as both a patient safety issue and added financial burden. Another issue with endotracheal tube security is the time requirements placed on the clinical team to change and re-apply endotracheal tube fasteners or tape. Methods: Anchor Faster Endotracheal Tube Fastener (Hollister, Illinois, USA) was utilized to maintain a secure airway on sixteen patients placed on mechanical ventilation over an eight week period. Criteria for utilization were any patient with an anticipated intubation and mechanical ventilation for greater than twenty-four hours. The incidence of lip ulcers and the number of times the endotracheal tube was moved were recorded. Below is the pre/post-Anchor Fast data: Post Anchor Fast data is noted in bold text: Results: After institution of the Anchor Faster Endotracheal Tube Fastener, there was a 25-82% reduction in the occurrence of lip ulcers in the assigned patient population. Incidence of Ventilator-Associated Pneumonias and ventilator days remained unchanged. There was a trend towards a reduction of tape changes, with an associated decrease of clinician time devoted to changing tape. There was no increase of inadvertent or accidental extubations. Conclusion: Based our clinical trial the Anchor Faster Endotracheal Tube Fastener is a safe alternative to securing an artificial airway. In this pilot study there was a reduction of lip ulcers with no increase of accidental extubation or Ventilator-Associated Pneumonia. Also the application of the Anchor Faster Endotracheal Tube Fastener may reduce clinician time utilized to re-adjust or re-apply endotracheal holders or adhesive. More research needs to be applied to a larger patient population to support the above results.

Sponsored Research - None

Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
VAP	0	0	0	0	0	0	0	0	0	0	0	0
Lip Ulcers	2	2	2	2	1	4	1	3	2	0	1	0
Tape Changes	54	41	77	89	71	72	71	76	75	57	40	38
Vent Days	186	158	183	212	202	175	158	163	205	189	109	177

621503

EVALUATION OF OPTIMAL EXTUBATION SETTINGS FOR PATIENTS WITH SEVERE BRONCHOPULMONARY DYSPLASIA.

Brandon Kuehne[1], Daniel Baird[1], Edward Shepherd[2]; [1]Neonatal Respiratory Care, Nationwide Children's Hospital, Columbus, OH; [2]Department of Neonatology, Nationwide Children's Hospital, Columbus, OH

Background Extubating patients with bronchopulmonary dysplasia (BPD) from mechanical ventilation is often difficult. There is little data in the literature to predict successful extubation in this group. The Comprehensive Center for Bronchopulmonary Dysplasia (CCBPD) is a chronic care facility focused on infants with BPD and has significant experience extubating such patients. Objective: Our objective is to review all planned attempts to extubate patients with severe BPD and to determine if any pre-extubation clinical variables or ventilator settings are associated with greater rates of success. Methods A chart review of planned extubation attempts in our CCBPD unit over a time period of 18 months was performed. We recorded standard clinical and demographic data, including corrected gestational age (CGA), patient weight at extubation, history of necrotizing enterocolitis (NEC), interventricular hemorrhage (IVH), and ventilator settings prior to extubation. We then compared clinical data between those successfully extubated and those reintubated using single factor analysis of variation (ANOVA). We defined successful extubation attempts as avoiding the need to intubate for at least 72 hours. Informal unit guidelines suggested achieving a level of 40% FIO2 or below before a planned extubation was attempted. Results Data was analyzed for 37 planned extubations involving a total of 26 patients. Twenty-seven attempts were successful (73 %). There were no statistically significant differences between successfully and unsuccessfully extubated groups in CGA (p=0.563), FIO2 (p=0.2155), PEEP (p=0.3941), or RR (p=0.108), however there was a statistically significant association between lower PIP (p=0.0237), weight at extubation (p=0.0434), MAP (p=0.032), and I.Time (p=0.0485) for successful extubations. Conclusions This study suggests that the ventilator parameters of PIP, MAP, and I.Time, as well as weight at extubation, are statistically associated with successful extubations in patients with severe BPD. Moreover, patient demographics such as CGA, history of NEC and/or IVH did not seem to predict success. Notably, this study does demonstrate that patients with severe BPD can be extubated successfully from very high ventilator settings.

Sponsored Research - None

Ventilator Settings at Extubation

Ventilator Paramenter	Successful Extubation Attempt	Failed Extubation Attempt
PIP cm H2O	38.29	44.0
PEEP cm H2O	7.33	7.6
Respiratory Rate Breaths per Minute	16.59	15.0
I-Time seconds	0.61	0.67
Mean Airway Pressure cm H2O	12.42	13.15
FIO2 %	37.37	42.77

642427

RADIOGRAPHIC COMPARISON OF ENDOTRACHEAL TUBE VISUALIZATION.

Frank M. Freihaut[1], Randeep S. Jawa[2]; [1]Respiratory Care, The Nebraska Medical Center, Omaha, NE; [2]Surgery, University of Nebraska Medical Center, Omaha, NE

Background: Critical Care physicians at a 700 bed tertiary care medical center expressed concerns regarding the ability to visualize endotracheal tube (ETT) placement on chest radiographs. Radiographic images are viewed via a Picture Archiving Communication System (PACS) on standard computer monitors at the patient bedside. The medical center used two brands of ETT. The following study was completed to determine if one ETT is significantly easier to view within a controlled set of parameters. **Method:** The two standard tubes used were a Sheridan/ HVT cuffed size 7.5 ETT and a Mallinkrodt Hi-Lo cuffed size 7.5 ETT. A Sheridan Preformed size 6.5 ETT was included as an additional variable because of its limited use as a "specialty" tube in this facility. The three tubes were randomly placed on the bottom of a plastic container filled with 8 inches of water to simulate body tissue. Four radiographic images were taken and comprised the "visuals" for scoring. A blinded "Visualization Survey" was conducted using the four different images of each of the ETT. The exact same artifact affected all the images. Physicians were individually surveyed, (24 Residents, 19 Attendings, and 7 Fellows) utilizing a Likert Scale to rank the visibility. A rating of 5 indicated the ETT had "Ideal" visualization and a rating of 1 indicated the ETT was not able to be seen. Weighted averages of the Likert scale ratings were calculated and Chi-squared method statistical analysis were performed. **Results:** Initial analysis compared all 3 ETT and demonstrated a significant visibility difference. (See table). We then compared the two best visualized ETT and also confirmed that there was a significant difference. Both analysis showed a P value of less than 0.001. **Conclusions:** The results of this *in vitro* blinded observational survey determined that the Malinkrodt Hi-Lo ETT is better visualized when compared with the Sheridan/HVT and Sheridan Preformed under the conditions tested. The medical center now uses the Malinkrodt Hi-Lo tube as it's primary ETT for all standard tracheal intubations.

Sponsored Research - None

Visualization Rating Data (number of responses)

ETT	Ideal-5	Good-4	Adequate-3	Difficult-2	Not Seen-1	Total Responses	Rating
Sheridan/HVT	10	72	101	15	2	200	3.365
Malinkrodt Hi-Lo	40	103	43	14	0	200	3.845
Sheridan Preformed	5	15	62	97	21	200	2.43

658121

IMPLEMENTATION OF A BLINDED BRONCHIAL LAVAGE SAMPLING PROTOCOL.

Sally Whitten, Christopher Hirsch, Robert Owens, Stephen Mette; Pulmonary & Critical Care Medicine, Maine Medical Center, Portland, ME

Background. Ventilator associated pneumonia (VAP), a common complication of ventilator care, can have a significant impact on morbidity and mortality. Adequate empiric antibiotic therapy should be initiated in patients with clinical evidence of the disease. Rapid identification of specific bacterial pathogens with implementation of appropriately targeted antibiotic therapy can improve outcomes in patients with suspected VAP. Our facility implemented a Respiratory Therapist (RT) protocol for obtaining tracheal aspirates via a blinded bronchial sampling or mini-broncho-alveolar-lavage ("mini-BAL") technique. The goals of this program were to minimize the use of the less reliable method of obtaining sputum culture through endotracheal tube suctioning, to expediently provide culture results comparable to directed bronchoscopic alveolar lavage, and to potentially reduce antibiotic days. Methods. Prior to implementation, a multi-disciplinary group reviewed VAP literature and assessed the safety and ease of use of commercially available catheters. RTs were provided specific training, with competency assessed by direct observation of a pulmonologist. Physician entry of a mini-BAL order triggered the RT paging system so tracheal samples could be immediately obtained and processed. Educational efforts aimed at promoting a shift to mini-BAL or bronchoscope directed BAL were undertaken. Results. Prior to the utilization of the mini-BAL, 98% of sputum samples were obtained via endotracheal tube suctioning. This was decreased to 39%, with the remaining 61% obtained via either mini-BAL or bronchoscopic BAL. Since mid-2006, RTs have submitted 1317 mini-BAL specimens, of which 544 (41%) were positive (organisms present at greater than 104 cfu/mL). Over a three-month interval, some 124 unnecessary antibiotic days were avoided by increasing usable microbiologic data. Conclusions. The protocol allows physicians to obtain quantitative bacteriology of alveolar fluid at any time. Rapid identification of pathogens allows the physician to precisely target antibiotic therapy. Prompt reductions in therapy, may decrease institutional antibiotic resistance development. No adverse patient events have been associated with the mini-BAL protocol or reduced antibiotic use.

Sponsored Research - None

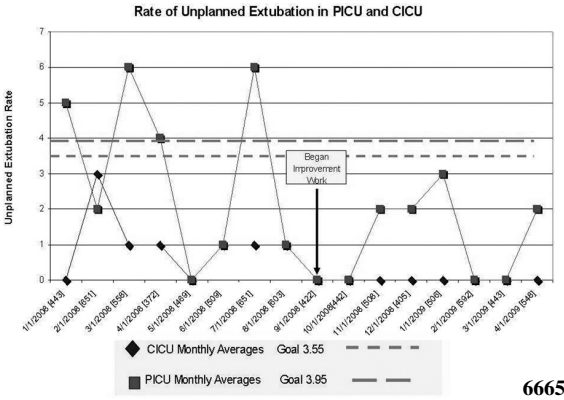
660384

REDUCING THE RATE OF UPLANNED EXTUBATIONS IN A LARGE PEDIATRIC MEDICAL CENTER.

Scott M. Pettinichi; Respiratory Care Division, Cincinnati Children's Hospital Medical Center, Cincinnati, OH

Background: Unplanned extubations (UEs) is a significant risk of mechanical ventilation resulting in poor patient outcomes. The Respiratory Care Division collaborated with the PICU and CICU to reduce the incidence of UEs in PICU from .79 UE per 100 days to less than .39 per 100 days, and from .71 UE per 100 days to less than .30 per 100 days in CICU. Key drivers identified to achieve change were: 1. Utilize best technique for securing endotracheal tubes (ETT). 2. Effective monitoring and verification of artificial airway placement in PICU and CICU. 3. Improve process for obtaining airway placement radiographs. Method: All Respiratory Care staff in PICU and CICU received training on a new technique for retaping ETTs. Signs were placed on the headboard of all patients with ETTs that detailed the size, placement and appropriate suction depth of the artificial airway. PICU and CICU staff were instructed to be present for all airway placement films to ensure consistency in the quality of airway placement films. Respiratory Care staff began a daily practice of reviewing airway placement radiographs. Results: Within a 6 month period the goal of a 50% reduction in our UE rate was met in PICU and CICU. Conclusion: The UE rate in the PICU decreased from .79/100 to .31/100. An 61% decrease.in UE. The UE rate in the CICU decreased from .71/100 to .10/100. An 86% decrease in UE. Incorporating best practices as well as utilizing a multidisciplinary approach is an excellent way to identify, brainstorm and solve performance improvement issues that are present. This collaborative approach resulted in a positive effect on patient outcomes.

Sponsored Research - None



666523

THE IMPLEMENTATION OF THE ADULT TRACHEOSTOMY TEAM: A QUALITY IMPROVEMENT PROJECT.

Sally Brewer[1], Sally Whitten[1], Chris Hirsch[1], Nicole Manchester[2], Sonja Orff-Ney[2], Danielle Tabor[2], Micheline Chipman[2], Darlene Realou[2], Jean Fecteau[2], John Dziodo[1]; [1]Pulmonary and Critical Care Medicine, Maine Medical Center, Portland, ME; [2]Department of Nursing, Maine Medical Center, Portland, ME

Background: At our facility tracheostomy patients are managed on multiple inpatient units by their primary medical or surgical teams. Policies and staff education regarding tracheostomies was unit specific. Our hypothesis was that by standardization of practice and training we will see a decrease in tracheostomy related complications and delays in decannulation. Initial indications of success will include increasing the confidence level of bedside staff in dealing with tracheostomy issues. Method: Nurses and physicians were surveyed to determine their perceived levels of competence when caring for the patient with a tracheostomy. A review of available tracheostomy supplies was conducted. We standardized bedside emergency equipment. We created a multidisciplinary team for the purpose of standardizing tracheostomy care and staff education throughout the institution. The multidisciplinary team, consisting of advanced level respiratory therapists and nurses, performed weekly rounds on all adult tracheostomy patients. Utilizing evidence based practice, weekly recommendations are made in the patient's chart. A database was created to analyze the desired outcomes. A follow up staff survey was administered to assess the value of a standardized education model and weekly 'trach rounds'. Results: The survey identified lack of consistent staff education, lack of consistent, easily accessible tracheostomy care supplies, and variable medical management in regards to downsizing and removal of the tracheostomy by physician groups as barriers to best practice. The team created and implemented a standardized education program to all nursing units who care for tracheostomy patients. The supply of in-stock tracheostomy supplies was reduced from 120 different types of tracheostomy tubes and accessories to 63. Conclusions: The follow up staff survey revealed a statistically significant improvement in the perceived value of the tracheostomy team. Database review suggested no statistical improvement in shortening the time to tracheostomy downsize and decannulation. Time to initial tracheostomy placement, initial downsize, and decannulation were consistent across service areas. As an unintended benefit, the standardization of in stock tracheostomy supplies has resulted in an estimated annual cost saving of $4200.00

Sponsored Research - None

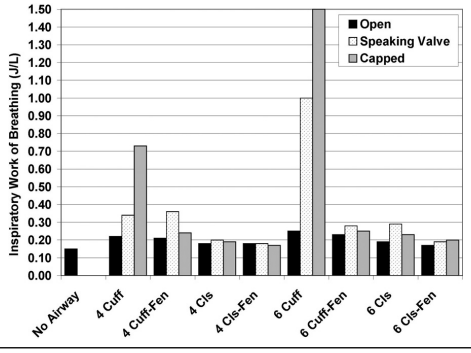
667086

BENCH EVALUATION FOR EFFECTS OF FENESTRATIONS, SPEAKING VALVES AND CAPPING ON WORK OF BREATHING THROUGH TRACHEOSTOMY TUBES.

John S. Emberger, Lisa Racine, Eric Krauss, Joel M. Brown; Respiratory Care, Christiana Care Health System, Newark, DE

BACKGROUND: Tracheostomy tubes (TT) and related devices may impose an increased work of breathing for spontaneously breathing patients. There is limited evidence for how different TT effect work of breathing, such as: tracheostomy brand/style, tracheostomy size, cuff versus cuffless, fenestrated versus non-fenestrated, use of speaking valve and TT capping. We use a variety of combinations of these TT daily in patient care. We wanted to determine how these TT and related devices such as speaking valves and capping effect inspiratory work of breathing. METHODS: We used a dual test lung (Michigan Instruments Inc.) with a lifting bar to simulate spontaneous breathing, connected to the trachea of our AirMan® manikin (Laerdal®). A NICO® Cardiopulmonary Management System (Philips Respironics) combined flowsensor was placed between the trachea and the dual test lung. A ventilator driving the dual test lung setup delivered simulated spontaneous breathing. (respiratory rate=20, tidal volume=400, I:E=1:2) TT tested were: size 4 and 6 Shiley®, cuffed (cuff) and cuffless(cls), fenestrated (fen) or non-fenestrated. Speaking valve (Shiley®) and capping were also tested. The cuffs of the tracheostomy tubes were completely deflated during the study. We examined imposed inspiratory work of breathing of the various TT and related devices during spontaneous breathing. RESULTS: In our spontaneously breathing airway model, three combinations yielded high (> 0.6 J/L) work of breathing: size 4 cuffed with cap, size 6 cuffed with speaking valve and size 6 cuffed with cap. The combinations that were most similar to having no TT inplace were cuffless size 4 with and without fenestration as well as cuffless size 6 fenestrated. See the chart for work of breathing for all tracheostomy combinations tested. CONCLUSIONS: Cuffless 4 and cuffless 6 tracheostomy tubes were associated with the least imposed work of breathing. Caution should be used when capping a 4 or 6 cuffed tracheostomy tube and when using a speaking valve on a 6 cuffed tracheostomy tube.

Sponsored Research - None



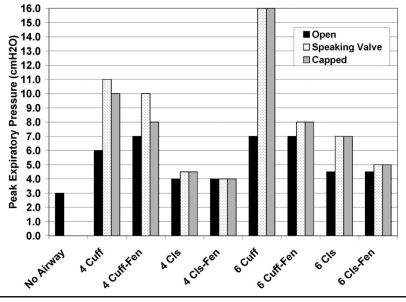
677655

EFFECT OF DEFLATED CUFFS, FENESTRATIONS, SPEAKING VALVES AND CAPPING ON EXHALATION WITH A TRACHEOSTOMY.

John S. Emberger, Eric Krauss, Lisa Racine, Joel M. Brown; Respiratory Care, Christiana Care Health System, Newark, DE

BACKGROUND: Expiratory resistance is a factor that can complicate the process of weaning from a tracheostomy. There is limited literature concerning the effect of tracheostomy tubes (TT), speaking valves and capping on exhalation. There are a variety of TT to consider including: different brands/styles, different sizes, cuff versus cuffless, fenestrated versus non-fenestrated. We use many different TT sometimes in combination with speaking valves or capping, everyday in clinical care. We wanted to examine the effects of the TT and related devices on the exhalation phase. METHODS: We used a dual test lung (Michigan Instruments Inc.) with a lifting bar to simulate spontaneous breathing, connected to the trachea of our AirMan® manikin (Laerdal®). A NICO® Cardiopulmonary Management System (Philips Respironics) combined flowsensor was placed between the trachea and the dual test lung. A ventilator driving the dual test lung setup delivered simulated spontaneous breathing. (respiratory rate=20, tidal volume=400, I:E=1:2) Tracheostomy characteristics tested were: size 4 and 6 Shiley®, cuffed (cuff) and cuffless(cls), fenestrated (fen) or non-fenestrated. Speaking valve (Shiley®) and capping were also tested. The cuffs of the TT were completely deflated during the study. We examined the expiratory "tracheal" pressure graphics with all of the various tracheostomy combinations which would indicate expiratory resistance. RESULTS: Our airway model showed 14 tracheostomy combinations that doubled the peak expiratory pressure and 5 tracheostomy combinations that more than tripled the peak expiratory pressure. Cuffed tubes with speaking valve or capped were the combinations with the highest peak expiratory pressures. Cuffless tubes created the least increase in peak expiratory pressures. See chart for data on all tracheostomy characteristics tested. CONCLUSIONS: Expiratory resistance is consistently increased by cuffed tubes during speaking valve and capping, as evidenced by the largest increases in peak expiratory pressures. Cuffless tubes consistently decrease the expiratory resistance. We are unsure of the effects that our observed increased expiratory pressure has on patients, however caution should be used whenever TT and related devices are used that could cause increased expiratory resistance. The expiratory pressures in our model were passive, a live patient could actively exhale creating greater expiratory pressures.

Sponsored Research - Non



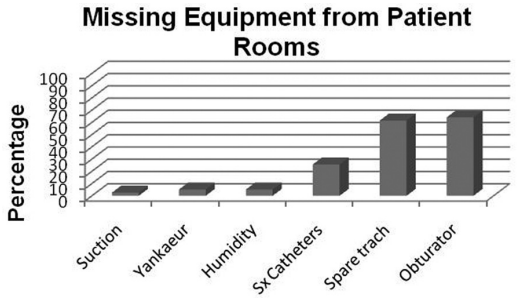
678230

POTENTIAL SAFETY ISSUES ASSOCIATED WITH MANAGEMENT OF TRACHEOSTOMIZED PATIENTS ON THE GENERAL WARDS—A PROCESS IMPROVEMENT PROJECT.

Dean Holland[1], Joanna Brown[2], Jennifer De La Garza[1], John Boynton[1], Kenneth Hawkins[1], Curtis Carey[1], Marissa Drees[3], Sharla Turner[5], Valeria Hart[4]; [1]Respiratory Care, Parkland Hospital, Dallas, TX; [2]Speech Therapy, Parkland Health and Hospital System, Dallas, TX; [3]Nursing Education, Parkland Health and Hospital System, Dallas, TX; [4]Clinical Research, Parkland Health and Hospital System, Dallas, TX; [5]Trauma Acute Care, Parkland Health and Hospital System, Dallas, TX

Introduction Care of tracheostomized patients in our 980-bed county facility is multidisciplinary with care delivered on several medical/surgical units. Our team identified communication problems between disciplines, lack of equipment knowledge and varying patient care skill levels as factors placing patients at risk for safety events. We addressed the variances in clinicians' care to reduce the safety risks. Method Assessment of current practice was completed in two steps. First, we determined if appropriate safety equipment was at the bedside. Thirty-nine patient rooms assigned to tracheostomized patients were screened for 6 types of essential equipment: suction, humidity, and spare trachs. Second, we evaluated staff's knowledge of trach equipment and skills. A committee was formed & updated trach care procedures. Staff education, including a new protocol for safety equipment and multi-disciplinary flow sheet for equipment and patient interventions, was completed. Results Pre-intervention data showed 87.2% of the patient care rooms (n=39) had at least one safety issue with missing equipment. Over 50% of the rooms had missing spare tracheostomy tubes (see figure). Knowledge testing (n = 44) showed 98% were unable to identify bedside safety equipment and 68% were unable to correctly answer a skills question. Discussion We identified a number of potential patient safety issues related to communication, equipment, staff education and care process. Of particular concern was the high percentage of rooms missing the required safety equipment and the deficiency in staff knowledge concerning basic tracheostomy skills. The primary interventions were to standardize tracheostomy care procedures housewide and to re-educate all clinical care staff. A multi-disciplinary tracheostomy safety committee is in the process of collecting data to measure the results of our interventions.

Sponsored Research - None



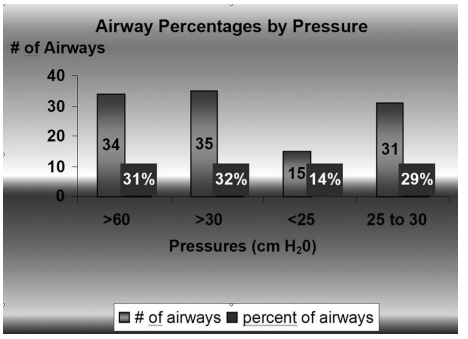
677939

POST-OP MONITORING OF ENDOTRACHEAL/TRACHEOSTOMY TUBES BLINDLY INFLATED IN THE OPERATING ROOM (OR).

Mary E. Nash[1], Susan LaGambina[1], Paul F. Nuccio[1], Gerald L. Weinhouse[2]; [1]Department of Respiratory Care, Brigham and Women's Hospital, Boston, MA; [2]Pulmonary & Critical Care Division, Brigham and Women's Hospital, Boston, MA

Background: Studies have shown that endotracheal tube cuff over-inflation exerts pressure on the tracheal wall decreasing capillary perfusion to the tracheal mucosa. Complications of excessive cuff pressures include tissue necrosis, tracheal stenosis, post intubation stridor, along with rupture and tracheal esophageal fistula. Safe cuff pressures have been determined to be 25-30cm H2O pressure. Underinflation increases the risk of aspiration. The purpose of this study was to determine the initial cuff pressures of intubated patients admitted from the OR. Method: Post-operative cuff pressures were measured in a blind study over a period of one hundred and fifteen days. One hundred and eight patients were intubated with a high volume low pressure cuffed oral endotracheal tube, seven patients with tracheostomy tubes. The measurements were taken with a manual cuff pressure manometer and recorded by the Respiratory Therapist on patient's arrival from the OR. Other factors were also included: Male or Female, intubation time and OR service. Results: Thirty-four patients had cuff pressures greater than 60cm H2O (30%),thirty-five patients had cuff pressures greater than 30 cm H20 (30%),fifteen patients (13%) had cuff pressures less than 25 cm H2O and the remaining thirty-one patients (27%) had cuff pressures within normal limits. 73% of patients were male and 27% were female. Average time patient was intubated before cuff pressures were assessed were Cardiac 387 minutes, Surgical 525 minutes, Trauma 440 minutes, Neuro 150 minutes and Medical 300 minutes. Conclusion: Reviewing cuff pressures on patients admitted from the OR showed an overall increase in cuff pressures. The risk of injury resulting from over-inflation of ETT cuffs can be minimized with evaluation of cuff pressure measurements. Review and education must be enhanced and implemented to enable improvement by having patients cuff pressures assessed immediately upon admission, and notifying appropriate teams when cuff pressures are above acceptable levels on the average patient.

Sponsored Research - None



679708

A DIFFICULT AIRWAY RESPONSE TEAM: IMPLEMENTATION AND RT PERCEPTIONS.

Georgianna Sergakis[1], Rachel Franz[1], Sincer K. Jacob[1,4], JoAnne P. Trees[2], Judy M. Opalek[3], Stuart Chow[3]; [1]Respiratory Therapy Division School of Allied Medical Professions, The Ohio State University, Columbus, OH; [2]Pulmonary Services, Grant Medical Center, Columbus, OH; [3]Trauma Services, Grant Medical Center, Columbus, OH; [4]Respiratory Therapy, OSU Medical Center, Columbus, OH

Background: In healthcare institutions across the world, situations arise when patients in a non-critical state need interventions to prevent cardiac arrest, respiratory failure or other critical conditions. In some cases, these potential emergencies may be avoided or at least recognized before they become uncontrollable or lead to fatal outcomes. The implementation of Rapid Response Teams has been shown as effective in addressing such situations. An example of a specialized response team is a Difficult Airway Response Team (DART). The DART is composed of a Physician, Respiratory Therapist (RT), and Registered Nurse that when called, evaluate and secure the airway of patients that have been pre-identified as a difficult airway. The implementation of a DART and perceptions of the RT as part of the team have not been addressed in the research literature. Methods: A retrospective chart review of DART activations explored the implementation of a DART at a level 1 trauma center in an urban metropolitan hospital. In addition, the RT's role and perceptions regarding the DART were examined. Descriptive statistics were employed to analyze results. Results: After conducting a review of activations, 26% of activations were pre-identified as a difficult airway, 35% had a failed intubation attempt, 11% were considered over triage, and 28% were called for an unknown reason. The total number of intubation attempts required prior to DART activation were decreased following implementation of the DART protocol. There were no activations that resulted in cricothyroidotomy and two activations resulted in tracheostomy. The method of airway placement included use of a Glidescope®(13), Video Laryngoscope(1), and Fiberoptic Laryngoscope(11). 56% of patients requiring a DART survived to discharge. The majority of RTs surveyed felt they understood their role in the DART, felt it improved patient outcomes, and agreed they were a valued part of the team and that RT involvement increased interdepartmental respect. Conclusions: The innovative utilization of the DART has improved overall patient safety and the quality of care to patients with difficult airways in a level-1 trauma center. RTs believe they play an integral role and are valuable to the team's success. The DART allows the RT to be recognized as an important part of the team and has increased collaborative teamwork within the institution.

Sponsored Research - None

679822

THE USE OF AIRWAY CLEARANCE TECHNIQUES IN THE UNITED STATES.

Georgianna Sergakis[1], Sarah M. Varekojis[1], Nicholas Koski[1,2], Matthew Weaver[1], Amanda Wuske[1,2]; [1]Respiratory Therapy Division School of Allied Medical Professions, The Ohio State University, Columbus, OH; [2]Respiratory Therapy, OSU Medical Center, Columbus, OH

Background: Clinical complications from retained pulmonary secretions are serious and can be costly to both the patient and healthcare system. To prevent and treat these complications, Respiratory Therapists utilize a variety of airway clearance techniques, many of which have been shown to be clinically effective. Therefore, the choice of technique is often based upon additional variables. The purpose of this study was to determine the variables that drive the current practices of airway clearance around the nation and determine if practice varies by type of patient, size of institution, type of institution, region or by use of therapist-driven protocol. Methods: An online survey of airway clearance practices and demographic information was sent to 650 Respiratory Therapy managers from the AARC Management section list serve. The pilot study modeled a previous state survey performed in Ohio. Descriptive statistics and chi square analysis were employed to analyze results. Results: 158 individuals responded to the survey. The single most frequently used airway clearance techniques were Acapella™, C & DB, and IS. Regarding frequency of use, more than half of respondents reported they often used IS, C& DB, Acapella™, and suctioning. In contrast, more than 67% stated they never used Autogenic Drainage, IPV®or IPPB. The greatest influences on decision making for airway clearance were protocol (23%) and physician preference (23%) followed by evidence based research (20%) and patient compliance (12%). 51% of respondents reported protocol use for airway clearance at their institution. When analyzing respondent variation there were no marginally valid chi-squares. However, there were notable patterns in airway clearance modality by patient population, protocol use and type of institution. Conclusions: Consistent with the literature, airway clearance techniques vary by institution and are often tailored. Self-administered airway clearance techniques were preferred. More labor and clinician-intensive techniques were not used. This is consistent with providing airway clearance techniques that are easy to use and likely to have increased patient compliance. Choices were influenced by preference, providing consistent care and maximizing quality for individual patients and not focused on factors of convenience such as cost or productivity. These choices are integral in addressing complications from retained secretions, thereby conserving future healthcare dollars.

Sponsored Research - None

679831

THE EFFICACY OF BACKFLUSHING SUCTION REGULATORS AS A METHOD OF INTERNAL DISINFECTION.

John J. Hill, Michael J. Neary; Respiratory Care Services, Deborah Heart and Lung Center, Browns Mills, NJ

Background: Suction Regulators, a standard piece of medical equipment, are implemented in procedures ranging from nasogastric suctioning to thoracic drainage. Most regulators are setup in a manner where a catheter or tube is connected from the patient to a canister. A piece of suction tubing connects the canister to the regulator. Materials removed from the patient are intended to be contained within the canister; however, there exists a potential for suctioned waste to overflow and grossly contaminate the regulator. Contamination inside the regulator may infect subsequent patients receiving intermittent suction. Regulator manufacturers recommend backflushing to clean the internal passageways. This study aims to evaluate the efficacy of these procedures in simulated and real world scenarios. Methods: Regulators from 5 manufacturers were contaminated with a simulated bacterial solution. Each regulator was cleaned according to the manufacturer's protocol. The regulators were opened and examined under a black light for signs of contamination. As a follow up, regulators in an acute care facility were cultured for bacteria. These regulators were cleaned according to manufacturer's recommendation and cultured in order to evaluate the efficacy of the procedure. Results: None of the regulators that were contaminated with the simulated bacterial solution were effectively cleaned when following manufacturer's recommendations. In the second half of the experiment, 36% of the regulators cultured positive for contamination. Bacteria found included S. aureus, S. epidermidis, P. aeruginosa, and B. cereus. After completing each respective backflushing procedure, the regulators still cultured positive. One regulator was autoclave compatible. Upon completing the autoclaving procedure, the culture of the internal lumen did not yield any growth. Conclusion: Regulators have the potential to spread contaminants between patients, thus contributing to the spread of hospital acquired infections. In addition, gastric colonization has been linked to respiratory and systemic infections. Most protocols do not adequately address this contamination problem and may lead to a false sense of security for the hospital and the patient. Only one regulator was adequately disinfected. Without the ability to thoroughly disinfect a suction regulator, situations in which intermittent therapy is applied to a patient could lead to increased costs and patient morbidity and mortality.

Sponsored Research - None

679849

MICROASPIRATION AND ENDOTRACHEAL TUBE CUFF LEAKAGE: A BENCH STUDY COMPARING POLYURETHANE AND POLYVINYL CHLORIDE ENDOTRACHEAL TUBE CUFF DESIGN.

Mark L. Rose, Mike Trevino, Gary Weinstein; Cardiopulmonary, Texas Health Presbyterian Hospital Dallas, Dallas, TX

Background: Reducing the risk of VAP is a major priority among healthcare facilities. Many ideas have been postulated to reduce VAP, including modification of the ETT. Our facility switched from the Mallinckrodt Hi-Lo Evac tube with a barrel-shaped polyvinylchloride (PVC) cuff, to the Kimberly-Clark Micro-cuff tube which incorporates an elongated barrel-shaped polyurethane cuff (PUC). We were then presented with the new Mallinckrodt Sealguard tube which uses a novel tapered-down PUC. We then evaluated the cuff for leakage of subglottic fluid in these three branded ETTs. Methodology: A bench-model was achieved by using a mechanical ventilator (1.0L VT, RR = 10), lung simulator and simulated trachea made from a clear plastic tube with a 25mm ID. The ETT was placed in the simulated trachea and its cuff inflated to 30 cwp. The lung simulator was attached to the simulated trachea below the ETT. Five ml's of blue-dyed water was instilled above each cuff and observed for 30 seconds prior to applying ventilation for a total of 3 minutes. We evaluated the #8.0 Sealguard, #8.0 Hi-Lo Evac, and the #8.0 and 9.0 Micro-cuff. Each ETT was tested 3 times and evaluated for visual leakage below the cuff before and during mechanical ventilation. Results: The Micro-cuff exhibited no visible leakage during each facet of testing. The remaining ETTs all had leakage. Interestingly, the Sealguard had a larger OD and cuff diameter than the Micro-cuff, yet leaked all 5 ml's of fluid in each of its 3 evaluations. Conclusion: It appears the PVC cuff creates greater folds or channels, which allow subglottic fluid leakage. The thinner PUC material appears to resist this channeling, thereby reducing leakage and potential microaspiration. Additionally, by using a tracheal model sized on the upper end of normal, we feel that cuff shape and overall surface area contact with the tracheal wall are contributing factors for leakage as well. The elongated PUC outperformed the new tapered-down PUC design in our testing model.

Sponsored Research - None

679852

USING TOYOTA PRODUCTION SYSTEM METHODOLOGY TO IMPROVE SAFETY OF TRACHEOSTOMY TUBE SPEAKING VALVES.

Robert Hase[1], Jeff Suenaga[1], James M. Marshall[2]; [1]Respiratory Care, Virginia Mason Medical Center, Seattle, WA; [2]Speech-Language Pathology, Virginia Mason Medical Center, Seattle, WA

Background: One-way speaking valves used with cuffed tracheostomy tubes carry an intrinsic dangerous potential if the cuff is inflated when the speaking valve is attached. This is compounded when bedside caregivers are marginally familiar with these devices. Traditional approaches to maximize safety include placing a warning flag on the pilot balloon, as well as universal education. Our facility employed these and other methods but lacked confidence regarding patient safety. Methods: We convened a work team to design a process change ensuring patient safety even when caregivers had minimal exposure to speaking valves and/or tracheostomy tubes. Our goal was to error-proof the system whereby standard procedures would be followed to maintain the tracheostomy cuff (call RT) and the cuff would not be inflated by well-meaning but untrained clinical staff. We performed root-cause analysis of potential errors, and then devised a prototype device using Toyota Production System (TPS) theory, that we tested over a course of PDSA (plan-do-study-act) cycles. Results: We were able to construct a device that prevents cuff inflation in conjunction with a speaking valve. Our device employs TPS elements of warning and control poke-yoke, as well as visual control. Conclusions. We improved safety at our facility for patients with speaking valves attached to cuffed tracheostomy tubes, using Toyota Production System methodoloy.

Sponsored Research - None

679884

AIRWAY MANAGEMENT SUPPORT BY RESPIRATORY CARE SERVICES IN AN ACADEMIC MEDICAL CENTER EMERGENCY DEPARTMENT; A 3 YEAR REVIEW.

Jhaymie L. Cappiello, Michael A. Gentile, Andrew Miller, Robert Delong, Janice Thalman, Neil MacIntyre; Duke Medical Center, Durham, NC

Background: Endotracheal intubation by Respiratory Care Practitioners (RCP) is common and well supported. Our airway management support in the emergency department (ED) is provided by a core group of practitioners that includes equipment maintenance, resident education as well as procedure operation. We sought to qualify the endotracheal intubation support from this team by reviewing ED intubation data over a three year (34 month) period. Method: A retrospective review of an airway database maintained by our ED core RCPs' reviewed 447 ED intubation events between 8/2006 and 6/2009. Data recorded included laryngoscopies per attempt, esophageal intubations, primary/secondary airway operator, type of patient (medical/surgical), and if intubation attempt was successful. Each attempt is limited at two laryngoscopies per departmental standards. An analysis was performed for RCP intubation impact alone. Result: During the reviewed period; RCP Intubations: 36%, 104 as primary, 55 as secondary Laryngoscopy per Attempt (avg) 1.2 Esophageal Intubation rate: 6% Trauma/Surgical Patient: 31% Medical Patient: 69% Success Rate: 98.7% Conclusion: Endotracheal intubation provided by the ED core group RCPs' is effective as evidenced by the low laryngoscopy and high success rates. The service is well utilized across the patient population and provides a significant portion of endotracheal intubation. Interval follow up is recommended for quality assurance.

Sponsored Research - None

679910

COMPARISON OF CHANGE DATE OF TRACHEOSTOMY TUBES FOR PERCUTANEOUS VS. OPEN TRACHEOSTOMY IN A RESPIRATORY ACUTE CARE UNIT.

Daniel F. Fisher[1], Tina Chisholm[1], Julie MacPherson-Clements[1], Dean Hess[1], George Velmahos[3], Ulrich Schmidt[2,1]; [1]Respiratory Care Services, Massachusetts General Hospital, Boston, MA; [2]Anesthesia & Critical Care, Massachusetts General Hospital, Boston, MA; [3]Trauma, Emergency Surgery, and Critical Care, Massachusetts General Hospital, Boston, MA

INTRODUCTION: Down sizing of the tracheostomy tube is often performed to allow the patient to tolerate a speaking valve. However tracheostomy change has been associated with a significant morbidity and mortality and tracheostomy tubes changes are recommended after day 10 post insertion. Percutaneous tracheostomy provides earlier maturation of the stoma and therefore tracheostomy changes might be performed safely at an earlier time. We hypothesize change of percutaneously inserted tracheostomy tubes before day 10 is safe and permits earlier use of a speaking valve compared to later changed tracheostomy tubes METHODS: A relational database was developed to track all patient activity that occurred in an acute care unit in a large academic medical center. All airway activity for the period of July 2, 2008 through May 4, 2009 was entered into this system by the respiratory therapists assigned to the unit. Specific information recorded was tracheostomy technique, date of tracheostomy, and event action date. The data was queried for interventions such as tracheostomy tube change, and first use of a speaking valve. Complications of tracheostomy tube change have been predefined as inability to change tracheostomy, loss of airway, desaturation, bleeding and aspiration RESULTS: During the period there were 72 initial tracheostomy changes. Of the 72 patients, 6 were excluded because they had a long-term history (> 1 year) having a tracheostomy. There were no complications noted during tube placement. For initial tracheostomy change 44% (n=29) of the percutaneously inserted were changed < 10 days after insertion, whereas 5 (8%) of the open tracheostomy tubes were changed within this time span ($p<0.001$). Patients who underwent a tracheostomy change prior to speaking valve 15 (36%) of the percutaneous insertion group and 1 (2%) of the open insertion group had a speaking valve placed within 10 days of the airway change ($p<0.05$). When all patients who had a speaking valve placed were compared, 20/83 (24%) of the percutaneous group were placed < 10 days and 10/83 (12%) of the open group . Speaking valve placement occurred after 10 days in 29/83 (35%) and 24/83 (29%), patients for percutaneous and open tracheostomy placement respectively ($p>0.2$). CONCLUSION: Percutaneous inserted tracheostomy tubes are changed earlier than open method of tracheostomy. Tracheostomy change of percutaneous tubes before day 10 was not associated with complications.

Sponsored Research - None

679942

IMPACT OF 70:30 HELIOX ON FLOW DELIVERY OF F&P HFNC.

Cynthia White, James Johnson, Robert Wackenthaler; PICU, Cincinatti Children's Hospital Medical Center, Cincinatti OH, OH

Background: Historically, recommendations for Heliox delivery has been to utilize a non-rebreather or closed system for gas delivery. Getting a small child or infant to wear a mask for a length of time is often a challenge for the bedside clinician. Due to lack of alternative interfaces, we have successfully used 70:30 Heliox via a HFNC device on several small children who presented at our institution with upper airway obstruction and stridor. In theory, the HFNC system should meet most of the minute ventilation requirements of a small child or baby who is an obligate nose breather. With differences in the density of the gas, we became interested i n trying to determine the optimal flow to set with Heliox via the HFNC. We also sought to determine how utilizing standard conversion factors for 70:30 Heliox would affect the company developed pop-off set at 40 cmH20 that comes packaged with the system. Method: The Fisher Paykel (F&P East Tamaki, New Zealand) HFNC device was set-up according to manufacturer recommendations. The F&P 850 heater setting was set on invasive at 37 degrees Celsius. The nasal cannula prongs were connected to a tubing device which was then connected to a standard air flow meter to measure flow. Baseline set vs. delivered flow measured were obtained at all three pediatric NC sizes (ranging from neonatal to pediatric.). A pressure manometer was also placed in line adjacent to the pop-off and the pop off was briefly removed from the system to test its function ability. Results 2-2.5L was the maximum flow that could be measured from the the neonatal HFNC prongs with or without Heliox. Both the infant and pediatric NC appeared limited to a delivered flow of 7-8LPM despite variances in set flow settings from a range of 6-15LPM. In scenarios where back pressure did not meet the 40 CMH20 threshold of the pop-off; measured flow with Heliox averaged 1LPM higher than set flow. Discussion: HNFC with the Fisher Paykel humidified HFNC system may be reasonable to use for small infants or children who cannot tolerate wearing a non-rebreather, but set flow is limited to 6L with the use the manufacturer's pre packaged silent pop-off. Flow limitations and flow delivered to the patient may be slightly altered with other Heliox mixtures or a FiO2 requirement greater than 30%.

Sponsored Research - None

HFNC Flow

Cannula	Set flow baseline	Delivered flow baseling	Set flow with Heliox	Delivered flow with heliox
Pediatric	8L	7L	6L	7L
Pediatric	10L	7L	7L	7L
Pediatric	15L	7L	10L	7L
Infant	8L	5L	5L	6L
Infant	10L	5L	6L	7L
Infant	5L	5L	7L	7L
Neonatal	8L	2L	2L	2.5L
Neonatal	5L	2L	3L	2.5L
Neonatal	3L	2L	6L	2.5L

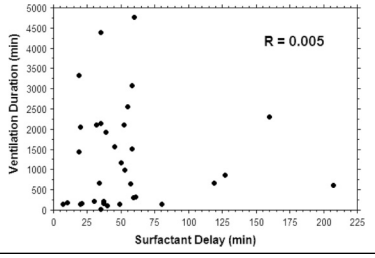
638930

DOES THE TIME POST DELIVERY OF SURFACTANT ADMINISTRATION HAVE IMPACT ON THE DURATION OF VENTILATION IN PREMATURE INFANTS WITH RESPIRATORY DISTRESS SYNDROME?

Khin-Kyemon Aung[1,2], Daniel W. Sutton[1,2], Susan M. Brant[1,2], John Dickson[1,2], Robert L. Chatburn[2], Firas Saker[1,2]; [1]Hillcrest Hospital, Mayfield Heights, OH; [2]Cleveland Clinic, Cleveland, OH

BACKGROUND: Conventional mechanical ventilation is a common modality that has significantly reduced the number of mortalities in very low birth weight infants (VLBW) with respiratory distress syndrome (RDS). However, extended duration on mechanical ventilation can lead to bronchopulmonary dysplasia, lung inflammation, chronic lung disease and other complications for neonates. Surfactant replacement therapy has been proven to reduce mortality and associated morbidities such as duration on mechanical ventilation in RDS patients. Data collected from our institution indicate a large variability in the time between birth and surfactant delivery and also duration on mechanical ventilation. Few data are available comparing treatment delay to outcome. The purpose of this study was to determine if there is a correlation between the surfactant delivery time and the duration of ventilation. **METHODS:** Data from 2004-2007 for VLBW neonates were collected from the Vermont-Oxford and the Hillcrest Hospital database. Records of 127 neonates were reviewed with 44 meeting the criteria (RDS, mechanical ventilation only, surfactant administration); 9 were excluded due to death, transfer or incomplete information plus one outlier. Surfactant delay (SD) was defined as time (minutes) from birth to the first surfactant dose and duration of ventilation (DV) was defined as the time (minutes) from intubation to extubation. Linear correlation and percentile analyses were used to evaluate the association between SD and DV. **RESULTS:** Gestational age ranged from 22-32 weeks. SD ranged from 7-207 min and DV ranged from 20-4,775 min. The 85th percentile for SD was 60 min and the 85th percentile for DV was 2,250 min. The figure shows SD versus DV. The low r value indicates virtually no correlation. A subset of the data (gestational age 29-31 weeks, n=20) was analyzed with comparable results. **CONCLUSION:** In this group of patients, the delay in surfactant delivery for up to four hours appears to have no association with duration of ventilation. However, a majority of patients in our study received surfactant within an hour. We speculate that the shorter the duration of ventilation before surfactant delivery, the lesser the risk of ventilator-induced injury and hence the lack of an association. These results provide benchmark data for further studies and suggest that efforts to improve protocol compliance related to treatment delay would be unnecessary.

Sponsored Research - None



677725

SIMULATED NEONATAL PATIENT-VENTILATOR INTERACTION USING SIPAP AND BILEVEL NCPAP.

Shannon E. Cook, Robert L. Chatburn; Respiratory Institute, The Cleveland Clinic, Cleveland, OH

INTRODUCTION: Although SiPAP (Viasys Healthcare) has been available for several years, it has remained relatively unexplored. Studies have evaluated BiPAP, SiPAP's close relative, but not SiPAP itself. We sought to test SiPAP against non invasive positive pressure ventilation from the Avea ventilator (Viasys), specifically looking at effect on tidal volume (V), patient work (W), drop to minimum pressure during inspiration (DPmin) and mean airway pressure (MAP). **METHODS:** The Avea and SiPAP were tested on an ASL 5000 lung simulator (Ingmar Medical, Inc). Lung simulator settings were: resistance = 125 cm H_2O/L/s, compliance = 0.5 mL/cm H_2O, rate = 65 breaths/min, patient effort (Pmus) = sinusoidal, 6.5-19.5 cm H_2O to generate tidal volumes of 3-9 mL, rise = 33%, hold = 0%, release = 33%. Nares were simulated by holes drilled into plastic tube. Nasal prongs were fitted according to the sizing template of the Infant Flow System (Viasys). The flow settings for the SiPAP were adjusted to approximate pressure settings on the Avea: "pressure high" flow = 3.75 L/min; "pressure low" flow = 6.5 L/min, which resulted in peak inspiratory pressure (PIP) = 9.8-10.8 cm H_2O (fluctuated automatically, highest possible without alarming); positive end expiratory pressure (PEEP) = 4.8-5.5 cm H_2O. For the Avea, in Bilevel NCPAP mode, PIP = 10 cm H_2O, PEEP = 5 cm H_2O. Rate on both machines was set to 20 breaths/min. Medium nasal prongs and a neonatal circuit (Infant Flow System) were used for the SiPAP setup and a Fisher and Paykel circuit and prongs (4030) were used for the ventilator. Both used a Fisher and Paykel neonatal humidifier. Averages of 10 breaths were used for analysis (ANOVA on V and W, t-tests on DPmin and MAP, $p<0.05$ significant). **RESULTS:** Both the SiPAP and Avea had large ranges of delivered tidal volume. Data are included in the figure. There was no significant difference at any of the Pmus levels for V, MAP or W. Only the DPmin at V = 9 mL had significance (P=0.01). **CONCLUSIONS:** SiPAP appears to offer the same quality support as that of the Avea ventilator with regard to V, W, DPmin and MAP. The variation in tidal volume is due to the non synchronized mandatory breaths. While some V were twice as large as unassisted breaths, others were half as large and thus loaded. On average, the SiPAP and the Avea offered the same tidal volume as unassisted.

Sponsored Research - None

Device	Pmus	Tidal Volume			Airway Pressure		Drop to Pmin		Patient Work	
		Mean	SD	Range	Mean	SD	Mean	SD	Mean	SD
Unassisted	6.5	3.00	0.00	n/a	-0.03	0.00	-0.02	0.01	0.66	0.01
SiPAP	6.5	3.27	1.29	1.25-5.45	5.78	1.10	-0.50	0.49	0.78	0.66
Avea	6.5	2.97	1.93	0.5-7.5	7.23	1.92	-1.02	0.93	0.81	1.43
Unassisted	13	6.10	0.01	n/a	-0.01	0.00	-0.02	0.01	2.86	0.01
SiPAP	13	6.09	1.17	3.75-8.25	5.80	1.09	-0.67	0.61	3.46	1.52
Avea	13	5.59	2.36	2.0-9.75	7.04	1.63	-1.43	0.98	3.09	2.08
Unassisted	19.5	9.18	0.01	n/a	-0.02	0.00	-0.02	0.01	6.57	0.02
SiPAP	19.5	9.11	1.20	6.75-11.25	5.85	1.12	-0.72	0.60	7.93	2.23
Avea	19.5	8.51	2.64	5.0-13.5	7.06	1.69	-2.07	1.46	7.70	3.89

672378

EVALUATION OF NITRIC OXIDE DELIVERY THROUGH AN INFANT HEATED HUMIDIFIED HIGH FLOW NASAL CANNULA.

Rick Carter, Kevin Crezee, Paul Stanley; Respiratory, Primary Childrens Medical Center, Salt Lake City, UT

Background: Primary Childrens Medical Center (PCMC) has historically has used Nitric Oxide with nasal cannula in our neonatal population. In many of those patients there was a large variance between set and delivered nitric oxide at flows of 1 lpm to 1.5 lpm. It was determined that a method of consistent delivery was needed. ***Method:*** A Fisher & Paykel (F&P) Heated Humidified High Flow (HHHFNC)system consisting of a MR850 heater, RT329 circuit, and various sizes of High Flow Nasal Cannulas. We used HHHFNC due to the flows we were testing for the < 5kg Neonate and infant populations. In clinical practice at PCMC, flows greater than 1.5 lpm are delivered with a HHHFNC. The F&P infant HHHFNC system has a functional flow range of .3 lpm to 10 lpm per the manufacturer. For testing purposes we used flows from 1 lpm to 6 lpm and Nitric Oxide(NO) doses ranging from 1 ppm to 20 ppm to evaluate consistency between set and delivered NO. A calibrated INO vent DS unit was adapted to deliver and sample NO in the HHHFNC system as per manufacturers recommendations. ***Results:*** The HHHFNC was set up with temperature at 37 degrees celsius on F&P MR850 heater. The testing consisted of different flows, set set / delivered nitric amounts, and cannula sizes recorded in the following table. HHHFNC input manifold pressures were also measured using a Dynatech 207B digital pressure meter. The measured pressures did not exceed the INO Vent DS manufacturer recommendations. Set FIO2 was 100% for testing all tested NO doses and HFNC variations. ***Conclusions:*** We found that the largest discrepancies between set and delivered NO were between 1 and 2 lpm, and 1 and 2 ppm of NO. The data showed 2 lpm on 1 ppm of NO was the most accurate. All other flows and NO doses delivered were comparable for accuracy between set and delivered. As a result of this data our institution no longer delivers NO at flows lower than 2 lpm.

Sponsored Research - None

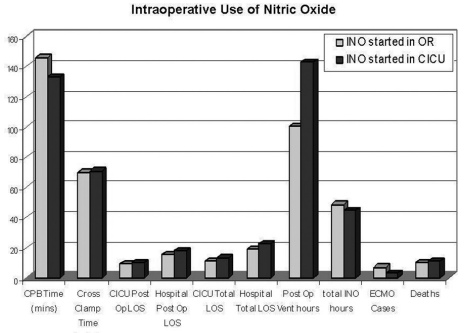
668214

INTRAOPERATIVE USE OF INHALED NITRIC OXIDE IN PEDIATRIC CARDIAC PATIENTS.

Jenni Raake[1,2], Catherine Krawczeski[2], Peter Manning[3], Scott Pettinichi[2]; [1]Cardiac ICU, Cincinnati Childrens Hospital Medical Center, Cincinnati, OH; [2]Respiratory Care, Cincinnati Children's Hospital Medical Center, Cincinnati, OH; [3]Cardiothoracic Surgery, Cincinnati Children's Hospital Medical Center, Cincinnati, OH

Background: Inhaled Nitric Oxide (INO) has been used in pediatric patients with congenital heart defects, who sometimes suffer from pulmonary hypertension, especially in the early post operative period. There have been reports of INO being initiated while the patient was still in the operating room. We studied our patient population to determine if initiation of INO in the operating room provided better patient outcomes. Methods: After IRB approval, chart reviews were performed on patients initiated on INO in the Operating room and patients initiated on INO in the Cardiac ICU. Data collection focused on: surgical procedures performed length of stay, time on INO, cardiopulmonary bypass time, progression to ECMO, death. Results: During the time frame being studied, 86 patients were initiated on INO while transitioning off Cardiopulmonary Bypass, and 70 were initiated on INO in the CICU postoperatively. The most frequent procedures for which INO was initiated in the operating room were Total Anomalous Pulmonary Venous Return repair (18), followed by Heart Transplant (12), Truncus Arteriosus repair (7), and repair of Atrial and Ventricular Septal Defect combined(6). The most frequent procedures for which INO was initiated in the CICU were Single Ventricle Palliative Procedures (22),Tetralogy of Fallot repair(15), followed by Total Anomalous Pulmonary Venous Return repair(6). Patients initiated on INO in the Operating Room experienced a reduced length of time on mechanical ventilation, a shorter length of stay, and a lower mortality rate. Conclusions: Initiating INO in the operating room may prove to be advantageous in certain congenital heart defects and may be considered as an adjunct to successful transition off of cardiopulmonary bypass. A Multivariate analysis with a larger cohort of patients may yield different results.

Sponsored Research - None



666952

NEONATES VENTILATED WITH NAVA HAVE BETTER BLOOD GASES THAN THOSE VENTILATED WITH SIMV/PC WITH PRESSURE SUPPORT.

Diane Howard, Howard Stein; Toledo Children's Hospital, Toledo, OH

Background: Neurally Adjusted Ventilatory Assist (NAVA) allows a patient to synchronize spontaneous respiratory effort with mechanical ventilation. Electrodes within a nasogastric tube detect the electrical activity of the diaphragm and transmit this information to the ventilator. The ventilator breath is triggered and terminated by changes in this electrical activity. The ventilator determines the inspiratory pressure in proportion to this electrical signal. The patient therefore determines respiratory rate, tidal volumes, peak pressures, inspiratory and expiratory times in total synchrony with the ventilator. There is currently no data about the ability of neonates to ventilate on NAVA. We hypothesized that NAVA is as effective as conventional ventilation using SIMV/PC with PS (CV) in ventilating neonates as evaluated by blood gases. Methods: From May 2008 – May 2009 we ventilated 87 neonates on NAVA ranging from 22 to 40 weeks gestation and birth weight 500-3930 grams. 85% had Respiratory Distress Syndrome or Chronic Lung Disease. Initially neonates were ventilated with CV and were then changed to NAVA at the discretion of the treating physician. We compared both the pH and CO2 levels on CV to those on NAVA. Statistics were 2 tailed t-test. Significant differences were at a p value < 0.05. Results: Both pre and post blood gases were obtained from 66 of the 87 patients. Patients who had an initial pH < 7.38 or pCO2 > 45 were considered under-ventilated and pH > 7.42 or pCO2 < 35 were considered over-ventilated on CV. After the initiation of NAVA, both over and under-ventilated groups significantly corrected their pH and pCO2 closer to the normal range (Table 1). Patients with normal pH (7.38 - 7.42) or pCO2 (35 - 45) remained unchanged (Table 1). Conclusion: We conclude that neonates have the capacity to ventilate better on NAVA as compared to CV. The neonatal brainstem appears sufficiently mature enough to regulate ventilation effectively on NAVA, achieving blood gases that approach the normal range in both under- and over-ventilated neonates.

Sponsored Research - None

pH and pCO2 values on SIMV/PC with PS compared to NAVA

	# PATIENTS	SIMV/PC with PS +- SD	NAVA +- SD	P-VALUE (<0.05)
PH < 7.38	46	7.29 +- 0.066	7.32 +- 0.055	0.018
PH 7.38-7.42	13	7.39 +- 0.01	7.38 +- 0.038	0.45
PH > 7.42	7	7.47 +- 0.037	7.39 +- 0.041	0.004
PCO2 > 45 mmHg	38	55.9 +- 9.3	49.5 +- 5.8	0.0008
PCO2 35-45 mmHg	18	39.5 +- 2.1	40.8 +- 7.3	0.82
PCO2 < 35 mmHg	10	29.9 +- 3.4	34.5 +- 6.7	0.05

665210

NEONATES VENTILATED WITH NAVA DO NOT HAVE AN INCREASED INCIDENCE OF IVH, PNEUMOTHORAX OR NEC/PERFORATION COMPARED TO THOSE VENTILATED WITH SIMV/PC WITH PS.

Howard Stein, Diane Howard; Toledo Children's Hospital, Toledo, OH

Background: Neurally Adjusted Ventilatory Assist (NAVA) allows a patient to synchronize spontaneous respiratory effort with mechanical ventilation. Electrodes within a specialized nasogastric tube detect the electrical activity of the diaphragm and transmit this information to the ventilator. The ventilator breath is triggered and terminated by changes in this electrical activity. The patient therefore determines respiratory rate, tidal volumes, peak pressures, inspiratory and expiratory times in total synchrony with the ventilator. We hypothesized that NAVA is as safe as SIMV/PC with PS and that the breath to breath variability in pressures and rate does not increase the incidence of Grade 3 or 4 Intraventricular Hemorrhage (IVH) or pneumothoracies (PTX), or that the specialized nasogastric tube does not increase the risk of Necrotizing Enterocolitis or spontaneous perforation (NEC/perforation) in the smallest, most susceptible premature neonates. Methods: From May 2008 – May 2009 we evaluated all neonates < 1500 grams birth weight or < 31 weeks gestation. Those neonates requiring ventilation were initially ventilated with SIMV/PC with PS and were then placed on NAVA at the discretion of the treating physician. Evaluation for IVH, pneumothorax and NEC/ perforation was done on all neonates on an ongoing basis. Statistics were Chi Squared with Fisher Exact test where appropriate. Results: 29% of neonates < 1500 grams birth weight and 28% of neonates < 31 weeks gestation were ventilated intermittently with NAVA. There were no statistical differences in the incidence of IVH, pneumothorax or NEC/perforation between all neonates and those ventilated on NAVA in either group (Table 1). Conclusion: This is the first study that looks at safety of NAVA in the premature neonate. We conclude that NAVA does not increase the risk of IVH, pneumothoracies or NEC/perf in neonates < 1500 grams birth weight or < 31 weeks gestation compared to SIMV/PC with PS.

Sponsored Research - None

Incidence of IVH, pneumothorax and NEC on patients ventilated with NAVA

	Total Patients	Total Patients on NAVA (% of total pts)	Total Grade 3 or 4 IVH (% of total pts)	Grade 3 or 4 IVH on or after NAVA (% of pts on NAVA)	Total PTX (% of total pts)	PTX on NAVA (% of pts on NAVA)	Total NEC/perf (% of total pts)	NEC/perf on or after NAVA (% of pts on NAVA)
< 1501 grams	180	52(29%)	22(12%)	4(8%)	9(5%)	1(5%)	10(6%)	1(5%)
< 31 weeks	185	52(28%)	21(11%)	4(8%)	9(5%)	1(5%)	12(6%)	1(5%)

665223

CPAP EFFECT OF HIGH FLOW NASAL CANNULA IN PEDIATRIC PATIENTS.

Jason Amadei[2,1], Shannon Cook[2], Teresa A. Volsko[1], Kathy Fedor[3], Robert L. Chatburn[2]; [1]Health Professions, Youngstown State University, Youngstown, OH; [2]Respiratory Institute, Cleveland Clinic Foundation, Cleveland, OH; [3]Pediatric Respiratory Therapy, Cleveland Clinic Foundation, Cleveland, OH

BACKGROUND: Limited data are available to describe the CPAP effects that can be expected when using high flows with a nasal cannula. The purpose of this study was to describe the relationship between the pressure generated at the airway opening and flow through a standard nasal cannula in simulated preterm, infant and pediatric models. We hypothesized the positive pressure generated by a standard cannula at flow rates greater than 2 L/min will be minimal and clinically insignificant. **METHODS:** Nares were simulated by drilling holes in plastic fixtures. The size of the nares corresponded with the Airlife nares template (preterm, infant and pediatric). The fixtures were connected to an ASL 5000 lung simulator (Ingmar Medical). An active lung model simulated spontaneous breathing adjusted to deliver tidal volumes of 3, 6, 9, and 12 mL. Lung compliance and resistance were standardized at 0.5 mL/cm H_2O and 125 cm H_2O/L/sec., respectively. Appropriately sized nasal cannulae were inserted in the fixtures. Cannula flow was adjusted from 2 – 6 L/min in 1 L/min increments. Data were averaged over twenty breaths. Mean airway pressure and %change in tidal volume were recorded. Differences in mean values were evaluated using one-way ANOVA. Statistical significance was set at $P < 0.05$. **RESULTS:** Values summarized over all volumes and flows are shown in Table 1. The greatest effect on tidal volume and pressure change was with the preterm model among the range of flows. **CONCLUSIONS:**Clinically important pressures were not generated by the use of high flows with a standard nasal cannula. Although statistically significant, differences in spontaneous tidal volume for each of the models across the range of flows were negligible.

Sponsored Research - None

Table 1.

	CPAP (cm H_2O)				% Delta V_T (mL)			
Models	Range	Mean	SD	p Value	Range	Mean	SD	p Value
Preterm	0.00 - 2.00	0.7	0.50	< 0.001	1.0 - 5.6	3.0	1.97	0.008
Infant	0.03 - 0.69	0.3	0.22	< 0.001	0.6 - 4.0	2.0	0.16	< 0.001
Pediatric	0.04 - 1.31	0.5	0.35	< 0.001	0.1 - 0.3	0.2	0.04	0.036

660987

ANALYSIS OF BLOOD GAS AND ELECTROLYTE COMPARISONS BETWEEN HAND-HELD AND BENCHTOP ANALYZERS IN A PEDIATRIC INTENSIVE CARE UNIT.

Ronald E. Dechert, Kenneth Bandy, Mark Konkle, Mary Britt, David Fickle; Mott Respiratory Care, University of Michigan Medical Center, Ann Arbor, MI

Background: Point-of-service (POS) labs have become a mainstay for many intensivre care units around the country. Respiratory Therapist frequently play an important role in support of these POS activities. Point-of-care (POC) test, using new hand-held technology (EPOC), allow RTs and other healthcare providers to move stat labs to the bedside. The purpose of this study was to document the agreement between POS and POC labs in a neonatal and pediatric environment. Method: Ordered STAT labs were analyzed on both POS and POC analyzers. Comparative analysis was performed to demonstrate agreement between anlyzer systems. Fifty-seven comparative studies were performed over a three day period. Results: We found no significant difference between the POS and POC analyzer performance in any (blood gases, electrolytes) analyte comparison. Observed difference were predominately associated with test sequence analysis. Conclusions: The use of the new EPOC POC analyzer provides reliable analysis of STAT labs and allows for analysis to be conducted at or closer to the patients bedside.

Sponsored Research - None

Comparative results for POS and POC analysis

Analyte	pH	PCO2	PO2	Na+	K+	Ca++	Hct
R squared	0.9735	0.9787	0.9847	0.9451	0.9379	0.9759	0.9478
Bias	0.023	-1.38	5.7	-2.8	-0.09	-0.049	-2.1

659803

VENTILATORY AND NON-VENTILATORY USES OF THE TELEFLEX® NEPTUNE ™ HUMIDIFIER IN THE NEONATAL INTENSIVE CARE UNIT.

Matthew S. Pavlichko[1,2], Kissinger Michael[1]; [1]Respiratory Care Services, The Reading Hospital and Medical Center, West Reading, PA; [2]NICU, The Reading Hospital and Medical Center, West Reading, PA

Background: Treating the critically ill neonate requires a special attention to detail to optimize patient outcomes; humidification is one of those details. Gases delivered at ambient temperature; with 100% humidity (44mg/L of water vapor) is vital in the respiratory care of all neonates. Heated and humidified delivered gases optimize secretion clearance, stabilize patient temperature, and decrease insensible water loss. The Teleflex Neptune humidifier was investigated to ensure proper humidification for its use in the NICU during ventilatory and non-ventilatory applications. Method: While evaluating the humidifier, it was important to identify the potential uses it would have in the NICU: ventilator and CPAP humidification, high flow nasal cannula, oxygen hood, and blow-by humidity for skin care. The humidifier was placed distal to the patient interface based on manufacturer's recommendations. The humidifier was set to deliver a temperature of 37C during all applications. The heater-to-patient temperature gradient control on the Neptune was adjusted to minimize condensation within the circuit and patient interface. The experiment measured the relative humidity (RH) and temperature, proximal to the patient, with an Extech Instruments SuperHeat psychrometer. Measurements were taken in a controlled experimental simulation and during patient use. Results: The Neptune, when used in conjunction with the Drager Babylog and Evita, high flow nasal cannula, and oxyhood, demonstrated stable temperatures of 37C at the patient interface. Experimentally and clinically, the Neptune delivered 99.9% RH to the patient as well. The use of blow-by humidity did show some variations due to inability to enclose the patient interface. The blow-by setup with humidifier measured 82.4-92.4% RH experimentally and up to 99% RH during patient use when the flow was directed at the patient. Patient ambient temperature may be the reason the results of the blow-by trial were different experimentally and clinically. A 10% decrease in RH was noted when the blow-by flow was not directed at the infant. Conclusion: The Neptune humidifier, when used properly, will heat and humidify medical gas therapy (ventilatory and non-ventilatory) effectively in the neonatal population. The humidifier is able to deliver 99.9% RH, at 37C, with minimal condensation. This allows the humidifier to be used during many respiratory care therapies in the NICU.

Sponsored Research - None

655458

SAFETY AND EFFICACY OF HIGH FLOW NASAL CANNULA AND ITS USE IN THE NEONATAL INTENSIVE CARE UNIT.

Matthew S. Pavlichko[1,2], Ronald S. Sherman[1], Gerard Brown[2]; [1]Respiratory Care Services, The Reading Hospital and Medical Center, West Reading, PA; [2]Neonatal Intensive Care Unit, The Reading Hospital and Medical Center, West Reading, PA

Background: The safety and efficacy of high flow nasal cannula (HFNC) has been a debated topic among clinicians for many years. HFNC uses optimally humidified oxygen which allows the clinician to turn up the flow. The higher flow applies a "splinting" affect to the airway which reduces the occurrence and severity of apneic events and work of breathing. The clinical dilemma is the unknown potential adverse events related to this therapy. Method: Over a nine month period, 69 infants were enrolled into the study with greater than 10,000 hours of HFNC therapy. Patient monitoring, quality assurance, and chart reviews were performed to look for adverse events of HFNC. The adverse events that were closely examined were pneumothoraces, infection, nasal dryness, and abdominal distention. A Teleflex Neptune humidifier with a single limb heated wire circuit was used and confirmed to deliver the high flow oxygen at optimal humidity (100% RH, BTPS). A Precision Medical oxygen blender and Hudson oxygen analyzer were used to guarantee flow rates and FiO2 delivered. Physicians ordered variable flow rates ranging in 1-5 lpm based on clinical need for respiratory support. Results: Patient indications for therapy included: Increased apneas, desaturations, or WOB (n=26); progressive weaning from ventilator assistance or NCPAP to bubble humidifier nasal cannula (n=41); or, the need for less invasive support with evidence of pneumothorax (n=2). Pneumothoraces occurred in only two of our study patients on HFNC. Two other patients resolved their previously diagnosed pneumothoraces while on HFNC. There was no evidence of airway infection. Five infants showed signs of nasal dryness, which was relieved with nasal saline drops. Three patients demonstrated abdominal distention, but it was relieved in two of the patients after NCPAP or NIPPV was switched to HFNC. Of the 69 patients enrolled, 25 (36.2%) demonstrated signs of apnea of prematurity, desaturations, and/or bradycardia. Of those patients, 12 required therapies such as assisted ventilation with surfactant administration (n=4), NCPAP (n=5), NIPPV (n=2), and oxygen hood (n=1), that are considered more invasive or restrictive than HFNC. Conclusion: This study demonstrated that high flow rate, heated, humidified nasal cannula is a well tolerated, safe, and effective adjunct therapy. It decreases respiratory distress and apneas, while filling the gap between NCPAP and bubble humidified oxygen.

Sponsored Research - None

646303

A SIX-YEAR REVIEW OF A PEDIATRIC RESPIRATORY THERAPY RESIDENCY PROGRAM.

Tim Macknight, Michelle Nylander; Respiratory Care Services, Primary Children's Medical Center, Salt Lake City, UT

Background- Primary Children's Medical Center (PCMC) is a 252-bed tertiary care facility located in Salt Lake City, Utah. The Respiratory Therapy (RT) staff spends the bulk of their productive time in either one of the two intensive care units or the Emergency Department. As these critical care areas have been continuously expanding for several years, the RT department has seen an increased need for full-time Registered Respiratory Therapists (RRT's). For a variety of reasons, traditional recruiting methods such as local and national advertising, job fairs, and state/national conferences have been largely unsuccessful in hiring experienced Pediatric RRT's. Beginning in 2003, we built upon an existing twelve week Internship and introduced the Respiratory Therapy Residency program in an attempt to address staffing needs for future growth. **Methods**- Demographics, training records, and employment information were reviewed from the 27 Residents accepted into the program from June 2003-June 2009. As there were distinct differences in the selection and orientation processes in the first three years (2003-2006) and the second (2006-2009), comparisons in retention rates, recruitment strategies, and training hours required to achieve full productivity are made in the two three-year periods. **Results**- See Table 1 for detailed data. As the program has evolved, retention of Residents has significantly improved. Contributing factors may include targeting new graduates from the local area, altering the selection process, adding multiple classroom sessions during specific unit orientations, and training additional preceptors. **Conclusions**- Our findings suggest local recruitment of candidates, multiple staff and management participating in the selection process, and the expansion of didactic hours will increase the likelihood of retaining Resident RRT's. We have also strengthened PCMC's relationship with the local Respiratory Therapy program based at Weber State University by adding student clinical hours and carefully selecting preceptors for students to be paired with. Though difficult to quantify, we have noted the higher performing students are tending to gravitate towards our facility and Residency program after their graduation. By Fall 2009, we expect to approach full staffing, eliminate the need for seasonal contract employees (aka " travelers"), and eventually reduce the need for staff overtime.

Sponsored Research - None

654123

USING SPECIALIZED PEDIATRIC TEAMS TO TRANSPORT INTERHOSPITAL PATIENTS

Rodney S. Plapp, Shelly R. Smith; PACU, Cincinnati Children's Hospital Medical Center, Cincinnati, OH

PURPOSE: The purpose of this observational study is to show the importance of a specialized pediatric team (Registered Nurse, Respiratory Therapist, a Physician or Nurse Practitioner) to transport interhospital neonatal and pediatric patients to procedures that require the mobilization of the high risk patient. The use of state-of-the-art medical equipment has become an essential part of patient care. However, using such high-tech products mean you need well-trained high-tech staff. A specialized interhospital transport team develops practices that decrease the occurrence of morbidity while increasing patient safety. Interhospital transport also allows primary staff to stay in the ICU, continuing to provide patient care. SETTING: Cincinnati Children's Hospital is a full service, not for profit pediatric academic medical center with 511 beds. There were 516 high risk patients, transported in house, for diagnostic testing in fiscal year 2007-2008. The transport team transports an average of 10.75 patients a week. The patients were considered high risk if they had an artificial airway, were ventilated with positive pressure, hemodynamically unstable, or neurologically compromised. INTERVENTION: The transport team receives a safe handoff report from the primary nurse. Vital signs and oxygen saturation are measured. The airway is checked for patency, proper placement, and security. The patient is placed on transport compatible equipment (ventilator, pumps, and monitor). If a patient can not tolerate a transport ventilator, they may be hand bagged. Some patients may require Nitric Oxide administration during transport, which can be placed in-line in either the ventilator circuit or via a disposable anesthesia bag. The patient is continously reassessed for synchrony and stability. Events such as loss of intravenous access, endotracheal tube extubation, and exhaustion of oxygen supply would be considered serious safety events. Results: Of the 516 patients transported, there was one event reported. The patient survived and had no long term morbidity. Conclusions: Having a specialized pediatric transport team may improve patient outcomes by preventing serious safety events from occuring during transport. It also assures safe hand-off of patients between caregivers. A specialized team enhances communication and relieves anxiety among family members as well.

Sponsored Research - None

638980

AN IN VITRO COMPARISON OF HELIOX AND OXYGEN IN ALBUTEROL DELIVERY USING PEDIATRIC HIGH FLOW NASAL CANNULA.

Arzu Ari[1], Robert Harwood[1], Meryl Sheard[1], Patricia Dailey[2], James B. Fink[1]; [1]Georgia State University, Atlanta, GA; [2]Baystate Medical Center, Springfield, MA

Background: Administration of aerosol via high flow nasal cannula (HFNC) has been described. Although the use of helium/oxygen mixture (heliox) in pediatrics has gained widespread support, the amount of aerosol delivery with a pediatric HFNC is not known. The objective of this study is to quantify aerosol delivery with heliox and oxygen in a model of pediatric ventilation. Method: A vibrating mesh nebulizer (Aeroneb Solo, Aerogen Inc., Ireland) was placed on the inspiratory inlet of a heated humidifier and heated wire circuit attached to a pediatric nasal cannula (Optiflow, Fisher and Paykel Healthcare Corporation, New Zealand). Pediatric breathing parameters of this study include: Vt 100 ml, frequency 20/min and I-time of 1 second. Using a vibrating mesh nebulizer was administered through a pediatric HFNC with oxygen (100%) and heliox (80/20% mixture). A total of 12 runs, 6 using oxygen and 6 using heliox were conducted at flow rates of 3 L/min and 6 L/min (n=3). A filter attached to the HFNC was used to collect aerosolized albuterol which was measured using spectrophotometry at 276 nm. Paired-samples t-test and independent-samples t-tests were conducted to compare aerosol delivery with heliox and oxygen at two different flow rates. Results: The % inhaled dose (mean± SD) is presented in the table below. Although the amount of albuterol delivery with heliox is similar to oxygen at 3 L/min, heliox increases aerosol deposition more than 2 fold at 6 L/min. Decreasing flow rate from 6 to 3 L/min increases aerosol delivery by 50% with heliox and 80% with oxygen. Conclusion: Using a pediatric HFNC, heliox at 6 L/min increased aerosol delivery by greater than 2 fold compared to oxygen. Reducing flow rate increased inhaled albuterol delivery in this model of pediatrics but decreased impact of heliox.

Sponsored Research - None

GAS / FLOW	3 LPM	6 LPM	p-values
Heliox (80/20%)	11.41 ± 1.54	5.42 ± 0.54	p=0.028
Oxygen (100%)	10.65 ± 0.51	1.95 ± 0.50	p=0.002
p-values	p=0.465	p=0.01	

653656

INFLUENCE OF BIAS FLOW, ACTUATION TIMING, AND INLINE SPACER ON DRUG DELIVERY DURING ADULT MECHANICAL VENTILATION.

Hui-Ling Lin[1], James B. Fink[2], Yue Zhou[3], Yung-Song Cheng[3]; [1]Respiratory Care Program, Chang Gung University, Tao-Yuan, Taiwan; [2]Respiratory Therapy, Georgia State University, Atlanta, GA; [3]Lovelace Respriatory Research Institute, Albuqureque, NM

Background: The deposition of medication delivered from a pMDI may be influenced by various factors. This in vitro study determined the influence of bias flow, actuation timing, and adapter type on drug delivery efficiency and particle size distribution distal to the ETT. Methods: Actuations (8) from HFA albuterol pMDI (Key Pharmaceuticals) through the AeroVent® chamber (Aero; Monaghan Medical), MiniSpacer® dual-spray nozzle (MI; Cardinal Health Corp), and the unidirectional nozzle built into the "Y" of the heated-wire circuit (Y; Fisher & Paykel Inc) with bias/trigger flows of 0.4 L/min, 2 L/min, and 5 L/min. All devices were placed in the inspiratory limb of the ventilator circuit proximal to the Y. Actuation was synchronized with beginning of inspiration (Synch), and one second before inspiration (1S). An Avea ventilator (Viasys Inc) delivered Vt of 700 mL, rate of 12 breaths/min, 50 L/min of inspiratory flow with descending flow pattern, and 5 cmH2O PEEP. An Impactor (NGI; MSP Corp.) was placed between the ETT and test lung to determine inhaled mass and mass median aerodynamic diameter (MMAD) (n=3). Samples were analyzed via spectrophotometer (224 µm), and a factorial ANOVA was performed ($p<0.05$). Results: The percentage of emitted dose (±SD) deposited distal to the endotracheal tube is shown in the Figure below. Discussion: The AeroVent spacer yielded significantly higher inhaled mass than other devices with no difference with bias flow or timing. Delivery with the MI and Y was more efficient with bias flow of 2 L/min than 5 L/min, and effect of timing was device dependent. The variables examined did not influence particle size distribution. Conclusion: Device design impacts the effect of trigger flow and actuation timing on aerosol delivery, but not MMAD, from a pMDI during mechanical ventilation. We thank the American Respiratory Care Foundation for the grants, and VIASYS Health Inc for the support of the AVEA ventilator.
Sponsored Research - None

Inhaled drug mass (%±SD) with each setting

Device \Timing\ BiasFlow	0.4 L	2L§	5L
MI- 1S	6.55± 0.98	6.37 ± 0.21	3.09 ± 0.0.4
MI- Synch	10.23 ± 1.89	12.38 ± 1.47	5.42 ± 0.77
Aero‡ – 1S	16.19 ± 0.08	16.79 ± 4.34	15.48 ± 2.88
Aero ‡– Synch	15.42 ±1.85	15.32 ± 5.35	12.62 ± 1.21
Y- 1 S	5.89 ± 2.15	13.16 ± 1.03	5.3 ± 1.69
Y- Synch	5.96 ± 0.56	7.68 ± 0.37	4.47 ± 0.73

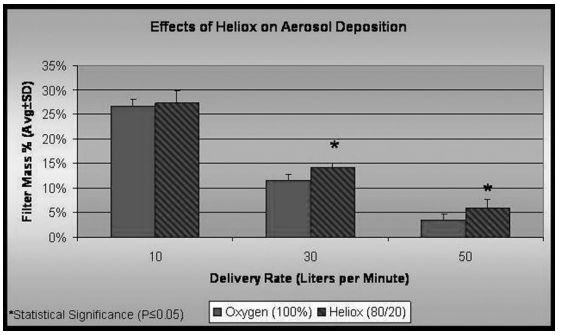
‡ Significant among overall spacers (p=0.00)
§ Significant to bias flow at 5 L/min (p<0.00)
No difference between two timings.

646957

AEROSOL DELIVERY THROUGH ADULT HIGH FLOW NASAL CANNULA: AN IN VITRO COMPARISON WITH HELIOX AND OXYGEN.

Patricia A. Dailey[1], Kyle Walsh[1], James B. Fink[2], Robert Harwood[2], Arzu Ari[2]; [1]Respiratory Care, Baystate Medical Center, Springfield, MA; [2]Division of Respiratory Therapy, Georgia State University, Atlanta, GA

INTRODUCTION. Heliox has been shown to reduce turbulence and improve aerosol delivery in a range of clinical settings. Delivery of aerosol with high flow nasal cannula (HFNC) has been applied to adults with severe asthma. A previously described model (Blaysham JAMPDD 2008) was modified to compare inhaled mass of albuterol with heliox and oxygen. METHOD. A vibrating mesh nebulizer (Aeroneb Solo, Aerogen) was placed at the inlet of a HFNC (Fisher & Paykel) A small adult cannula (Optiflow) was placed distal to the heated wire circuit with prongs placed into loose orifices simulating nares with a T-shaped trap and absolute filter connected to a breathing simulator (Vt 500 ml, 12 bpm, I:E of 1:2) 2.5 mg of albuterol sulfate in 3 mL was nebulized with Heliox (80:20) and Oxygen at 10, 30 and 50 lpm (n=3). Drug was eluted from the filter and assayed with UV spectrophotometry (276 nm). RESULTS. At 50 and 30 lpm, inhaled mass of albuterol was greater ($p<0.05$) with heliox (6 and 14%) than O2 (3.5 and 11%, respectively), but not at 10 lpm (28% and 27%). Aerosol delivery was inversely related to flow with both heliox and O2. CONCLUSIONS. Heliox increased aerosol delivery via HFNC up to 71%. Decreasing flow increased aerosol delivery via HFNC in this model.
Sponsored Research - None



654073

EDUCATIONAL INTERVENTION FOR AN EFFICIENT USE OF PULSE OXIMETRY AT ST. MARY'S HOSPITAL LACOR, GULU, UGANDA.

Simone Gambazza[1], Elisabetta Zampogna[2]; [1]Servizio Riabilitazione Funzionale, Azienda Ospedaliero-Universitaria Meyer, Firenze, Italy; [2]Divisione di Pneumologia, Fondazione Salvatore Maugeri I.R.C.C.S., Tradate, Italy

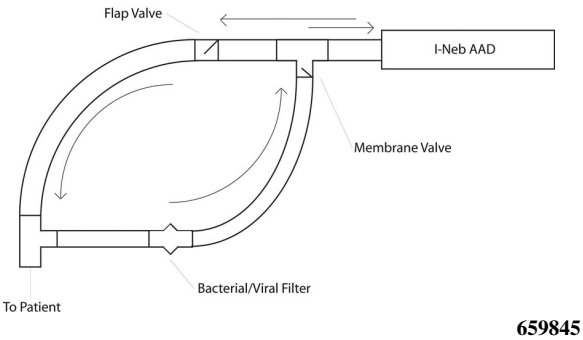
Background Medical and diagnostic information offered by technological devices that usually help the western medicine, are scanty or non-existent in developing countries; and if suitable instruments are available in the more depressed rural areas it is impossible to benefit from such devices without considering watering and electricity supply. The accuracy of instruments set on white-skin population and the lack of trained health workers may also lead to a misinterpretation of the read values and waste of economic resources. This project was developed to describe existing procedures of administering oxygen and monitoring SpO2 in a rural sub-Saharian hospital and to design and implement an educational intervention aiming to promote an efficient use of pulse oximetry among nursing staff. Method The project was carried out at St. Mary's Hospital Lacor in Gulu, Uganda from August 2007 to January 2008. Data from 323 dark-skin subjects from different wards were collected to determine their hypoxaemic risk (SpO2<94%). Using the Nellcor NPB-40 pulse-oximeter, the saturation was registered, considering reliable every value taken after 60 seconds. A questionnaire was then administered to nursing staff to assess their knowledge about pulse-oximetry technique through four questions: definition of SpO2 2) meaning of the read value, 3) knowledge of human physiology and 4) of oxygen. A series of meetings was organized to give nursing staff all the relevant information about pulse oximetry techniques. Results Patients in Medicine ward (30%) and Nutrition unit (20%) were the most exposed to hypoxaemic risk ($p<.05$) and only 16,6% of those with SpO2≤90% had been receiving the appropriate oxygen therapy. Only 28 out of 93 nurses gave the right answer to the first three questions and a substantial lack of rudiments concerning nature and use of oxygen as medical therapy was highlighted by the answers to the last question. The content of the educational meetings was developed accordingly to the results of the questionnaire; the importance of administering oxygen was particularly stressed suggesting to consider oxygen as any other medical therapy. Conclusions Oxygen concentrators and pulse-oximeters represent an important but rare combination in rural African hospitals. Increasing safety of patients through a more conscious use of pulse-oximetry and a consequent better fruition of oxygen has represented a small but significant result for this project lasted five months.
Sponsored Research - None

654598

MODIFIED I-NEB FOR THE DELIVERY OF ILOPROST AEROSOL IN CATHETERIZED PATIENTS.

Ganesh P. Devendra, Richard A. Krasuski, Robert L. Chatburn; The Cleveland Clinic Foundation, Cleveland, OH

The I-Neb Automated Aerosol Device (AAD) (Respironics, Cedar Grove, NJ) is the only FDA approved nebulizer for the administration of Iloprost (Ventavis, Cotherix, San Francisco, CA) in the treatment of pulmonary arterial hypertension. The I-Neb is a hand-held vibrating mesh nebulizer designed for single patient use. Furthermore the I-Neb will only deliver drug when held in a horizontal position. This design limits the administration of Iloprost as such: (i) clinical trials with Iloprost require purchasing an I-neb for each participating patient and (ii) the I-Neb will not work for catheterized patients who are always supine. The purpose of this study was to evaluate a circuit to filter exhaled gas and allow reuse of the I-Neb for multiple patients. **METHODS:** A filter circuit was constructed using a valve from the Circulaire nebulizer (Westmed, Tucson, AZ), Figure 1. The circuit directed exhaled air through a nonconductive bacterial/viral filter (Cardinal Health; McGaw Park, IL) and back to the I-neb. The I-Neb requires feedback from inhalation and exhalation to function properly as an adaptive device. Ventilation was simulated with an ASL 5000 (Ingmar Medical Inc, Pittsburgh, PA) with frequency = 15 breaths/min, tidal volume = 500 mL, sinusoidal flow pattern. Inhaled aerosol was estimated as the change in mass of a HEPA filter placed between the circuit and the ASL 5000. Normal saline (2 mL) was nebulized and captured on the HEPA filter. Measurements were repeated in triplicate. Mean inhaled aerosol with and without the circuit was compared with t-test, significance at $P < 0.05$. **RESULTS:** Nebulization time was approximately 10 minutes. The mean inhaled aerosol of the unmodified I-Neb was 0.32 ± 0.01 g. The inhaled aerosol with the filter circuit decreased to 0.29 ± 0.02 g ($P = 0.03$). **CONCLUSIONS:** These data show that the addition of a check valve and 18 inches of plastic tubing to the I-Neb reduced aerosol delivery by a clinically negligible amount. This suggests that the I-Neb AAD may be modified for administration of Iloprost in the cath lab and may have utility in future clinical trials.
Sponsored Research - None



659845

INHALED MEDICATIONS FOR NEONATES AND SMALL CHILDREN VIA A NOVEL AEROSOL CHAMBER: LABORATORY SIMULATION OF DELIVERY OPTIONS.

Rob DiBlasi[1], Dominic Copollo[3], Jolyon Mitchell[2], Cathy Doyle[2], Valentina Avvakoumova[2], Rubina Ali[2], Mark Nagel[2]; [1]Respiratory Care/Center for Developmental Therapeutics, Seattle Children's Research Institute, Seattle, WA; [2]Aerosol Research Laboratory, Trudell Medical, London, ON, Canada; [3]Monaghan Medical, Syracuse, NY

Background: Delivery of bronchodilators to infants and small children by pressurized metered-dose inhaler-holding aerosol chamber (pMDI-AC) is limited by airway narrowness, short respiratory cycle times, and low tidal volumes. There is a need for a versatile, efficient AC, given the variety of treatment modalities. Experiments with such an AC were undertaken to answer the question: 'Are differences in the delivery of inhaled beta2-agonist medication associated with the simulated delivery options: (a) mechanical ventilation (MV) via endotracheal tube (ETT); (b) manual resuscitation (MR) via ETT; (c) spontaneous breathing (SB) via facemask? Methods: ACs with internal geometry optimized for aerosol delivery and capable of accepting GSK pMDI canisters with dose counter (AeroChamber Mini*, n=5 devices/test) were evaluated for the delivery of HFA-albuterol (90 μg/actuation). Tidal breathing of a premature neonate with tidal volume (6-mL), designated NEO-P; term neonate with tidal volume (20-mL), designated NEO-T; and a small child (~2 year) with tidal volume (60-mL), designated CH-S. were simulated. Aerosol collection was obtained by electret filter with quantitative assay for albuterol. Results: Total emitted mass albuterol/actuation (TEM) ex AC was marginally greater for the SB (12.1 ± 1.8 μg) than the MR (10.0 ± 1.1 μg) child model ($p = 0.046$). Albuterol delivery by MV, though measureable and comparable for each model (3.3 ± 1.2 μg NEO-P; 3.8 ± 2.1 μg NEO-T; 4.2 ± 2.3 μg CH-S ($p = 0.63$)), was significantly lower than via the other simulated delivery options ($p < 0.001$). Similar TEM was measured for the SB (6.0 ± 1.0 μg NEO-P; 10.5 ± 0.7 μg NEO-T), or MR (5.5 ± 0.3 μg NEO-P; 10.7 ± 0.9 μg NEO-T) neonate (1-way ANOVA, $p \geq 0.46$). Conclusion: Reduced delivery of medication for MV was likely associated with the saturated atmosphere within the breathing circuit (T = 37∞C/>99%RH) compared with conditions (T = 22 ± 1∞C/44±7% RH) for the other modalities. The new AC may provide a versatile alternative to existing devices designed exclusively for each treatment modality.

Sponsored Research - Trudell Medical provided devices, testing equipment, and assisted with data organization and statistics.

664372

EFFECT OF INTERMITTENT AND CONTINUOS OPERATION ON NEBULIZER CHARACTERISTICS : AN IN-VITRO STUDY.

Ariel Berlinski[1,3], Randy Willis[2]; [1]Pediatrics, UAMS COM, Little Rock, AR; [2]Arkansas Children's Hospital, Little Rock, AR; [3]Pediatric Aerosol Laboratory, ACHRI, Little Rock, AR

Background: In-vitro evaluation of nebulizers includes characterization of the devices at different intervals during their operation time. Nebulizers are stopped at scheduled times and characteristics are measured. We hypothesized that running and stopping the nebulizers could affect the characteristics of the measured variables when compared to the same units operated in a continuous fashion. Methods: 4 small volume nebulizers (UP-DRAFT II OPTI-NEB, Hudson RCI, Temecula, CA) were loaded with 2.5mg/3ml of albuterol nebulizer solution and were run at 6 lpm of air. Nebulzer weight was determined on a precision scale while dry, after loading, and at every scheduled interruption. 10 μl aliquots were obtained before each weight to measure osmolarity (Osmette II, Precision Systems, Natick, MA). Nebulizers were run continuously for 1, 2, 3, 4, 5 and 6 minutes and intermittently for 6 minutes with stops at 1 and 2 minute intervals. 4 large volume nebulizers (HOPE, B&B Technologies, Carlsbad, CA) were loaded with 16 ml of 0.5% albuterol nebulizer solution and 184 ml of saline solution. Units were operated with air at 10 lpm. Nebulizer weight was determined on a precision scale while dry, after loading, and at every scheduled interruption. Nebulizers were run continuously for 1, 2, 3, 4, 5 and 6 hours and intermittently for 6 hours with interruptions at 1 and 2 hours intervals. Anova for repeated measures was used followed by Dunnet's test when necessary. Statistical significance set at 0.05. Results: (mean ± SD of 4 samples). See table: Intermittent nebulization resulted in an increase of solution output at 6 min of operation and an increase in osmolarity at 2, 4 and 6 min of operation for the Hudson nebulizer. Less frequent interruptions had less effect on outcome variables. Intermittent operation of the Hope nebulizer did not affect its solution output. Conclusions: The use of intermittent operation of nebulizers to determine their characteristics at different points in time requires previous validation of the procedure demonstrating that the operation mode does not affect the measured variables.

Sponsored Research - None

Hudson: cumulative solution output (mls)				
Time	Continuous	Every 1 min	Every 2 min	p value
2 min	0.63±0.05	0.67±0.05	0.52±0.15	0.07
4 min	1.15±0.06	1.3±0.08	1.08±0.19	0.05
6 min	1.58±0.05	1.83±0.05*	1.530.17	0.018
Hudson: osmolarity (mosm, increase from baseline: 289±1 mosm)				
2 min	16±2	19±2*	16±0	0.03
4 min	34±2	44±4*	37±1	0.001
6 min	57±2	89±8*	66±4*	0.002
Hope: cumulative solution output (mls)				
	Continuous	Every hour	Every 2 hours	
2 hours	40.6±1.7	40.1±1.2	40.6±1.7	> 0.05
4 hours	80.4±4.4	81.1±2.6	81.9±4.1	> 0.05
6 hours	124.4±7.1	124.8±6.5	124.6±7.1	> 0.05

* $p < 0.05$ when compared to continuous

664447

THE CARDIOPULMONARY EFFECT OF HEAT AND MOISTURE EXCHANGE MASK ON COPD PATIENTS DURING COLD EXPOSURE.

John Seifert; Health and Human Development, Montana State University, Bozeman, MT

Background It has been well established that cold air inhalation exacerbates cardiopulmonary stress in COPD patients. The frequency of exacerbations increases during the winter which will decrease pulmonary function. As pulmonary function decreases, there is a concomitant decrease in the quality of life because most outdoor activities are eliminated. Thus, minimizing cold air inhalation is an important factor in maintaining functional capacity. A heat and moisture exchange mask (HME) warms and humidifies cold, dry inspired air via latent heat exchange. However, it is not known if COPD patients would benefit from such a mask. The purpose of this study was to investigate the influence of an HME on the cardiopulmonary responses in COPD patients. Methods Following IRB approval, nine COPD patients (stage I: n=6, stage II: n=3) completed 4 intervals of cycling for 5 minutes at 30W followed by 10 minutes seated rest. Subjects completed one trial at 21C (RT) and two trials at -7C. Patients wore an HME or no mask (NM) during cold exposure. Pulmonary function was assessed immediately pre- and 5 min post trial while BP was measured at 15 min intervals during the 60 min exercise. Subjects were dressed in insulated clothing for the cold trials. An ANOVA with repeated measures and paired t-tests were used to analyze data. Alpha level of significance was set at $p<.05$. Results Percent change from baseline to 60 min was significantly different in the HME (3.3 +4.5%, 5.0+6.8%, 6.2+8.3%) and RT (9.0+11.8%, 8.0+12.5%, 3.4+17.0%) trials compared to the NM trial (-5.3 +5.9%, -7.1+12.0%, -8.9+113.7%) for FVC, FEV1, and FEV.5. % Change for systolic BP was significantly lower at 60 min for HME (3.0+4.0%) and RT (1.5+6.7%) than NM (14.2+6.1%). No differences were observed between HME and RT. One subject was unable to complete the exercise under the NM trial, but was able to complete the 4 intervals during the HME and RT trials. Conclusions Wearing an HME significantly improves cardiopulmonary function in the COPD patient compared to not wearing a mask during cold exposure. Similar results were observed between RT and cold exposure when wearing the HME. Functional capacity can be maintained, similar to that in thermal neutral conditions, when an HME is worn during cold exposure. The evidence suggests that an HME used by COPD patients should be considered as preventative treatment during cold exposure.

Sponsored Research - AirGuard Medical Products

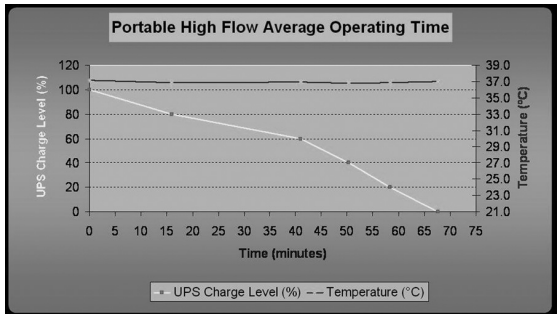
664466

PORTABLE HIGH FLOW NASAL CANNULA SYSTEM ADULT MODEL.

Kyle M. Walsh[1], Patricia A. Dailey[2], Ploypan Thongpradit[1]; [1]Clinical Engineering, Baystate Health, Springfield, MA; [2]Respiratory Care, Baystate Health, Springfield, MA

INTRODUCTION: Humidified High Flow Nasal Cannula (HHFNC) application is often implemented in critically ill patients presenting with respiratory distress to provide a less invasive means of support. Interruption of HHFNC therapy during transport has been implicated in detrimental patient outcomes. Our objective was to develop a practical system for patient transport with our HHFNC. METHOD: The HHFNC system included a calibrated air entrainment device (Maxtec OptiVenturi, Salt Lake City, Utah) connected to a 50psi oxygen source which provided 40% oxygen at 50 lpm to the humidifier (Fisher & Paykel MR 850, Auckland, New Zealand) attached to a small high flow cannula (Fisher & Paykel Optiflow, Auckland, New Zealand). The humidifier was plugged into AC power through the Uninterruptible Power Supply (UPS) battery (Leviton U1500-OSK, Little Neck, NY) until heated and humidified to 37∞C in the invasive mode. The UPS was then disconnected from AC power providing DC power to the humidifier and was run to depletion. RESULTS: The UPS was able to power the humidifier for an average of 67 minutes (n=3; SD 0.58) while maintaining a constant temperature of 37∞ C (SD 0.16) at 50 lpm of 40% oxygen. CONCLUSIONS: In this model, a UPS with a pure sine wave was required to produce a recognizable current to power the humidifier. Our project demonstrated that this system was able to provide more than an hour of usable time while consistently maintaining a temperature of 37∞ C, creating a viable, practical and portable option for HHFNC transport.

Sponsored Research - None



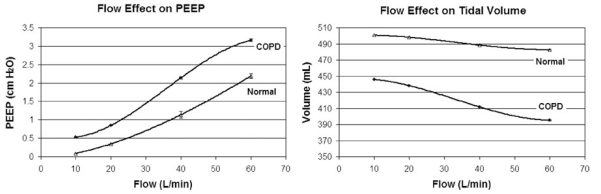
664899

MECHANICAL EFFECTS OF HIGH FLOW NASAL CANNULA IN NORMAL AND OBSTRUCTIVE ADULT LUNG MODELS.

Sherry Babic, Shannon Cook, Robert L. Chatburn; Respiratory Institue, Cleveland Clinic, Cleveland, OH

BACKGROUND: Studies demonstrate that high flow (>2 L/min) nasal cannulas in neonates produce continuous positive airway pressure (CPAP) similar to conventional nasal CPAP. The purpose of this study was to measure the mechanical effects generated by high flow nasal cannula (HFNC) adult normal and obstructive lung models. Specifically, we tested the hypothesis that both cannula flow and lung mechanics affect tidal volume and end expiratory pressure. **METHODS:** One adult HFNC (Hudson RCI) was used. Nares were simulated by holes drilled through an aluminum block. Breathing was simulated with an ASL 5000 lung simulator (Ingmar Medical, Inc.). Simulator settings for the COPD patient were: compliance = 85 mL/cm H_2O, resistance = 12 cm H_2O/L/sec, frequency = 24 breaths/min, muscle pressure (Pmus) = sinusoidal, 15 cm H_2O, 33% rise, 0% hold, 33% release, to generate a volume of 500 mL. Settings for the normal patient were: compliance = 90 mL/cm H_2O, resistance = 3 cm H_2O/L/sec, frequency = 12 breaths/min, 33% rise, 0% hold, 33% release, Pmus = sinusoidal, 5.2 cm H_2O to generate volume = 500 mL. Cannula flows 0, 10, 20, 40 and 60 L/min. For each experimental setting averages of 10 breaths were compared by t-tests for both PEEP and volume. Differences between lung modes were tested with Mann Whitney Rank Sum test. Differences with $P < 0.05$ were considered significant. **RESULTS:** The added resistance of the cannula in the nose, without flow, caused a decrease in tidal volume (498 and 467 mL, normal and COPD respectively, $P < 0.001$). For both the normal and COPD lung, a perfect, negative, polynomial (degree = 3) correlation ($R^2 = 1$) between volume and flow and a positive polynomial (degree = 3) correlation between PEEP and flow ($R^2 = 1$) were observed (Figure). For COPD. tidal volume was 44 mL lower than normal across flows and PEEP was higher 1.0 cm H_2O ($P < 0.029$). **CONCLUSION:** HFNC generates a small PEEP effect which is larger in COPD. However, with an increased airway resistance (i.e., COPD patients), it can be assumed that significant air trapping occurred, evident by a decrease in expiratory volume. Caution should be used when using HFNC in adult COPD patients.

Sponsored Research - None



666593

THE EFFECT OF AEROSOL DRUG DELIVERY ON AIRWAY RESISTANCE THROUGH HEAT-MOISTURE EXCHANGERS (HME): AN IN VITRO MODEL.

Matthew Hart, Arzu Ari, Robert Harwood, Lynda Goodfellow, Meryl Sheard, James B. Fink; Georgia State University, Atlanta, GA

Background: The impact of aerosol generators placed between Heat Moisture Exchanger (HME) and endotracheal tube (ETT) on resistance has not been reported. The purpose of this study is to determine the effects of aerosol drug delivery on resistance through HMEs. Method: A ventilator (Respironics Esprit, Respironics Inc.) delivered adult parameters (Vt 500 mL, frequency 15/min, PEF:60 L/min, PEEP 5 cmH2O and I:E ratio 1:3) through an HME (Hyrgobac S, Tyco Healthcare) and 8.0 mm ETT to a heated humidifier simulating exhaled humidity (37 C and 100% RH) and test lung. Airway resistance of HME was determined through the ventilator with humidity alone at 5 min intervals for 45 min (placebo), and after 15 min with humidity followed by 6 standard doses of albuterol sulfate (2.5 mg/3 mL) via jet nebulizer (JN; Salter Labs), vibrating mesh (VM) nebulizer (Aeroneb Solo; Aerogen Inc.) or 6 puffs of albuterol via pMDI (ProAir HFA, Teva Pharmaceuticals) and spacer (Minispacer, Thayer Medical). All tests repeated in triplicate (n=3). ANOVA with post-hoc multiple comparisons were performed ($p<0.05$). Results: The resistance in cmH2O/L/sec (mean ± SD) with the pMDI, JN and VM nebulizer presented in the table below. Resistance with placebo from 15 – 45 min ranged from 9.1 to 9.26. A linear relation between number of treatments and airway resistance was observed with each type of aerosol generators. pMDI increased resistance above placebo at treatment 6 ($p<0.05$). JN and VM were greater than placebo after dose 1. Resistance was greatest with VM. Conclusion: Placement of aerosol devices between the HME and ETT increased airway resistance up to 35%. Caution should be exercised when operating nebulizers in this position.

Sponsored Research - None

Aerosol Devices	Initial Airway Resistance	Aerosol Treatments					
		1st	2nd	3rd	4th	5th	6th
pMDI	9.1±0.01	9.1±0.0	9.2±0.1	9.2±0.1	9.3±0.1	9.3±0.1	9.4±0.1
JN	9.1±0.07	9.5±0.0*	9.9±0.2*	10.3±0.1*	10.5±0.1*	11.1±0.1*	10.8±0.4*
VM	9.1±0.06	10.4±0.1*¥	11.0±0.3*¥	11.7±0.2*¥	12.4±0.1*¥	12.7±0.2*¥	13.1±0.1*¥

* Significantly different from pMDI ($p < 0.05$),

¥ Significantly different from pMDI and JN ($p<0.05$)

667514

COMPARING PRESSURE CHANGES AND AEROSOL DEPOSITION OF A STANDARD SMALL-VOLUME NEBULIZER AND A MINI-HEART LOW FLOW NEBULIZER DURING HFOV.

Shane Cheney, Kevin Crezee, Tim Macknight, Jeff Wright; Respiratory Care Services, Primary Children's Medical Center, Salt Lake City, UT

Introduction: Aerosolized medications are often administered to intubated neonates within the Newborn Intensive Care Unit at Primary Children's Medical Center (PCMC). The standard as the means of delivery for aerosolized medications via the Sensormedics 3100A High Frequency Oscillator Ventilator (HFOV) has been an Metered Dose Inhaler (MDI). Previous bench lab studies conducted at PCMC showed that aerosol deposition was more effective via a Small Volume Nebulizer compared to an MDI in a neonatal lung model (Davidson et al, 2005). To build upon this information, we hypothesized that the efficiency of deposition would not be compromised and the turbulence / resistance to exhalation caused by the increased amount of flow at the closed suction catheter connection with the standard SVN setup could be minimized by using a Mini-HEART Low-Flow nebulizer (MHN). We further hypothesized that the post endotracheal tube (ETT) pressures would be higher than the set pressures on the HFOV with the standard SVN compared to a MHN with little or no change in aerosol deposition. **Methods:** To measure post ETT pressures, a neonatal lung model was attached to 2.5 - 4.0 ETT's and ventilated with the HFOV. The MHN and standard SVN were connected to the suction port of the "Y" adapter and run at multiple settings. The post ET pressures were read and measured from the LifePort jet adapter connected to the Bunnell HFJV. To measure medication deposition, a lung model was used in conjunction with a MHN and SVN. The mini-heart dosage consisted of a pre-mixed unit dose of 2.5 mg (0.5ml) albuterol and 2.5 ml NS. Ventilator settings comparing aerosol deposition were as follows: Mean Airway Pressure (PAW)= 20 cmH20, Amp= 30 cmH20, Hz= 10. A wide spectrum of HFOV settings were used to test post-ET pressure differences with both types of nebulizers. **Results:** Mean Albuterol delivery for the MHN onto the filter was the following: 2.5 ET= 6.8%, 3.0 ET= 8.8%, 3.5 ET= 10.0%, 4.0 ET= 10.1%. The average of the above means was 9.2%. Mean PAW increase as measured post ET was **1.95** cmH20 using the standard SVN and **0.5** cmH20 using the MHN. When comparing post ET pressures the mini-heart consistently demonstrated lower post ET pressures. **Conclusions:** Post-ET pressures were minimized with the MHN, with similar deposition results of SVN aerosolized medication. Evidence suggests the MHN may provide the same benefit of an aerosolized medication without altering intrapulmonary pressures.

Sponsored Research - None

668451

SOLUTION OUTPUT OF A LARGE VOLUME NEBULIZER DURING CONTINUOS ALBUTEROL NEBULIZATION: IN-VIVO VS. IN-VITRO STUDY.

Randy Willis[1], Ariel Berlinski[2,3]; [1]RCS, Arkansas Childrens Hospital, Little Rock, AR; [2]Dept of Pediatrics, UAMS, Little Rock, AR; [3]Pediatric Aerosol Research Laboratory, ACHRI, Little Rock, AR

Background: The use of continuous albuterol nebulization using a large volume nebulizer (LVN) is a common practice in the treatment of status asthmaticus. Predictable aerosol delivery is paramount to treat these patients. Real life performance of delivery devices might vary from laboratory evaluation performed under optimal conditions. In this study we compared the solution output of an LVN during in-vitro and in-vivo conditions. Methods: 50 LVNs (HOPE Nebulizer, B&B Medical Technologies, Carlsbad, CA) used by patients in the PICU were studied. The LVNs were operated at 10 Lpm as per manufacturer recommendations. The nebulizer was connected to a 6 feet corrugated tubing. Loading volume was 200 mls (prescribed albuterol dose + saline solution). There was no intervention by the research team. The fluid level was checked and the time of the observation and fluid level were marked at the beginning and at around the 2nd, 4th and 6th hours of operation. Once the treatments were completed the LVNs were weighted dry and with saline solution up to each of the previously made marks. Solution output (SO) was then calculated by the gravimetric method (PATNEB). A separate set of 4 LVNs were run under similar conditions in the laboratory and the output was measured by same technique (LABNEB). SO was expressed as ml/2hours of operation. Analysis of variance (ANOVA) and ANOVA for repeated measures followed by multiple comparison analysis Tukey when necessary were used to compare between conditions and within nebulizers respectively. A $p < 0.05$ was considered statistically significant. The study was approved by UAMS IRB. Results: 40 and 6 nebulizers had data for the first 6 and 4 hours respectively. 4 nebulizers had prolonged intervals between observations and were not included. Patient characteristics were (mean, CI95%): 65% female, age; 6.3 years, 5 –7.6 years; weight 27.1 kg, 21.8 – 32.4 kg. Albuterol dose was 0.5 and 1 mg/kg/hour for 37% and 63% of the patients respectively. SO (ml/2hours, mean ± SD) for PATNEB was 45.5 ± 10, 43.6 ± 12.2 and 40.7 ± 8.1 at 2nd, 4th and 6th hour respectively ($p = 0.11$). SO (ml/2hours) for LABNEB was 40.6 ±1.7; 41.3 ±2.5 and 42.7 ± 3.4 at 2nd, 4th and 6th hour respectively ($p = 0.86$). No differences in SO between PATNEB and LABNEB were noted ($p = 0.33$, 0.71 and 0.64 for the 2nd, 4th and 6th hour respectively). Conclusions: This large volume nebulizer showed similar solution outputs both in a laboratory and real life settings

Sponsored Research - The study was partially supported by an unrestricted educational grant from S&T Medical Technologies, Inc.

671055

EFFECT OF CONSERVER SYSTEMS ON JET NEBULIZER PERFORMANCE.

Robert L. Chatburn[1], Thomas J. Williams[2]; [1]Respiratory Institute, Cleveland Clinic, Cleveland, OH; [2]Strategic Dynamics, Scottsdale, AZ

BACKGROUND: The performance of pneumatic jet nebulizers varies greatly among brands. One key feature of newer nebulizer systems is the addition of a reservoir that conserves aerosol during expiration. Few data are available regarding performance of these conservers. The purpose of this study was to compare 4 different nebulizer configurations (1) a standard continuous flow nebulizer with a simple flex tube reservoir, a standard continuous flow nebulizer with a valve/bag conserver system, a dosimetric nebulizer operated in a breath actuated mode and a dosimetric nebulizer operated in the continuous flow mode. Hypotheses tested were that system efficiency and component efficiencies (i.e., nebulizer, delivery, and conserver efficiency; *Respir Care* 2007;52:1037) were different among nebulizer configurations. **METHODS:** Devices evaluated were Westmed VixOne nebulizer with t-tube connector only or 3 different conservers: standard flex tube, Westmed Circularire II or Healthline Medicator Plus (latter 2 are bag/valve systems); Monaghan AeroEclipse II in breath actuated or continuous mode. Nebulized solution was 3 mL normal saline. Breathing was simulated with an ASL 5000 (Ingmar Medical); tidal volume = 500 mL, sinusoidal volume pump at 50% inspiration, frequency = 15/min. Aerosol was collected on a HEPA filter and aerosol quantities measured by weight changes of nebulizer and filter (weight loss due to evaporation was insignificant up to 11 minutes nebulization time). Nebulization was stopped at sputter, defined as the start of the flat portion of the aerosol output/time curve. Mean values were compared with one way ANOVA, $P < 0.05$ considered significant. **RESULTS:** Summary data shown in Table. Nebulizer efficiency was the same for VioxOne and AeroEclipse ($P = 0.195$). Inhaled aerosol was different among nebulizer systems due to conserver performance ($P < 0.001$). Conservers improved system efficiency for the VixOne ($P = 0.006$) with bag/valve systems having higher efficiency than the flex tube ($P < 0.001$). For AeroEclipse, system and delivery efficiency were better for breath actuated mode ($P = 0.012$). **CONCLUSIONS:** For the systems tested, bag/valve conservers improve nebulizer performance compared to the standard flex tube. Breath actuated operation is more efficient than continuous nebulization but requires a longer treatment time.

Sponsored Research - Study funded by Westmed Inc. Tuscon AZ

Nebulizer	Configuration	Neb. Time (min)	Inhaled Aerosol (mL)	Output Aerosol (mL)	Neb. Effic. (%)	Consrv. Effic. (%)	Delivery Effic. (%)	System Effic. (%)
VixOne	T tube	4.4	0.42	1.51	50	0	28	14
VixOne	Flex tube conserver	4.4	0.51	1.69	56	3	30	17
VixOne	Circulaire II	4.4	0.7	1.58	52	17	44	23
VixOne	Medicator Plus	4.4	0.77	1.63	54	20	47	26
AeroEclipse II	Continuous	3.5	0.67	1.68	55	0	40	22
AeroEclipse II	Breath Actuated	5.9	0.94	1.65	55	17	57	31

675119

COMPARISON OF DELIVERED FIO2 AT TWO DIFFERENT FLOWRATES USING THE PULMANEX® HI-OX 80® OXYGEN MASK.

Dennis Rose, Doug Pursley, Aaron Light, Joseph Bishop, John Myers, Jennifer Brundridge; Ozarks Technical Community College, Springfield, MO

Background: The Pulmanex Hi-Ox 80 Oxygen Mask (Summit Technologies, Canada) is a disposable mask with low resistance valves and reservoir bag. According to the manufacturer's website, it is capable of producing an FIO2 of >80% at 8 L/m and >99% at 15 L/m of oxygen flow. A previous study performed at our institution found that the Hi-Ox 80 mask at 8 L/m produced a mean FIO2 of 72% (SD 11%). In this study, we sought to determine the mean FIO2 at 15 L/m and compare it to the previous study. Methodology: After obtaining IRB approval from our institution, we recruited 15 healthy adults with a mean age of 23.8 years into our study. All participants were required to be less than 35 years of age, have a DLCO value of 90% of predicted or greater, be a non-smoker, and have no history of lung disease. Individuals meeting these criteria were then seated, placed on a tight-fitting Hi-Ox 80 mask at 15 L/m, and were instructed to relax, breathe normally, and not talk for a period of 15 minutes. During the testing period, all subjects were observed to perform quiet, restful breathing. At the end of the fifteen minute period, we performed a radial artery blood gas and measured pH, PaCO2, and PaO2 using a GEM 3000 blood gas analyzer. No air bubbles were observed in any of the syringes and all samples were analyzed within five minutes. Assuming that our young, healthy subjects had normal cardiopulmonary anatomy and physiology, we estimated PAO2 by dividing PaO2 by a normal a/A ratio of 0.9 to reflect a ten percent higher partial pressure of oxygen in the alveoli than in arterial blood. Knowing approximate PAO2, we then calculated FIO2 by the following formula: $FIO2 = [(PaO2 \div 0.9) + (PaCO2 \times 1.20)] \div (PB - 47)$. Results: The mean PaO2 produced by the Hi-Ox 80 mask at 15 L/m was 458 mmHg. This resulted in a mean calculated FIO2 of 80.7%. Results from the previous 8 L/m study and the current study were tested for normal distribution and then a paired t-test was performed. The test showed that there was a statistical difference in delivered FiO2 between the two flowrates with a p value of 0.048. When subjects from the 15 L/m group with PaCO2 values < 35 mmHg were removed (n=9), the mean FiO2 increased to 86%. Conclusion: Although the mean FIO2 at 15 L/m did not reach 99% as suggested by the manufacturer, it did effectively increase FIO2 to a high level. Increasing the flowrate from 8 to 15 L/m produced a statistically significant increase in delivered FiO2.

Sponsored Research - None

677501

RANGE OF OXYMASK™ FIO2 AT 40 L/M IN YOUNG, HEALTHY SUBJECTS.

Brandon Burk, Charlton Blake, Doug Pursley, Aaron Light, Glory Coy, Jean Davenport; Ozarks Technical Community College, Springfield, MO

Background: The OxyMask (Southmedic Inc, Canada) is an open-designed oxygen mask that, according to the manufacturer's website, is capable producing an FIO2 of 60%-90% at 15 L/min or greater of O2 flow. A previous study performed at our institution showed that the OxyMask delivered a mean FiO2 of 44% with a standard deviation (SD) of 6% (range 34%-55%) on 15 L/min of O2 flow. In this study, we sought to determine if setting the flowrate for 40 L/m would be more likely to meet the manufacturer's reported FIO2 range of 60%-90%. Methodology: After obtaining IRB approval from our institution, we recruited 15 healthy adults with a mean age of 23.9 years into our study. All participants were required to be less than 35 years of age, have a DLCO value of 90% of predicted or greater, be a non-smoker, and have no history of lung disease. Individuals meeting these criteria were then seated, placed on a tight-fitting OxyMask at 40 L/m, and were instructed to relax, breathe normally, and not talk for a period of 15 minutes. 40 L/m flow was verified using a TSI Certifier FA Plus pneumotachometer. During the testing period, all subjects were observed to perform quiet, restful breathing. At the end of the fifteen minute period, we performed a radial artery blood gas and measured pH, PaCO2, and PaO2 using a GEM 3000 blood gas analyzer. No air bubbles were observed in any of the syringes and all samples were analyzed within five minutes. Assuming that our young, healthy subjects had normal cardiopulmonary anatomy and physiology, we estimated PAO2 by dividing PaO2 by a normal a/A ratio of 0.9 to reflect a ten percent higher partial pressure of oxygen in the alveoli than in arterial blood. Knowing approximate PAO2, we then calculated FIO2 by the following formula: $FIO2 = [(PaO2 \div 0.9) + (PaCO2 \times 1.20)] \div (PB - 47)$. Results: The mean PaO2 produced by an OxyMask at 40 l/m was 321.2 mmHg with a SD of 42 mmHg. This resulted in a mean calculated FIO2 of 58.8%, a SD of 6.87%, and produced a two SD FIO2 range of 45.0%-72.5%. During the testing period, our subjects had a mean pH of 7.43 and a mean PaCO2 of 37 mmHg. The average DLCO of the fifteen participants was 114% of predicted. Conclusion: In our group of young, healthy subjects, the range of FIO2 produced by an OxyMask at 40 L/m was less than stated by the manufacturer. In order for the OxyMask to achieve an FiO2 of 60%, the flowrate needs to be increased to approximately 40 L/min in normally breathing individuals.

Sponsored Research - None

677363

GLUTAMINE INHALATION ATTENUATES ENDOTOXIN-INDUCED LUNG INJURY IN RATS: ROLE OF ENHANCED HEAT SHOCK PROTEIN 72.

Yvonne Y. Juang[1], Chiao-Wen Tu[1], Huei-Ping Dong[2], Rei-Cheng Yang[1], Ming-Shyan Huang[1], Tung-Heng Wang[1]; [1]Department of respiratory Therapy, Kaohsiung medical university, Kaohsiung, Taiwan; [2]Foo-Yin University, Kaohsiung, Taiwan

Background: Studies have demonstrated that heat shock proteins (HSPs) play an important role in the protection of stressed organisms. The development of strategies for enhancing HSPs expression may provide novel means of minimizing inflammatory lung condition, such as acute lung injury. This study aimed to examine that glutanmine (L-alanyl-L-glutamine) inhalation may enhance pulmonary HSP expression and attenuate lung damage in a model of acute lung injury induced by Lipopolysaccharide (LPS) inhalation. Methods: Male Sprague-Dawley rats weighing 280-380g were randomly assigned to four experimental groups, Group 1:saline inhalation; Group 2:glutamine inhalation (1.5g); Group 3: pretreatment of saline inhalation 12 hours before LPS inhalation (2mg); Group 4: pretreatment of glutamine inhalation (1.5g) 12 hours before LPS inhalation(2mg). Samples were obtained 12 hours after treatment in group 1 and 2, and 8 hours after LPS inhalation in group 3 and 4. Nebulization of inhaled agents was performed by Aeroneb Pro (AERO). The degree of lung injury was assessed by various parameters including pathologic change in lung tissue, and protein concentration, lactate dehydrogenase(LDH) activity, total cells and polymorphonuclear leukocyte (PMN) cell counts in the bronchoalveolar lavage fluid (BALF). HSP 72 was examined by Western blot analysis. The data are expressed as mean±SEM. Statistical differences among groups were determined using paired Student t test. Results: Glutamine, compared with saline administration, led to significant increase in lung HSP 72 both in non LPS-treated rats (group 1 compared with group 2, $P \leq 0.002$) and LPS-treated rats (group 3 compared with group 4, $P \leq 0.05$). In LPS-treated rats, pretreatment of glutamine inhalation exhibited less lung injury by the evidences of decrease in histological damage score (11.4±1.5 Vs. 7.0±1.7, $P \leq 0.001$) and dramatic decrease protein concentration (2.61±0.63 Vs. 1.02±0.35mg/mL, $P \leq 0.05$), LDH activity (129.2±24.5 Vs.78±14.48 mAbs/min, $P \leq 0.001$) and differential cell counts,PMN % (88.6±7.3 Vs. 52.3±17.6%, $P \leq 0.001$) in the BALF. Conclusion: The present results indicate that previous glutamine inhalation associated with the enhancement of HSP 72 synthesis attenuates tissue damage in experimental lung injury.

Sponsored Research - None

677631

COMMON CANNISTER PROCESS FOR DELIVERING AEROSOL MEDICATIONS: THE FINAL STEPS TO ASSURE PATIENT SAFETY.

H. D. Mantz[1], Linda Radke[2], Jeanine Gunn[3]; [1]Respiratory Care, Salina Regional Health Center, Salina, KS; [2]Department of Pharmacy, Salina Regional Health Center, Salina, KS; [3]Infection Control Department, Salina Regional Health Center, Salina, KS

BACKGROUND: Financial savings, improved staffing efficiency and prevention of cross contamination (utilizing appropriate infection control methods) of the Common Canister (CC) process for delivering aerosol medications have been established and published 1, 2. Also well defined is the variable compliance of clinical staff members with infection control methods, even as simple as performing proper hand hygiene 3. OBJECTIVE: To assure that our CC protocol is safe for our patients; our staff remains compliant with the infection prevention process defined in our protocol and to confirm cost savings in our institution. METHODS: We developed a protocol that assured the hands of the respiratory therapist (RT) did not contaminate the patient's Valved Holding Chamber (VHC) or other surfaces. The protocol is specific to the point of outlining which hand to use to pick up each item involved in the process. We implemented CC in July 2008. Utilizing a multidisciplinary approach, we provided specific training, periodic validation of competence, unannounced observation of aerosol medication administration and patient interviews to identify the techniques used by the RT. We validated our protocol utilizing a florescent dye and black light to show if there was contamination during a mock CC process. Infection rates pre and post implementation of CC were followed by our Infection Control team using standard methods. MRSA rates were used to confirm that cross-contaminating was not occurring between isolated patients and patients receiving CC. Our departmental compliance is managed by making expectations clear and promoting staff accountability. Non-compliance is identified and the disciplinary process is utilized as needed. RESULTS: Our protocol proved to be valid. Since July 2008 we have delivered over 9,000 CC aerosol medication treatments while maintaining our hospital MRSA infection rate at 0.298% compared to the national average of 2.0% 4. For the most recent quarter in FY 2009, we had a zero infection rate for MRSA infections. We confirmed average cost savings to be near 30% and saw substantial time savings over standard nebulizer therapy after implementation of the CC process. CONCLUSION: CC delivery does provide cost-saving, efficient, effective and safe aerosol medication delivery with our proven protocol and methods to assure staff compliance.

Sponsored Research - None

679698

INTEGRATED ASTHMA CARE DELIVERY SYSTEM: A NEW MINDSET IN PRACTICE ACROSS CARE SETTINGS.

Donna L. Petersen[1], Peter Kilbridge[2]; [1]Respiratory Care, St Louis Children's Hospital, St Louis, MO; [2]Medical Director Information Technology and Clinical Effectiveness, St. Louis Children's Hospital, St Louis, MO

Background: The Department of Respiratory Care at St. Louis Children's Hospital(SLCH) noted an increase in the number of asthmatic patients requiring urgent administration of bronchodilator therapy. A Quality Initiative project began investigating the increased need for Now/Stat calls. Closer examination revealed significant delays in treatment during the admission process from the Emergency Department(ED), resulting in patient deterioration. Since 2001, more than 50% of the asthma patients admitted from the ED had times between treatments in excess of 3 hours, when standard of care dictates a maximum period of 2 hours for these patients. The deterioration in care during the transfer process appeared to be related to the removal of respiratory therapist from the ED in 1999 due to resource limitations. Current care is based on broadly accepted NHLBI guidelines available for outpatient, ED, and inpatient asthma management, but there is substantial room for improvement during patient transitions between these care settings. Method: In 2007 there were 2300 ED visits and 885 admissions for Diagnosis of Asthma, the number one admitting diagnosis at SLCH. A task force, compromised of a multidisciplinary committee was charged by hospital leadership to examine the extent and nature of the problem and develop recommendations for improvement. Three subgroups were formed: ED to inpatient floor, floor to ICU/ICU to floor, and discharge process group. The charge for each group were to map out processes, identify opportunities, and recommend an implementation plan. Final recommendations made by the task force were implemented in June 2008 with the exception of an assigned RT to the ED which is anticipated in Summer 2009. Results: Average times between last ED treatment and first inpatient treatment decreased from 163 minutes to 127 minutes ($p<0.01$). Proportion of patients waiting more than 140 minutes between treatments decreased from 65% to 27%. (Image 1) Conclusion: Keys to success include working with the ED nursing and medical staff to reinforce the concept that they are but one component of an integrated care delivery system, not an independent clinic. Common goals (particularly that the asthma patients should receive timely treatments regardless of location), common measures across settings, and common accountability permitted the task force to work as a team introducing significant changes in mindset as well as practice across settings.

Sponsored Research - None

642121

\IS ELEVATED BILIRUBIN A PROTECTIVE FACTOR FOR ASTHMA? AN ANALYSIS OF NHANES 2005-2006 DATA.

Venkata Subhash Gorrepati, Joseph Arthur, Pramil Cheriyath, Daniel Fischman; Harrisburg Hospital:Pinnacle Health, Harrisburg, PA

Background: Asthma, an intermittent, potentially life-threatening pulmonary disease, affects nearly 7.7% of the United States population. Previous literature has shown an inverse relation between serum Total Bilirubin (TBili) and atherosclerosis, particularly in men. Thus, we hypothesize that an elevated TBili level will confer a protective effect against asthma. Methods The National Health and Nutrition Examination Survey (NHANES) 2005-2006 is a population- based cross sectional survey of the non-institutionalized United States population. The data was collected in form of questionnaires, physical examination findings, and body fluid laboratory results. The presence of Asthma is assessed by the question "Has the doctor or other health professional ever told you that you have Asthma?" Statistical analysis was performed using a SAS 9.1 Statistical Software PROCSURVEY methodology. Results 4,085 eligible participants were selected after excluding all patients younger than twenty years, those with a history of abnormal liver function tests, or those who disclosed a history of liver disease. After adjusting for age, a TBili level of >14mmol/l was found to be inversely associated with asthma (odds ratio (OR) of 0.74, 95% CI 0.57-0.97) in males. Although a statistically significant relationship was not found in women, a trend towards a similar inverse relationship was found(OR of 0.75 (95% CI 0.43- 1.29). On adjusting the model for race, tobacco use, and marital status, a statistically significant protective effect for males remained (OR 0.74, with 95% CI 0.54 - 0.99). Conclusion: Our data analysis supports the previously observed, gender-specific protective effect that higher TBili levels convey with respect to Asthma risk. Although the reasons why this effect would not extend to women are not clear, studies do indicate that TBili's anti-oxidant effects promote beneficial airway remodeling and convey an anti-inflammatory effect. Since a similar effect, where higher TBili levels preferentially protect males against atherosclerosis has been reported in the literature; perhaps, higher estrogen and progestin levels in women counteract the beneficial effects of TBili. Further research is definitely warranted to better delineate this disparity in TBili's disease preventative properties.

Sponsored Research - None

680013

ROLE OF ALCOHOL ABUSE IN ASTHMA EXACERABATION- AN ANALYSIS OF NHANES 2005 2006 SURVEY.

Joseph Arthur, Venkata Subhash Gorrepati, Pramil Cheriyath, Daniel Fischman,Umar Farooq[1]; Harrisburg Hospital: Pinnacle Health, Harrisburg, PA,[1]PinnacleHealth Hospital, Harrisburg, PA

Background: Many factors trigger the flare up of Asthma leading to the increased number of emergency department visits and posing a risk to their lives. Alcohol is reported to cause airway inflammation through the release of its metabolite acetaldehyde. Alcohol-induced asthma has been well studied among the Asian population. However data on occurrence of this phenomenon among Caucasians and other races are quite sparse. Our objective is to determine the relation between consumption of alcohol and exacerbation of Asthma. Methods: The National Health and Nutrition Examination Survey (NHANES) is a cross sectional study of non institutionalized population of the United States in form of surveys, examinations and laboratory tests. Heavy alcohol consumption was defined as more than 4 drinks in a day for men up to 65 years, or more than 3 drinks in a day for women and men more than 65 years. Asthma exacerbation is defined as the visit to the emergency care or urgent care received because of asthma within the past year. The NHANES data was used and the relation was assessed using statistical software SAS version 9.1 PROC SURVEY methods. Results: 10348 participants took part in the survey and after deleting those with age less than 20 and no history of asthma we had 650 participants. After the age adjustment the relation between the asthma exacerbation and heavy alcohol consumption was found to be insignificant(odds ratio (OR) 0.66, with 95% CI 0.25-1.69). Even after the adjustment for gender, race, marital status and smoking the relation was not found to be insignificant (OR 0.7, with 95% CI 0.29- 1.67) Conclusion: Our results showed that there is no relation between alcohol consumption and asthma exacerbation in the Caucasian, African American and Hispanic Population. This can be explained on the fact that these groups lack a genetic defect in the gene for aldehyde dehydrogenase which is specific for Asian population. The lack of this defect could effectively clear the alcohol preventing the accumulation of acetaldehyde thus preventing the airway inflammation.

Sponsored Research - None

680016

HOW DO TIDAL VOLUME AND PEEP SETTINGS AFFECT EXPIRATORY RESISTANCE? A BENCH STUDY OF THE LTV® 1200 HOMECARE VENTILATOR.

James A. Matsuura, Andrea Young, Candice McClain, Kady May, Jody Lester; Respiratory Care, Boise State University, Boise, ID

Background: Home care ventilators hold a prominent place in the world of mechanical ventilation, and careful selection of ventilator modes and settings profoundly impact patient outcomes. In addition to patient factors, exhalation valves can generate expiratory resistance (ER) and can increase work-of-breathing and contribute to auto-PEEP. Analyzing ER on new homecare ventilators is crucial to patient care. The purpose of this study is to analyze the affects of tidal volume (Vt) and PEEP on ER on the Pulmonetics LTV® 1200 homecare ventilator. Method: ER was measured on the Pulmonetics LTV® 1200 (LTV) homecare ventilator. The LTV was attached to the Hans Rudolph Electronic Breathing Simulator (HR 1101) using Pulmonetics' non-heated circuit. Pressure and flow transducers (Hans Rudolph 4700 series) were calibrated using DT Foundry software and a Downs CPAP generator. Both transducers were placed before the exhalation valve, and ER was calculated using the equation (P1-P2/V). P1 = pressure before the exhalation valve, P2 = ambient pressure after the exhalation valve, and V = flow in liters per second. The ventilator was placed in volume A/C mode, frequency 15 breaths/minute, using tidal volumes (Vt) of 300-900 mL, ER was measured and recorded at each change. This process was repeated with set PEEP levels of 8-14 cmH2O. Results: See Table 1. Conclusion: As expected, this study found that ER changed when Vt and PEEP were manipulated. The values for ER in this study are consistent with previous studies which reported ER values of 2.1 – 159.0 cmH2O/L/sec for modern intensive care ventilators. The apparent inconsistency of expiratory resistance values at Vt 500 ml and 900 ml was possibly due to a defect in sampling methods—insufficient time devoted to letting the LTV stabilize after adjusting Vt. Future studies should utilize a longer sampling period. Overall, additional studies are necessary to thoroughly evaluate expiratory resistance in the clinical setting since patient variables may also impact expiratory resistance.

Sponsored Research - None

Table 1

	Vt 300 ml	Vt 500 ml	Vt 700 ml	Vt 900 ml	PEEP 8 cmH2O	PEEP 11 cmH2O	PEEP 14 cmH2O
Mode	Vol. A/C	Vol. A/C	Vol. A/C	Vol. A/C	Vol. A/C	Vol. A/C	Vol. A/C
Set Rate	12	12	12	12	12	12	12
Cst (ml cmH2O)	40	40	40	40	40	40	40
PIP (cmH2O)	14	19	25	31	25	28	31
PEEP (cmH2O)	5	5	5	5	8	11	14
VE (L/min)	3.6	6.0	8.4	10.8	7.2	7.2	7.2
Vte (ml)	255	427	592	770	490	480	500
Vt (ml)	300	500	700	900	600	600	600
Exp. Flow (L/sec)	0.76	1.25	1.06	1.50	1.37	1.41	1.13
P1-P2 (cmH2O)	11.47	17.90	23.52	29.73	23.55	26.28	29.35
Exp. Resistance (cmH2O/L/sec)	15.09	14.32	22.19	19.82	17.19	18.64	25.97

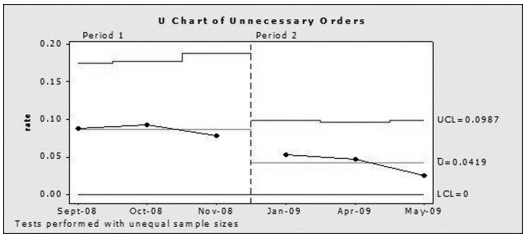
679928

EVALUATION OF THE EFFICACY OF A SCREENING PROCESS TO AVOID UNNECESSARY ORDERS FOR HOME OXYGEN ASSESSMENT:.

Dorothy G. Biggar[1], Patricia Nellis[2], Darnetta Clinkscale[1]; [1]Respiratory Care Services, Barnes-Jewish Hospital, St. Louis, MO; [2]Physical Therapy, Barnes-Jewish Hospital, St. Louis, MO

Background: Inpatients anticipated to require home oxygen must be assessed using specific criteria indicating medical necessity for Medicare coverage. Test results must be documented within a 48 hour window prior to discharge. At our hospital this process was problem prone and resulted in a significant incidence of unnecessary orders. Prior to September 2008, the testing was shared by Pulmonary Rehabilitation and Physical Therapy. Confusion occurred as to whom nursing divisions should call. Upon going to the floor to test the patient, the patients often were unable to walk during the assessment, it was discovered the wrong test had been ordered or the wrong department had been notified of the order. This confusing process resulted in unnecessary work (ordering a test on a patient who cannot perform the test) or re-work (performing test twice since it was ordered outside of acceptable 48 hour window). Materials and Methods: In order to clarify and improve the process in Sept., 2008, Pulmonary Rehabilitation took full responsibility for the inpatient home oxygen assessment. In October, 2009 Pulmonary Rehabilitation staff began a screening phone call process to eliminate unnecessary orders prior to going to the patient care unit. Criteria used in the screening included: discharge within 48 hours and patient's ability to walk. All calls were entered into a data base. Results: Comparison of overall rate from Period 2 (post intervention order screening process) to Period 1 (pre intervention prior to screening tool) shows a statistically significant difference (p=.024; 2 proportion test) in the rate of unnecessary calls for non-indicated tests. Conclusion: Implementation of screening tool for Home Oxygen Assessment appears to be effective in decreasing the rate of unnecessary calls.

Sponsored Research - None



679754

RETENTION OF ASTHMA KNOWLEDGE IN SCHOOL PERSONNEL.

Kathleen Hernlen[1], Randall Baker[1], Pamela Collins[2], James Dias[1], Allison Vaughn[1], Cierra Fortson[1], Kristi McMullen[1]; [1]Medical College of Georgia, Augusta, GA; [2]American Lung Association, Atlanta, GA

BACKGROUND: Between September 2006 and 2008, six children under 14 years of age residing in the Augusta, Georgia area were reported to have died from asthma. The asthma death rate in Richmond County, including Augusta, was significantly higher than the state and national pediatric asthma death rates during this time. The Richmond County Board of Education requested Georgia's American Lung Association's (ALA) Asthma 101 training for school personnel to address the need for education about asthma. The ALA's Asthma 101 program is a one hour class designed to educate the lay community, including school personnel, about asthma. Many schools have since requested repeat Asthma 101 programs, which prompted the investigators to ask if the Asthma 101 information is retained among teachers and school staff. The retention of knowledge after Asthma 101 training has not been examined. This study evaluated the retention of knowledge presented in the Asthma 101 program 18 months after the program. METHOD: Asthma 101 training was provided for teachers by the same instructor at two schools in the fall of 2007. A post-test to assess knowledge of asthma management was administered at that time. An identical post-test was administered to teachers who participated in the 2007 program in the spring of 2009. Individual and group results from 2007 and 2009 were compared to determine the retention of knowledge. RESULTS: Post tests from 2007 were matched to post tests in 2009. There were 85 participants in the 2007 training from both schools. However only 28 could be matched to post tests in 2009 (33%) There was no significant difference in yearly scores for either school (p= 1.00 and p= 0.718) or when the scores for both schools were combined (p= 0.779). There was no significant difference in school scores for 2007 (p=0.721) or for 2009 (p= 0.569). There was no significant difference in school change scores (p=0.824). Chi square analysis revealed no differences in responses for each individual question from 2007 to 2009 (p values ranging from 1.0 to 0.065). Wilcoxon Signed Ranks test revealed no significant difference in the total number of incorrect responses by year (p=0.903). CONCLUSION: There were no significant differences in the school scores or the individual questions from 2007 to 2009. However, the sample size was small. Further studies with larger numbers of subjects are recommended.

Sponsored Research - None

679721

DECREASING THE LENGTH OF STAY IN THE EMERGENCY DEPARTMENT FOR PATIENTS DISCHARGED WITH ASTHMA.

Mary K. Hart, Vannie Alexander, James D'Etienne, Mark Millard; Baylor University Medical Center, Dallas, TX

Background On an average, 80 adult asthma patients are treated in the Emergency Department (ED) at Baylor University Medical Center each month. The average length of stay (LOS) is 278 minutes for those discharged and 516 minutes for those admitted. Asthma can be controlled with proper treatment and ED management should take no longer than 180 minutes based on Expert Panel Report 3. The opportunity for improvement was evident. Methods A quality improvement multidisciplinary Asthma ED Team was formed to determine what was causing the significant LOS. The team leader coordinated and facilitated meetings with MDs, RTs, and RNs. Quality improvement tools, such as a fishbone cause and effect diagram, run charts, and affinity charts, were used to help identify and prioritize problems identified by the team. During the first brainstorming session the team discovered that no standardized asthma protocol existed for ED staff to follow. An asthma protocol was developed and FEV1 meters were given to all RTs to use to determine severity and treatment effectiveness. A breath actuated nebulizer (BAN) was introduced to deliver all bronchodilator therapy more effectively and safely. Staff was educated on the asthma guidelines, choice of medications, how to use the protocol, document, and communicate effective patient handoff. The team leader spent time working with staff in the ED to help improve their performance as they gained more confidence. Physician champions met one on one with physicians to discuss specific cases. Ongoing chart reviews helped identify areas that needed further improvement. Results Having an asthma protocol streamlined the management of asthma in the ED. It has taken time to see the improvements purely because of "changing the culture". Having the RTs "Drive the Protocol" has made a big difference. This has given them the opportunity to prove themselves as invaluable members to the team. After implementing the asthma protocol 4 months ago, the average LOS has decreased by 51 minutes and FEV1 measurements are performed 99% of the time. Medication delivery using the BAN is effective allowing some patients to be discharged who would normally be admitted. Conclusion The ED Asthma Protocol Team has made a positive impact in how asthma care is delivered in the ED. They will continue to work towards their goal as they improve their team dynamics. The next steps for this team are to tackle discharge planning, physician referrals and follow-up care.

Sponsored Research - None

679280

COMPLIANCE OF CPAP/BIPAP PATIENTS IN HOME CARE.

Julie A. Jordan, Laura Bazyk, Mike Jones, Alfred Daley, Donna Auston, Jeri Prosser, Brenda Small, Elizabeth Rockwell; Mid-Atlantic Healthcare, Alexandria, VA

Background: CPAP and BiPAP machines are most often used in the home to treat patients diagnosed with Obstructive Sleep Apnea (OSA). Once a sleep study has been completed and a diagnosis of OSA has been established, these patients are then instructed in the use of the CPAP/BiPAP machine, and are fitted for an appropriate mask. Follow-up with a Respiratory Therapist is done within 72 hours. This study investigates the compliance of patients suffering with OSA. Methods: Compliance was studied in 527 patients over a 6 month period. 30 days after initial set-up, data cards stored in the CPAP/BiPAP machines were downloaded onto Encore Pro Data software which transferred compliance results so that the patients' therapy compliance could be assessed. This process was repeated at 90 days and in some patients, at 200 days. Results: Of the 527 patients studied on both CPAP and BiPAP, the total average days of usage was 88.51, total average hours were 3.83, and total average compliance was 49.7%. The highest compliance was measured in patients using BiPAP at 63.6%, Auto BIPAP with Bi-Flex at 62.7%, and BiPAP S/T at 62.3%. The lowest compliance was measured in patients who used BiPAP with Bi-Flex at 36.8%. Conclusion: Our findings suggest that despite the severity of symptoms associated with OSA and the proven favorable outcomes of consistent use of CPAP/BiPAP devices, many patients are reluctant to adhere to their prescribed therapy. This indicates a need for increased therapist and physician involvement in assessing individual needs and concerns regarding CPAP/BiPAP usage, and determining appropriate intervention that will improve compliance.

Sponsored Research - None

OVERALL REPORT TOTALS FOR COMPLIANCE

Device Mode	# of Patients	Average Days of Use	Average Hours of Use	Average Percent Compliance
Auto Bi-Level with Bi-Flex	27	102.15	4.56	62.7%
Auto CPAP	6	36.83	3.32	49.5%
Auto CPAP with C-Flex	82	72.50	4.20	53.6%
Bi-Level	3	159.33	4.78	63.6%
Bi-Level S/T	6	190.83	5.27	62.3%
Bi-Level with Bi-Flex	42	76.38	2.83	36.8%
CPAP	9	205.89	4.39	55.5%
CPAP with C-Flex	386	80.40	3.77	48.8

# of Patients-527

Average Days of Use-88.51

Average Hours of Use-3.83

Average Percent Compliance-49.7%

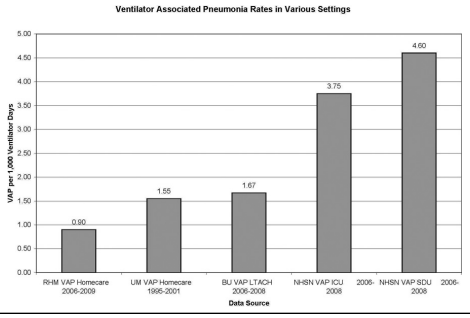
679057

INCIDENCE OF VENTILATOR ASSOCIATED PNEUMONIA IN ADULTS IN THE HOMECARE SETTING.

Louis M. Kaufman; Roberts Home Medical, Inc., Germantown, MD

BACKGROUND: Ventilator-associated pneumonia (VAP) is a significant complication among mechanically ventilated patients. An increasing number of ventilator-dependent patients are cared for at home. Epidemiologic data from a study performed in Michigan from 1995 to 2001 indicated the incidence of VAP is much lower in the homecare setting. METHOD: A retrospective review of adult ventilator-dependent patients cared for at home during 29 consecutive months was conducted. Roberts Home Medical, a privately owned for-profit durable medical equipment supplier, provided equipment, education and monitoring. Results were compared with published data of VAP infection rates in the hospital, skilled nursing facility and home. Eighty-four adult patients (age range 24 to 85; mean 53) received invasive mechanical ventilation in their home during the period January 2007 to May 2009 (total number of ventilator days = 47,806). A Respiratory Care Practitioner (RCP) visited each patient monthly to provide ongoing patient and caregiver training, perform environmental and patient assessments and maintain equipment. RCP documentation included all respiratory infections reported by the patient and/or caregiver. RESULTS: There were 36 reported cases of pneumonia and 7 reported upper respiratory infections; or 0.90 episodes per 1,000 ventilator days. The patient and/or caregiver information may have been non-specific for VAP; therefore, all reported respiratory infections were included in the data. Recently published reports include data from the National Healthcare Safety Network (NHSN) during 2006 to 2007 noting 3.75 incidents of VAP per 1,000 ventilator days in a variety of adult intensive care units (ICU) and 4.6 incidents of VAP per 1,000 ventilator days in adult step down units (SDU); the Boston University (BU) during 2006 to 2008 noting 1.67 incidents of VAP per 1,000 ventilator days in a long-term acute care hospital (LTACH); and the University of Michigan during 1995 to 2001 noting 1.55 incidents of VAP per 1,000 ventilator days in the homecare setting. CONCLUSION: In this population of adult ventilator-dependent patients receiving invasive mechanical ventilation at home, the incidence of respiratory infections is lower than in recently published reports of infection data in the ICU, SDU, LTACH and homecare settings.

Sponsored Research - None



678415

EVALUATION OF DISINFECTION OF REUSABLE PULSE OXIMETRY SENSORS USED IN THE HOMECARE AND PRE-HOSPITAL EMERGENCY CARE SETTINGS.

Louis M. Kaufman[1], Benjamin T. Kaufman[2]; [1]Roberts Home Medical, Inc., Germantown, MD; [2]Montgomery County Fire & Rescue Service, Montgomery County, MD

BACKGROUND: In homecare and pre-hospital emergency care settings reusable pulse oximetry sensors are to be surface cleaned between patient use by wiping with a solution of 70% isopropyl alcohol. The current study evaluated patient-ready sensors being used by respiratory care practitioners (RCP) or paramedics (PM) for spot checks or continuous overnight oximetry by testing them for bacterial contamination. METHOD: Patient ready reusable oximetry sensors from various locations were tested for bacterial contamination. The inner aspect of oximeter sensors were swabbed using sterile cotton swabs. These swabs were transferred to agar plates and incubated. 1. Columbia CNA agar (CAN) is a media selective for the growth of gram-positive bacteria by inhibiting the growth of gram-negative bacteria. 2. Eosin Methyline Blue (EMB) agar is a media selective for the growth of gram-negative bacteria. RESULTS: A total of 12 sensors were evaluated: 6 sensors (RT01-06) maintained by individual RCP's for spot check use in the homecare setting; 2 sensors (PM01-02) maintained by PM's for spot check use in the pre-hospital emergency care setting; and 4 sensors (ST01-04) maintained by RCP's for overnight oximetry testing in the homecare setting. There was no growth on any of the sensors used in the pre-hospital emergency care setting or for overnight oximetry testing. All 6 of the sensors used by individual RCP's for spot check use in the homecare setting exhibited bacterial contamination. No growth was noted on any EMB plate indicating no gram-negative bacteria on any sensor. Growth noted on the CNA agar plates is the result of gram-positive bacteria. It is likely these colonies are the result of staphylococcus epidermitis, normal flora bacteria of the skin. CONCLUSIONS: This study indicates disinfection of reusable pulse oximetry sensors between patient use by wiping with a solution of 70% isopropyl alcohol is effective when performed. Sensors which are not thoroughly cleaned between patient use contain microbes. Personnel responsible for between patient use disinfection must remain diligent to assure the disinfection process is performed effectively.

Sponsored Research - None

SAMPLE ID	CNA	EMB
PM01	no growth	no growth
PM02	no growth	no growth
RT01	14 colonies	no growth
RT02	3 colonies	no growth
RT03	7 colonies	no growth
RT04	20 colonies	no growth
RT05	2 colonies	no growth
RT06	1 colony	no growth
ST01	no growth	no growth
ST02	no growth	no growth
ST03	no growth	no growth
ST04	no growth	no growth

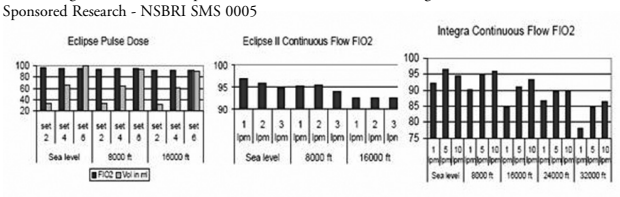
666978

PERFORMANCE OF OXYGEN CONCENTRATORS AT ALTITUDE.

Dario Rodriquez[1], Thomas Blakeman[2], Richard Branson[2]; [1]CSTARS (Center for Sustainment of Trauma and Readiness Skills), University Hospital, Cincinnat, OH; [2]Surgery, University of Cincinnati, Cincinnati, OH

Background: The space program and military air transport represent challenging environments for medical care. Size and weight of compressed gas and the possible added risk of fire, compound the arduous task of patient transport. A proposed solution is to use a portable oxygen concentrator (POC) for O2 administration. An assessment of the Sequal Eclipse II and Integra POCs was conducted evaluating the fraction of inspired oxygen (FIO2) and flow/volume across the range of capabilities. Methods: Evaluations were conducted in a hypobaric chamber. The POCs were tested at sea level and simulated altitudes of 8000 ft, 16000 ft, 24000 ft, and 32000 ft. Each POC was attached to an analyzer measuring FIO2, flow, volume (pulse dose), temperature and power consumption. Measurements were made across the range of POC capabilities at each altitude. The Eclipse II was evaluated in both continuous and pulse dose modes. Measurements of chamber barometric pressure (PB), temperature, and relative humidity were recorded at each altitude. A trial of battery duration of the Eclipse II at sea level and altitude of 8000 ft was performed. Data shown are the average of three measurements produced with each condition on both POCs. Results: The delivered FIO2 was highest at sea level. FIO2 diminished as PB decreased. The Eclipse II failed to operate above 22000 ft. Power consumption was reduced at higher altitudes. At the highest flow settings, power consumption diminished by 30% during continuous flow and 31% during pulse dose in the Eclipse II and 19% in the Integra comparing sea level to 8,000ft. Battery duration on the Eclipse II at 8000 ft and 3 lpm was 1 hr 48 mins compared to 1 hr and 22 mins at sea level. Conclusion: The relatively high FIO2 delivered by the POCs makes this method of O2 delivery a viable alternative to compressed O2 in select situations. POCs cannot deliver an FIO2 of 1.0, necessitating complementary compressed gas for these scenarios. At operational PB, POC function remains equivalent to operation at sea level. The PIO2 available to the patient however, remains constrained by lower PB as altitude increases. At sea level (PB of 750 mmHg) an FIO2 of 0.90 produces an alveolar O2 of 582 mmHg, at 8,000 ft (PB of 564 mmHg) an FIO2 of 0.90 produces an alveolar O2 of 415 mm Hg whereas, at an altitude of 32,000 ft (PB of 206 mmHg) an FIO2 of 0.90 produces an alveolar O2 of 93 mmHg.

Sponsored Research - NSBRI SMS 0005



678059

MAXIMIZING OXYGEN DELIVERY WITH AN OXYGEN CONCENTRATOR DURING MECHANICAL VENTILATION.

Dario Rodriquez[1], Thomas Blakeman[2], Richard Branson[2]; [1]CSTARS (Center for Sustainment of Trauma and Readiness Skills), University Hospital, Cincinnat, OH; [2]Surgery, University of Cincinnati, Cincinnati, OH

Background: Transportation of the critically ill/injured warfighter requires the coordinated care and judicious use of resources. Availability of oxygen (O2) supplies for the mechanically ventilated patient is crucial. Size and weight of cylinders makes transport difficult and presents an increased risk of fire. A proposed solution is to use a portable oxygen concentrator (POC) for mechanical ventilation. We tested the Sequal Eclipse II POC paired with the Impact 754 and Pulmonetics LTV-1200 ventilators in the laboratory and evaluated the fraction of inspired oxygen (FIO2) across a range of minute volumes. Methods: Each ventilator was attached to a test lung (TTL) and pressure, volume, flow, and inspired oxygen (FIO2) was measured by a gas/flow analyzer. Ventilators were tested at a tidal volume (VT) of 500 ml, inspiratory time of 1.0 second, respiratory rates of 10, 20, and 30 breaths/minute, and PEEP of 0 and 10 cmH2O. The LTV 1200 was tested with and without the expiratory bias flow. The Eclipse II was modified to provide pulse dosing on inspiration at three volumes (64,128,192 ml) and continuous flow at 1-3 liters/minute. Six combinations of ventilator settings were used with each POC setting for evaluation. O2 was injected at the ventilator gas outlet and patient wye for pulse dose and continuous flow. Additionally, continuous flow O2 was injected into the oxygen inlet port of the LTV 1200, and a reservoir bag, on the inlet port of the Impact 754. All tests were done with both ventilators using continuous flow, wall source O2 as a control. We measured the FIO2 with the concentrator on the highest pulse dose setting while decreasing ventilator tidal volume to compensate for the added volume. Results: The delivered FIO2 was highest when oxygen was injected into the ventilator circuit at the patient wye using pulse dosing, with the VT corrected. The next highest FIO2 was with continuous flow at the inlet (LTV), and reservoir (Impact). Electrical power consumption was less during pulse dose. Conclusion: The relatively high FIO2 delivered by the POC makes this method of O2 delivery a viable alternative to O2 cylinders. Patients requiring an FIO2 of 1.0 would require additional compressed oxygen. This system allows O2 delivery up to 76% solely using electricity. An integrated ventilator/POC capable of automatically compensating VT for POC output is desirable. Further patient testing needs to be done to validate these laboratory findings.

Sponsored Research - None

Ventilator	Respiratory Rate	Tidal Volume	PEEP	Continuous or Pulse	O2 setting	Injection Site	FIO2
Impact 754	10	500	0	Continuous	3 Liters	Reservoir	62.9
Impact 754	10	500	10	Pulse	Setting 6†	Wye	58
Impact 754	10	300#	10	Pulse	Setting 6†	Wye	76.2
LTV 1200*	10	500	10	Continuous	3 Liters	Inlet	56.4
LTV 1200*	10	500	10	Pulse	Setting 6†	Wye	48.5
LTV 1200*	10	300#	0	Pulse	Setting 6†	Wye	59.9

*O2 conserve on #Tidal volume corrected for pulse dose volume Pulse dose of 192 ml

678038

SIGNIFICANT DECREASE IN UTILIZATION SEEN AFTER INSTITUTION OF ASTHMA HOME CARE PLAN.

Anne E. Kwiatkowski; Respiratory Care, St. Vincent Mercy Medical Center, Toledo, OH

Background The Joint Commission and the Children's Asthma Care advisory panel recommended three core measures to be implemented nationwide to address the lack of hospital performance measures relevant to children's asthma healthcare. These core measures are: reliever medications administered, systemic corticosteroids administered, and a home management plan addressing: Use of controllers/relievers Triggers Timing of rescue actions Patient/Caregiver signature Appointment made with primary care physician (or pulmonologist) for follow-up after discharge A copy of the plan placed in the chart and a copy given to the caregiver St. Vincent Mercy Medical Center/Mercy Children's Hospital adopted these core measures. Prior to implementing these standards, our compliance with asthma education was 11%. Methods Our hospital instituted a pathway to manage asthmatics in 1994. This increased our consistent use of medications, both relievers and controllers, from 12% to 96%. Our written plan contains all of the required information. Included on this form is a section addressing symptoms and/or peak flows and the appropriate response. It is color coded in the stoplight format. The family receives asthma education both oral and written during their admission. The asthma educator provides and reviews the completed plan with the parents upon discharge. In the educator's absence the plan is given to the family by the respiratory therapist or nurse. We explored utilization of 157 children that received the plan upon discharge from the hospital. Results Our asthma education and discharge controller medications have improved from 12% to 96%. Of the 157 children that received a plan, 79 had ER visits and/or hospitalizations prior to this particular admission. ER visits included the diagnoses of asthma, URI, viral infection, cough, wheezing, bronchitis and respiratory abnormalities. After receiving the plan, only 23 had repeat utilization in the ER or as an inpatient. Conclusions Our institution's compliance has increased dramatically for using an action plan, and for patients being discharged on controller medications. Our plan is neither revolutionary nor experimental. We are simply consistently applying what we know works. Can having an asthma action plan in place impact future ER and/or hospital utilizaion? This is something that has yet to be determined. However based on our findings, it appears that having a plan coupled with education is certainly beneficial.

Sponsored Research - None

677762

PORTABLE OXYGEN CONCENTRATOR (POC) FUNCTION DURING HIGH ALTITUDE SIMULATION TEST (HAST).

Michael Czervinske, Bethene L. Gregg; Dept of Respiratory Care Education, University of Kansas Medical Center, Kansas City, KS

Background: Most HAST use 15% oxygen to simulate an altitude of 8,000 feet and a barometric pressure of approximately 567 torr. Patients with pulmonary problems breathe in a 15% oxygen environment with supplemental oxygen supplied via a nasal cannula to determine if arterial oxyhemoglobin saturation levels can be maintained during flight. Typically the cannula is supplied with 2 LPM of 100% oxygen. Several brands of POCs were recently approved for air travel. A POC delivers >90% oxygen concentration at sea level will not function as specified at altitude. We hypothesized that a POC would not deliver a similar oxygen concentration when 15% oxygen was created by a drop in pressure as compared to 15% oxygen at sea level. Methods: We measured the FIO2 produced from a POC for eleven minutes for each of two test conditions: 1) 15% oxygen at sea level and 2) 15% oxygen from reducing the ambient (box) pressure to approximately 564 torr. For condition 1, a body box was flushed with nitrogen to lower the box FIO2 to 15% and maintained by mixing N2 and compressed air. A leak in the box prevented any increase in pressure. For test condition 2, the pressure inside the body box was reduced by applying vacuum to the box until the FIO2 inside the box dropped to 15%. A leak in the box was adjusted to maintain a pressure of -3.68 to -3.72 psi (569.7 to 567.7 torr) subambient pressure measured by a Timeter RT-200 Gas Analyzer. The highest and lowest FIO2 were recorded each minute at both test conditions. One oxygen analyzer measured the FIO2 from the POC and a second oxygen analyzer measured body box FIO2. Breaths were simulated using a Harvard pump to trigger the pulsed dose delivery from the POC. The exhaust gas was isolated by collection in a Tissot bag to prevent changes in body box FIO2. The POC was triggered at 15 bpm and a VT of 380(+/- 13%)mL. All three POC settings (1,2,3) were tested. Each POC setting is the equivalent of its continuous liter flow. Data were analyzed using a paired samples t-test, SPSS 16.0. Results: Table 1 shows the mean differences in FIO2 at each test condition. Conclusions: There was a significant difference in POC performance when tested with 15% oxygen at sea level as compared to 15% oxygen created by dropping the pressure to 567 torr. HAST testing should use an air/oxygen blender set at 71% to simulate a POC to determine which setting maintains the patient's oxygen saturation at altitude.

Sponsored Research - None

Table 1. Mean Differences In FIO2 Delivered By POC.

POC Setting	High FIO2			Low FIO2		
	Ambient	Altitude	Mean Difference	Ambient	Altitude	Mean Difference
1	0.928	0.717	0.212*	0.901	0.692	0.209*
2	0.894	0.702	0.191*	0.865	0.673	0.192*
3	0.817	0.712	0.106*	0.793	0.682	0.111*

*p<0.001

665060

ASTHMA GREEN LIGHT, AN INNER CITY COMMUNITY-BASED ASTHMA EDUCATION PROGRAM.

Elgloria A. Harrison[1], Susan D. Lockwood[1], Felecia Moore Banks[2]; [1]Nursing and Allied Health, University of the District of Columbia, Washington, DC; [2]Howard University, Washington, DC

Background: Asthma is considered the most common cause of chronic illness in children. In this community, pediatric asthma affects 11.8% of its children. The 2007 National Asthma guidelines suggests that asthma education is one key to maintaining control of asthma symptoms. This study seeks to determine if a single education program, coupled with individualized telephone follow-up for parents of low income, inner city asthmatic children will empower families to effectively manage their children's asthma and enhance their quality of life. Methods: This project was an educational intervention study with a pretest, posttest repeated measures design with no control group. Small, 1½ hour focus groups of parents of children with asthma were conducted during the required, regular parent meetings of children enrolled in daycare at 15 Head Start program sites. 54 families participated. Prior to the intervention, each parent completed a pretest to establish baseline asthma management experience and quality of life. Following the pretest, parents engaged in discussions on asthma triggers and management, followed by hands-on demonstrations. Families were provided with ethnographically-designed selfcare kits containing an asthma action plan, educational materials and monitoring devices. Each family received a 30-day follow-up support call. 90-days later, the initial survey was repeated by telephone as a posttest. Results: Analysis revealed statistically significant improvement in participants' use of the asthma action plans (33% pretest to 82% posttest) and use of environmental actions to control symptoms (50% pretest to 89% posttest). Further, the number of sequential, symptom-free days increased from 2.16 to 4.57 days, and the number of hospital visits decreased radically, from 25 in the 90-day period prior to the intervention, to 2 days at the 90-day posttest. Conclusion: This educational intervention has generated improvements in the ability of families to manage their children's asthma. They have demonstrated an increase in the use of asthma action plans and taken environmental steps to reduce asthma symptoms. A single small-group educational program, accompanied by telephone follow-up can be an effective, low-cost means of enabling families to self manage asthma symptoms.

Sponsored Research - None

668034

VARIABILITY OF EXHALED NITRIC OXIDE MEASUREMENT IN A PEDIATRIC SEVERE ATOPIC ASTHMA PATIENT.

Stephanie King, Peter H. Michelson, Barbara McLurkin, Christopher Fortner; Pediatric Pulmonary Function Lab, Duke Children's Healthcare Center, Durham, NC

The past few decades have seen an evolution in the definition of asthma from that of a bronchoreactive airways disease to that of a TH-2-directed inflammatory disease that involves both the large and the small airways. Exhaled nitric oxide(FENO) provide an alternative noninvasive marker of inflammation in asthma that is convenient, quick, and inexpensive. Nitric oxide is elevated in human lungs in a variety of inflammatory diseases. FENO is elevated in untreated or undertreated asthma. FENO decreases in a dose-dependent manner with the use of inhaled corticosteroids. In this case report we describe the varibility of pre and post bronchodilator FENO results with a pediatric severe atopic asthmatic patient. Case Summary: A 13 year old black male with severe atopic asthma with Allergic Bronchopulmonary Aspergillosis presented in the pediatric pulmonary function lab with an upper respiratory infection with congestion, sinus drainage and cough for the past 72 hours. His physical exam revealed expiratory wheezing and nasal mucosa edematous with clear rhinorrhea. His pre spirometry results with the VIASYS Vmax Encore PFT equipment showed FVC(90%), FEV1(63%), FEF25-75%(25%), PEF(82%) of predicted values and Aerocrine NIOX Flex pre FENO results 84.5 parts per billion(ppb) with an SpO2 of 97% on room air. The patient received 0.63mg Levalbuterol in 3ml normal saline for pre and post spirometry testing. His post spirometry results showed FVC(103%),a 14% improvement. FEV1(87%), a 38% improvement. FEF25-75%(52%),a 108% improvement. PEF(100%), a 21% improvement of predicted values and post FENO increased to 118ppb. A prolonged expiratory phase noted on pre and post spirometry testing, but shorter on post spirometry test. Patient stated a subjective improvement in breathing quality following nebulizer treatment. The patient was diagnosed with having an asthma flare and was placed on a course of tapered oral steriods. Discussion: Asthma flares increases airway constriction and results in decreased airflow and gas exchange. Increased airflow following nebulizer treatment administration resulted in an increase in the FENO measurement due to a subsequent decrease in bronchoconstriction of the smooth muscle in the bronchioles thus resulting in increased airflow and gas exchange. The decrease in bronchoconstriction increased gas intake and output which resulted in a higher FENO measurement for the patient.

Sponsored Research - None

662274

NON-INVASIVE POSITIVE PRESSURE VENTILATION OUTCOMES OVER A.

Kenneth J. Miller; Respiratory care, LVHN, Allentown, PA

Introduction: Prevention of intubation and the institution of mechanical ventilation during acute respiratory failure is a threshold that today clinicians strive for. This is especially a major objective for patients with an acute process that can be reserved quickly after appropriate interventions or those patients with chronic respiratory decompensation where the initiation of mechanical ventilation can be associated with many problems. Objective: To retrospectively review patients placed on Non-Invasive Positive Pressure Ventilation (NIPPV) with the diagnosis of either Congestive Heart Failure (CHF) or Chronic Obstructive Pulmonary Disease (COPD) over a one year-time frame. Methods: NIPPV was initiated and maintain with the Respironics Vision (Carlsbad, California). Patients diagnosed with either CHF or COPD were placed on NIPPV and then followed to see if the patient required intubation and mechanical ventilation or stabilized and placed on supplemental oxygen administration over a one-year time span.. Results: Thirty-five patients were diagnosed with CHF and thirty-three were diagnosed with COPD. Twenty-nine patients (80%) with CHF were stabilized and placed on supplemental oxygen therapy post NIPPV. Twenty-three patients (71%) diagnosed with COPD were stabilized on NIPPV and placed on supplemental oxygen therapy. Patient demographics were similar in all cases and total duration of NIPPV utilization was .85 day in the CHF patients that were stabilized on NIPPV and 1.45 days in those patients stabilized with the diagnosis of COPD. Conclusion: In our respective review to better get a perspective of our internal NIPPV practice; our results demonstrate that NIPPV utilization in the CHF and COPD patient populations can result in clinical stabilized and the reduction of the institution of mechanical ventilation.

Sponsored Research - None

621506

ONE HOSPITAL'S EXPERIENCE WITH THE IMPLEMENTATION OF HIGH FREQUENCY OSCILLATORY VENTILATION FOR PULMONARY VERSUS EXTRAPULMONARY CAUSES OF ACUTE RESPIRATORY DISTRESS SYNDROME.

Daniel P. Rausch, Reid Ikeda; Respiratory Care Services, The Queen's Medical Center, Honolulu, HI

Danny P. Rausch RRT, Reid Ikeda MD, The Queen's Medical Center, Honolulu, HI. BACKROUND: One year after the introduction of HFOV for ARDS, a retrospective review was conducted to examine the effectiveness of HFOV in pulmonary versus extrapulmonary causes of acute respiratory distress syndrome (ARDS). A successful HFOV outcome was defined as a patient being weaned off of HFOV back to conventional mechanical ventilation. METHOD: The implementation of HFOV was evaluated on a case by case basis by the same respiratory therapist with a strict inclusion and exclusion policy of P:F ratio < 200 on positive end expiratory pressure > 10, infiltrates in 3 of 4 quadrants on chest x-ray,pulmonary artery catheter wedge pressure <18 and a mean airway pressure > 24 on conventional ventilation. RESULTS: A total of 19 patients meeting the above criteria were evaluated. Twelve patients with pulmonary causes of ARDS (predicted APACHE II mortality 55.4%) and 7 patients with extrapulmonary causes of ARDS (predicted APACHE II mortality 49.5%) were evaluated. The results are in table one. Table 1. Results for patients with pulmonary verses extrapulmonary causes of ARDS CONCLUSION: In this small sample, both groups had an improvement in oxygenation index (OI) after 16 hours on HFOV. Although the pulmonary ARDS group had a slightly higher predicted APACHE II mortality and a higher OI before and after HFOV initiation and more total ventilator days, there was a trend toward more successful outcomes and less hospital mortality in this group.

Sponsored Research - None

Table 1. Results for patients with pulmonary verses extrapulmonary causes of ARDS

Pulmonary ARDS						
Vent days proir to HFOV 2.05	HFOV days 4.8	Vent days post HFOV 5.07	OI pre HFOV 29.8	OI 16 hours post HFOV 15.7	Successful outcomes 81%	Hospital mortality 23%
Extra-pulmonary ARDS						
Vent days proir to HFOV 2.2	HFOV days 4.3	Vent days post HFOV 3.15	OI pre HFOV 24.9	OI 16 hours post HFOV 14.1	Successful outcomes 75%	Hospital mortality 50%
Table 1.	Results extra	for pulmonary	patients causes	with of	pulmonary ARDS	verses .

629134

THE EFFECT OF LUNG COMPLIANCE CHANGES ON DELIVERED TIDAL VOLUME AND AMPLITUDE IN AN ADULT PATIENT VENTILATED WITH HIGH FREQUENCY OSCILLATORY VENTILATION: A BENCH MODEL.

John England, Lynda Goodfellow, Arzu Ari, Robert Harwood, Yong Wang; Respiratory Therapy, Georgia State University, Atlanta, GA

Clinical concerns exist regarding the delivered tidal volume (Vt) during high-frequency oscillatory ventilation (HFOV). HFOV is increasingly being used as a lung protective mode of ventilation for patients with Adult Respiratory Distress Syndrome (ARDS). The purpose of this study was to investigate the effect of lung compliance on Vt delivered by HFOV to an adult patient. Method: An in-vitro model was used to simulate an ARDS patient using a high fidelity breathing simulator (ASL 5000,IngMar Medical,Pittsburgh,PA). The simulation included independent lung ventilation with a fixed resistance of 15 cm H2O/L/s and adjustable compliances of 10, 15, 20 and 25 ml/cmH2O. The ventilator SensorMedics 3100B (Cardinal Health,Dublin,Ohio) was fixed at a power setting 6.0,insp-% 33, bias flow 30 L/min, oxygen 50% and Hz of 5.0 for each compliance setting (n=5). Vt and amplitude (AMP) varied as compliance changes were made. Approximately 250 breaths were recorded at each compliance setting and the data was collected via the host computer and transferred to a log to be analyzed by SPSS v.16. Data Analysis: The data analysis performed included descriptive statistics, One-way ANOVA, Post Hoc Bonferroni test and Pearson Correlation Coefficient to determine the statistical significance ($p < 0.05$) of the delivered Vt and different AMP at different compliance settings. Results: As compliance improved Vt increased and there was a corresponding decrease in AMP. The one-way ANOVA test showed that there were significant differences between the delivered Vt and AMP. When the Post hoc Bonferroni test was used the data showed significant differences between AMP achieved with each compliance change. Pearson Correlation Coefficient showed that there was a significant inverse relationship between Vt delivered and the AMP readings. Conclusion: Vt is not constant during HFOV. Compliance is one determinant of Vt in adults with ARDS during HFOV. An ARDS patient suffers from very non-compliant lungs. As shown by this study, if the patient's lung compliance improves so will the Vt delivered at a lower ventilating pressure. Lower ventilating pressures and smaller tidal volumes are considered the proper ventilating strategies for ARDS patients. AMP and Vt are inversely related during HFOV, therefore the patient may receive a larger Vt at a lower ventilating pressure as compliance improves.

Sponsored Research - None

Amplitude and Vt at each Compliance Setting

Compliance (ml/cmH2O)	AMP (cmH2O)	Vt (ml)	Compliance (ml/cmH2O)	AMP (cmH2O)	Vt (ml)	Compliance (ml/cmH2O)	AMP (cmH2O)	Vt (ml)	Compliance (ml/cmH2O)	AMP(cmH2O)	Vt (ml)
10	88	118.31	15	86	121.93	20	84	123.58	25	82	131.93
10	88	116.36	15	86	123.42	20	84	123.79	25	82	132.02
10	87	118.87	15	86	121.02	20	84	126.99	25	82	132.85
10	87	117.36	15	86	119.64	20	84	125.77	25	82	131.68
10	87	117.29	15	86	122.62	20	84	126.08	25	82	132.11

655004

A COMPARISON OF THREE VENTILATORS AND THEIR HELIOX CONSUMPTION EFFICIENCY.

Thomas D. Baxter, Holly Coulliette; Respiratory Care, St. Johns River Community College, St. Augustine, FL

Background: How efficient ventilators with heliox capability are in terms of heliox consumption was evaluated. Three ICU ventilators that have a heliox feature were studied using a simple bench technique. Method: The following ventilators were evaluated: Maquet SERVO-i (Solna, Sweden), Hamilton G-5 (Rhazuns, Switzerland), Cardinal Health AVEA (Yorba Linda, CA). During testing each ventilator was connected to an H-cylinder of 80:20 heliox using a heliox regulator (Western Medica, Westlake, OH) and a heliox high pressure hose. An H-cylinder of 100% medical grade oxygen was connected using a high pressure oxygen hose to the other ventilator gas connector. The ventilator being tested was connected to a test lung using a patient circuit without humidification. A size 7.0 I.D. Rüsch endotracheal tube (ETT) (Teleflex Medical, Research Triangle Park, NC) was attached to the circuit wye-connector. The ETT cuffed end was placed into a 6-inch piece of tygon tubing and inflated until no leak was present. The ETT tubing adapter was then connected to a test lung (B & B Medical Technologies, Carlsbad, CA). Each ventilator was set for volume control with a tidal volume of 500 ml, a rate of 15 breaths/minute, and inspiratory time of 0.9 seconds. The oxygen delivery control was set to 21% (80:20 heliox). Ventilation was begun with each ventilator's start-up procedure and the start time was noted. The ventilators were run continuously until the low inlet pressure alarm sounded and/or the pressure regulator read zero. Results: All three ventilators cycled consistently with the heliox mixture. Table 1 shows the results of the time duration for each ventilator. Conclusion: There was little difference in the rate of heliox consumption in two of the three ventilators, while the third had a much higher (66.8%) rate of consumption. This may have been due to the internal blending system the Avea uses is dual proportional solenoids that require a minimum flow to maintain the blended oxygen percentage and cannot shut off during exhalation.

Sponsored Research - None

Table 1

Ventilator	Starting heliox psi	Hours	Minutes	Ending heliox psi	Low inlet gas alarm
Maquet Servo-i	2300	11	5	<0	Yes
Hamilton G-5	2300	11	30	0	No
Cardinal Health Avea	2300	3	49	<0	Yes

655591

HUMIDIFICATION DURING HIGH FREQUENCY OSCILLATION VENTILATION FOR ADULTS.

Yusuke Chikata[1,2], Hideaki Imanaka[1], Masahiko Ueta[2], Masaji Nishimura[1]; [1]Department of Emergency and Critical Care Medicine, The University of Tokushima Graduate School, Tokushima, Japan; [2]Medical Equipment Center, Tokushima University Hospital, Tokushima, Japan

Background: High frequency oscillation ventilation (HFOV) has recently been applied to acute respiratory distress syndrome in adults. As conventional mechanical ventilation, inspiratory gas humidification during HFOV is essential. However, humidification during HFOV for adults has not been clarified. In this bench study, we tested if humidification was affected by ventilatory settings and humidifying devices during HFOV for adults. ***Method:*** We evaluated two brands of adult HFOV ventilators: R100 (Metran, Tokyo, Japan) and 3100B (SensorMedics, Yorba Linda, CA, USA). We set a standard heated humidifier: a heated humidifier consisting of porous hollow fiber (Hummax II, Metran) for R100 and a passover-type heated humidifier (MR850, Fisher & Paykel) for 3100B. We connected each ventilator to a lung model in an incubator set at 37∞C. We measured absolute humidity and temperature at the airway opening under a variety of ventilatory settings: 3 stroke volumes /amplitudes (100, 150, and 200 mL for R100, and 30, 45, and 60 cmH_2O for 3100B), 3 frequencies (5, 7, and 8 Hz), and 2 mean airway pressures (20 and 30 cmH_2O). ***Results:*** The R100 ventilator showed higher absolute humidity and lower temperature than the 3100B ventilator. In the R100 ventilator, as stroke volume increased, absolute humidity and temperature became higher. As frequency increased, absolute humidity and temperature became higher. Settings of mean airway pressure did not affect absolute humidity or temperature. In the 3100B ventilator, effects of amplitude, frequency, and mean airway pressure on absolute humidity and temperature were not significant. ***Conclusions:*** Humidification during HFOV for adults was affected by stroke volume and frequency in the R100 ventilator but is not in the 3100B ventilator.

Sponsored Research - None

Average absolute humidity during each condition of HFOV

		R100	3100B
Amplitude/ stroke volume	Small	42.8±0.8	41.0±0.4
	Middle	44.9±1.2	41.5±0.6
	Large	46.9±1.1	40.3±1.0
Frequency	5 Hz	43.8±2.0	41.0±0.4
	7 Hz	44.9±1.5	40.7±1.0
	8 Hz	45.9±2.2	41.1±1.0
Mean airway pressure	20 cmH_2O	44.9±2.1	41.1±0.9
	30 cmH_2O	44.9±2.1	40.8±0.8

656006

DECREASED AMBIENT TEMPERATURE AND FAN BREEZE DECREASES DELIVERED ABSOLUTE HUMIDITY FROM A VENTILATOR CIRCUIT.

Tim Op't Holt, Charles Langley; Cardiorespiratory Care, Univ of South Alabama, Mobile, AL

Background: Maintaining adequate humidity to patients receiving mechanical ventilation is an important aspect of maintaining physiologic humidity and tracheobronchial hygiene. Ambient temperature of the ventilated patient's room and the presence of a box fan in the room are not often considered when delivering heated humidity. We sought to determine the effect of ambient temperature and the presence of a box fan blowing in the vicinity of the ventilator circuit on absolute humidity and humidity deficit. Method: The ambient temperature in an intensive care unit was determined. In an in vitro bench study, we measured the temperature and relative humidity of gas being delivered to a test lung ventilated with a Servo 900C ventilator with a hygrometer. Humidity was provided by a Fisher & Paykel MR850 via a Fisher & Paykel RT100 dual heated wire circuit. The Hygro-thermometer sensor was placed between the Y-piece and the test lung. Absolute humidity was calculated from the relative humidity and temperature. This study was done with an ambient room temperature of 23-24 degrees C and 20-21 degrees C. The ventilator circuit and patient interface were subjected to breeze from a fan at three speeds and both temperatures. A balanced ANOVA was used to analyze the data. Results: In the cooler room, the mean delivered absolute humidity level was less than the mean delivered absolute humidity in the warmer room ($p<.000$). When the fan speed was set to low or high, the mean absolute humidity level decreased further ($p<.000$). Humidity deficit increased with a decrease in room temperature or an increase in fan speed ($p<.000$). Conclusions: Delivered absolute humidity and humidity deficit were affected by the ambient room temperature as well as breeze from a fan. The compounding effect of both ambient temperature and breeze cooling the circuit was significant. Delivered absolute humidity decreases below recommended levels in the presence of breeze from a fan, which may have clinical consequences.

Sponsored Research - None

658002

THE NEXT VENTILATOR BUNDLE.

Michael J. MacAulay, Amy Denniston, Brian Rothermel; Respiratory Care, St Joseph Hospital, Bellingham, WA

Introduction: Many hospitals have successfully decreased ventilator length of stay with daily checklists or bundles. These bundles required small amounts of time and reminded us to complete simple evidence based steps in patient care. We wanted to use the same idea when transporting intubated patients after we noticed many intubated patients being transported without the head of the bed (HOB) elevated. Method: In January 2009, we started a ventilator transport bundle with the goal of preventing aspiration; we also added some questions to ensure adequate oxygen supply and emergency equipment. Respiratory Therapists (RTs) need to complete sections of the bundle before moving the patient from their room, before leaving the procedure room, and upon returning to their room. After a transport, the bundles are submitted and the data is compiled monthly. We have been using this bundle for 5 months and completed it on 84 patients. Results: Before we implemented the transport bundle, we gave a questionnaire to our staff (23 of 37 responded). We compared these results each month to the bundles that were submitted. Some of the questions and results are below. Conclusion: Completing a checklist or bundle when transporting intubated patients has significantly improved our standards of care for preventing micro aspiration and ensuring we have enough oxygen and resuscitation equipment.

Sponsored Research - None

Before transporting, did you complete the following with 76% - 100% of your patients?	Pre-Bundle Survey Results	Audited Bundles at end of the 5th Month
Suction the mouth and above the ETT cuff	13%	100%
Increase the ETT cuff pressure	9%	100%
Check the O2 pressure and presence of a mask	87%	100%
Keep the HOB at least 30 degrees	22%	100%

At the end of the 5th month, the bundles showed a 93% – 94% completion rate for similar questions during transports and at the end of patient transports.

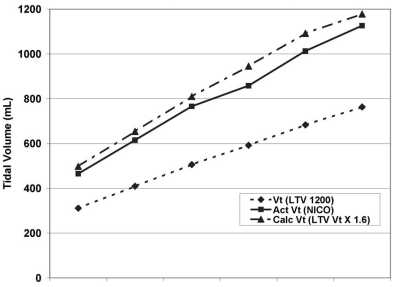
659382

HELIOX DELIVERY VIA THE LTV 1200 VENTILATOR.

Joel M. Brown, John S. Emberger, Rozelle Clark, Victoria Weaver; Respiratory Care, Christiana Care Health System, Newark, DE

Background: Heliox is a therapeutic gas used for the improvement of respiratory distress and to reduce work of breathing in a variety of obstructive airway pathologies. Heliox is traditionally delivered via NRB mask but at times clinicians may be asked provide this gas mixture via mechanical ventilation. The most common concerns with heliox delivery via mechanical ventilation is portability and accurate delivery of volume. The LTV® 1200 (LTV)is a portable turbine driven ICU and transport ventilator that we have used at our facility for the past 3 years. In this study we wanted to determine if the LTV 1200 could accurately deliver Heliox. Method: This bench study was performed using a Michigan Instruments Inc. Dual Adult TTL test lung with the lung compliance set at 50 mL/cm H20 and a 5 cm H20/L/sec fixed airway resistor in line. The Novametrix NICO® Cardiopulmonary Management System (NICO) was used to obtain Vt_{exh}, Insp flow, and PIP data at the test lung. The NICO was calibrated to monitor Heliox 70/30. We obtained a calculated Vt_{exh} and Insp flow by multiplying the data found on the LTV patient monitoring screen by the heliox density factor of 1.6. Heliox 70/30 was supplied to the LTV ventilator via the high pressure oxygen inlet. A new ventilator circuit was used for each trial. The following ventilator setting were used: Volume Assist Control, RR=12, It= 1.0 second, PEEP=5. All data was collected at 6 different tidal volumes (300mL, 400mL, 500mL, 600mL, 700mL, and 800mL). Results: A total of 3 trials were completed with 3 different ventilator circuits. The calculated Vt_{exh} had a direct correlation with the actual Vt_{exh} (R^2=0.998). The LTV PIP had a direct correlation with the actual PIP (R^2=0.989). The calculated flow had a direct correlation with the actual flow (R^2=0.991). The LTV delivered no false alarms and functioned within normal limits throughout the bench study. See Graph#1 for additional results. Conclusion: Our data indicates that the LTV can effectively deliver accurate Vt_{exh}, Insp flow, and PIP when delivering Heliox 70/30 in volume controlled ventilation.

Sponsored Research - None



Graph#1: This graph depicts the average values from the three trials. Vt (LTV1200)=Exhaled Vt read on the LTV monitor, Act Vt (NICO)= Exhaled Vt from the NICO at the test lung, Calc Vt (LTV Vt X 1.6)= Exhaled Vt calculated by multiplying the LTV monitor reading by 1.6.

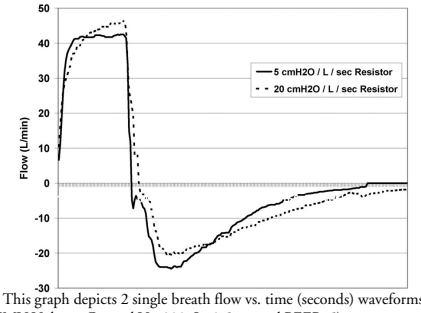
660881

BENCH STUDY OF THE DRAGER APOLLO ANESTHESIA MACHINES FLOW DELIVERY.

Joel M. Brown, John Emberger; Christiana Care Health System, Newark, DE

Background: Inhaled isoflurane therapy is often used in the management of patients with severe status asthmaticus (SA). At our facility we have recently began to use the Draeger Apollo® Inhalation Anesthesia Machine (Apollo), a bellows driven anesthesia ventilator, to deliver inhaled isoflurane to SA patients. In addition to lung sounds, changes in PIP and Raw are often used to assess the effectiveness of inhaled isoflurane therapy. The Apollo does not consistantly use a squre flow pattern during volume ventilation. This inconsistancy makes it difficult to calculate Raw and forces the clinician to rely on PIP and lung sounds to assess the effectiveness of therapy. The purpose of this study is to assess the flow characteristics of the Apollo and observe its effects on PIP. Methods: This bench study was performed using a test lung (Michigan Instruments Inc.) with the lung compliance set at 50 mL/cm H20. The Novametrix NICO® Cardiopulmonary Management System was used to obtain PIP and peak inspiratory flow at the test lung. The Draeger Evita® 4 was used as our control (square flow ICU ventilator). Each trial was performed using Volume SIMV, RR=12 and PEEP=5 with the following variables: set Vt's of 300 and 500, inspiratory times (It) of 0.5 and 1.0 seconds, and fixed airway resistors of 5, 20, 50 cm H20/L/sec. Results: A total of 3 trials were completed. The peak flow and PIP produced by the Apollo were consistently higher than those delivered by the control. The peak flow produced by the Apollo increased when the resistance on the test lung was increased. The resulting PIP from the Apollo had a direct correlation with the control's PIP as the resistance on the test lung changed (R2=0.973 at 0.5 sec It, and R2=0.998 at 1.0 sec It). The flow time graphic from the Apollo changed from a square waveform to an accelerating waveform as the resistance on the test lung increased (see attached graphic) Conclusion: Our data indicates that the Apollo will increase the peak inspiratory flow and change from a square to an accelerating flow pattern if the airway resistance increases. These automated changes resulted in higher PIP's than those of the square flow control ventilator. When changing a patient from a fixed flow ventilator to the Apollo it is important to recognize these tendencies in order to properly assess the effect of the ordered therapy.

Sponsored Research - None



Graph#1. This graph depicts 2 single breath flow vs. time (seconds) waveforms delivered by the Apollo (SIMV Volume Control Vt=300, It=0.5sec, and PEEP=5).

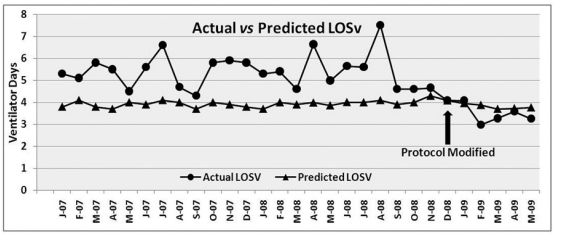
660890

MODIFICATION OF A WEANING PROTOCOL DECREASES VENTILATOR LENGTH-OF-STAY.

Mark Grzeskowiak, Andrew Martin, Michael McPeck; Respiratory Care, Long Beach Memorial Medical Center, Long Beach, CA

BACKGROUND. Our department's ventilator weaning protocol required night shift RTs to perform a daily assessment on MICU ventilator patients for their readiness to wean. Patients who met criteria (hemodynamic stability, level of consciousness, adequate oxygenation, stable vital signs) also had measurements of "weaning parameters" (WP), i.e., NIF, RSBI, performed by night shift staff. If test results met or exceeded established thresholds, day shift would start the patient on a spontaneous breathing trial (SBT). When compared to the APACHE IV database, we found that Length of Stay on Ventilator (LOSv) was frequently 1-2 days longer than predicted by APACHE. Two possible reasons for this were identified during Performance Improvement review: (1) Some patients were excluded from weaning by virtue of relative hypoxemia; Oxygenation Index (OI) <200 (P02/FI02). (2) WP data obtained by night shift did not always represent patient condition observed hours later on day shift. METHODS. We modified our weaning protocol to include 3 fundamental changes: (1) the threshold for OI was lowered from 200 to 170; (2) responsibility for both screening and starting SBT became the sole responsibility of day shift RTs; (3) the practice of routinely using WP as the basis for starting an SBT was eliminated. Monthly data was compiled and submitted to APACHE to obtain actual and predicted LOSv. We calculated ΔLOSv (deviation from APACHE-predicted value). RESULTS. During the first 6 months on the modified protocol, mean LOSv fell from 5.41 ±0.78 days (n=23 months) to 3.54 ±0.46 days (n=6 months). ΔLOSv over the same period fell from +1.47 ±0.773 days to -0.31 ±0.378 days. During the first 6 months using the modified protocol, there were no significant changes in patient volume or morbidity or mortality that could have skewed these results. CONCLUSIONS. Implementation of a modified version of an established weaning protocol resulted in a decrease in the number of vent days and a closer correlation to what was predicted from the APACHE IV data base.

Sponsored Research - None



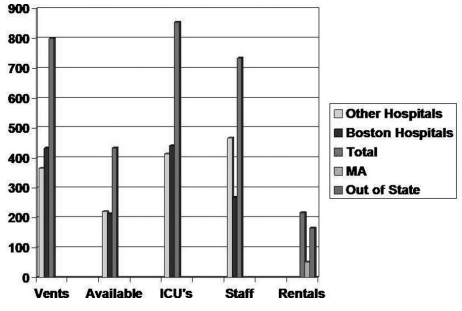
661733

BIOTERRORISM; VENTILATOR ACQUISITIONS IN MASSACHUSETTS.

Sigita Gsell, Paul Nuccio; Brigham and Womens Hospital, Boston, MA

Bioterrorism produces a public health emergency that requires several types of strategies to manage. With a bioterrorist event the victim's clinical signs and symptoms could occur hours or days later depending on the agent and the incubation period. Many symptoms are misdiagnosed or share the same symptoms of other diseases. The respiratory problems associated with inhaled biotoxins would require long term mechanical ventilation, which would easily overload the ventilator resources available. Certain disaster ventilators can be useful for short term mass casualties but not for long term intubated patients. Would the hospitals have adequate resources to accommodate the influx of patients requiring ventilators? Methods Massachusetts hospitals were surveyed to find their ventilator availability. Questions posed include the following: 1. How many ventilators does your hospital have in house? 2. How many ventilators(average)do you run per day? 3. How would you obtain additional ventilators? 4. What vendor do you use for ventilator rentals? 5. How many ICU beds within your institution? 6.How many(RT)staff? Results In Massachusetts, the healthcare system includes 73 acute care hospitals. 29 hospitals responded to the survey including five major teaching hospitals in the metro Boston area. 1.The total ventilators for the twenty-nine hospitals are 800 (434 in Boston hospitals) 2.The total average ventilators that run per day are 367, Leaving 433 available ventilators for new patients(213 in Boston) 3.All hospitals stated they would rent ventilators 4.Three vendors were listed as contracted suppliers for all ventilators rentals 5.There are 855 ICU beds (441 in Boston) 6.734 Respiratory therapists (268 in Boston) Total available ventilator rentals from the three Massachusetts vendors are 52 and an additional 165 ventilators may be available from neighboring state vendors. Massachusetts does not have a strategic stock pile of ventilators. The Federal government has 1400 ventilators in their strategic stock pile with 81 ventilators allocated for Massachusetts. Conclusion The hospitals that replied to the survey appear to lack the resources to respond to a Bioterrorist event,they had limited number of ventilators and were relying on vendors to augment their supply. When there is a critical shortage of ventilators to meet patient demand, the difficult decision of ventilator allocation would need to be addressed.

Sponsored Research - None



662263

Mary K. Hart, Erika Abmas, Lucy Aguirre-Kelly, Ana Lotshaw, Mark Millard; Baylor University Medical Center, Dallas, TX

Introduction: Lung Volume Reduction Surgery (LVRS) in patients with severe emphysema may improve COPD outcomes, but carries a defined perioperative risk. By reducing lung hyperinflation, the surgery has shown improvements in spirometry, respiratory muscle function, gas exchange, breathlessness, and exercise capacity all leading to improved quality of life. Patient selection criteria are strict and pre and post operative care significantly impacts the outcomes. Method: All patient charts from LVRSS performed during 2005 - 2006 were reviewed by the LVRS Committee for outcomes data with the finding of unacceptable lengths of stay (LOS), morbidity and mortality. In response, a multidisciplinary team of specialists that included MD, RRT, OT, PT, RN, SW began work on how to improve the process. Using a fishbone cause and effect diagram and affinity chart, areas of improvement were identified and prioritized. A flow chart was used to track the current process which showed lack of communication and staff training to be the greatest causes for these findings. As a result, a plan was developed for the team to standardize appropriate care plans, and was broadly disseminated to all ICU and general care clinicians by the LVRS team members. The new process was adopted and quickly put into action. Special attention was given to providing the post-operative LVRS patient with a quiet and supportive environment and assuring adequate pain control. Same day surgery mobilization by PT with exercise was instituted. Results: 4 patients prior to and 5 patients post implementing the new process and coordinated team approach were compared for length of stay (LOS), post surgical complications and mortality. Prior to intervention, LOS was 51 days compared to the national average of 7-14 days which was related to post-operative complications, as well as, excess mortality. Implementing a new paradigm of care decreased the average LOS to 11 days with minimal morbidity and zero mortality. Conclusion: We used established quality improvement tools to quickly identify deficiencies, put a plan in place and tracked outcomes. The changes made in the delivery of care significantly improved patient outcomes. Our success is based on having a dedicated well trained multidisciplinary LVRS team.

Sponsored Research - None

663940

TRANSFUSION RELATED ACUTE LUNG INJURY: A COMPLEX CASE STUDY.

Damien P. Beilman[1], Mark L. Wencel[2,1], Donald G. Vasquez[3], William M. Palko[4]; [1]Respiratory Care, Wesly Medical Center, Wichita, KS; [2]Pulmonary, Wichita Clinic, Wichita, KS; [3]Trauma Services, Wesley Medical Center, Wichita, KS; [4]Pathology/Blood Bank, Wesley Medical Center, Wichita, KS

Introduction: First identified in 1951(1), transfusion-related acute lung injury (TRALI) is a rare, but potentially fatal adverse event that affects about 1 in 5000 patients who receive transfusions.(2) TRALI is characterized by the sudden onset of respiratory failure, severe hypoxemia and pulmonary edema despite normal cardiac function.(2) We present a case in a surgical patient to bring to light the pulmonary challenges and complications with TRALI. Case Summary: A 24-year-old female, gravida 2, para 0, patient was admitted from an outlying facility, status post resection of an ectopic pregnancy with acute pulmonary edema and hypoxemia requiring mechanical ventilation with a PEEP of 24 cmH2O. Patient had received 6 units of red blood cells and 2 plaetletpheresis packs. Human leukocyte antigen (HLA) antibody screen was positive. Chest radiograph revealed ARDS. Despite aggressive mechanical ventilation hypoxemia persisted with PaO2 47 mmHg. Ventilator mode was changed to APRV with PEEP 37/0 and PaO2 improved to 126 mmHg. Ventilatory status slowly improved, but patient's clinical course was complex and included complications of septic superficial thrombophlebitis, thrombosis of the superior vena caval catheter, right atrium and right pulmonary artery, pericardial effusion, right pneumothorax, systemic inflammatory response syndrome, and excision of right median basilica vein. Patient had a tracheostomy tube placed. Length of stay was 51 days. Patient was discharged to a LTAC hospital where she was liberated from mechanical ventilation, received rehabilitation and was discharged home. Discussion: Two basic mechanisms have been proposed for immunocompetent hosts. One hypothesis is TRALI is secondary to a single antibody-mediated event involving HLA antibodies.(3,4) Stronger data suggests that TRALI is a multi-factorial syndrome occuring when a patient is at increased risk for transfusion reaction.(5) Activation of the pulmonary endothelium resulting in polymorphonuclear neutrophil (PMN) sequestration occurs first followed by activation of primed PMNs resulting in endothelial damage, capillary leak and ALI. This case illustrates the importance of recognizing the complications that can occur with transfusion and that unless a patient is symptomatic for anemia, the benefits of transfusion should be carefully weighed against the risks.(5)

Sponsored Research - None

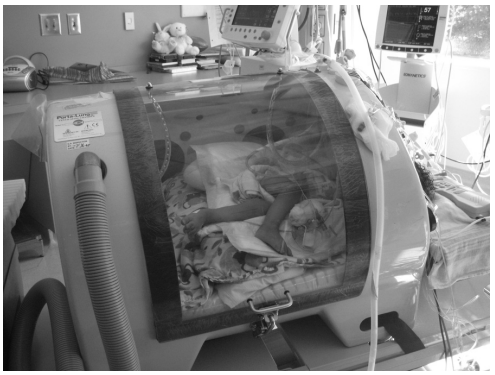
654023

NEGATIVE PRESSURE VENTILATION IN A PATIENT WITH FONTAN TYPE PHYSIOLOGY TO ENHANCE PULMONARY BLOOD FLOW.

Kevin Maher[1,2], Ginger Weido[1], Joey Rowe[1], Susan Roark[3]; [1]CICU, Children's Healthcare of Atlanta, Atlanta, GA; [2]Cardiology, Sibley Heart Center, Atlanta, GA; [3]NICU, Children's Healthcare of Atlanta, Atlanta, GA

Introduction: A low cardiac output state post-operatively can cause increased morbidity and mortality following complex congenital heart surgery. Further compromise can occur when positive pressure ventilation (PPV) is used with some surgical repairs. Ventilatory management of patients with single ventricle anatomy resulting in passive pulmonary blood flow can be challenging. PPV can decrease pulmonary blood flow, cardiac output and contribute to venous stasis in patients with this type of anatomy. Negative pressure ventilation decreases intrathoracic pressure and increases cardiac output, being preferable to PPV in patients with passive pulmonary blood flow. Case Summary: We are reporting successful use of negative pressure ventilation in conjunction with pressure support ventilation in a 9 month old with single ventricle physiology. This patient post-operatively had Fontan type physiology and was unable to wean from PPV due to inadequate pulmonary blood flow and low cardiac output. The patient was on high oscillatory ventilator support when transitioned to negative pressure ventilation(NPV). The endotrachael tube remained in place with pressure support during NPV and full ventilator support when off NPV. Initially, the patient was placed on PS of 10 on the PPV and NPV of -25/-3mmHg and 34bpm. With NPV, this patient was able to rapidly and dramatically reduce the PPV, allowing for sternal closure within a week. The NPV was gradually weaned, and extubation to high flow nasal cannula was successful. Discussion: NPV is particularly suited to patients with passive pulmonary blood flow physiology due to its ability to decrease intrathoracic pressure. This case demonstrates that NPV may have a role as adjunctive therapy in patients with Fontan type physiology who are compromised by PPV and unable to wean from positive pressure ventilation.

Sponsored Research - None



657538

CONCOMITANT USE OF CONTINUOUS NEBULIZED BRONCHODILATORS AND HEATED HIGH FLOW NASAL CANULA IN ACUTE RESPIRATORY DISTRESS IN A CHILD SIGNIFICANTLY DECREASES WORK OF BREATHING.

Greg Jones[1], Ariel Berlinski[2]; [1]RCS, Arkansas Childrens Hospital, Little Rock, AR; [2]Pediatrics, University of Arkansas for Medical Sciences, Little Rock, AR

Introduction: Pediatric patients with acute respiratory distress and high oxygen demands might also require continuos bronchodilator therapy (CBT). This case study shows that the use of heated high flow nasal canula (HHFNC) concomitantly with CBT could be an effective therapy for those patients. Case Summary: A six-year old female presented to the ER of an outside hospital with a chief complaint of respiratory distress and history of wheezing. The patient was noted to be tachypneic and hypoxemic [RR = 48 and O2 saturation (O2SAT) = 86% on room air]. Multiple nebulized albuterol treatments were given with slight improvement in work of breathing. Due to worsening hypoxemia the patient was placed on a 100% nonrebreather mask and transported to ACH for further care. Upon arrival, the patient was admitted to the PICU (RR = 67 bpm, HR = 129 bpm and O2SAT = 90% on 100% FIO2). Expiratory wheezes and coarse breath sounds were present and patient complaint of chest tightness. Accessory muscle use was noted. Chest radiography revealed right lower lobe pneumonia. The patient was placed on CBT (albuterol 1 mg/kg/hr via HOPE nebulizer at 10 lpm) in-line with a HHFNC (Fisher Paykel) with a FiO2 of 100% and a flow of 15 lpm, for a total flow of 25 lpm. The additional flow was added via T-piece and connected to the HHFNC before the humidifier. She was also started on IV steroids and antibiotics. Within the first hour, the FiO2 was weaned to 60% with O2SAT 94%, RR = 60 and HR = 170. At the 8th her vitals were O2SAT 99% on FiO2 60%, RR = 40 and HR = 156. Her breath sounds were coarse and expiratory wheezes were present. Patient was able to verbally communicate to mother and caregivers. Discussion: Use of a heated high flow nasal canula, along with continuous bronchodilator therapy in a child in respiratory distress and hypoxemia resulted in clinical improvement as evidenced by physical exam, and patient report. The use of these 2 devices together kept the patient's face "mask free" decreasing some of the fear that pediatric patients experience in the PICU and allowed a better communication with the patient as well.

Sponsored Research - None

659868

A CASE OF SEVERE RESPIRATORY SYNCYTIAL VIRUS PNEUMONIA REQUIRING MECHANICAL VENTILATION SUCCESSFULLY TREATED WITH INHALED RIBAVIRIN.

Wen Xi Zhuang, Constance PL Lo, Herng Lee Tan; Singapore General Hospital, Singapore, Singapore

Introduction: Respiratory syncytial virus (RSV) is increasingly recognised as an adult pathogen and a cause of severe community acquired pneumonia (CAP) 1. Inhaled ribavirin is the only antiviral available in the treatment of RSV. Delivery of aerosolised ribavirin is especially challenging in patients receiving mechanical ventilation. We report a case of severe RSV pneumonia in an adult requiring mechanical ventilation successfully treated with aerosolised ribavirin delivered via a Puritan Bennett (PB) 7200 mechanical ventilator. Case Summary: A 53 year old Chinese male, with a 30 pack year smoking history and Ankylosing spondylitis with pulmonary restriction was admitted in July 2007 with acute hypercapneic respiratory failure requiring intubation and mechanical ventilation. He was treated initially as for severe pneumonia with intravenous antibiotics. Bronchoscopy with bronchoalveolar lavage confirmed RSV infection. After 2 failed attempts at extubation, a decision was made to deliver aerosolised ribavirin treatment (2g every 8 hours) via the Small Particle Aerosol Generator (SPAG), connected inline with PB7200 ventilator. After 3 days of treatment, the patient was successfully extubated. Outpatient review at 2 months showed resolution of his chest x-ray with his effort tolerance returning to his pre-hospitalisation level. Discussion: Aerosolised Ribavirin is the only antiviral treatment available for severe RSV. Delivering inhaled ribavirin through the ventilator circuit is technically challenging. The difficulties encountered included assembling an in-line water column relief valve that approximate the actual one (which we did not have), and fitting the different components of SPAG into the inspiratory limb of the ventilator. Initially, we experienced ventilator shut downs from the repeated opening of the high pressure safety relief valve. This problem resolved with a reduction of the external flow set on the blender. Accumulation of ribavirin crystals within the circuit mandated close monitoring of the airway pressures and frequent filter and circuit changes. Our experience demonstrates it is technically feasible to deliver aerosolised ribavirin through the ventilator circuit. This is made possible via close collaboration between respiratory therapists, nurses, physicians and biomedical engineers.

Sponsored Research - None

661789

PULMONARY HYPERTENSION AND NEW ONSET ASTHMA DURING PREGNANCY: A CASE REPORT.

Betty L. Blake, Ghada Bourjeily; OB Medicine, Women and Infants Hospital, Providence, RI

Betty L. Blake B.S., RRT, NPS, and Bourjeily, Ghada, MD. Women and Infants Hospital, Providence, Rhode Island. INTRODUCTION: Pulmonary hypertension (PH) is characterized by mean pulmonary artery pressure (PAP) >25mmHg at rest or >30mmHg with exercise. In a normal pregnancy, the increase in cardiac output (CO) and plasma volume are counterbalanced by a reduction in pulmonary vascular resistance, with no change in PAP. However, patients with PH are unable to compensate for that change in CO and PH significantly worsens in pregnancy. Therefore, women with this disease are strongly advised against pregnancy and many times pregnancy termination is needed. We describe a case of a pregnant patient with mild PH secondary to an acute bronchospastic episode. CASE STUDY: A 38 year old female Gravida 3 Para 2 at 27 weeks, without past medical history, was evaluated for dyspnea on exertion and then at rest. Exam was negative except for tachypnea and pregnancy body mass index of 37. Chest x-ray and perfusion scan were normal. 2D echocardiogram (ECHO) revealed PAP of 40 mmHg, an enlarged right ventricle (RV) with normal left ventricle. Spirometry suggested a restrictive physiology. The patient then developed worsening symptoms of dyspnea and wheezing on exam. She was treated with Levalbuterol, Ipratropium, oral and inhaled steroids along with long acting beta-agonists. Symptoms significantly improved with spirometry showing a significant increase in both FEV1 and FVC (33% and 40% from baseline respectively). ECHO showed normalization of RV size then of PAP. The patient remained on Advair 500/50 for the remainder of her pregnancy and had an uneventful labor, delivery and postpartum period. She had a healthy girl weighing 3900g. DISCUSSION: Close observation of this patient was necessary because of concern for PH manifesting in pregnancy and the high risk of mortality with the progressive increase in plasma volume and CO. In her case, PH was likely related to an exacerbation of newly diagnosed asthma. Once the patient's asthma was controlled, PAP dropped to the normal range. Pregnancy could have theoretically predisposed the patient to develop elevations in PAP with a relatively mild insult.

Sponsored Research - None

DATE	FEV1/FVC	FEV1(% of predicted)	FVC (% of predicted)	PAP	RV
2/3/2009	87.32	2.09 (75%)	2.39 (67%)	> 40 mmHg	Dilated
2/13/2009	83.21	2.78 (99%)	3.34 (93%)	42 mmHg	Normal
3/4/2009	83.93	2.84 (108%)	3.38 (94%)	Normal	Normal

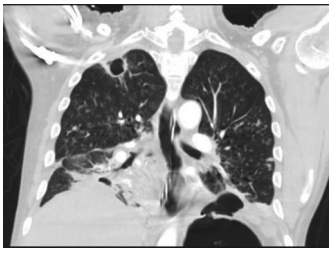
665442

ACUTE RESPIRATORY FAILURE AND INDEPENDENT LUNG VENTILATION IN AN ADULT WITH GASTRIC BRONCHIAL FISTULA SECONDARY TO NECROTIZING ASPERGILLUS PNEUMONIA.

Ernie C. Chou[1], Dean R. Hess[1], Alexander I. Geyer[2], John C. Wain[3]; [1]Respiratory Care Services, Massachusetts General Hospital, Boston, MA; [2]Pulmonary and Critical Care, Massachusetts General Hospital, Boston, MA; [3]Thoracic Surgery, Massachusetts General Hospital, Boston, MA

Introduction: Gastric bronchial fistula (GBF) is a rare and devastating disease process. We report a case of GBF secondary to necrotizing Aspergillus pneumonia. Case Summary: A 50 year-old male, with past medical history significant for B-cell acute lymphoblastic leukemia and Aspergillus pneumonia, presented to the emergency department shortly after a meal with nausea, vomiting, productive cough and acute respiratory distress. He was intubated and placed on volume-controlled continuous mandatory ventilation. After intubation, positive epigastric sounds were present with copious amounts of vomitus filling the endotracheal tube. Chest X-ray and end-tidal CO2 confirmed adequate tube position. However, inhaled VT was significantly greater than exhaled VT and air bubbles were observed emitting from the nasogastric tube. Ventilation was difficult with pH 7.15, PaCO2 61 mm Hg, PaO2 65 mm Hg on FiO2 1.0. Computed tomography revealed a communication between the left lower lobe and the fundus of the stomach (Figure). A bronchial blocker was placed into the basilar segment of the left lower lobe to reduce air leak. However, its position was difficult to maintain despite sedation and paralysis. Independent lung ventilation (ILV) was implemented because serious hemodynamic and respiratory instability occurred each time the bronchial blocker moved. The right lung was ventilated with VT 300 mL and PEEP 10 cm H2O. The left lung was ventilated with VT 200 mL and PEEP of 0 cm H2O with an air leak of 40 - 60 mL. There was a marked improvement in ventilation and oxygenation with ILV. Over the ensuing 5 days, the patient stabilized, after which a left lower lobectomy, partial gastrectomy, and prosthetic reconstruction of left hemidiaphragm were performed. His recovery was slow and he was discharged 2 months later. Pulmonary cultures were positive for Aspergillus; presumably this infection produced the fistula. Discussion: GBF is rare, with only 38 prior cases reported. The diagnosis is often difficult and requires a high index of suspicion. It is most commonly seen in patients with previous gastroesophageal surgery, subphrenic abscess, gastric ulcers, trauma, or foreign body ingestion. This case illustrates respiratory care issues encountered while caring for a patient with GBF, including the use of ILV until the patient can be stabilized for definitive surgical correction.

Sponsored Research - None



Computed tomography (coronal reconstruction) showing a gastric bronchial fistula between the left lower lobe and the fundus of the stomach

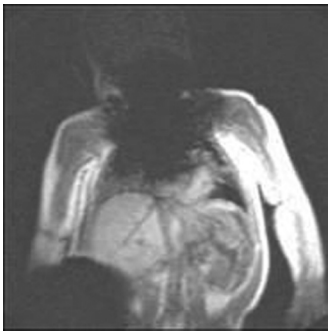
665470

WIRE REINFORCED TRACHEOSTOMY TUBES MAY PRODUCE UNACCEPTABLE SCANNING INTERFERENCE DURING MAGNETIC RESONANCE IMAGING IN CHILDREN – REPORT OF A CASE.

Darcy O'Brien-Genrich[1], Edward Truemper[2]; [1]Respiratory Care Services, The Nebraska Medical Center, Omaha, NE; [2]Department of Pediatrics, Critical Care Medicine, The Nebraska Medical Center, Omaha, NE

Introduction: Our chronically ventilated pediatric population typically uses custom wire reinforced tracheostomy tubes (TT) manufactured by Bivona® to ensure proper fit and length. Some patients require magnetic resonance imaging (MRI) which precludes most metal containing medical devices because of magnetism and heat production. Changing to a standard length non-wired reinforced tube poses an increased risk such as tube dislodgement during the procedure because of limited monitoring options and line of sight. The Nebraska Medical Center contacted the manufacturer for safety information. According to Smith-Medical®, "When leaving a Bivona® wire reinforced TT in place during an MRI there will be no interference between the magnet and the metal/wire to cause heat damage to the patient or movement of the tracheostomy tube. However the wire may distort the image at the tracheostomy site." Given this statement, the Respiratory Department was prepared to forgo tube changes prior to MRI scanning if image quality was not compromised. We report a case of a toddler who underwent an MRI of the chest with a Bivona® in place. Case Summary: A 22 month-old-female with a history of primary prematurity, multiple visceral organ transplants and tracheal tube dependency was admitted with severe pulmonary hemorrhage and hypoxic respiratory failure. An MRI of the chest was performed to investigate for a vascular source of the pulmonary bleeding. Because of the potential risks of tracheal tube dislodgment coupled with the need for positive pressure settings to prevent further hemorrhage, the Bivona® was left in place. The initial scans however, revealed considerable image disruption extending upwards to the base of the skull down to the upper abdomen. Image quality was too poor to allow for radiographic interpretation. The TT was changed to a non-reinforced tube and a repeat MRI scan resulted in acceptable images with no image distortion. Discussion: Although Bivona® TT are considered medically safe for MRI; the wire can result in distortion, significantly degrading image quality. Computed tomography should be considered as an imaging option or a non-wire reinforced TT should be substituted in the pediatric population when MRI scanning is required of the head, neck and chest. Changing from custom fit to standard length TT should necessitate increased visual surveillance and direct clinical assessment during the MRI procedure to avoid respiratory compromise.

Sponsored Research - None



668084

OPTIMAL PEEP GUIDED BY ESOPHAGEAL BALLOON.

Tom Piraino, Deborah J. Cook; St. Joseph's Healthcare, Hamilton, ON, Canada

Introduction: In theory, esophageal pressure monitoring utilized early in the management of the acute respiratory distress syndrome (ARDS) may aid lung protection ventilation by providing optimal settings specific to each patient. However, current best practice for ARDS is lung protective ventilation targetting 4-6mls/kg tidal volume and plateau pressures < 30 cm H2O. A key limitation to mechanical ventilators is that they report peak airway pressures without distinguishing compliance that reflects intrinsic lung mechanics or chest wall and abdominal pressures. We utilized esophageal pressure monitoring to help guide optimal positive end expiratory pressure (PEEP) and to estimate the transpulmonary pressure distending the lungs in a patient suspected of having decreased compliance due to elevated abdominal pressures. Case Summary: A 45 yr old female was admitted to the ICU with septic shock due to an obstructive ureteric stone. When she was turned during routine care, the SpO2 decreased to 78%. The patient had ascites and an elevated bladder pressure of >32 mmHg . Despite an increase in FiO2 to 1.0, high PEEP levels, and intermittent recruitment maneuvers, it was challenging to obtain and sustain a SpO2 > 85%. We inserted an esophageal balloon to determine whether the abdominal pressures were affecting lung compliance. PEEP was guided to a level of 32 cm H2O to achieve a transpulmonary pressure of 0 cm H2O. Within 6 hours, the FiO2 was weaned and the PaO2/FiO2 ratio increased from 80 to 244. We made subsequent PEEP changes according to transpulmonary pressures with reference to Talmor's study (NEJM, November 2008), and the patient was weaned from mechanical ventilation in 8 days with no adverse sequelae associated with very high PEEP levels. Discussion: The care of this patient renewed our interest in measuring esophageal pressures to determine optimal PEEP during mechanical ventilation. These PEEP levels were much higher than expected, and helped us to liberate the patient from mechanical ventilation sooner than expected.

Sponsored Research - None

677658

EFFECT OF BUBBLE CPAP AND HIGH FLOW NASAL CANNULA THERAPY ON THE ELECTRICAL ACTIVITY OF THE DIAPHRAGM IN A PREMATURE INFANT.

Thomas C. Noblet; Respiratory Therapy, St.Vincent Women's Hospital, Indianapolis, IN

Introduction: The effects of bubble CPAP and HFNC on the diaphragm's electrical activity (Edi) are unknown. The Edi can be used to quantify neural respiratory drive to the diaphragm.1-2 Alterations of the Edi intensity with changes in therapy suggest changes in central respiratory drive.3 During therapeutic management of a premature infant, the Edi was monitored during bubble CPAP and during adjustments in flow using a HFNC (Vapotherm, Stevensville/MD). Case Summary: A 26-week old infant was intubated and received ventilatory support for respiratory distress using the SERVO-i. ventilator (Maquet, Inc., Solna, Sweden). A catheter for measuring the Edi (Maquet, Inc., Solna, Sweden) was nasally inserted to establish the infant's current Edi level, and to begin ventilation with NAVA (neurally adjusted ventilatory assist). Shortly after catheter placement, the infant self-extubated in an unrelated event. The Edi catheter remained in place. The baby was placed on 5 cm H2O of bubble CPAP, which was increased to7 cm H2O to help improve oxygenation. Following initiation of bubble CPAP, the presence of sternal and intercostal retractions and the use of accessory muscles indicated labored breathing. The mean Peak Edi was 58.2 +/- 8.7 microvolts (normal range 5-10 microvolts). The elevated Edi suggested an increased neural input to the diaphragm. 2-3 The infant was switched to a high flow nasal cannula (HFNC, Vapotherm) to try to reduce the labored breathing. The flow through the HFNC was progressively increase from 2, 4, 6 to 8 L/min. Edi progressively decreased with each flow increase to an Edi minimum at a flow of 8 L/min (mean Edi Peak values [microvolts] 78 +/- 5.6; 60 +/- 7.2; 50.4 +/- 20.1; 24.3 +/- 4, respectively). Discussion: The high Edi level measured during bubble CPAP, and during lower flows with a HFNC suggest that the central respiratory drive to breath was high.1-3 Eight (8) L/min of HFNC produced the lowest Edi signal. The ability to monitor the effects of therapies such as bubble CPAP and HFNC on the diaphragm's electrical activity may provide a tool in identifying how these therapies affect the Edi, which represents neural drive to the diaphragm.2

Sponsored Research - None

678892

AN UNUSUAL CASE OF RESPIRATORY ALKALOSIS.

Jeffrey Brown, Christopher Hirsch, Kevin Crowley, Stephen Mette; Maine Medical Center, Portland, ME

Introduction Unexplained ventilator autocycling poses a challenge for the respiratory care practitioner Case Summary A 25 year old woman 5 days postpartum presented to our emergency department complaining of severe chest pain. Cardiac catheterization revealed acute left main coronary artery dissection. The patient was brought emergently to the operating suite for coronary artery bypass grafting and ultimately required nitric oxide, an Intra Aortic Balloon Pump (IABP) and a Thoratec IVAD® (Thoratec, Pleasonton, Ca.) Left Ventricular Assist Device (LVAD) for left ventricular support. Postoperatively the patient was brought to the cardiothoracic intensive care unit and placed on the Drager Evita XL® (Drager, Lubeck, Germany). Slight hyperventilation was requested for pulmonary vasodilation. Initial settings were CMV rate 16, 600 ml (9.4 ml/kg). The first postoperative ABG was 7.42/26/17/336. Over the next 24 hours a respiratory alkalosis with hyperchloremic (serum chloride 113-120 mEq/l) metabolic acidosis persisted. The patient received propofol 80 mg/hr. but continued to hyperventilate (mandatory rate 14, total rate 16-20, PaCO2 18-27). The patient was paralyzed with vecuronium bromide, confirmed with nerve stimulation. The ventilator rate was decreased from 14 to 8 sequentially. The total breath rate remained 16. Trigger sensitivity was minimized and ultimately turned off. Analysis of the flow/ time waveform continued to depict regular "spontaneous efforts" (60 ml). The mode was changed to SIMV, rate 8, PSV 5 cm H2O. Minute volume dropped from 9.6 to 6 lpm. ABG after 45 minutes was 7.33/33/17/160. The patient's ABGs continued to improve and she was extubated the following day. Discussion No factors characteristically associated with ventilator autocycling (ETT cuff leak, inappropriate ventilator sensitivity, bronchopleural fistula, diaphragmatic pacing) were noted. Given that the LVAD is both a pump and a sump the possibility arises that intrathoracic pressure fluctuations could occur which may cause the ventilator to cycle. Although a literature search failed to reveal other instances of ventilator autocycling related to LVAD use, further study of factors contibuting to autocycling would be useful.

Sponsored Research - None

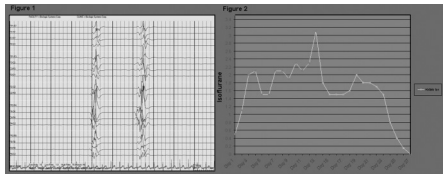
679097

PROLONGED USE OF ISOFLURANE IN A CHILD WITH STATUS EPILEPTICUS.

Christopher Fawcett[1], Stefanie Gauguet[2], Brian K. Walsh[1,2], John H. Arnold[2,1], Robert Groom [1,2]; [1]Respiratory Care, Children's Hospital Boston, Boston, MA; [2]Division of Critical Care, Children's Hospital Boston, Boston, MA

Introduction: Isoflurane is a commonly used inhalational anesthetic, but it is rarely used in the ICU setting, except for cases of severe status asthmaticus or status epilepticus refractory to conventional medical management. Historically, many of the anesthetic ventilators have performed appropriately at delivering and conserving anesthetic agents, but were unable to properly ventilate the spontaneously breathing child. We report the prolonged use of isoflurane in the ICU for management of a patient with intractable seizures. In this case, the desired effect of isoflurane was to achieve and maintain burst suppression while minimizing adverse effects. Case Summary: A 3 year old previously healthy male with a 2 week history of intractable seizures progressing to uncontrollable status epilepticus. Treatment for this patient was complicated by severe allergic and idiosyncratic hypersensitivity to most antiepileptic drugs. In an attempt to achieve seizure control, he was electively intubated and sedated with escalating doses of midazolam, which became progressively less effective. He was then switched to a Servo 900c ventilator with an attached isoflurane vaporizer and isoflurane was titrated to achieve burst suppression successfully (Figure 1). By day 13, however, the length of treatment and the continuously escalating dose of isoflurane required to maintain seizure control was concerning to elicit potential adverse effects (Figure 2). A ketamine infusion was added which allowed weaning of the inhaled isoflurane to lower levels. Ultimately, the patient was diagnosed with cortical dysplasia per brain biopsy and subsequently underwent a successful temporal lobe resection with resulting post operative neurological deficits. The isoflurane was weaned off after a total course of 26 days and the patient was discharged to a rehabilitation hospital. He suffered no adverse effects clearly attributable to the prolonged isoflurane use. Discussion: The delivery of isoflurane at reliable, titratable doses while allowing appropriate ventilation over a several week course was challenging due to technical difficulties using a Servo 900c anesthesia machine, which is more difficult to trigger than modern ventilators and has difficulty with the conservation of anesthetic agents. We recommend the use of closed-loop anesthetic work stations, such as the Draeger Apollo for patients requiring treatment with prolonged inhaled anesthetics and ventilator support in the ICU setting.

Sponsored Research - None



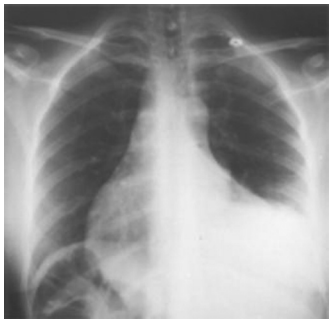
679071

PARSONAGE-TURNER SYNDROME AND HEMIDIAPHRAGMATIC DYSFUNCTION.

Christine Perino[1], Susan LaGambina[1], Paul F. Nuccio[1], Gerald L. Weinhouse[2]; [1]Department of Respiratory Care, Brigham and Women's Hospital, Boston, MA; [2]Pulmonary & Critical Care Division, Brigham and Women's Hospital, Boston, MA

Introduction: Parsonage-Turner Syndrome is a rare syndrome of unknown cause, affecting mainly the lower motor neurons of the brachial plexus. Case Summary: A 47 year old male, presents with fatigue, fever, chills, a dry non-productive cough, dyspnea on exertion (DOE) and left shoulder pain/weakness. A CXR is taken which read: left lower lobe pneumonia with minimal atelectasis. Despite treatment, all symptoms remained. Breath sounds were diminished over the left base. A chest CT showed an elevated left diaphragm. The patient is a chemistry teacher. He conducts laboratory research with minimal chemical exposures. He is a non-smoker. The patient stated he has slight DOE for some time, attributed to weight gain. He also experienced a "sensation" in his left arm when lifting. He suffered from pneumonia's as a child. The patient also complained of excessive daytime sleepiness. PFT's revealed a restrictive defect, consistent with diaphragmatic paralysis. No response to bronchodilator therapy and a significant decrease in Vital Capacity and FEV1 while supine. A Sniff Study revealed paradoxical movement of the left hemi-diaphragm. The Exercise Study was relevant for mild cardiovascular limit to exercise based on a decrease VO2max and a decreased anaerobic threshold (AT), suggesting secondary pulmonary mechanical limit. A sleep study showed disordered breathing during REM sleep-mild severity of apnea hypopnea index, with desaturations to 81% (average SpO2 of 94% throughout study). A follow up sleep study with BiPAP of 10/6cmH2O showed a positive response. His neurology exam showed evidence of a left brachial plexus lesion, affecting the phrenic nerve. An EMG revealed low amplitude left phrenic motor response. The needle EMG exam of the LUE revealed fibrillation potentials and moderate chronic changes in the infraspinatus. These abnormalities, led to a diagnosis of Parsonage-turner Syndrome. Discussion: We present a case of Parsonage-Turner syndrome which is rare, but should be considered when upper extremity weakness of unknown origin is present, especially in the setting where the patient is also showing symptoms of diaphragmatic dysfunction.

Sponsored Research - None



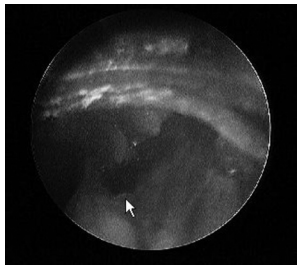
679893

TREATMENT OF A BRONCHIAL LACERATION BY SELECTIVE FIBEROPTIC-GUIDED LEFT MAINSTEM INTUBATION IN A 480 GRAM NEONATE.

Steven Sittig, Cody Koch, Shelley Ahrens, Charlotte Van Dorn, Dana Thompson, William Carey; mayo clinic, Rochester, MN

INTRODUCTION: Laceration of the tracheobronchial tree is a rare cause of pulmonary air leak in neonates. Often resultant from traumatic intubation, causative factors include multiple attempts at intubation or inappropriately deep placement of the endotracheal tube. These injuries often present with subcutaneous emphysema, mediastinal emphysema and pneumothorax. For the smallest patients, premature newborns weighing <1 kg, conservative, non-surgical management is the standard of care, despite the high mortality rate associated with this condition. CASE REPORT: Our patient was born at 24 weeks gestation, estimated weight of 600 grams. Multiple intubation attempts were made both during the initial resuscitation and over the first three days of life. After several of these intubations there was radiographic evidence of right mainstem intubation. On the third day of life the patient developed a right pneumothorax. Placement of a thoracostomy tube initially relieved the intrapleural air, but within 12 hours the air reaccumulated. On the fourth day of life the patient was transported to our facility for further management of her persistent air leak. Despite the use of high frequency ventilation, replacement of a thoracostomy tube and patient positioning maneuvers, the pneumothorax did not resolve, leaking continuously until day of life 11. The otolaryngology service then was consulted, and on rigid bronchoscopy a laceration was identified at the take-off of the right upper lobe bronchus. As surgery would have been challenging in a patient of this size (480 gm on that day), the left mainstem bronchus was selectively intubated with fiberoptic guidance. The endotracheal tube was left in this position for the next 24 hours with the patient placed in the right lateral decubitus position. After this time, the ETT was withdrawn to a midtracheal position and the pneumothorax did not reaccumulate. Conclusion: In this case, traumatic intubation led to a bronchial laceration that was complicated by a life-threatening bronchopleural fistula. Making a diagnosis was challenging, given the absence of subcutaneous or mediastinal emphysema. Rigid bronchoscopy enabled us to make the correct diagnosis, and fiberoptic-guided left mainstem intubation allowed us to treat this tiny infant rapidly and effectively. To our knowledge, this is the first case of tracheobronchial laceration so treated in a patient weighing <500 grams.

Sponsored Research - None



Rt Mainstem bronchial laceration. Arrow denotes laceration

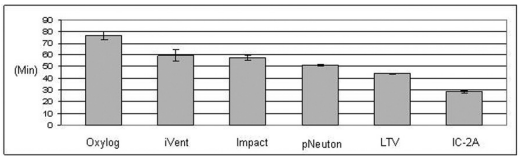
679989

GAS CONSUMPTION OF SIX PORTABLE VENTILATORS.

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

Background: The amount of gas consumed is a product of the ventilator settings and the operating characteristics of the portable ventilators. We evaluated the gas consumption of portable ventilators in a laboratory setting. Methods: We measured the effects of PEEP and FIO2 on gas consumption of six portable ventilators: Impact 754, Versamed iVent, Biomed IC2A, Pulmonetics LTV 1200, Drager Oxylog 3000 and Airon pNeuton. Each ventilator was attached to a Michigan Instruments Training Test Lung to verify FIO2 and tidal volume. Lung Compliance was set at 0.5 L/cmH2O and resistance was 5.0cm H2O/L/s. The respiratory rate was set at 20 breaths/min, tidal volume was 500 ml, and inspiratory time was 1.0 second. We placed a pneumotachograph between the ventilator and the test lung. The output was recorded to document the start and stop time of each study and to verify tidal volume. FIO2 was continuously measured to verify delivered FIO2. Ventilators were evaluated using PEEP of 0 and 20 cmH2O and FIO2 of 1.0, 0.6, and 0.4, if the specific FIO2 options were available. Each ventilator was attached to a full E-type oxygen cylinder and operated until the low oxygen pressure alarm was activated. Data below represents the cylinder duration of each ventilator operating at an FIO2 of 1.0 and PEEP of 0. Data are mean ± SD. Results: Oxygen consumption varied widely between ventilator models. The duration of operation on a full E cylinder ranged from 24 – 276 minutes across all test conditions. Conclusions: Gas consumption of portable ventilators is affected by ventilator operating characteristics. Clinicians must be aware of these differences when planning for patient transport.

Sponsored Research - None



665258

DIAPHRAGMATIC ELECTRICAL ACTIVITY MONITORING UNMASKS BREATH-CYCLE ASYNCHRONY DURING CONVENTIONAL MECHANICAL VENTILATION.

Daniel D. Rowley[1], Stuart M. Lowson[2], Jurgen Witte[2], Frank J. Caruso[1]; [1]Pulmonary Diagnostics & Respiratory Therapy Services, University of Virginia Medical Center, Charlottesville, VA; [2]Anesthesiology, University of Virginia Medical Center, Charlottesville, VA

BACKGROUND: It has been reported that up to 27% of spontaneously breathing adult patients experience pneumatically triggered breath-cycle asynchrony (BCA) while on conventional modes of mechanical ventilation (MV). Clinicians commonly use airway pressure and flow scalar graphics to identify BCA objectively. Varying clinician skill levels and patient monitoring limitations may contribute to unrecognized and under reported BCA prevalence. An advancement in mechanical ventilation technology permits detection of BCA by measuring and displaying cyclic diaphragmatic EMG (Edi) signals and corresponding airway pressure waveforms simultaneously. We evaluated this technology to determine if Edi monitoring can be used to identify pneumatically triggered BCA during conventional modes of mechanical ventilation. METHOD: 16 adult MV patients were identified prospectively for BCA assessments if they were spontaneously breathing with an Edi catheter inserted. Scalar graphics were recorded and 10 sequential breaths were randomly selected and examined for asynchrony. Asynchrony was determined visually by comparing and identifying differences in corresponding Edi and airway pressure waveform morphology. Differences in waveform morphology at the beginning or end of a breath-cycle was considered an asynchrony. RESULTS: All 16 patients experienced delayed breath-cycle trigger (64%) and delayed inspiratory cycle-off (84%) asynchrony. Asynchrony existed during volume A/C (n= 7) and PSV (n= 9) modes regardless of flow or pressure triggering. 5 patients experienced ineffective breath-cycle triggering despite detectable Edi activity; 3 patients triggered breaths with minimal or no Edi activity; 1 patient triggered breath assistance for 8 of 10 breaths before Edi activity was detected. Refer to table. CONCLUSION: In a study of ventilated patients examining pressure and flow graphics, Thielle et al reported that significant asynchrony (defined as asynchrony in > 10% of breaths) was present in 25% of patients. The authors stated that more sensitive forms of respiration monitoring, such as diaphragmatic EMG, would likely detect an even greater incidence of asynchrony. Our data confirms their hypothesis. Using NAVA preview as a monitoring tool, significant asynchrony was present in all ventilated patients we assessed. Future studies should evaluate Edi measurement trends to determine if proportional changes in Edi peak and Vt measurements are predicive of extubation readiness.

Sponsored Research - - Edi catheters were provided by Maquet.

Patient	Mode	Trigger- On Sensitivity	Trigger-Off Sensitivity	Trigger-On Delay	Trigger-Off Delay	Trigger Effort Ineffective	Assist with Edi ≤ 2μV	Assist Before Edi Signal
1	PSV	Flow	Flow	9	10	0	0	0
2	A/C	Flow	Volume	4	9	0	0	0
3	PSV	Flow	Flow	2	5	0	2	0
4	PSV	Pressure	Flow	5	5	5	0	0
5	A/C	Pressure	Volume	5	7	3	0	0
6	A/C	Pressure	Volume	10	10	1	0	0
7	PSV	Flow	Flow	4	10	0	0	0
8	A/C	Flow	Volume	9	9	1	0	0
9	PSV	Flow	Flow	6	9	0	0	0
10	PSV	Flow	Flow	3	8	0	0	0
11	A/C	Flow	Volume	10	10	0	0	0
12	A/C	Flow	Volume	9	10	0	0	0
13	PSV	Flow	Flow	9	8	0	0	0
14	A/C	Pressure	Volume	8	10	0	0	0
15	PSV	Pressure	Flow	6	6	0	5	0
16	PSV	Flow	Flow	4	8	8	2	8

665329

AN 80% REDUCTION:VANQUISHING VAP VIA CUFF PRESSURE VIGILANCE.

Joe Dwan, Brian Wartell; Respiratory Care, Kaiser Sunnyside Med Center, Clackamas, OR

Benchmarking our VAP rate in 2006 showed our 13 bed Med-Surg ICU had a much higher rate at 9.7 VAPs/1000 vent days than acceptable. With the IHI Ventilator Bundle measures, our multidisciplinary teams developed the Zap Vap Program using evidence based medicine. Literature was reviewed, policies changed, extensive inservicing was completed and outcome reports were built. Four subgroups completed this work, including groups for Oral Care, Existing Practices, Kinetic Bed Protocols, and Best Practices for ETT tubes, cuffs and suctioning. Aspiration was a recurrent theme in VAP literature. A RC reference to 'vigilant cuff pressure monitoring' was developed into a Q4 hour cuff pressure measurement policy. Other policy changes included: RN & RT suction policies now match; limiting installation of saline; limiting breaking the vent circuit; not changing vent circuits or in-line suction devices; ending Qshift ETT retapping, minimizing transports/any ETT movement; promoting NIV; shortening VLOS, and HMEs over heated wire circuits. Additional IHI measures included Readiness to Wean protocols,& HOB>30 by RTs. Subglottal suction ETTs evidence of the RCTs of Kollef (43.2-34.5), Valles (39.6-19.9) and Smulders (22.5-9.2) was unimpressive. METHODS: Audits of RT cuff pressure monitoring frequency were completed periodically based on ventilator pts in MS ICU over 4-8 weeks. Data was collected by date, room, shift, individual RT and meeting the Q4 hr cuff measurement frequency. VAP rates were also monitored quarterly while VLOS was measured monthly. RESULTS: VAP rates fell from 9.7 in 2006, to 4.9 in 2007, to 1.98/1000 vent days in 2008. VLOS decreased from 3.13 to 2.15 days despite a 19% increase in volume. BIPAP usage increased 630% 2006-2008. Cuff pressure audits were estimated at 50% documentation in 2006 of Q shift cuff monitoring. By 2008, compliance with Q4 cuff press monitoring increased in Jan to 93%, and to 99% by May 2009. CONCLUSIONS: Multiple changes in practice resulted in decreased VAP rates, with vigilant cuff pressure monitoring just one factor in the improvement. Auditing compliance, posting results, and providing positive and negative feedback to individual RTs resulted in improved compliance in monitoring. Outlying RTs self-corrected when their coworkers results were better. Frequent discussion of VAP Vigilance, VLOS, and reporting audit results plus training new hires in VAP all contributed to our success.

Sponsored Research - None

665486

DEFINING A MINIMUM SET OF WEANING CRITERIA.

Carla Wollens, Robert L. Chatburn, Jorge Guzman; Respiratory Institute, Cleveland Clinic, Cleveland, OH

We previously reported results of a set of ventilator weaning criteria as baseline data for determining readiness for weaning (wean screen WS), successful spontaneous breathing trials (SBT) or readiness for extubation (extubation screen ES); *Respir Care* 2008;53(11):1576. The purpose of this study was to evaluate the effects of reducing the number of WS and SBT criteria. **METHODS:** The ventilator management protocol, as previously reported, had 4 phases of ventilatory support: (1) initial stabilization on full support; (2) daily assessment until WS met; (3) weaning by daily 60 minute SBT alternated with full support; (4) extubation. Wean and SBT criteria are shown in the Table. The strikethrough text indicates the criteria that were deleted in a subsequent group of patients. Extubation screen criteria were not changed. The subsequent group included all patients requiring mechanical ventilation between 12/27/08 and 4/14/09. Patients transferred out of the MICU before extubation were excluded. Outcome data were compared with t-test and Chi Square test; $P < 0.05$ considered significant. **RESULTS:** Data from 37 patients were evaluated. The duration of ventilation showed an insignificant drop from the baseline period 4.7 vs 6.4 days; $P = 0.248$. However, the percentages of patients who failed the first WS dropped significantly from 70% to 50% ($P = 0.006$). There was no difference in the percentage of patients who failed the first SBT ($P = 0.161$) or in the percentage of patients needing reintubation within 24 hours (2% vs 8%; $P = 0.105$). **CONCLUSION:** A reduced criteria set for WS was associated with a drop in the number of first time WS failures without an increase in SBT failure or reintubation rate. We speculate that the reduced failure of WS would show a reduction in the duration of ventilation if the sample size was larger. We also speculate that labor time was reduced using the reduced criteria set.

Sponsored Research - None

Wean Criterion	SBT Criterion	Outcome	Baseline	Reduced	P
Breathing efforts	~~PaO_2 > 60~~	Failed first WS	70%	50%	0.006
FiO2 < 40%	~~Δ pH < 0.10~~	Failed first SBT	25%	16%	0.161
PaO2 > 60	~~Δ $PaCO_2$ < 10~~				
pH > 7.30	RR < 40 for > 50 min				
PEEP < 8	~~Δ Systolic BP < 20%~~				
RR < 35	Systolic BP > 80				
~~HR < 140~~					
~~Systolic BP > 90 or < 180~~					
Levophed < 5 micrograms/min					
~~Temperature < 38.5~~					

673791

EFFECT OF PRESSURE RISE TIME ON VOLUME DELIVERY WITH CHANGING PULMONARY MECHANICS.

Teresa A. Volsko[1], Gina McMonagle[3,1], Shannon Cook[2], Robert L. Chatburn[2]; [1]Health Professions, Youngstown State University, Youngstown, OH; [2]Respiratory Institute, The Cleveland Clinic, Cleveland, OH; [3]Anesthesia Institute, The Cleveland Clinic, Cleveland, OH

BACKGROUND: During pressure controlled ventilation, the inspiratory pressure rise time (PRT) - the time it takes to reach the set peak airway pressure - may be operator adjusted. Available PRT settings vary among manufacturers and there are few data describing PRT performance. The purpose of this study was to compare the effects of PRT setting and lung mechanics on tidal volume delivery with a lung simulator. **METHODS:** The Ingmar Medical ASL 5000 was used to simulate a passive respiratory system with normal compliance (NC = 75 mL/cm H_2O) and low compliance (LC = 12 mL/cm H_2O). Airway resistance was 6 cm H_2O/L/second for all experiments. Ventilators evaluated: PB 840 (Covidien Healthcare), Servo i (Marquet), Evita XL (Draeger Medical), G5 (Hamilton Medical) and the Avea (Cardinal Health). Ventilator settings: mode = pressure controlled continuous mandatory ventilation, frequency = 30/min, inspiratory time = 0.7 seconds, inspiratory pressure = 15 cm H_2O above PEEP of 5 cm H_2O. Inspiratory PRT was set at lowest and highest settings. The change in tidal volume (ΔV_T) and time to reach 90% of peak inspiratory pressure (ΔT_{90}) were the difference between low and high rise times. Mean ΔV_T and ΔT_{90} were compared with t-test and ANOVA, $P < 0.05$ considered significant. **RESULTS:** T_{90} varied greatly among ventilators. At LC, T_{90} range was 38 ms (PB 840) to 260 ms (G5) for the shortest PRT settings. At NC the range was 147 ms (PB 840) to 267 ms (Avea). The table shows summary means and standard deviations (SD). Increasing PRT increased T_{90} and decreased V_T (average about 18%) for all ventilators but to different degrees ($P < 0.001$). The effect on V_T was magnified with NC compared to LC. **CONCLUSIONS:** Differences in design of pressure rise time algorithms among ventilators and differences in lung mechanics, lead to statistically significant and potentially clinically important effects on volume delivery.

Sponsored Research - None

	C = 12 mL/cm H_2O				C = 75 mL/cm H_2O			
	ΔV_T (mL)		ΔT_{90} (ms)		ΔV_T (mL)		ΔT_{90} (ms)	
Ventilator	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Puritan Bennett 840	-33	3	110	1	-105	1	108	4
Drager Evita XL	-18	1	127	10	-168	2	77	29
Maquet Servo-i	-4	0	109	4	-156	1	35	2
Hamilton G-5	-31	1	7	2	-123	3	5	2
Viasys Avea	-8	1	31	4	-42	2	10	10
	P = <0.001		P = <0.001		P = <0.001		P = <0.001	

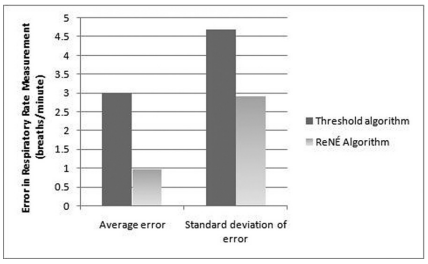
675139

ARTIFICIAL NEURAL NETWORK TO IMPROVE CAPNOMETRY DURING SEDATION.

Joseph Orr, Ken B. Johnson, Lara Brewer; Anesthesiology, University of Utah, Salt Lake City, UT

Background: Capnometers are used during sedation in non-intubated patients to monitor respiratory rate (RR) and end-tidal CO2 (etCO2). Since capnometers detect RR based on changes in CO2 concentration rather than gas movement, it is common for spurious changes in CO2 to be mis-identified as breaths. This leads to false alarms and missed detection of periods of apnea. Cardiogenic oscillations, attempts by the patient to speak and unsuccessful breath attempts during obstruction are common causes of changes in CO2 that can be falsely detected as breaths. An artificial neural network (ANN) is a type of computer algorithm that can be trained to recognize patterns and events. We trained an artificial neural network to estimate the tidal volume (TV) of each breath based on the shape of its capnogram. If the trained ANN identified the capnogram as having a TV of at least 200 mL it was categorized as a valid breath; otherwise it was rejected as artifact. We evaluated the accuracy of this combination ANN algorithm and a simple threshold algorithm compared to a reference RR, as measured using a pneumotach. Methods: 24 volunteers were fitted with a tight-fitting, sealed mask connected to a combination flow and CO2 sensor. Combinations of propofol and remifentanil concentrations delivered as target controlled infusions were administered to each volunteer to simulate various sedation conditions. The threshold algorithm defined a breath as any deviation of the CO2 signal above 10 mm Hg and below 5 mm Hg. Using data from 12 volunteers, the ANN was trained to estimate the TV associated with each breath. The detected TA breath was considered valid only for breaths identified by the ANN as having a TV larger than the airway dead space (200 mL). Both algorithms were compared to the reference resp. rate using data from the remaining 12 volunteers. Results: Using the threshold method, the average detected RR was 3 breaths per minute (bpm) higher than the reference rate. The standard deviation of the difference (SD) was 4.7 bpm. When the ANN modification was applied, the average RR was 0.07 bpm lower than the reference with SD of 2.5 bpm. The plot shows RR data of both methods for a typical volunteer. Conclusions: An ANN can be applied as a intelligent filter to provide breath-by-breath analysis of the capnogram and improve alarm reliability during sedation.

Sponsored Research - Philips/Respironics



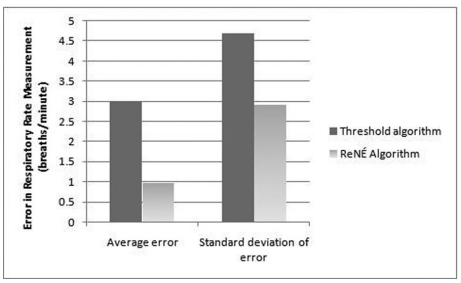
675443

EVALUATION OF BREATH RATE MEASUREMENT BY CAPNOGRAPHY IN SEDATED VOLUNTEERS.

Joseph Orr, Lara M. Brewer, Dwayne Westenskow, Ken B. Johnson; Anesthesiology, University of Utah, Salt Lake City, UT

BACKGROUND: Capnometry is used to monitor respiration in non-intubated, spontaneously breathing patients undergoing procedural sedation, patient controlled analgesia and other procedures where respiration may be compromised. Capnometers detect a breath when a change CO2 expired CO2 concentration is observed without regard for the volume of gas responsible for creating this change. Accurate respiratory rate (RR) measurement using capnometry in non-intubated patients is prone to false breath detection and missed breaths due to sample site location changes, irregular breathing, patient movement, etc. We evaluated the accuracy of capnometry breath detection algorithms in volunteers administered several combinations of a sedative hypnotic and a short acting opioid. METHODS: 24 volunteers were fitted with a tight-fitting, sealed mask connected to a combination flow and CO2 sensor. Each volunteer received 15 effect site concentration combinations of propofol and remifentanil delivered as target controlled infusions. We separately compared the accuracy of two breath detection algorithms (1) a simple threshold and (2) an advanced breath identification algorithm (ReNE) algorithm, as implemented in the test capnometer (Capno5/LoFlo, Respironics, Wallingford CT), against RR detected by a reference pneumotach system. The simple threshold algorithm detects a breath each time the CO2 exceeds 10 mm Hg and then goes below 5 mm Hg. The ReNE algorithm incorporates a complex set of heuristics for detecting breaths and rejecting spurious changes in PetCO2. Breaths smaller than 200 mL, which did not clear the airway dead space, were not counted as breaths. RESULTS: Using the simple algorithm, the average detected RR was 3.0 breaths per minute (bpm) higher than the rate detected by the reference. The standard deviation of the difference (SD) was 4.7 bpm. Using the ReNE algorithm, the detected breath rate was 0.97 bpm higher than the reference with SD of 2.92 bpm. CONCLUSIONS: While both algorithms detected more breaths than the pneumotach reference did, the ReNE algorithm was substantially more accurate than the typically used threshold method. False breath detects were often attributed to cardiogenic oscillations detected during periods of apnea and small breath attempts that occurred during periods of airway obstruction. Both of these conditions may cause the capnometer to fail to identify periods of respiratory failure during sedation.

Sponsored Research - Philips/Respironics



675443

CORRELATIONAL STUDY FOR PREDICTOR VARIABLES AFFECTING DURATION ON BUBBLE CPAP.

Alison Stoeri; Georgia State University, Atlanta, GA

BACKGROUND: Bubble CPAP (BCPAP) is used in the neonatal intensive care unit (NICU) as a form of non-invasive ventilation and is commonly employed in neonates demonstrating respiratory distress. BCPAP may be used to avoid the need for intubation and mechanical ventilation thereby reducing lung injury and other morbidities as well as decrease hospital stay. METHODS: A retrospective study investigating the length of stay on BCPAP considering gestational age, birth weight, and surfactant delivery using existing data between October 1st, 2007 and April 1st, 2009 from an urban tertiary high load level three NICU was completed. The data was used to answer the preset research questions. Data analysis was performed using SPSS 16.0 including descriptive statistics, contingency tables and Pearson product-moment correlations. RESULTS: Descriptive statistics indicated the mean gestational age at birth to be 32.263 weeks SD = ±2.978, mean neonatal weight to be 1.899 kg SD = ±0.728, and mean length of time on BCPAP to be 124.430 hours SD = ±185.474. Contingency statistics showed a substantial association (reta = 0.562) between the gestational age at birth and surfactant delivery, a very strong association (reta = 1.000) between the birth weight and surfactant delivery, and a very strong association (reta = 0.914) between the length of time the neonate was on BCPAP and surfactant delivery. Pearson product-moment correlation coefficients showed gestational age at birth has a very strong positive association with birth weight ($r = 0.811$, $p < 0.01$) and a moderate negative association with length of time on BCPAP ($r = -0.439$, $p < 0.01$). Intercorrelations also showed birth weight has a moderate negative association with length of time on BCPAP ($r = -0.306$, $p < 0.01$). CONCLUSIONS: The data demonstrates that the older the gestational age at birth, the heavier the neonate's birth weight, and the shorter length of time spent on BCPAP, the less likely that neonate was to receive surfactant delivery. The data also demonstrates that the older the neonate's gestational age at birth, the heavier the neonatal birth weight and the shorter length of time on BCPAP. Lastly the data demonstrates that the heavier the neonate's birth weight, the shorter length of time on BCPAP.

Sponsored Research - None

677492

SIMULATION IN RESPIRATORY CRITICAL CARE AND EXTRACORPOREAL MEMBRANE OXYGENATION.

Michael Minneti, Eryn Miller, Lara P. Nelson; University of Minnesota Medical Center, Fairview, Minneapolis, MN

Background: Traditional approach to continued medical education for respiratory critical care and Extracorporeal membrane oxygenation (ECMO) training focuses on didactic teaching. Afterward, staff are assigned to preceptors to demonstrate their critical thinking skills as opportunities arise. This model is limiting because it relies on unfavorable events occurring for staff to demonstrate competence and receive evaluation of their actions. Staff may finish training without having proved their ability to react appropriately in emergencies. The Respiratory Care Department at University of Minnesota Medical Center created a simulation lab to address these limitations. Methods: An infant CPR manikin was adapted to resemble an ICU or ECMO patient and connected to appropriate monitoring equipment. Physiologic variables can be modified based on the learners' interactions with the environment, such as: vital signs, symmetry of breath sounds and chest rise, ventilator pressures, chest tube output, endotracheal tube complications, and ECMO circuit dynamics. Critical care and ECMO scenarios were developed to test staffs' reactions to emergencies. The scenarios were video recorded and the learners' critical thinking skills were evaluated by the instructor. Substantative feedback was provided in the debriefing period immediately following the scenario. Results: Seventeen learners each completed three scenarios. Upon conclusion learners completed an evaluation form. Overall the participants felt the experience was beneficial. Questions about the scenarios and debriefings used a 5-point Likert scale with 1 = poor and 5 = excellent. Cumulative scores showed a mean score of 4.7 for the scenarios (SD=0.5) and a mean score of 4.8 for the debriefings (SD=0.4). In addition, the instructor also felt he was able to create "real" scenarios that tested critical thinking skills of staff and provide feedback to staff based on his observations. Conclusion: Creation of a simulated critical care environment provides respiratory therapists and ECMO specialists guaranteed exposure to high risk scenarios that test behavioral and technical skills. Through interaction in the simulated environment instructors have a means to assess competence and give substantative feedback to staff.

Sponsored Research - None

677524

CURRENT PRACTICES RELATED TO LUNG PROTECTIVE STRATEGIES IN PATIENTS WITH ACUTE RESPIRATORY DISTRESS SYNDROME IN OHIO HOSPITALS.

Sarah Varekojis, Megan Anzak, Nagham Houssami; Respiratory Therapy Division, The Ohio State University, Columbus, OH

Introduction: Ventilating patients with Acute Respiratory Distress Syndrome (ARDS) and acute lung injury (ALI) is a complex process. There is considerable research on methods of lung protective strategies for ARDS/ALI patients, but little is known about actual use of these strategies. Objective: To explore current practices related to lung protective strategies for patients with ARDS/ALI in Ohio hospitals. Methods: Participants were Ohio licensed respiratory therapists who had current or recent experience in critical care. Survey Monkey® was used to administer a survey that included questions regarding ventilator modes and parameters (tidal volume, respiratory rate, PEEP) used with ARDS/ALI patients as well as the use and implementation of ventilator management protocols for ARDS/ALI patients. The survey was distributed to respiratory therapists that participated in a large state-wide continuing education conference. Descriptive statistics and chi square were used as appropriate to answer research questions. Results: The two most common lung protective strategies being used were tidal volume (Vt) 6-8ml/kg IBW (81%) and optimization of peak end-expiratory pressure (PEEP) (59%). The least common strategy being used was high frequency oscillatory ventilation (HFOV) (16%). 52% of facilities had a ventilator management protocol in place for patients with ARDS/ALI, and 80% indicated that the protocol was being used. Teaching hospitals were more likely to use a Vt 6-8ml/kg, early HFOV, and prone positioning than community hospitals. Conclusion: In Ohio, the majority of both teaching and community hospitals are compliant with ARDSNet guidelines by using the recommended Vt and PEEP. Since the benefits of having protocols are well established in the literature, there is room for improvement in the use of protocols for mechanical ventilation of patients with ARDS/ALI.

Sponsored Research - None

677697

A RETROSPECTIVE CHART REVIEW OF LOW TIDAL VOLUME VENTILATION STRATEGY IN MEDICAL INTENSIVE CARE UNIT PATIENTS.

Sarah Varekojis[1], Natalie Bonomo[1], Filomena Iacovone[1], Christopher Phelps[1], Naeem Ali[2]; [1]Respiratory Therapy Division, The Ohio State University, Columbus, OH; [2]Division of Pulmonary, Allergy, Critical Care, and Sleep Medicine, The Ohio State University Medical Center, Columbus, OH

Background: Patients with ALI and ARDS often receive low Vts (<6 mL/kg). This approach has not been widely adopted in a broad group of patients without ALI/ARDS. We sought to determine the effectiveness of an RT-driven ventilator management protocol in applying appropriate Vt settings. Methods: Retrospective chart review conducted involving MICU patients. A before-and-after implementation study design was chosen. Data collection included demographics, ALI/ARDS at intubation and 72 hrs post-intubation, ventilator settings, duration of mechanical ventilation, ABGs, ICU and hospital LOS. Descriptive statistics, t-tests and chi square used to determine appropriateness and safety of lower Vts in patients without ALI/ARDS. Results: There was a statistically significant decrease in the Vts utilized following implementation of the protocol that persisted for at least 72 hrs. Patients with ALI/ARDS were more likely to receive a Vt <6 mL/kg after implementation of the protocol, whereas there was a numeric increase in the proportion of non-ALI/ARDS pts receiving <8 ml/kg Vt, suggesting a strong trend toward personalized ventilator initiation. While PEEP levels appeared numerically higher, they were not significantly different with implementation of the protocol. There appeared to be a trend to worsened oxygenation at 72 hrs. However, survival was no different between the groups or for subjects receiving appropriate Vt, suggesting a lack of harm. There was no statistically significant difference in ventilator days, plateau pressures, FiO2, or PaO2/FiO2 ratios in the 2008 non-ALI/ARDS cohort. Conclusion: Implementation of an RT-driven ventilator management protocol had a statistically significant impact on the Vts used at initiation of MV largely because of a significant improvement in appropriate Vt for ALI/ARDS patients. However, delivery of appropriate Vt for non-ALI/ARDS patients also increased. A trend toward improved survival for patients receiving appropriate Vt in our cohort confirms that this approach is safe and consistent with findings in larger RCTs. The use of a protocol can effectively reduce the prescribed Vt for all patients, and can provide some personalization of Vt settings based on disease process. This reduction appears well tolerated as the Vts remained consistently lower for at least 3 days without difference in ventilator or survival outcome. Low Vt practices appear to be appropriate and safe for non-ALI/ARDS populations in the MICU.

Sponsored Research - None

677721

THE RESPIRATORY CARE PRACTITIONER AND PROCEEDURAL SEDATION IN THE EMERGENCY ROOM SETTING.

Robert Delong, Jhaymie Cappiello, J Brady Scott, Michael Gentile, Janice Thalman, Neil MacIntyre; Duke Medical Center, Durham, NC

BACKGROUND: Procedural sedation and analgesia (PSA) is a technique of administering sedatives or dissociative agents with or without analgesics to induce a state that allows the patient to tolerate unpleasant procedures while maintaining cardiorespiratory function. PSA is intended to result in a depressed level of consciousness that allows the patient to maintain oxygenation and airway control independently. Existing literature does not provide clear evidence on the number of personnel necessary to safely provide PSA. The presence of support personnel with advanced airway skills assumes increased importance when the physician is involved in a procedure that precludes the ability to continually assess the patient's clinical status. We sought to evaluate the safety and efficacy of utilizing a Respiratory Care Practitioner (RCP) providing airway monitoring and support during PSA in the emergency room setting. METHOD: After IRB approval, a retrospective chart review was performed over a 12 month period. Medications used included ketamine, versed, fentanyl, morphine, etomidate, and ativan. The three person team consisted of RN, RCP and MD. The RN documented procedure, monitored vital signs, and administered medications; The RCP monitored vital signs, ETCO2 via nasal prongs, airway patency and provided airway support as indicated; the MD ordered medications and performed the procedure. A Modified Ramsey Scale (MRS) was used to measure depth of sedation. Adverse events were identified as cyanosis, loss of airway, bradycardia, hypotension, aspiration, and the need for intubation. RESULT: During our study period, PSA was performed on 146 patients. The outcome of all of the procedures performed met physician's satisfaction, 20 patients reached a MRS of 6 and only one of those required a brief period of bag-valve-mask ventilation. No other adverse events or outcomes were noted. Common indications for PSA were fracture reduction, laceration repair and cardio-version. No patient required intubation. The maximum ETCO2 was 66. The lowest level of oxygenation was SpO2 of 99%. CONCLUSION: Utilizing a Respiratory Care Practitioner (RCP) providing airway monitoring and support during PSA in the emergency room setting is safe and efficacious. More study is recommended to determine if primary airway personnel is required in this setting.

Sponsored Research - None

677802

TITLE: A COMPARISON OF THE ROCHE MICROSAMPLER AND THE PORTEX PROVENT SAMPLING SYRINGE, USING THE ROCHE OMNI 6 AVL AND THE ROCHE COBAS B 221 BLOOD GAS SYSTEMS.

Richard M. Hoskins; Dept of Resp Care, Presbyterian Hosp of Plano, Plano, TX

In our ICU, ER, NICU, OR's and General Care areas; Blood Gases, Electrolytes and Co-Oximetry are frequently obtained to determine the current pulmonary and metabolic needs of our patients. Materials: At this time, we utilize the Portex Pro-Vent Dry Lithium Heparin vented syringe. After the purchase of our Roche Cobas b 221 Blood Gas System, we were offered some trial packs of the Roche Microsampler. 75 of the Roche Microsampler were tested in this study; the remainder was used in clinical sampling. The Roche MICROSAMPLER utilizes a 26 gauge needle; while the sampler contains twin glass capillary tubes in a "U" configuration, for a sample volume of approximately 220 µL. These capillary tubes are internally coated with both sodium and lithium heparin, and are contained in a plastic holder that is not designed to be opened by the user. The Portex Pro-Vent syringe can be obtained either as a syringe alone with a 25 gauge needle, or as a kit with a 25 gauge and a 23 gauge needle included. Neither of these products are designed or suitable for aspiration of a sample, such as from a Swan-Ganz Catheter, but are expressly designed to fill using arterial pressure. Methods: 46 Post Cardiac Surgical patients were dual-sampled from a closed-system arterial line (SafeSet, Hospira). The SafeSet uses a standard solution of 1000 units Sodium Heparin to 500 ml 0.9% NaCl. All sampling was per routine sampling times & protocols. Either the Microsampler or the Pro-Vent syringe was used to obtain the first sample, and then the other was used for the immediate second sample. Both samples were analyzed on a matched pair of Roche Omni 6 AVL, or on a paired Roche 6 AVL and the Cobas b 221, when used in the NICU, If enough sample was available, then the samples were ran on the opposite analyzers. Most patients had several sets of samples obtained, at various times, for clinical management. Comments: Only the initial analysis from the institutional approved device (Portex Pro-Vent) was used for patient management. Any analysis of the Roche Microsampler, or split-sample data was collected for study purposes only. Results: There were small statistically insignificant differences between the two sampler systems. pH (r=9932; p<.01), PaCO_2 (r=9904; p<.01), PaO_2 (r=9891; p<.01), COHb (r=9847; p<.01), MetHb (r=9911; p<.01), K+ (r=9804; p<.01) Na (r=9791; p<.01) and ionized Ca (r=9833; p<.01)

Sponsored Research - Blood gas syringes were donated as part of purchase of new analyzer. Roche is not aware of this study, nor were there any financial incentives to use these products.
No other contributions were made by roche or its representatives, to myself or my facility.

651488

IN A SWINE PLEURAL EFFUSION MODEL, FUNCTIONAL RESIDUAL CAPACITY (FRC)CAN BE DETERMINED BY A NITROGEN WASHIN-WASHOUT METHOD DURING MECHANICAL VENTILATION.

Jeronimo Graf[1], Alex B. Adams[1], David Dries[1], Arnoldo Santos[1], Joseph Tashjian[2], John Marini[1]; [1]Pulmonary Research, Regions Hospital, St. Paul, MN; [2]Radiology, Regions Hospital, St. Paul, MN

Purpose: The monitoring of FRC in ventilated patients, if available, could evaluate an effect on the lungs of a pleural effusion. Changes in FRC could also reveal the propagation/retreat of a pneumonia when gas exchange data is unavailable or deceptive. In a radiology suite, computerized tomography (CT) can accurately measure FRC. An online nitrogen washin/washout (NWW) method that adjusts FIO2 from .5 to .6 to .5 while inferring nitrogen concentration changes has been developed to measure FRC in ventilated patients. Methods: In a deeply anesthetized swine model, a catheter was inserted into the right chest for saline instillation to create a pleural effusion. In the CT suite we measured FRC concurrently by CT and NWW methods under conditions of PEEP = 0, 10 cmH2O and pleural effusion with 0, 400, 800 ml of saline injected into the pleural space via the inserted catheter. Results: FRC measures from 31 simultaneous observations found a mean difference between the techniques of 23 ml or 7.1%. Both techniques tracked, in parallel, the expected FRC-increasing effects of PEEP and decreases in FRC as a pleural effusion was created. Gas exchange data did not necessarily track with the FRC changes. Conclusion: FRC measurements from CT studies verified the accuracy of an online NWW-FRC technique under varying PEEP and pleural effusion conditions. No problems were encountered that would preclude use of the NWW-FRC technique under other settings or conditions. Implications for Translation into Practice: The effect of a pleural effusion (or pneumonia) on lung volume status can be determined by FRC measurements during mechanical ventilation.

Sponsored Research - We have use of the GE carestation ventilator for this FRC comparison study as well as support from GE support for other specific projects in our lab.

653856

SEMI-QUANTITATIVE TRACKING OF INTRA-AIRWAY FLUIDS BY COMPUTED TOMOGRAPHY.

Jeronimo Graf[2], Alex B. Adams[2], Joseph Tashjian[1], David Dries[2], John Marini[2]; [1]Radiology, Regions Hospital, St. Paul, MN; [2]Pulmonary Research, Regions Hospital, St. Paul, MN

Background: Airway secretions are a source of complications for patients with acute and chronic lung diseases, yet lack of techniques to quantitatively track secretions hampers research into clinical measures to reduce their pathologic consequences. Methods: In a preserved swine lung model we tracked a contrasted mucus simulant (CMS) using sequential computed tomography (CT). Known drivers of secretion movement - gravity and ventilation - were tested. Ten ml of CMS were unilaterally introduced (1ml/min) into the airways of 12 lung sets. After instillation, 6 lung sets were maintained prone and 6 were rotated 180∞. Subsequently, all were mechanically ventilated for 10 minutes. CTs were obtained before infusion, after infusion, and after ventilation/rotation. For CT analysis, the lungs were partitioned into 8 sub-cuboids using anatomic landmarks. The volumes of two CT number ranges representing CMS and poor aeration/collapse were computed in every sub-cuboid for each CT acquisition. Volume differences between study time points were used to quantify changes. Results: CMS and poor aeration/collapse volume change distributed gravitationally after infusion. After ventilation without rotation, the CMS and poor aeration/collapse volumes remained within the originally injected sub-cuboid, though the poor aeration/collapse volume expanded (27.3±6.1 to 50.5±7.4 ml, p<0.05). After ventilation+rotation there was a reduction in the CMS and poor/aeration collapse volumes in the originally injected sub-cuboid (14.4±1.7 to 4.4±0.6 ml, p<0.05 and 18.3±3.8 to 11.9±2.7 ml, p<0.05 respectively) accompanied by increases in the gravitationally opposite sub-cuboid (1.7±0.2 to 11.1±1.1 ml, p<0.05 and 0.8±0.5 to 40.6±3.5 ml, p<0.05 respectively).Conclusion: Movement of fluids within the bronchial tree can be semi-quantitatively tracked with analysis of sequential CT acquisitions. In this isolated swine lung model, gravity had an important and brisk effect on movement of a viscous fluid, while ventilation tended to embed it peripherally. Implications for Translation into Practice: Positioning of a patient with pneumonia can have a direct influence on propagation.

Sponsored Research - None

653852

ANTHROPOMETRIC MEASURES OF BODY FAT AND PULMONARY FUNCTION: A PILOT STUDY.

Penelope S. Benedik[1], Mara M. Baun[3], Roman Shypailo[2], Ellis Kenneth[4], Akhil Bidani[5], Janet Meininger[3]; [1]Anesthesiology, Brazos Anesthesiology Associates, Bryan, TX; [2]Body Composition Laboratory, Children's Nutrition Research Center, Houston, TX; [3]Nursing Systems, University of Texas Health Science Center at Houston, Houston, TX; [4]Pediatrics, Baylor College of Medicine, Houston, TX; [5]Department of Chemical and Biomedical Engineering, University of Houston, Houston, TX

Background: Centrally distributed excess adipose tissue has been implicated in altering spirometry and lung volumes. However, it is not clear which specific measure of adipose tissue distribution, if any, is associated with losses in resting lung volume. This pilot study sought to quantify both overall adiposity and abdominal adiposity in overweight and in mildly to moderately obese subjects using anthropometric measures, dual X-ray absorptiometry, and computed tomography data, and to describe which measures of fat distribution are associated with altered pulmonary function. Methods: Lung volumes were measured with the helium dilution technique. Anthropometric measures (body mass index, waist circumference, waist-to-hip ratio), computed tomography at L4-L5 (visceral and subcutaneous adipose tissue [VAT, SAT]), and dual energy X-ray absorptiometry (total and trunk fat) were used to quantify adiposity. Results: Waist circumference (WC) was highly correlated with visceral adipose tissue (r = 0.936, p = 0.019, N = 5). Functional residual capacity (FRC) correlated with SAT (r = -0.903, p = 0.036, N = 5), BMI (r = -0.817, p = 0.047, N = 6), and WC (r = -0.755, p = 0.083, N = 6) but not VAT or WHR. SAT was strongly correlated with expiratory reserve volume (ERV) when measured in the sitting (r = -0.961, p = 0.009), supine (r = -0.963, p = 0.008) and 30∞ Fowler's position (r = -0.895, p = 0.04, N = 5). ERV in the sitting, supine, and 30∞ Fowler's position correlated with total body fat in grams (r = -0.984, p = 0.002; r = -0.910, p = 0.032; and r = -0.969, p = 0.007, respectively) and with trunk fat in grams (sitting r = -0.923, p = 0.025 and wedge r = -0.923, p = 0.026, N = 5.) Conclusions: Although extremely limited by sample size, these data suggest that in overweight and mildly obese subjects, both excess total body fat and excess subcutaneous fat impairs resting lung volumes.

Sponsored Research - None

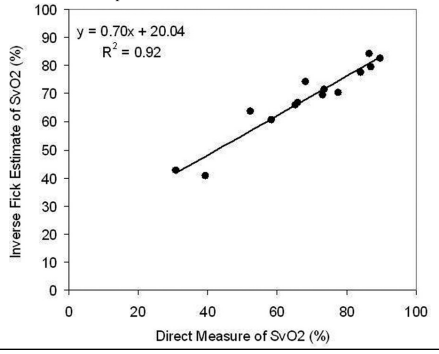
653864

EVALUATION OF INVERSE FICK CALCULATION FOR SVO_2 ESTIMATION.

Lara Brewer, Matthias Goerges, Joseph Orr; Anesthesiology, University of Utah Health Sciences Center, Salt Lake City, UT

Background: Mixed venous oxygen saturation (SvO_2) measurement can be used to assess the global oxygen supply-demand relationship. Direct SvO_2 measurement requires either placement of a fiber optic central venous catheter or central venous blood gas measurement. SvO_2 can be calculated using the inverse Fick equation if oxygen uptake (VO_2), cardiac output (Q) hemoglobin (Hb), and arterial oxygen saturation (SaO_2) are known. We used the data provided by a noninvasive cardiac output computer, which utilizes the partial Fick method, as the basis for SvO_2 calculation. We compared the estimated SvO_2 to the directly measured SvO_2 in anesthetized pigs. Method: SvO_2 is calculated by the inverse Fick equation as SaO_2 less VO_2 divided by the product of Q and arterial oxygen content (CaO_2). The NM3 monitor (Philips, Wallingford, CT) measures CO_2 excretion (VCO_2), arterial oxygen saturation via pulse oximetry (SpO_2) and Q. Assuming a respiratory quotient of 0.85, the VO_2 was calculated from directly measured VCO_2. CaO_2 was calculated from SpO_2 and Hb. Five pigs (30-40 Kg) were intubated and anesthetized with 1 MAC of isoflurane. A pulmonary artery catheter (Edwards Lifesciences, Irvine, CA) was placed to obtain mixed venous blood samples. Arterial blood samples were simultaneously drawn. The NM3 monitor sensor was placed in the breathing circuit between the endotracheal tube and the wye. Q, VCO_2, SpO_2 and other parameters measured by the NM3 monitor were saved to a computer so that SvO_2 could be calculated off line by the inverse Fick method. Continuous infusions of dobutamine or norepinephrine were used to raise Q. Blood gas samples were drawn at baseline levels and during periods of high or low cardiac output. We compared corresponding estimated and direct SvO_2 measurements. Results: The average estimated SvO_2 was 67.8% and the average directly measured SvO_2 was 68% (range of 30.8 to 89.6%). The bias was -0.16% and the standard deviation of the difference was 6.4%. Figure 1 shows a scatter plot of the estimated versus the direct measurement ($R^2 = 0.92$). Conclusions: Direct SvO_2 measurement is invasive and expensive. These data show an estimate of SvO_2 may be calculated from the parameters provided by a partial rebreathing cardiac output monitor and Hb. This method makes assumptions about the respiratory quotient that are only valid during periods of respiratory stability. The error may potentially be reduced by using SaO_2 in place of SpO_2 to estimate SvO_2.

Sponsored Research - Philips Medical



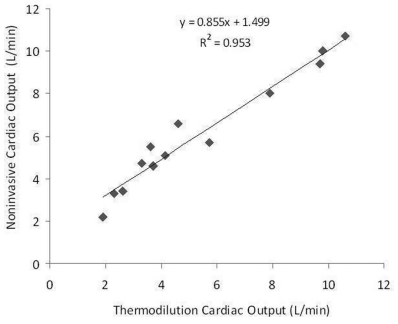
665010

EVALUATION OF A NEW PARTIAL REBREATHING CARDIAC OUTPUT MONITOR.

Lara Brewer, Joseph Orr, Matthias Goerges; Anesthesiology, University of Utah Health Sciences Center, Salt Lake City, UT

Background: The partial CO_2 rebreathing method makes use of measured changes in end-tidal CO_2 ($PetCO_2$) and CO_2 excretion (VCO_2) to noninvasively calculate cardiac output (CO). The ratio of the change in these two signals, which occurs due to a period of partial rebreathing, is used as the input to the differential Fick equation. We tested a newer version of the partial rebreathing system which compensates for the non steady-state transfer of CO_2 between the blood and the FRC, thereby improving measurement accuracy. This algorithm has been implemented in a new monitor (NM3, Philips, Wallingford, CT). The new monitor also incorporates improvements to the measurement of airway flow and pressure, making the measurements more reliable. Method: We evaluated the performance of a new monitor in five 30-40 kg pigs. Each animal was intubated and anesthetized using 1 MAC of isoflurane. The partial rebreathing sensor (flow, CO2 and rebreathing volume) was placed in the breathing circuit between the endotracheal tube and the wye adapter. Rebreathing CO measurements were taken automatically and saved to a notebook computer once every three minutes. A pulmonary artery catheter was placed (Edwards Lifesciences, Irvine, CA) and reference CO measurements were taken as the average of three to five bolus thermodilution measurements (10 ml iced 5% dextrose solution) which had been randomized with respect to respiration. Comparison between the two CO measurements was made at baseline conditions, during infusions of either dobutamine or norepinephrine, and immediately following discontinuation of the drug infusions. Arterial blood gas measurements were entered into the NM3 monitor for shunt estimation. Noninvasive CO measurements were compared to corresponding average bolus thermodilution measurements. Results: The average noninvasive measurement was 6.1 L/min and the average thermodilution measurement was 5.4 L/min (range of 1.9 to 10.6 L/min). The bias was 0.72 L/min. The standard deviation of the difference was 0.74 L/min. Figure 1 shows a scatter plot comparing the two methods ($R^2 = 0.95$). Conclusions: The partial CO_2 rebreathing method as implemented in the new NM3 monitor measures cardiac output accurately as compared to bolus thermodilution measurements. The updated algorithm removes the need for steady state conditions during both rebreathing and non-rebreathing states and decreases the likelihood of error caused by venous blood recirculation during rebreathing.

Sponsored Research - Philips Medical



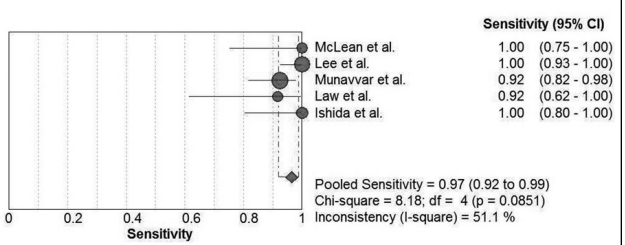
665011

DIAGNOSTIC ACCURACY OF MEDICAL THORACOSCOPY IN DIAGNOSIS OF PLEURAL EFFUSION OF UNDETERMINED ETIOLOGY; A SYSTEMATIC REVIEW.

Subhash Chandra[1], Dipti Agarwal[2], Anant Mohan[1], Randeep Guleria[1]; [1]Medicine, All India Institute of Medical Sciences, New Delhi, India; [2]Emergency Medicine, Mayo Clinic College of Medicine, Rochester, MN

Background and Objective: A pleural effusion of undetermined etiology (PEUE), where blind pleural aspirate/biopsy is failed to yield an answer, is often a difficult problem and needs histological study for a definitive etiological diagnosis. Several studies form different parts of the world have proved role of medical thoracoscopy (MT) in diagnosis of PEUE but results are not uniform. Hence, we sought to determine the diagnostic accuracy of MT in PEUE through this systematic review. Methodology: The electronic search was performed in Pubmed without language restriction. References of relevant records and abstracts of American Thoracic Society and CHEST were hand searched. We selected articles for review based on the following criterion: 1) Prospective study, 2) Based on original research, 3) Enrolled consecutive patients of PEUE, 4) Full paper available in English.5) MT preformed under local anesthesia in brochoscopy or endoscopy suite using semi-rigid (flex-rigid) instrument and 6) Reported sufficient data to construct a 2 • 2 contingency table. We assessed study quality and extracted data independently and in duplicate using a standardized data extraction form. Results: 5 studies met inclusion criterion, encompassing 154 patients. All the procedures were performed under local anesthesia with mild sedation in endoscopy or bronchoscopy suite using semi-rigid (flex-rigid) instrument. During the procedure, patients were positioned in lateral decubitus position with affected side up. Pooled sensitivity (95% CI) was 0.97 (0.92-0.99), specificity (95% CI) was 1.00 (0.69-1.00), positive likelihood ratio (95% CI) was 5.47 (1.11-16.86) and negative likelihood ratio (95%CI) was 0.08 (0.04-0.18). No major complications with 0% 30 days mortality noted. Conclusion: MT is a highly sensitive and specific diagnostic modality in PEUE. Negative likelihood ratio of less than 0.1 (0.08) in our study provides strong evidence to rule out the diseases in most circumstances. Also, it is easy to perform, devoid of anesthesia complications and operation theater requirements.

Sponsored Research - None



Forest plot of sensitivity: Point estimates of sensitivity along with 95% confidence intervals (CIs) (horizontal bars) are plotted for each study population.

665065

EFFECTS OF MEAN ARTERIAL PRESSURE AND NEEDLE SIZE ON ARTERIAL SAMPLER FILLING TIME.

Kimberly L. Johnson, Ashley J. Johnson, Katherine A. Barnes, F Herbert Douce; Respiratory Therapy, Ohio State Medical Center, Columbus, OH

BACKGROUND: Arterial blood sampling is subject to numerous sampling errors, which may potentially result in venous blood sampling rather than arterial. A mistake such as this may lead to delayed care, poor medical treatment, multiple percutaneous punctures, as well as increased risk of infection. PURPOSE: We are investigating the effects of mean systemic blood pressure and needle gauge on blood sample filling times in order to find a way of verifying whether or not blood collected is in fact arterial, prior to the actual sample analysis. METHODS: We constructed a model using the bio console extracorporeal blood pump speed control to circulate whole blood at a constant 4 liters per minute. From simulating a circuit mimicking the human vascular system, blood was collected via plastic syringes. The effects of varying blood pressures and needle sizes were used to determine a correlation between arterial blood pressures and sampler filling times. Hemostats were used to create six pressures, including 57 mm hg (shock), 70 (low normal), 93 (normal), 107 (high normal), 133 (severe hypertension), and 14 (peripheral venous pressure). Random assignment was used to determine order of gauge and pressure for experiment. RESULTS: There was a significant difference between venous and arterial blood pressure sampler filling times. There was a significant difference between hypo- and hypertensive MAPs. There was a significantly faster filling time at higher pressures. There was no significant difference in filling times based on needle gauge. The Pearson correlation coefficient between mean blood pressures and sampler filling times was –0.86. CONCLUSION: Monitoring filling times may enable RTs to confirm successful arterial punctures. A sampler filling time of greater than 20 seconds indicates vein puncture. Confirming successful arterial puncture prior to the time of analysis would expedite appropriate patient care decisions and reduce unnecessary health care costs.

Sponsored Research - None

Sampler Filling Times

Pressure (mmHg) Clinical Condition	Mean (s) 22 ga.	Mean (s) 23 ga.
14 Venous	53.5 (8.0)	49.2 (3.5)
57 Shock	19.4 (4.0)	20.5 (.7
70 Low Normal	18.5 (3.5)	18.6 (1.4)
93 Normal	16.1 (1.1)	15.7 (4.0)
107 High Normal	14.3 (2.3)	13.0 (1.0)
133 Severe HTN	11.2 (1.2)	11.5 (1.0)

666798

A COMPARISON BETWEEN PATIENTS HEIGHTS RECORDED IN THE ELECTRONIC MEDICAL RECORD AND THE PATIENTS ACTUAL MEASURED HEIGHTS: THE IMPACT ON THE SETTING OF TIDAL VOLUME.

Donald L. Bellerive, Scott Kopec, Rachel Carragher, Luanne Hills, Scott Leonard, Earl Dyer, Pam Leclaire, Larry Owens, Paul Alger, Patrick Dowd, Sharon Pare, Patricia Lemire, Thomas Canedy, Darlene Levasseur, Thomas Collins, Kathy McLane, Debbie Hendrickson; Respiratory Care, UMass Memorial Health Care, Worcester, MA

Background: Patient heights and weights are important patient data frequently entered into the medical record from a variety of sources including patient self reporting, family reporting, actual measurements, and MD or RN estimates. Heights used to calculate IBW impacts medical decisions such as medication dosages and tidal volume. Because not all heights and weights entered into the electronic medical record are a result of a direct measurement, there is that possibility that errors could be made in treatments based on the inaccuracy of the recorded heights. Recommended tidal volume is based on IBW, which in turn is calculated from the actual height. We conclude that some patients are placed on incorrect tidal volumes based on inaccurate height data entered into the electronic medical record. Methods: We reviewed 100 consecutive, intubated patients admitted to 7 adult ICUs (medical, surgical, trauma, and CT surgery). Patients were excluded if on pressure cycled modes of ventilation such as Bilevel or PCV. Patient heights recorded in the electronic medical record were used to calculate recorded IBW. All patients were then measured and this measured height was then used to calculate measured IBW. Recorded and measured heights and recorded and measured IBWs were then compared. Tidal volumes based on recorded IBWs were then compared to tidal volumes based on measured IBWs. Results: Of the 100 patients, 3 were excluded due to being on pressure cycled ventilation. Recorded heights were on average 1.3 inches (2.9cm) higher than the measured heights (P=0.001). Tidal volumes based on recorded IBW were on the average 25.4ml higher than tidal volumes based on the measured IBW (P<0.001). In 30 of 97 patients (30.9%) the set tidal volumes based on their recorded IBW were more than 50ml higher than the predicted tidal volumes based on their measured IBW. In only 21 patients (21.6%) were the recorded heights identical to the measured heights. Conclusions: Heights recorded in the patient's record are inaccurate nearly 80% of the time. Using recorded heights instead of the actual measured heights results in incorrect calculations of IBW and results in incorrect tidal volumes. Recorded heights tend to be higher than actual heights leading to the use of larger than required tidal volumes. These larger tidal volumes based on inaccurately recorded heights can potentially result in worsening acute lung injury and a higher mortality in patients with ARDS or ALI.

Sponsored Research - None

667073

VENTILATORY RESPONSE DURING CARDIOPULMONARY EXERCISE TESTING IN PEDIATRIC PATIENTS WITH AND WITHOUT CONGENITAL HEART DISEASE.

Carl D. Mottram, Amber N. Loiacono, Michael Legesse, Simon Zzimbe, David Driscoll; Pulmonary and Critical Care, Mayo Clinic, Rochester, MN

Background: The ventilatory response during cardiopulmonary exercise testing has been fairly well characterized in the adult patient population. However it has not been well defined in the pediatric subject and in particular the pediatric subject with congenital heart disease. The adult subject's minute ventilation increases throughout exercise to meet metabolic demand. In the adult the kinetics of minute ventilation recruitment is by increasing tidal volume to approximately 50% of the subject's vital capacity with maximal breathing frequencies increasing to 36 (+ 9.2)1. We would like to identify the ventilatory recruitment strategies in the pediatric patient. Hypothesis: The ventilatory response to exercise in the pediatric population with and without congenital heart disease is similar and the same as the adult subject. Method: A retrospective review of the cardiopulmonary exercise test results from 150 pediatric patients (ages 10-16 yrs) will be conducted. 75 patients with a non-cardiac working diagnosis and 75 patients who have a history of congenital heart disease. Conclusion: Pediatric patients with a working non-cardiac diagnosis and pediatric patients with a diagnosis of cardiac origin show no significant difference between their ventilatory recruitment strategies in response to exercise. Even though there was a statistically significant difference in the Vtmax/FVC ratio it is relatively small and of no clinical significance. The minute ventilation recruitment strategy was also very similar to the strategies described in the adult population; although our data showed a slightly higher RRmax and lower Vtmax/FVC ratio. 1.Blackie S P, Fairbarn M S, McElvaney N G, et al. Normal values and ranges for ventilation and breathing pattern at maximal exercise. Chest 1991;100;136-142

Sponsored Research - None

Results

	Non-Cardiac	Cardiac	p value
Number (M/F)	75 (21/54)	75 (47/28)	
Age	10-16	10-16	
FVC mean (SD)	3.75 (0.75)	3.15 (1.23)	
Vtmax (ml)mean (SD)	1584 (411)	1439 (650)	0.10
VEmax (L)mean (SD)	71.5 (20)	65.8 (24.5)	0.13
RRmax mean (SD)	45.9 (10)	48.5 (12.3)	0.16
Vtmax/FVC mean (SD)	42.3 (7.4)	45.0 (7.8)	0.03

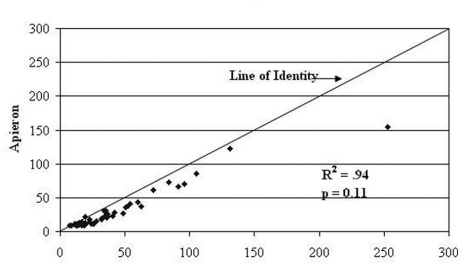
667184

COMPARISON OF THE APIERON SINGLE BREATH EXHALED NITRIC OXIDE (ENO) DEVICE WITH THE MULTIPLE BREATH SIEVERS ENO ANALYZER IN PATIENTS REFERRED FOR ENO TESTING.

Carl D. Mottram, Deqa A. Abdi, Amina M. Ahmed, Idil I. Gureeye, Jong W. Lim, Lori J. Hanson, Paul D. Scanlon; Pulmonary and Critical Care, Mayo Clinic, Rochester, MN

Background: Exhaled nitric oxide (ENO) is a biomarker of airway inflammation and is a relatively new clinical testing modality. ENO is measured by having the subject inhale maximally and then exhale their breath through a patient-interfaced mouthpiece to the ENO analyzer at a target flow rate. The Apieron Insight is a new device which is easier to use from both a practical and technical aspect when compared to our current Sievers testing unit. However, it differs from the Sievers unit in both analyzer technology and testing methodology. The American Thoracic Society (ATS) and European Respiratory Society (ERS) have set forth testing guidelines but these guidelines were based on available testing methods at the time. The ATS-ERS recommendations include performing 2 acceptable and repeatable maneuvers and reporting the mean of these data, whereas the Aperion device only requires a single maneuver after performing numerous practice maneuvers to fine tune the testing technique. There is a significant reduction in the cost per test if this new device proves to be accurate. Hypothesis: The data measured by the Apieron Insight device is comparable to the Sievers Nitric Oxide Analyzer (NOA 280i). A single acceptable measurement following practice maneuvers is comparable to multiple acceptable measurements that are repeatable according to current ATS-ERS recommendations. Methods: 50 subjects (> 16 yrs) for whom exhaled nitric oxide is ordered as a clinical test will be used in the comparison. Both the Sievers and Apieron units will be calibrated according to manufactures recommendations prior to testing and compliance with pretest instructions with be evaluated by the testing technologist. The subjects with be randomize to either testing with the Apieron or Sievers unit first. Data will be analyzed using a linear regression, student paired t-test, and Bland Altman plot. Results/Conclusion: The data collected by the Apieron Insight device were comparable to the Sievers Nitric Oxide Analyzer (R2 = 0.94, p=0.11), which is considered the "laboratory quality" measurement of exhaled nitric oxide in our lab. Even though the instruments correlated and no statistical difference between the two devices, there was a bias with the Sievers unit reading higher than the Apieron (11 ppb). The bias should be considered when comparing longitudinal results from the two different instruments

Sponsored Research - None



667205

CORRELATION OF THE SENTEC DIGITAL MONITOR TRANSCUTANEOUS CO2 MEASUREMENT TO ARTERIAL CO2 USING ALTERNATE SITE PLACEMENT PROBES.

Amber Chitwood, Aaron Light, Doug Pursley, Susan Howard, Ashley Ray, April Fritz, Alison Sorensen; Ozarks Technical Community College, Springfield, MO

Background: Previous studies have compared the TcCO2 measurement from the ear probe of the SenTec Digital Monitor (SenTec AG, Therwil, Switzerland) to PaCO2. In this study, we sought to evaluate the ability of SenTec's V-Sign™ multi-site placement probe at monitoring TcCO2 using three different sites recommended by the manufacturer. Our hypothesis is that the three sites will accurately correlate with PaCO2. Methods: After obtaining IRB approval from our institution, we recruited 15 healthy adults already enrolled in one of two other institutional research projects. The other projects required participants to breathe oxygen from a particular oxygen delivery device while an arterial blood gas was performed. This study was performed simultaneously with one of the other two projects. After subjects were seated, V-Sign™ sensors were placed on the subject's right clavicle, forehead above the right eyebrow, and left mastoid area. Participants were then instructed to relax, breathe normally, and not talk for a period of 15 minutes. During this period of time, stabilization of the SenTec Digital Monitor (SDM) was achieved. After a fifteen minute period, we performed a radial artery blood gas and measured PaCO2 using a GEM 3000 blood gas analyzer. No air bubbles were observed in any of the syringes and all samples were analyzed within five minutes. Upon flash of blood in the syringe, TcCO2 values were transcribed from the three SDMs. Between each individual, the sensors were cleaned and calibrated using recommended manufacturer's guidelines. The SDM associated with each site placement was also rotated to ensure that any variance in values was not associated with a particular monitor. Results: All three site placements showed strong positive correlation with PaCO2. The forehead site showed no statistical difference between mean TcCO2 and mean PaCO2 using a paired t-test, whereas the mastoid and clavicle site's mean readings were both 3.1 mmHg lower than actual PaCO2 and had a 0.57-1.0 mmHg higher standard deviation. Conclusion: All three multi-site placements that we evaluated offer clinicians reliable correlation between TcCO2 and PaCO2. Although the mastoid and clavicle sites showed statistical difference ($p < 0.05$) from PaCO2, the clinical difference appears minimal when one looks at the proximity of the means and standard deviations. Further research needs to be performed in the clinical setting to see if our results are similar in patients.

Sponsored Research - None

Value	Mean	SD	r value with p < 0.01	paired t-test p value	95% CI
PaCO2	37.53	4.17	n/a	n/a	n/a
TcCO2 forehead	38.25	5.05	0.861	0.301	-0.7 to 2.1
TcCO2 mastoid	34.37	5.18	0.741	0.003	-5.1 to -1.2
TcCO2 clavicle	34.35	4.74	0.818	0.001	-4.7 to -1.7

677440

RADIAL ARTERY CATHETERIZATION BY RESPIRATORY CARE PRACTITIONERS WITH ULTRASOUND GUIDANCE.

Andrew G. Miller, Andrew Almond, Jhaymie L. Cappiello, Michael A. Gentile, Janice J. Thalman, Neil R. MacIntyre; Duke Medical Center, Durham, NC

Background: Respiratory Care Practitioners (RCP) commonly place indwelling radial artery catheters. Ultrasound devices have emerged as an adjunct to assist clinicians with line placement. The purpose of this study was to review the use of ultrasonic guidance by RCPs in the placement of radial artery catheters. Methods: RCPs certified in arterial line insertion were trained in radial artery catheterization using ultrasound by Emergency Medicine physicians. After obtaining IRB approval for this study, patients were enrolled based on the need for an arterial line placement. The catheters used were Sharps Radial Artery Catherization Set with a 20 gauge catheter, 22 gauge introducer wire, and spring wire guide with integral needle protection. The ultrasound devices were the Sonosite iLook and the Sonosite MicroMaxx. Data recorded included strength of pulse, number of attempts (2 or less punctures per attempt), number of previous attempts, and successful/unsuccessful artery cannulation. Catheterizations were performed according to institutional policy and procedure. Results This review covers a 6 month period (12/08 - 5/09). The age of the patients was 56 ± 14 years. Their systolic blood pressure was 111 ± 32.9 mmHg. There were a total of 50 attempts at cannulation with 44 arteries successfully cannulated. 33 were placed on the first puncture with the ultrasound while the remaining 11 were placed on the second puncture. The unsuccessful attempts were due to: difficulty threading two wires, unable to penetrate two arteries, unable to advance one catheter due to calcification, and one artery was difficult to visualize with the ultrasound. Of note, 14 arterial lines were placed following multiple attempts by other practitioners. Conclusion: Ultrasound guided arterial line placement can be safely and effectively performed by RCPs. The radial artery was successfully cannulated in 85.7% of patients without a palpable radial pulse. The 100% success rate in patients with a normal palpable radial pulse suggests ultrasound may be a beneficial teaching tool to instruct other clinicians in line placement.
Sponsored Research - None

Pulse	Successful Cannulation	Total Attempts at Cannulation	Success Rate
0	12	14	85.7%
1+	16	20	80%
2+	16	16	100%
Total	44	50	88%

0 = Unable to palpate

1+ = Weak and Thready

2+ = Normal

678857

INFLUENCE OF SAMPLING SITE ON END TIDAL CARBON DIOXIDE LEVELS (PETCO2) DURING NON-INVASIVE POSITIVE PRESSURE VENTILATION (NPPV).

Arthur Taft[1], Jonathan Waugh[2], Glenn Pippin[3]; [1]Department of Respiratory Therapy, Medical College of Georgia, Augusta, GA; [2]Respiratory Therapy Program, University of Alabama at Birmingham, Birmingham, AL; [3]Department of Respiratory Therapy, Shelton State Community College, Tuscaloosa, AL

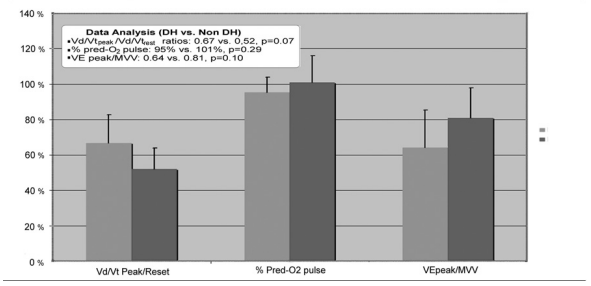
INTRODUCTION: Capnography use in intubated patients is well established. However, NPPV has become a popular method of ventilating selected patients. The variety of patient interfaces available and lack of data for use with capnography make it unclear how to best utilize capnography during NPPV. The purpose of this study was to identify how different sampling sites influence PETCO2 during NPPV. METHODS and MATERIALS: This study was performed at the University of Alabama at Birmingham (UAB) and the Medical College of Georgia (MCG), was approved by each IRB, and informed consent was obtained. Forty healthy volunteers (20 at each site) received NPPV (VIVO 40®, Breas) at three levels of ventilation (CPAP +5 cm H2O, BiPAP +10/+5 cm H2O, and BiPAP +20/+5 cm H2O) using three different masks (FlexiFit 431, Fisher & Paykel (FP); Mirage Quattro, ResMed (RM); and PerformaTrak, Respironics (RP)). The order in which ventilating pressures and mask types were studied was randomly assigned. PETCO2 was measured (Capnostream™ 20, Oridion) simultaneously at the oral/nasal opening (ONO) and at the mask port (MP). PETCO2, was obtained for 6 min prior to initiating NPPV and afterwards at one minute intervals for 6 min for each setting and mask. Statistical analysis used t-tests to compare pooled data from UAB and MCG. Multivariate Repeated-Measures ANOVA was used to compare the effects of 1) level of ventilation, 2) mask type, and 3) sampling site on PETCO2 values. Pair-wise comparisons were made using the Bonferroni-Sidak test. Data was compared to baseline values using Pearson's Correlation Coefficient and paired t-tests. RESULTS: There were no statistical differences between data obtained at UAB and MCG ($p=0.143$). PETCO2 values were different depending upon mask type (FP = 18.0±3.07 mmHg [mean±SD], RM = 25.3±4.42 mmHg, RP = 28.7±4.38 mmHg; $p<0.001$), level of ventilation (CPAP +5 = 24.7±3.98 mmHg, BiPAP 10/5 = 24.3±3.90 mmHg, BiPAP 20/5 = 23.0±3.50 mmHg; $p<0.001$), and measurement site (ONO = 30.6±5.73 mmHg, MP = 17.4±3.24 mmHg; $p<0.001$). When comparing outcome data to baseline, for all masks and levels of ventilation, correlations were strongest with measurements made at ONO as opposed to measurements made at MP. CONCLUSIONS: When using capnography to monitor patients receiving NPPV through a full face mask, measurements should be made at the oral-nasal opening rather than the mask port. If using the mask port, caution must be used in interpreting PETCO2.
Sponsored Research - This project was supported by unrestricted educational grants from Oridion Capnography Inc. Equipment was either loaned or donated by the individual manufacturer.

679763

INCREASED DEADSPACE DURING PEAK EXERCISE IN THE PRESENCE OF DYNAMIC HYPERINFLATION IN PATIENTS WITH EXPIRATORY FLOW LIMITATIONS.

Noel I. Moreno[1], Paul F. Nuccio[1], Atul Malhotra[2], Po-Shun Lee[2]; [1]Pulmonary & Respiratory Care, Brigham and Women's Hospital, Boston, MA; [2]Pulmonary & Critical Care Division, Brigham and Women's Hospital, Boston, MA

Background: Exercise-induced dynamic hyperinflation (DH) may be an under-recognized limitation to exercise in cardiopulmonary exercise test (CPET) by multiple physiologic mechanisms. While ventilatory and cardiac limitations have been previously reported, DH-induced deadspace increase has not been explored. Therefore, we hypothesize that DH increases pulmonary deadspace. Method: We conducted a chart review of CPET conducted in our center with inspiratory capacity (IC) measured at rest (ICrest) and at peak exercise (ICpeak). We arbitrarily define DH as ICpeak/ICrest <95%. Examined variables include O2pulse, peak VE, estimated deadspace fraction (Vd/Vt) at rest (Vd/Vtrest) and at peak exercise (Vd/Vtpeak). Intergroup comparisons are performed by Student's t test. Results: We identified eleven consecutive CPETs performed since March 2009. Three of the cases met our criteria as having DH. Comparing the two groups, (DH vs. non-DH), Vd/Vt worsens at peak exercise compared to at rest (Vd/Vtpeak/ Vd/Vtrest ratios were 0.67 vs. 0.52, p=0.07). Other parameters, such as O2pulse % predicted (95% vs. 101%, p=0.29), VEpeak/MVV (0.64 vs. 0.81, p=0.10), were also found to be different but to a lesser degree. Conclusion: Exercise-induced DH is associated with increased deadspace at peak exercise. Such increases in deadspace may be an under-recognized limitation to exercise and inappropriately interpreted as pulmonary vascular abnormality in flow-limited patients with diseases such as COPD.
Sponsored Research - None



679865

DO HIGH FREQUENCY OSCILLATION VESTS REDUCE VITAL CAPACITY IN NORMAL SUBJECTS?

Brad W. Hughett, Colleen Monteith, Vida Khaliki, Jody Lester; Respiratory Care, Boise State University, Boise, ID

Background: High frequency oscillation vests are an important therapy in numerous disease states. The therapy vests physically compress and shake the chest serving to loosen and mobilize pulmonary secretions. Aerosolized medications are frequently delivered concurrently with vest therapy. Patients receiving aerosolized medications are instructed to breathe deeply. However, the design and operation of the vest may affect a patient's ability to do so. It is our hypothesis that a healthy person's vital capacity (VC) will decrease with the use of these vests at medium and high pressure and frequency settings. Method: This study used four subjects with healthy lungs. We obtained a baseline slow VC using a Medical Graphics Corporation 1085/D Spirometer calibrated following American Thoracic Society guidelines and using BreezeSuite 6.2 software, these measurements served as our control. Participants were then fitted with the Vest ®Airway Clearance System: Model number 104 and slow VC measurements were repeated. We performed measurements at medium settings of 15 Hz, 6 or 60% pressure and high settings of 20 Hz and 9 or 90% pressure. Subjects wore a thin single layer of cotton clothing and were sitting throughout testing. This process was then repeated using the inCourage™ RespirTech Model number ICS-IM-US . Manufactures specific full vests, tubing, and connections were used and fitted according to manufacturer's instruction for both the inCourage™ and the Vest ®Airway Clearance Systems. Results:See Table 1 Conclusion: The VC of all subjects was lower when wearing the high frequency oscillation devices. The VC of subject three was significantly reduced. In most cases the high pressure settings resulted in the lowest VC measurements. VC reductions ranged from 50cc's to 1,380 cc's. We were unable to easily explain the large reduction in VC for subject 3, as vest fit was correct and similar to other subjects and four VC measurements demonstrated reproducibility. These reductions may be clinically significant. Further testing is required to fully realize the impact of combining high frequency chest oscillation vests with nebulized medication therapy.
Sponsored Research - None

Table 1

		Subject One		Subject Two		Subject Three		Subject Four	
	Baseline VC	3.98 L	96%	4.52L	108%	4.54 L	110%	5.39L	105%
The Vest® Airway Clearance System	Frequency 15 Hz Pressure 6	VC↓ 140cc	92%	VC↓ 210cc	103%	VC↓ 810cc	91%	VC↓ 510cc	95%
	Frequency 20 Hz Pressure 9	VC↓ 170cc	91%	VC↓ 210cc	103%	VC↓ 890cc	89%	VC↓ 620cc	93%
RespirTech inCourage™	Frequency 15 Hz Pressure 60%	VC↓ 110cc	93%	VC↓ 50cc	107%	VC↓ 780cc	92%	VC↓ 350cc	98%
	Frequency 20 Hz Pressure 90%	VC↓ 240cc	90%	VC↓ 260cc	102%	VC↓ 1380cc	77%	VC↓ 460cc	96%
*All percentages are % of predicted Vital Capacity									

679885

ASSESSING METHODS FOR ESTIMATING HEIGHT IN RECUMBANT ADULTS.

Randall Baker, Susan R. Whiddon, Simmons Catherine, Aleksandr Gulchuk, Verna-Virginia Lehockey; Respiratory Therapy, Medical College of Georgia, Augusta, GA

Introduction: Actual height is used to determine Ideal Body Weight (IBW) for the calculation of the delivered tidal volume in ventilated patients. However, actual and 'ideal" body weight may differ, and an actual measurement of height may not be available. So, health practitioners must often estimate height in order to calculate IBW. The purpose of this study was to determine a method for accurately and easily estimating height in recumbent patients in order to calculate IBW. Methods: After IRB approval, thirty-six subjects [female=24 and male=12)] were enrolled in the study. Actual height was measured using a stadiometer. Measurements of Demi-Span (DS), Forearm Length (FL), and Knee Height (KH) were made with subjects in both supine and semi-fowler positions. Demi-Span was measured from the subject's sternal notch to the tip of the middle finger. For FL, the subject's arm was positioned diagonally across their chest with their fingers extended toward the clavicle, and measurements were made from the point of the elbow to the prominent bone on the wrist. Knee Height was determined by positioning the subject's ankle at a 90o angle and measuring from the bottom of the foot to the anterior surface of the knee. Estimated height was calculated using the standard, method- and gender-specific formulas or tables. After each measurement, an investigator rated the difficulty in making the measurement as "Least" to "Most" Difficult on an Ease of Use Scale (EUS) ranging from 1 to 3. Results: The DS overestimated height and showed excessive bias with subjects in either the Semi-Fowler [-11.69 cm (females) and -10.36 cm (males)] or Supine positions [-11.70 cm (females) and -10.32 cm (males)]. Furthermore, DS was rated as moderately difficult to obtain (2.13 on the EUS). Knee length not only showed significant gender differences overestimating height by 4.12 cm in females and underestimating height in males by 11.10 cm, but also was rated the hardest to measure on the EUS (2.65). Forearm Length slightly overestimated height in both females and males (3.2 cm and 1.85 cm, respectively), and was the easiest to obtain (1.18 on the EUS). Conclusions: Of the three methods tested, Forearm Length demonstrated the least bias regardless of patient's position or gender and may be ideal method for estimating height and calculating ideal body weight in the ICU.

Sponsored Research - None

679950

DEVELOPING A CHARGE CHARTER TO ENHANCE THE ROLE OF THE CHARGE THERAPIST.

Kenneth J. Miller, Angela Lutz, Linda Cornman, Lawarance Mann, Williams Laura; Respiratory care, LVHN, Allentown, PA

Introduction: Coordinating and maintaining the daily operations of a progressive respiratory care department can be quite challenging. This is especially true when supervisory resources are scared or over taxed. Commonly senior staff therapists are placed in charge to direct the day to day operations of clinical management and allocation of personnel. Often the charge role is ill-defined and learned by trial and error. This nebulous defined role can lead to inconsistent and less than optimal departmental coordination and clinical management. To address some of these problems our department developed a Charge Charter to help defined the charge role and to be utilized as an educational model for future charge therapists. Methods: To assess the current role of the charge therapist several discussion forum were conducted and an on-line survey was developed. Issues that needed to be addressed include, inconsistent departmental management, confusion of the role of the charge therapist, and questions regarding clinical management. After feedback from the sessions and survey were evaluation, the department's leadership team was given the project of developing a well-defined list of responsibilities and roles the charge therapist would be responsible for. A Charge Charter was developed and educational sessions were conduct prior to its implementation. A review of the charge role was presented to the entire department's staff by the Respiratory Care Services Director for a clearer global understanding of the charge role. Results: Charge therapist educational sessions were conducted bimonthly by the clinical leadership team and the Charge Charter were reviewed during the employee's orientational session and again with a clinical coordinator prior to being assigned to the charge role. Those staff individuals placed in the charge role after implementation of the Charge Charter displayed a greater job satisfaction post survey and discussion results. Also there was a clearer understanding of the charge departmental wide. Conclusion: The development of the Charge Charter has clearly defined the role of the charge therapist and continues to act as an educational tool for future charge therapists. Bi-monthly educational sessions continue to help address current coordination and management issues.

Sponsored Research - None

621495

THE UTILIZATION OF ELECTRONIC DOCUMENTATION TO ASSESS THERAPIST COMPLIANCE TO PERFORM DAILY WEANING ASSESSMENTS AND SPONTANEOUS BREATHING TRIALS.

Kenneth J. Miller, Robert Lehsko, Angela Lutz, Matthew McCambridge; Respiratory care, LVHN, Allentown, PA

Introduction: Mechanical Ventilation is supportive and is utilized to maintain adequate gas function. After clinical stabilization has been achieved, progression to ventilatory liberation becomes a major objective. Daily weaning assessments and spontaneous breathing trials (SBT) are cardinal in evaluation of the patient's progress towards venilatory liberation. Therapist compliance towards this important end-point sometimes is less than desire. Heavy workloads, chaotic time management, and not fully understanding role responsibilities are a few barriers to complete the required assessment and intervention. By utilizing electronic documentation we examined the practice regarding performing daily weaning assessments and spontaneous breathing trials (SBT). Methods: Utilizing traditional methods to assess if our staff was compliant with the daily documentation became impractical. We moved to adding daily check parameters to our electronic charting system Meta-Vision (iMDsoftR). A learning packet and in-services were provided to the staff to re-educate them on the importance and significance of this documentation. These parameters were placed with the daily assessment of the patient and would act as a reminder that a VWA and SBT needed to be conducted on a daily basis. At the end of each month we now have the ability to query compliance and gather the data within and hour, and can give feedback to each therapist on compliance. Results: Prior to therapist education, our data demonstrated a less than optimal compliance of daily weaning assessments (VWA) and spontaneous breathing trials (SBT). Compliance was below the desire threshold of 95% prior to re-education from January to June 2007. Post education, which included development of a learning manual, inservices, and bedside teaching the compliance level, was near 100% over a six month period from July to December 2007. Conclusion: Electronic Documentation helped our leadership team to asses our current level of therapist compliance towards to perform daily weaning assessments and spontaneous breathing trials. When standards were not at the desired level it also provided post re-education compliance levels. Electronic documentation is a non-objective way to evaluate pre and post intervention data. Our next assessment will determine if increasing the number of Daily weaning assessments and SBT will reduce our ventilator days

Sponsored Research - None

Month	Jan 07	Feb 07	March 07	April 07	May 07	June 07	July 07	August 07	Sept 07	Oct 07	Nov 07	Dec 07
VWA	91	93	92	90	88	86	97	98	99	99	99	99
SBT	85	86	87	84	84	85	89	91	99	100	98	99

621498

HOW A MEDICAL EMERGENCY TEAM HAS INCREASED THE VALUE OF THE RESPIRATORY CARE PRACTITIONER IN A LARGE MEDICAL CENTER.

Stephanie Stanley, Julie McKinney; Respiratory Care Department, Charleston Area Medical Center, Charleston, WV

Background: The Medical Emergency Team (MET) was implemented at Charleston Area Medical Center (CAMC) Memorial Hospital, in August 2006. The initiative was to prevent unstable patient events outside of the Intensive Care Unit (ICU). CAMC Memorial Hospital is a 424-bed facility, primarily focusing on cardiac, respiratory, and oncology services. CAMC Memorial Hospital is one of three teaching hospital campuses under the CAMC umbrella, totaling 893 beds. Method: The MET was developed to intervene in impending medical emergencies with the goal of decreasing mortality rates in non-ICU patient areas. The MET is comprised of a Registered Respiratory Care Practitioner (RCP) and an ICU Registered Nurse (RN). The team is notified by a paging system, which is activated by any health care professional or family member. The team provides treatment/assistance to the patient, following protocols specifically developed to be utilized in the absence of a physician. All MET calls are tracked electronically through the electronic medical record (EMR). Results: When the program began in August 2006, there were 7 MET calls. The target/goal was 23 calls per month. From August 2007 to August 2008, the average number of MET calls was 40.79 per month. Of these calls, 40.6% were respiratory problems. The other reasons for the calls were cardiac (27.3%), neuro (19.1%), and medical (13.0%). The total number of non-ICU codes for 2006 were 93, and for 2008 were 70. From 2007 to 2008, there was a decrease in non-ICU codes of 25.5%. Conclusion: From the beginning of implementation in August of 2006 to present, the Respiratory Care Services MET responsibilities have grown tremendously. We have gone from just responding to calls to full-time staff for scheduled patient rounds, as well as calls. We continue to add responsibilities to the team and provide continuing education for advance assessment skills. We are continually looking at different diagnoses to target patients for early intervention. The MET has had a positive response throughout the medical center.

Sponsored Research - None

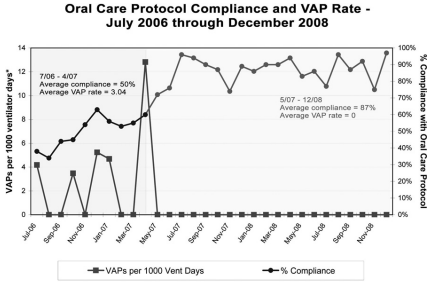
642280

INTENSIVE CHANGE-MANAGEMENT AND ENHANCED COMPLIANCE RESULTS IN SUCCESSFUL AND CONSISTENT IMPLEMENTATION OF VENTILATOR BUNDLE AND ORAL CARE PROTOCOL, 0 VAP FOR OVER 685 DAYS, AND SUBSTANTIAL ECONOMIC SAVINGS.

Patricia DeJuilio; Respiratory Care, Central DuPage Hospital, Winfield, IL

Background: Ventilator-associated pneumonia (VAP) is calculated per 1,000 ventilator days, and ranges from 2.1 to 10.7, making it the most frequently reported healthcare-acquired infection in mechanically ventilated patients.1 Patients intubated >72 hours have VAP incidence rates of 20%.2 Prevalence rates are between 10% and 20%.3 Two 16-bed Intensive Care Units (ICUs) noted that after implementation of the Institution for Healthcare Improvement (IHI) ventilator bundle, the ICUs continued to have cases of VAP. A clinical practice specialist from the Department of Respiratory Care conducted a literature review to determine best practices for VAP prevention, and implemented a protocol incorporating additional oral care, change management, and a focus toward ventilator bundle and oral care compliance. Methods: The protocol consisted of the IHI bundle and oral care with cetylpyridinium chloride suction toothbrush and hydrogen peroxide (H2O2) swabs q2h oral care kit (changed from prior H2O2 oral care kit); intensive change-management strategies including evidence-based caregiver bundle and oral care protocol education and multi-disciplinary team approach; compliance tracking; awards and incentives for protocol compliance; family education and "family involvement posters"; ongoing qualitative metrics to determine need for additional education and change management; and quantitative metrics to track compliance in relation to VAP rates. Results: - Compliance with oral care protocol increased from 30% in July 2006 to 96% by end-2008 - Compliance with oral care was 60% in 04/07 and the VAP rate was 12.82; however, in 05/07 compliance rose to 72% and continued with an upward trend, with VAP rates dropping to 0 through 2008 - 650 days with 0 VAPs indicate 28.4 VAPs were prevented and 14 lives possibly saved - IHI bundle compliance is 100% Conclusion: Multidisciplinary change-management is essential to ensure compliance with a ventilator bundle and oral care protocol and prevention of VAP. Cost estimates range widely from $11,897 to $150,841 per case.4,5 Savings are calculated based on prevention of 28 VAPs and a cost per case of $40,000, resulting in an estimated savings of $1,120,000. 1. Edwards JR, et al. Am J Infect Control 2008;36:609-26. 2. Piazza O, et al. Panminerva Med 2005;47:265-7. 3. Safdar N, et al. Crit Care Med 2005;33:2184-93. 4. Warren DK, et al. Crit Care Med 2003;31:1312-7. 5. Kollef MH, et al. Chest 2005;128:3854-62.

Sponsored Research - None



645890

PHYSICIANS PERSPECTIVES' OF THE RESPIRATORY CARE PRACTITIONER AS A MID-LEVEL PRACTITIONER IN SPECIFIC DOMAINS AND SETTINGS OF CLINICAL PRACTICE.

Carlton R. Insley, Sidney R. Schneider, Robert L. Joyner; Department of Health Sciences, Salisbury University, Salisbury, MD

BACKGROUND: Gaining an understanding of physician perspectives on Respiratory Care practice expansion to mid-level provider (MLP) capability is necessary to define an appropriate professional development pathway. After specifying domains and settings pertinent to the respiratory care practitioners' (RCPs) scope of practice, we queried, "What are physicians perspectives on Respiratory Care Practitioners as mid-level practitioners?" METHODS: An expert committee validated survey was presented via electronic mail to American Thoracic Society (ATS) physicians. Approximately 7300 ATS members were surveyed, with 428 responding (approximately 5.8%). The survey instrument included a 9-item questionnaire that used a Likert scale from 1 to 5 (1 strongly disagree to 5 strongly agree). It was divided into three domain-specific categories (three questions per domain) pertaining to RCPs as mid-level practitioners in: (1) Role, (2) Cost Effectiveness, and (3) Care & Safety. Each domain incorporated the following three settings: health care, office practice, and hospital. SPSS 16.0 for Windows (Chicago, IL) was used for statistical analyses. Cronbach's Alpha (α) was used to test the reliability of the 9-item questionnaire and its three subscales and one-way ANOVAs compared differences in settings for each domain. Significance was set at $p \leq 0.05$. Values expressed in means with 95% confidence intervals. RESULTS: The reliability of the 9-item questionnaire showed a Cronbach's α of .95; and for each domain, .92, .87, and .90, respectively. Significant differences were found for each of the three domains ($p < 0.0005$). Post hoc analysis revealed differences for RCPs as MLP's in office practice, as compared to the settings in health care ($p < 0.0005$), and hospital, ($p < 0.0005$). CONCLUSION: Physicians' perspectives on the specific-domains and settings pertinent to RCPs scope of practice as mid-level practitioners were found to be favorable for each of the three domains (Role, Cost Effectiveness, and Care & Safety), and for each domain's three settings (health care, office practice, and hospital). Although rated favorably, physicians scored RCPs as mid-level practitioners in the office practice setting (in each domain) lower than the settings of health care, and hospital.

Sponsored Research - None

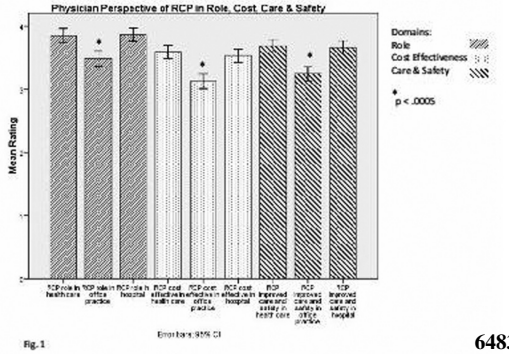


Fig. 1

648383

UPDATED RESPIRATORY CARE PROTOCOL IMPROVES UTILIZATION AND DECREASES COST.

Damien P. Beilman, Debra Fox; Respiratory Care, Wesly Medical Center, Wichita, KS

Introduction: The Respiratory Care Department of a 760 bed tertiary acute care referral center instituted a hospital wide application of respiratory care protocol to provide optimal care and decrease costs. The previous respiratory protocol system was updated utilizing the evidence-based guidelines outlined in the Global Initiative for Chronic Lung Disease (GOLD). This updated protocol system utilized a dichotomy that differentiated between patients admitted with underlying chronic obstructive lung disease (COPD) and those with non-COPD pathology and was approved by the medical center's Medical Executive Committee. The objective was to decrease unnecessary utilization, length of stay, cost of care and the use of levalbuterol and ipratropium bromide. Method: This study evaluated average utilization, length of stay and pharmacy inventory costs before (January 2006-April 2008) and after (May 2008-December 2008) implementation of the updated protocol. Results: Table 1 shows the pre and post utilization data. It was expected that MDI administration would increase as respiratory therapists assumed delivery of a medication modality that had been traditionally given by nursing. Medication nebulizer and lung expansion therapy decreased by 16% and 11%, respectively. The length of stay for COPD, asthma/bronchitis and major chest trauma decreased an average of 1.01, 2.7 and 2.3 days, respectively. Increase in the utilization of secretion clearance is directly attributable to patient administered use of the Acapella secretion device that was included in the updated protocol system. Decreased use of levalbuterol and ipratropium during the six month trial resulted in a cost savings of $5,456.64. Pharmacy inventory costs for metered dose inhalers decreased $40,000 per month with implementation of a common canister process. Conclusion: Our data suggests that evidence-based respiratory care protocols that differentiate between patients with COPD and non-COPD pathology are associated with a decrease in resource utilization, length of stay and pharmacy costs. This study did not evaluate quality patient outcomes or appropriateness of care. Further evaluations are necessary to determine that this protocol model improves patient outcomes.

Sponsored Research - None

Modality (average per month)	Pre-Utilization January 2006-April 2008	Post-Utilization May 2008-December 2008
Protocols	125	400
Medication Nebulizer	938	783
Metered Dose Inhaler	221	1350
Secretion Clearance (CPT, Cough Assist, Acapella)	206	355
Lung Expansion Therapy (IPPB, TheraPEP, EzPAP)	580	520

651665

USE OF TECHNOLOGY TO IMPROVE PATIENT HANDOFF COMMUNICATION.

Christopher J. Benitez; Respiratory Care, Primary Childrens Medical Center, Salt Lake City, UT

Christopher J Benitez RRT. Primary Childrens Medical Center Salt Lake City Utah Background: JCAHO 2007 National Patient Safety Goal 2E stressed the importance of implementing a standardized approach to Handoff communication that is accurate and concise. In April 2007 the Primary Children's Medical Center, Respiratory Care Services, PICU core group questioned the effectiveness of handoff communication between shift caregivers. At this time handoff communication included reusable patient information cards. These cards often became unreadable after 2-3 days due to pencil erasing of outdated information. Methods: The group setout to create a computerized version of these report cards that would be printable with each shift. The system was developed and implemented using Microsoft Access as the run program. Over the next 6 months input was taken from therapists for what items should be included, examples include ventilator settings, test results, history, and care plan information. The cards are printed each shift. Results were determined by direct observation. Results: Previously, history was often limited to primary diagnosis and the previous days events. After use of the computerized report system it was noted that 2 weeks of information was available in the Events and Changes area and a complete history of the stay including surgeries, important tests, and other new findings are placed in the History area. Current ventilator settings, Ett tube information, and blood gases were also much easier to record and read. Archival ability allows for continuum of care on readmission. Conclusion: The change to the computerized system has resulted in an improvement in the quality of data and knowledge for Respiratory Care Services. For Handoff communication between shifts card portability allows for better patient daily rounds, up to date information, and ability to suggest changes to the patient care plan. Card Example

Sponsored Research - None

651850

AN ANALYSIS OF THE COMMON FACTORS INFLUENCING THERAPIST DISCIPLINE.

Anthony L. DeWitt; Bartimus Frickleton Robertson & Gorny PC, Jefferson City, MO

Background: Since the AARC effort to obtain licensure, 48 states have opted to license therapists. In almost every state, the disciplinary process has forced therapists from the field for a variety of reasons. This study sought to determine if there were common factors influencing therapist discipline. Method: 100 therapist discipline cases were obtained from licensing boards in California, Missouri, and numerous other states. Cases were grouped into two categories: clinical error and therapist misconduct. Clinical error was defined as the primary reason for discipline being related to an error or mistake in patient care. Therapist misconduct cases were defined as cases dealing with misconduct occuring outside the health care setting (DUI, child abuse, etc.) Cases were evaluated for the presence of common factors. Results: Review of the case files indicates that alcohol and drug abuse play a dominant role in therapist misconduct cases, and are cited prominently as mitigating factors in clinical error cases. The common factors in clinical error cases tend to be fatigue and a lack of attention to detail. Conclusion: Identification and interdiction of substance abuse processes in therapist education programs may be the most effective way to reduce therapist discipline cases.

Sponsored Research - None

653845

IMPLEMENTING AN EVIDENCE-BASED, OUTCOMES DRIVEN, INTERDISCIPLINARY TEAM IN A RURAL, CRITICAL ACCESS HOSPITAL: THE IMPACT ON INTERDISCIPLINARY CHARTING.

Kimberly J. Bennion[1], Carri Aguiar[1], Julie Ballard[2,1], Ezra Segura[1], Michele Ludlow[1], Michelle Colledge[1], Jenny Chambers[1], Kathie Coleman[1]; [1]Heber Valley Medical Center, Respiratory Care Services, Intermountain Healthcare, Heber City, UT; [2]System Improvement, Primary Children's Medical Center, Intermountain Healthcare, Salt Lake City, UT

Introduction:Heber Valley Medical Center (HVMC) is a 19-bed critical access hospital owned & operated by Intermountain Healthcare. Utah state law requires 2 licensed caregivers & a physician be present at newborn deliveries. With limited nursing (RN) resources,leadership piloted the use of respiratory therapists (RT) as the licensed caregiver specifically charged with the care of the newborn. RT was added during February 2008. An electronic charting program, StorkBytes (SB), was introduced to RNs during 2006 to promote timely, accurate documentation during labor. In 2007, it was noted RNs were occasionally utilizing paper forms & not SB. Discrepancies were also noted in the various data points that comprised the total APGAR<1> score which is an objective method of quantifying the newborn's condition & for conveying information about the newborn's overall status & response to resuscitation. A "Delivery Scratch Note" was also developed. While not part of the patient's medical record, it is a paper tool utilized by both disciplines to coordinate scoring during deliveries. We sought to identify what if any impact a RT/RN team model & APGAR scoring standardization might have on the documentation of pt care.Method:Comparison data of all HVMC Live Births (LB) during 2007 & 2008 (post-RT & "Delivery Scratch Note" implementation) were identified via the corporate database. Initial inclusion criteria were: (1) LB occurring at HVMC defined by year,(2) mode of delivery, & (3) post-delivery status (inpatient or transfer for a higher level of care). Respectively, 256 & 252 total LB were initially identified for 2007 & 2008. Vaginal births were randomized for 2007 but not for 2008. A total of 372 charts for both years were included in the final review. Results: Outcomes are reported in Table One. Discussion: We did not note a statistically significant improvement in SB charting when comparing years; however, a statistically significant improvement in APGAR score discrepancy was noted with $p < 0.005$. The positive impact of a RT/RN team approach to pt care, clearly defined team member roles & the standardization of data collection/reporting cannot be over-emphasized. Specific employees not complying with SB charting were provided with additional education. With the addition of RT, an Early Lung Recruitment guideline using continuous positive airway pressure was introduced. Outcomes are reported in a separate abstract.

Sponsored Research - None

Table One: Birth Type/Post Delivery Status & Documentation

		2007 Documented Storkbyte Charting	2008 Documented Storkbyte Charting	2007 APGAR Score Charting Discrepancy*	2008 APGAR Score Charting Discrepancy*
2007 HVMC Live Births With Charts Reviewed n=133 # (%)	2008 HVMC Live Births With Charts Reviewed n=252 # (%)	n=133 # (%)	n=239 # (%)	n=133 # (%)	n=239 # (%)
Vaginal 61 (46)	Vaginal 162 (68)	58 (44)	141 (59)	21 (16)	13 (5)
C-Section 65 (49)	C-Section 68 (28)	48 (36)	50 (21)	27 (20)	7 (3)
Transferred 7(5)	Transferred 9 (4)	3 (2)	6 (2)	3 (2)	1 (<1)
Total Pts 133 (100)	Total Pts 239 (100)	109 (82)	197 (82)	51 (38)	21 (9)

*APGAR scoring discrepancy defined as: variance between Storkbyte & hardcopy charting or individual elements that did not support the total score.

<1>American Academy of Pediatrics, Perinatal Continuing Education Program (PCEP)

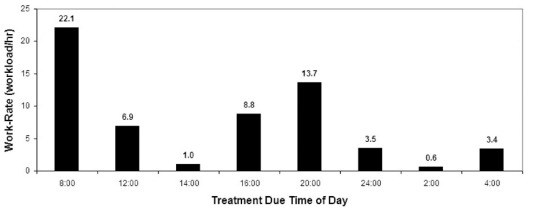
658018

VALIDATING WORK-RATE: A NEW PARAMETER FOR DISTRIBUTING RESPIRATORY THERAPY WORKLOAD.

Susan Gole[1], Mike Rado[2], Robert L. Chatburn[1]; [1]Respiratory Therapy, Cleveland Clinic, Cleveland, OH; [2]Management Engineering, Cleveland Clinic, Cleveland, OH

We previously reported a pilot study of a new management parameter, work-rate (workload due per hour based on cumulative standard treatment times) to equalize distribution of workload and the timeliness of delivered treatments (*Respir Care* 2008;53(11):1532). The purpose of this study was to collect baseline data for a quarter of 2009. Our hypotheses were that (1) work-rate is unevenly distributed over a 3 shift day and (2) despite a reasonable average workload, work-rate may attain unachievable values. **METHODS:** Data were defined as non-ICU scheduled treatments and were collected using a custom Crystal Reports program (sapglobal.com) to query a MediLinks database (MediServe, Phoenix AZ). The database is used to record billing and charting information. Workload data consisted of scheduled treatments for small volume nebulizers (standard time = 9 min), metered dose inhalers (6 min), positive expiratory pressure (10 min), bronchopulmonary hygiene (10 min), continuous positive airway pressure (8 min), bilevel positive airway pressure (8 min), and nasotracheal suctioning (8 min). Workload was calculated as cumulative standard treatment times aggregated by hour of the day when treatments were due. Workload due times were base on ordered frequency. Policy requires therapies to be completed 30 minutes before or after due times (i.e., 1 hour window around due time). Average work-rates (workload/hour) were compared for due times during the day (08:00, 12:00, 14:00, 16:00, 20:00, 24:00, 02:00, 04:00) using one way ANOVA. P values < 0.05 were considered significant. **RESULTS:** Data were collected from 3/7/9 to 4/23/9. Average work-rates varied greatly (Figure) during the 24 hour day ($P < 0.001$). Scheduled staff averaged 7.5, 6.5, and 3.0 therapists for day, evening, and night shifts respectively. Our staff efficiency standard is 64% and assigned workload averaged 5 hours/shift. Required staffing was 34.5, 10.8, 1.6, 13.8, 21.4, 5.5, 1.0, 5.3 therapists at 08:00, 12:00, 14:00, 16:00, 20:00, 24:00, 02:00, 04:00 respectively, assuming standard treatment times were adhered to for all treatments. **CONCLUSIONS:** Work rates were unachievable with available staffing for 75% of scheduled due times despite presumed achievable average workload assignments. This study suggests that assignment practices common to the profession are based on questionable assumptions. Further quality improvement efforts are required to plan and implement a better work assignment system.

Sponsored Research - None



664872

EXTENT OF CARDIOPULMONARY PRACTICE AND FACTORS AFFECTING CARDIOPULMONARY PRACTICE AMONG PHYSIOTHERAPISTS IN NIGERIA.

Nse A. Odunaiya[1,2], Kemi Oketogun[1]; [1]Physiotherapy, University of Ibadan, Ibadan, Nigeria; [2]Physiotherapy, Stellenbosch University, Western Cape, South Africa

BACKGROUND:Increasing prevalence of cardiac and respiratory conditions in Nigeria presently makes cardiopulmonary therapy an indispensable component of medical care and Physiotherapists are involved in the management of these patients from intensive care to Community level.However, there is paucity of information on the extent of Cardiopulmonary practice among Physiotherapist and factors affecting cardiopulmonary practice in Nigeria. METHODS:Sixty five participants from seven hospitals in south western Nigeria were selected using purposive sampling technique.The research design was descriptive survey. A three – sectioned questionnaire developed by the researcher and validated (face and content validity) using panel of expert was used for data collection. The reliability of the instrument was assessed using Cronbach alpha r= 0.93. Data was analyzed using descriptive statistics of mean, standard deviation and percentages. Pie and bar charts were used to present findings. The findings of the study showed that most of the Physiotherapist are involved in the management of cardiac and respiratory patients, however few cardiac and respiratory patients were managed by physiotherapists in Nigeria (majority having managed between 1 – 5 patients in the last 12 months). Twelve (18.4%) of the participants rated themselves good and excellent in >10 (>50%) of the basic cardiac and respiratory therapy skills and techniques. Six (9.2%) of the participants employed >10(76.9%) of the basic cardiopulmonary assessment tools. Factors affecting management are lack of referrals of cardiopulmonary patients by Doctors, inadequate knowledge and lack of proficiency in cardiopulmonary techniques and skills among Physiotherapists in Nigeria and non availability of facilities for management of these patients in the some of the selected Hospitals. Based on the findings of the study, it was concluded that physiotherapists in Nigeria manage cardiopulmonary patients, however, majority (more than 70%) of the participants are not proficient in cardiac and respiratory skills and techniques. We recommend continuing educational program and improved academic and clinical training of cardiopulmonary therapy component to improve knowledge and proficiency of Physiotherapist in Nigeria. There should also be forum for Physiotherapist and doctors interaction for appreciation of role of Physiotherapists in management of cardiopulmonary patients.

Sponsored Research - None

RATING OF CARDIORESIPRATORY TRAINING

UNIVERSITY	CLINICAL GOOD AND EXCELLENT	CLINICAL FAIR AND POOR	ACADEMIC GOOD AND EXCELLENT	ACADEMIC FAIR AND POOR
UNIVERSITY OF IBADAN	17(54.8%)	14(45.1%)	19(61.3%)	12(38.7%)
OBAFEMI AWOLOWO UNIVERSITY	13(59.1%)	9(40.9%)	12(55.%)	10(45.%)
UNIVERSITY OF LAGOS	3(25%)	9(75%)	5(41.7%)	7(58.3%)
ALL UNIVERSITIES	33(50.7%)	32(49.3%)	36(55.3%)	29 (44.7%)

665758

IMPLEMENTING AN EVIDENCE-BASED, OUTCOMES DRIVEN, INTERDISCIPLINARY TEAM IN A RURAL, CRITICAL ACCESS HOSPITAL: THE IMPACT OF AN EARLY LUNG RECRUITMENT GUIDELINE (ELRG) IN NEWBORNS—A PILOT STUDY.

Kimberly J. Bennion[1], Carri Aguiar[1], Julie Ballard[2], Ezra Segura[1], Michele Ludlow[1], MIchelle Colledge[1], Jenny Chambers[1], Kathie Coleman[1]; [1]Heber Valley Medical Center Respiratory Care, Intermountain Healthcare, Heber City, UT; [2]System Improvement, Primary Children's Medical Center, Intermountain Healthcare, Salt Lake City, UT

Introduction: Heber Valley Medical Center (HVMC) is a 19-bed critical access hospital of the Intermountain Healthcare Corporation. Utah state law requires 2 licensed caregivers & physician be present at all infant deliveries. With limited nursing resources, leadership piloted the use of respiratory therapists (RT) as the second licensed caregiver specifically charged with the care of the newborn. An existing corporate ELRG was adapted in an attempt to determine if infants with respiratory distress (RD) defined as grunting &/or respiratory rate ≥70 could safely be cared for with continuous positive airway pressure (CPAP) in a rural setting. The existing corporate ELRG utilized an initial CPAP of 6, but we chose a CPAP of 4. It was our hypothesis that utilizing a lower initial CPAP pressure might prove effective in pts ≥37 weeks gestation presenting with RD.CPAP was delivered on all pts via a T-piece resuscitator. Method: Inclusion criteria were: (1) Live Birth occurring at HVMC during 2008, (2) mode of delivery,& (3) post-delivery status(admitted or transfered to another facility). There were 252 pts initially identified, but 13 charts were unavailable leaving us with 239 pts for final review.We report that 223 (93%)of the pts were ≥37 weeks. Forty (17%)of pts were enrolled in the ELRG. Results: Outcomes are reported in Table 1. Discussion: We report only 1 (3%) of the 40 pts enrolled developed an air leak(asymptomatic pneumomediastinum with pt being discharged with mother). It is interesting to note that of the 239 pts,1 additional infant had a reported air leak but had never received positive pressure. Only 1 (3%) of the 40 pts required a CPAP pressure of 8 being performed at the request of the receiving neonatologist. Only 9 (4%) of the 239 live births required transfer to a higher level of care. Recent studies suggest that lung remodeling may be a result of untreated RD in the newborn population. It is our impression that pts with gestational age ≥ 37 weeks with RD can be safely cared for with CPAP in a rural setting if thorough education with a clearly defined ELRG, specially trained staff & standardized outcomes are used to identify & timely adapt processes. A process for implementing the ELRG to all corporate rural facilities is being defined. More studies need to be performed before conclusions can be drawn.

Sponsored Research - None

658307

IMPLEMENTING AN EVIDENCE-BASED, OUTCOMES DRIVEN, INTERDISCIPLINARY TEAM IN A RURAL, CRITICAL ACCESS HOSPITAL: THE IMPACT ON INHALED BRONCHODILATOR OUTCOMES.

Kimberly J. Bennion[1], Carri Aguiar[1], Julie Ballard[2], Segura Ezra[1], Ludlow Michele[1], Michelle Colledge[1], Jenny Chambers[1]; [1]Heber Valley Respiratory Care, Intermountain Healthcare, Heber, UT; [2]System Improvement, Primary Children's Medical Center, Intermountain Healthcare, Salt Lake City, UT

Introduction: Heber Valley Medical Center (HVMC) is a 19-bed critical access hospital of the Intermountain Healthcare Corporation. With limited nursing resources, leadership piloted the use of a Respiratory Therapy (RT) department to implement evidence-based guidelines (EBG) & educate medical/nursing staffs. EBGs are medical executive committee approved & allow RTs to tailor care plans per patient (pt) response. One EBG introduced to medical & nursing staffs was inhaled bronchodilator delivery. The EBG includes the documentation of pre- & post-treatment (tx) breath sounds (BS) & peak flows (PF) which are utilized to evaluate efficacy of tx & determination of care plans. Prior to RT implementation, all RT txs were performed by nursing. As of February 1, 2008, RTs were scheduled from 0700-1900 daily, 3 night shifts per week (1900-0700) & on-call for the remaining 4 nights. RTs use a pre-printed progress note to document daily assessments of pts ordered on txs. The pre-printed note reports txs ordered, txs delivered, pt response & suggested care plans. We sought to compare 2007 (pre-RT) to 2008 (post-RT) bronchodilator outcomes to determine what if any impact the RT department contributed. Method: Comparison data of all 2007 & 2008 pts ordered on an inhaled bronchodilator (ie: Xopenex, Albuterol and/or Atrovent) were identified. Inclusion criteria were pts with at least 1 inhaled bronchodilator tx ordered. Initially, 211 pts were identified. Of these, 55 charts were unavailable which left us 156 (74%) of the total pts for final review. Results: Outcomes are reported in Tables One. Discussion: When comparing the documentation of PF & BS, a statistically significant improvement with $p < 0.05$ was noted post implementation of a RT department. PF & BS should be documented pre- & post-bronchodilator tx but were performed less frequently by nursing than RT. EBG revision is planned to include the measure of FEV<1> as a determinant of tx efficacy. Bronchodilator care plans on the night shift (1900-0700) were followed less than on the day shift (0700-1900)with documentation as to why txs were not given rarely being noted. Processes for improvement were identified & are being implemented to improve pt outcomes & to enhance interdisciplinary adherence to the EBG. It is our impression that the addition of a RT department with education, an EBG & outcomes reporting improved inhaled bronchodilator guideline compliance when comparing 2007 to 2008.

Sponsored Research - None

660388

IMPLEMENTING AN EVIDENCE-BASED, OUTCOMES DRIVEN, INTERDISCIPLINARY TEAM IN A RURAL, CRITICAL ACCESS HOSPITAL: THE IMPACT OF PRE-OPERATIVE OBSTRUCTIVE SLEEP APNEA (OSA) ASSESSMENTS.

Kimberly J. Bennion[1], Carri Aguiar[1], Julie Ballard[2], Ezra Segura[1], Michele Ludlow[1], Michelle Colledge[1], Jenny Chambers[1]; [1]Heber Valley Respiratory Care, Intermountain Healthcare, Heber, UT; [2]System Improvement, Primary Children's Medical Center, Intermountain Healthcare, Salt Lake City, UT

Introduction: Heber Valley Medical Center is a 19-bed critical access hospital of the Intermountain Healthcare Corporation.With limited nursing resources, administrative leadership piloted the use of respiratory therapists (RT) to perform a detailed pre-surgical assessment. We obtained a pre-surgical OSA assessment guideline from our sister hospital<1> & obtained medical executive committee approval for implementation. The guideline included a Modified Berlin Score(MBS. The MBS is a scoring tool utilized to determine a patient's(pt)risk of OSA post-anesthesia. The score assigns points for positive responses to questions about snoring,pauses in breathing,sleepiness in the morning/during the day&assigns points based on body mass index.Scores > 25 were considered a predictor of possible post-operative airway compromise & need for interventions such as continuous positive airway pressure(CPAP)or bi-level ventilation(BLV). RTs received pt referrals for assessments triggered by a positive response to the question of snoring.The day of surgery,RT gathered an initial assessment,detailed history, existing co-morbidities & general medication use. Nurses&physicians were notified of pts scoring >25. We sought to identify what if any impact an interdisciplinary team using a second more detailed assessment&MBS might have on the outcomes of post-operative pts. Method:Comparison data of all 2008 surgical pts who received the second assessment were identified via the RT OSA assessment database which was kept concurrently throughout 2008. Initial inclusion criteria were pts scheduled for surgery who received an OSA by RT.Eighty-one pts were identified who met the criteria,none were excluded. Results:Outcomes are reported in Table One.Discussion:It is our impression that the MBS is a reliable screening tool for identifying possible airway post-operative complications requiring CPAP/BLV in pts who have undiagnosed but suspected OSA since 48% of those pts screened did require CPAP/BLV. We have used the MBS to proactively assemble equipment,notify staff, and improve the continuum of care from the operating room, to the recovery room & the inpatient setting. An Executive Summary of our findings was reported to administration & the interdisciplinary Quality Workgroup for process refinement/improvement. 1Utah Valley Regional Medical Center, Provo, Utah (Karl Ludwig RRT & Douglas Ross MD). Modified Berlin Questionaire used & modified with permission of Kingman P. Strohl MD.

Sponsored Research - None

666032

DETERMINING THE BASIS FOR A TAXONOMY OF MECHANICAL VENTILATION.

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

The respiratory care community has not adopted a standardized classification system for modes of ventilation. As a result, the risk for confusion affects many aspects of the profession, including patient care, education, and marketing. To date, no official consensus has been attempted among either manufacturers or professional organizations related to a lexicon of mechanical ventilation, despite book chapters and published papers on the subject. The purpose of this pilot study was to determine if there may be a basis for such a consensus. The specific hypothesis tested was that among thought leaders in respiratory care, there is sufficient agreement on a few basic concepts related to modes of ventilation to form the basis for a standardized taxonomy. **METHODS:** I created an online survey based on 10 constructs: (1) definition of a breath (2) definition of "assisted" breath (3) definition of pressure control, PC, and volume control, VC (4) definitions of trigger and cycle (5) machine vs patient triggering/cycling (6) definition of "spontaneous" vs "mandatory" breaths (7) breath sequences: continuous mandatory ventilation, CMV, intermittent mandatory ventilation, IMV, continuous spontaneous ventilation, CSV (8) "ventilatory patterns" as control variable-breath sequence combinations like VC-CMV or PC-IMV (9) adding detail to ventilatory patterns using targeting schemes (10) using the above constructs to define "mode". Respondents used a 5 point ordinal scale ranging from strongly agree to strongly disagree. A pilot sample of volunteer respondents was obtained from respiratory therapist members of the AARC Educational Specialty Section. The study was approved by the institutional review board of Youngstown State University. A significant agreement value was arbitrarily set at > 50%. **RESULTS:** The survey was returned by 8 respondents. Percent agreement with the 10 constructs is shown in the Table. Overall agreement was 84%. The lowest agreement centered on the concept of "assist". **CONCLUSIONS:** These pilot data suggest that enough potential consensus exists among educators to justify a larger survey including stakeholders working in patient care and manufacturing. Lack of consensus about the word "assist" is not surprising given the wide range of interpretations for this term in the literature and common usage. The results of a larger study (in progress) will inform future efforts to establish an international standard.

Sponsored Research - None

Construct	1	2	3	4	5	6	7	8	9	10
% Agree	62.5	37.5	75	100	100	100	87.5	87.5	100	87.5

678061

IMPROVED SELECTION OF INITIAL TIDAL VOLUME FOR MECHANICAL VENTILATION BASED ON THE RADFORD NOMOGRAM.

Shannon E. Cook, Robert L. Chatburn; Respiratory Institute, Cleveland Clinic, Cleveland, OH

BACKGROUND: General acceptance of ARDSnet guidelines have resulted in a standard of care for initial tidal volume for mechanical ventilation based on 6-8 mL/kg ideal body weight, originally an arbitrary "rule of thumb". We have developed regression equations based on the Radford nomogram (J Appl Physiol. 1955;7(4):451) that incorporate both weight (W) and spontaneous breathing frequency (F) for a potentially more appropriate tidal volume prediction. The purpose of this study was to compare the predicted tidal volumes (Radford) to the currently accepted heuristic (ARDSnet). **METHODS:** Equations show V in mL, F in breaths/min and W in lb: Adults (80-250 lb, F = 8 - 18): -Male: V = 466.969 + (2.4 * W) - (26.342 * F), R2= 0.97. -Female: V = 456.408 + (1.794 * W) - (22.716 * F), R2= 0.97. Initial Vs for mechanical ventilation were generated using these equations and compared to conventional (6 mL/kg) for the set of W used to create the equations for weights from 80 to 250 lbs in 5 lb increments for frequencies from 8-18 breaths/min. Differences in volumes were calculated as Radford prediction minus ARDSnet prediction. Mean differences were evaluated with 1 sample t-test or Mann-Whitney Rank Sum Test. **RESULTS:** For both sexes and all weights, tidal volumes predicted using the Radford equation were 2% to 24% lower than the ARDSnet convention when spontaneous breathing frequency was at least 17/minute ($P < 0.001$). Tidal volume reduction was proportional to body weight and was higher for females (mean 7% vs 17%; $P < 0.001$). **CONCLUSION:** Current ARDSnet guidelines for selection of initial tidal volume during mechanical ventilation are based first on a linear regression equation for prediction of ideal body weight but then a simple rule of thumb for calculating the subsequent tidal volume. Substitution of the Radford equations, incorporating information about the patient's pre-intubation breathing frequency, may offer additional advantage by reducing initial tidal volume to enhance lung protective ventilation strategies. Prediction equations may be programmed into bedside computers or mechanical ventilators.

Sponsored Research - None

678079

PREDICTION EQUATIONS FOR TIDAL VOLUME BASED ON THE RADFORD NOMOGRAM.

Shannon E. Cook, Robert L. Chatburn; Respiratory Institute, Cleveland Clinic, Cleveland, OH

BACKGROUND: Selection of initial tidal volume for mechanical ventilation is often based on arbitrary "rules of thumb" such as 6 mL/kg ideal body weight. A more formal approach was developed by Radford (J Appl Physiol. 1955;7(4):451). However, this tool is probably underused because alignment nomograms are virtually obsolete. With the wide availability of microprocessors, we postulated that the Radford nomogram could be converted into a computer program to facilitate application, perhaps even incorporated into mechanical ventilators. The purpose of this study was to derive and evaluate mathematical models for predicting tidal volume based on patient weight and ventilatory frequency, which Radford never published. **METHODS:** First, the nomogram was divided into three sections: an infant, a pediatric and adult (male and female) based upon average weight (kg) for each type of patient. Using the nomogram, we selected all combinations of weight (W) and frequency (F) indicated by tick marks to predict the associated tidal volumes (V) so that each weight received several F and V to account for patients with a range of breathing patterns. Then, a linear regression equation was calculated for each patient type: infants, pediatric patients and both male and female adults. **RESULTS:** After an examination of the residual plot, the linear regression equations were determined to be the best fit. Equations are for V in mL, F in breaths/min and W in lb: -Infant (6-9 lb, F = 30-50): V = 7.160 - (0.265 * F) + (2.820 * W), R2= 0.98. -Pediatric (10-79 lb, F = 8-25): V = 154.137 + (3.470 * W) - (6.861 * F), R2= 0.91. Adults (80-250 lb, F = 8 - 18), -Male: V = 466.969 + (2.4 * W) - (26.342 * F), R2= 0.97. -Female: V = 456.408 + (1.794 * W) - (22.716 * F), R2= 0.97. **CONCLUSION:** The high R^2 values indicate that the equations were a good fit to the data from the nomogram. These equations provide a more scientific approach than the current "rules of thumb." As such, they can easily be incorporated into programmable systems, like ventilators. The inclusion of information regarding frequency may offer the advantage of a more individualized tidal volume.

Sponsored Research - None

678069

CREATING VENTILATOR SCENARIOS COMBING LAERDAL SIMMAN AND INGMAR ASL 5000.

Jose D. Rojas, Albert Ho, Reed Perkins, Joy J. Powell, Jon O. Nilsestuen; Respiratory Care, University of Texas Medical Branch, Galveston, TX

Background: The use of human patient simulators in medical education has been common practice for several decades. A limitation of all current simulators is the inability to realistically alter lung characteristics, thus limiting their usefulness in creating ventilator scenarios. We have modified Laerdal's SimMan to incorporate Ingmar's ASL 5000 as its breathing compartment. The combined hardware and software enables students and clinicians to develop expertise in managing complex ventilator cases. Clinicians will be able to make ventilator adjustments that best address changes in a patient's physiologic parameters and follow in real time the consequence of those adjustments. We demonstrate how to combine these two technologies on one computer simultaneously without any delay in response or other technical issues. Method: Laerdal's SimMan combined with Ingmar's ASL 5000 are programmed with the actual physiologic data of a patient who is being mechanically ventilated. Patients are being ventilated with Viasys Avea ventilators. Trend data of the patients' respiratory parameters are downloaded and programmed into the ASL 5000. Screen captures of the patients' ventilator graphics verify that the programmed ASL 5000 connected to SimMan and ventilated with the patients' ventilator settings actually mimics the patients' condition. Conclusion: We have developed two adult ventilator scenarios utilizing actual patient data programmed in an Ingmar ASL 5000 running in parallel with the Laerdal SimMan. We demonstrate how this combined technology can be used to improve medical education and patient care.

Sponsored Research - None

678156

FFECT OF EDUCATIONAL OUTREACH IN ACHIEVING VENT-BUNDLE COMPLIANCE AND DECREASING VAP RATE.

Sally Whitten[1], John Dziodzio[1], Christopher Hirsch[1], Sally Brewer[1], Cynthia Honess[2], Nicole Manchester[2], Sonja Orff[2], Micheline Chipman[2]; [1]Division of Pulmonary and Critical Care Medicine, Maine Medical Center, Portland, ME; [2]Department of Nursing, Maine Medical Center, Portland, ME

Background. As part of a strategy toward decreasing incidence of VAP in our institution, we introduced a "vent bundle" of best-practice procedures and policies. Although we were (by electronic data collection) 100 percent compliant with the bundle, subsequent VAP rate tracking did not indicate a satisfactory level of response to the intervention. We decided to examine the specific elements constituting vent-bundle compliance. In order to increase compliance with the component constituents of the vent bundle a follow-up remedial educational effort was conducted for Respiratory Therapists (RTs), Nurses, and Physicians. Methods. A questionnaire touching on the main concepts of the bundle was provided in 2007 to assess the general level of understanding, and again in 2008, to assess the effect of the educational program amongst caregivers. Questions addressed oral care, suctioning, use of HME, timely weaning, and other aspects of VAP prevention and general knowledge. Results. Among all respondents, there was a 25% overall increase in positive responses across all questions in 2008 compared to 2007. Respondents increased most strongly in their feeling that they were kept aware of the recent VAP rate (Δ%=69.7, P<0.0000001), VAP reporting requirements (Δ%=58.9, P<0.0000001), VAP as the leading cause of nosocomial infection (Δ%=30.3, P=0.0005), and the need in diligence to maintain appropriate endotracheal tube cuff inflation pressure (Δ%=21.6, P=0.0048). Other statistically significant increases concerned the evidence supporting use of HME vs. heated-wire circuits (Δ%=26.4, P=0.0032), and that VAP is preventable (Δ%=21.2, P=0.0357). Non-statistically significant increases were seen in questions of timely weaning (Δ%=11.1, P=0.18), and understanding of causes and definition of VAP (Δ%=13.4, P=0.15) as these responses were fairly high in both the 2007 and 2008 evaluations. Conclusions. Comparison of the mean VAP rate in the months preceding and following the vent-bundle educational effort, together with the effects of implementation of the bundle, demonstrated an overall decrease of 28% (P=0.011). We attribute the dissemination of knowledge about the bundle components as a motivation for the caregivers to come more fully into compliance, and to more significantly impact VAP incidence.

Sponsored Research - None

678858

OUTPUT PERFORMANCE OF 2 BRANDS OF LARGE VOLUME CONTINUOUS NEBULIZERS (LVN).

Dave N. Crotwell, Jim Weatherbee, John Salyer; Respiratory Care, Seattle Children's Hospital, Seattle, WA

Background: Anecdotal reports from clinicians led us to speculate that there was significant variability in the aerosol output of the LVN we were using for the delivery of Albuterol Sulfate in our emergency department and our inpatient units. We currently use the Misty Finity® LVN from Airlife for all our continuous nebulization. This led us to an evaluation of two brands of LVN. Methods: Testing of the two brands (Misty Finity® from Airlife, and Flo-Mist™from Smiths Medical)of LVN was done using a single oxygen flow meter and oxygen outlet in the laboratory area of our department. We tested 3 LVN of each brand from the same product lots. We filled the each LVN with 0.9% normal saline to a volume for 4 hours of nebulization, based on the manufacturers specified hourly output. Manufacturers specifications were as such; Misty Finity® 30 mL/hr of output at 11 L/m of flow and Flo-Mist™ 25 mL/hr at 13 L/m of flow. Each LVN was run at the manufacturers specified flow rate and the hourly nebulized volume was determined by measuring the volume left at the end of each hour of nebulization and subtracting that from the total volume the LVN was originally filled with. This was repeated for all four hours and the residual volume was documented at the end of the four hour period. Results: Results are displayed in the table below. Conclusion: The testing showed that there was great variability in the aerosol output of both brands of LVN. This confirmed the reports from our staff that the Misty Finity® LVN had a large amount of residual volume at the end of the nebulization period. Even though both nebulizers had a large amount of variation in nebulization, we chose to switch from the Misty Finity® LVN to the Flo-Mist™ LVN after this evaluation. We did this because the Flo-Mist™ LVN did not have residual volume at the end of the nebulization period, which we feel would increase the chance of medication delivery. We speculate that all disposable continuous nebulizers have highly variable aerosol output. Inconsistent drug delivery may have important implications for acutely ill patients in whom timely administration of bronchodilators is essential. We further speculate that the characteristics of the aerosols produced by these devices might also be highly variable and thus potentially inefficient. Further study of the aerosol characteristics of these devices needs to be done.

Sponsored Research - None

Nebulizer Type	Output (mL)				
	Hour 1	Hour 2	Hour 3	Hour 4	Residual
Flo-Mist™					
1	13	35	15	37	0
2	30	28	36	6	0
3	33	28	28	11	0
Misty Finity®					
1	27	25	20	25	23
2	12	14	9	9	76
3	13	8	14	18	67

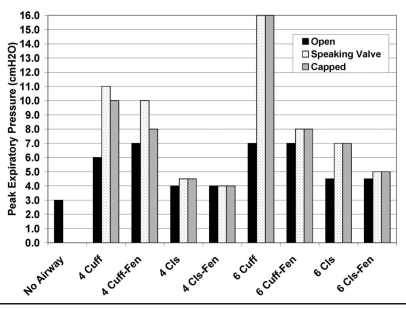
678995

EVALUATION OF A NEW CIRCUIT CONFIGURATION FOR THE VDR-4® HIGH FREQUENCY PERCUSSIVE VENTILATOR.

Kathy Short[1], Samuel W. Jones[2], Bruce A. Cairns[2], William J. Hanson[1], Anthony G. Charles[2]; [1]Respiratory Care, UNC Hospitals, Chapel Hill, NC; [2]Department of Surgery, UNC Hospitals, Chapel Hill, NC

Background: The VDR-4 ® high frequency percussive ventilator (HFPV) is primarily used in the management of inhalation injuries. The standard VDR-4 ® ventilator circuit consists of the ventilator connected to pressure tubing and a sliding venturi manifold made of molded hard plastic that is directly attached to the endotracheal tube (ETT). The hard plastic manifold is heavy and can cause undue torque on the patient's ETT. In this study, we evaluate a new circuit for the VDR-4® that relocates the sliding venturi mechanism away from the ETT and into the ventilator proper in order to eliminate the potential for undue torque on the airway. Method: The VDR-4 ® ventilator was connected to the Ingmar Medical Adult/Pediatric Demonstration Test Lung and the PMG 3000 data collection module using both the standard or experimental condition and different levels of compliance and resistance measured. Each circuit was tested with the operating pressure set at 45 psi, oscillatory peep at 5 cmH2O, inspiratory time at 2 seconds, a respiratory rate of 12 breaths per minute and high frequency percussive rates set at 600 pulses per minute and were not changed. Experimental conditions included varying peak inspiratory pressures from 20, 25, 30, 35 to 40cmH2O, varying compliance levels from 20, 30 to 40ml/cmH2O and changing resistance levels from 10, 15 to 50cmH2O/Liter. Results: For all of the given variables the difference in the PIP and PEEP measured between the old and new circuit was insignificant and would not be expected to influence the clinical effectiveness of the VDR-4 ventilator. Conclusion: Our evaluation demonstrated that the new manifold maintains clinically effective levels of PIP and PEEP while decreasing the weight of the manifold and subsequently the torque on an artificial airway. This new configuration may have an important impact on patient safety as well as the use of HFPV in the management of inhalation injury.

Sponsored Research - None



679074

EFFECT OF LARGE BORE TUBING ON PEAK PRESSURE DURING INTRAPULMONARY PERCUSSIVE VENTILATION.

Jean Davenport, Aaron Light, Nicole Kirk, Jason Grimes, Doug Pursley; Ozarks Technical Community College, Springfield, MO

Introduction: Intrapulmonary percussive ventilation (IPV) is an airway clearance technique that uses a pneumatic device called a Phasitron® to deliver bursts of pressurized gas at rates of 100-225 cycles per minute to the airway[1]. In our community, some therapists add large bore corrugated tubing between the Phasitron and the mask or mouthpiece allowing them to place the Phasitron in the holder instead of manually holding it at the patient's airway. We sought to determine if this method caused a change in pressure delivered to the patient. We hypothesize that the additional tubing will cause the peak pressure to decrease during an IPV treatment. Method: We connected a TSI Certifier FA Plus ventilator tester (TSI Inc., Shoreview, MN) to the outlet of an IPV 1C Phasitron (Percussionaire Corporation, Sandpoint, ID) and placed varying lengths of large bore corrugated tubing between the Phasitron and another Certifier FA Plus, which was connected to a calibrated Michigan 5601i Test Lung (Michigan Instruments, Grand Rapids, MI). The test lung's compliance was set for 40 ml/cmH2O and resistance was set for 5 cmH2O/L/second. The length of tubing ranged from 6 to 72 inches. After setting the working pressure for approximately 40 psi, we recorded the highest peak pressure observed at three different settings: completely clockwise (percussive), completely counterclockwise (diffusive), and one with the control arrow in the 12:00 position (middle). During our bench test, the tubing was kept on a horizontal plane between the Phasitron and Michigan Test Lung. Results: The peak pressure decreased from the Phasitron to the test lung on all three settings and all lengths of tubing. The peak pressure measured at the test lung was also found to reduce every time we added longer tubing. The greatest pressure change occurred on the percussive setting with a mean pressure drop of 12 cmH2O. The mean change in pressure for the diffusive setting was 6.1 cmH2O and 6.6 cmH2O for the middle setting. Conclusion: Based on the data we collected, we caution against adding large bore tubing to the IPV circuit between the Phasitron and mask or mouthpiece due to the reduction of peak pressure supplied to the airway. If the practice of adding tubing is performed, the clinician should consider increasing the working pressure of the IPV unit to compensate for this reduction. 1.Wilkins, R., Stoller, J., & Kacmarek, R. (2009). Egan's Fundamentals of Respiratory Care. Mosby.

Sponsored Research - None

Tubing (6 inch links)	Phasitron Ppeak diffusive setting	Test Lung Ppeak diffusive setting	Diffusive change in pressure (cmH2O)	Phasitron Ppeak percussive setting	Test Lung Ppeak percussive setting	Percussive change in pressure (cmH2O)	Phasitron Ppeak middle setting	Test Lung Ppeak middle setting	Middle setting change in pressure (cmH2O)
1	41.6	37.0	4.6	41.6	31.6	10.0	41.1	37.1	4.0
2	41.8	36.8	5.0	42.3	31.4	10.9	41.2	36.1	5.1
4	41.7	36.1	5.6	41.8	30.4	11.4	40.8	35.1	5.7
6	42.1	35.9	6.2	42.0	29.7	12.3	40.6	34.0	6.6
8	41.5	35.1	6.4	41.8	29.4	12.4	40.5	33.7	6.8
10	41.6	34.9	6.7	41.6	28.8	12.8	41.0	32.8	8.2
12	41.4	33.3	8.1	41.8	28.4	13.4	40.8	31.3	9.5

Pressure in cmH2O

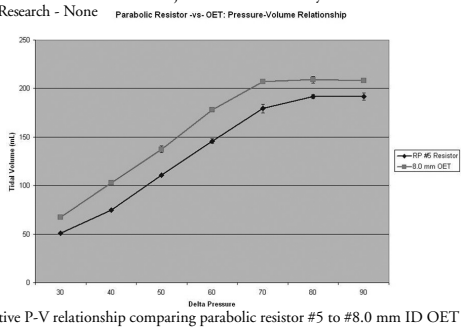
679080

PRESSURE-VOLUME CHARACTERISTICS OF THE 3100B HIGH FREQUENCY OSCILLATOR USING TWO DIFFERENT BENCH MODELS TO MIMIC AIRWAY RESISTANCE.

Tom J. Blackson[1], Joseph A. Ciarlo[1], Tim Cox[2], Thomas H. Shaffer[3]; [1]Allied Health Education, Christiana Care Health Services/DT&CC, Newark, DE; [2]Respiratory Care, duPont Hospital for Children, Wilmington, DE; [3]Nemours Research Lung Center, Nemours Biomedical Research, Wilmington, DE

Background: One ventilation strategy that is espoused for use with the 3100B high frequency oscillator (HFO), is to adjust the pressure amplitude (ΔP) based upon "wiggle factor". The assumption is that ventilation increases with increasing ΔP. We have previously reported a sigmoidal shaped pressure-volume response from the 3100B during ΔP adjustment using a Michigan test lung model with parabolic resistors (PR) to mimic airway resistance. One critique focused on the potential for the PR to cause the artifactual "flat" volume response at high ΔP. **Purpose**: To evaluate the pressure-volume characteristics of the 3100B HFO using two different bench models of airway resistance (RAW) in a simulated ARDS patient. **Materials & Methods**: A bench model of ARDS was created with a Michigan test lung, (Michigan Instruments, Grand Rapids, MI) set with a compliance of 0.02 L/cm H_2O. All trials were conducted with a mean airway pressure: 30 cm H_2O, bias flow: 30 L/min., and inspiratory time: 33%. We evaluated frequencies of 3 through 6 HZ in combination with ΔPs between 30 and 120 cm H_2O adjusted in 10 cm H_2O pressure increments. Raw was varied using PR #5 and #20 for one lung model and endotracheal tubes (Mallinckrodt, St. Louis, MO) with an ID of 6.0, 7.0, and 8.0 mm for the second model. A hot-wire anemometer flow sensor, (Florian, Acutronics), was placed between the ventilator "Y" and the airway resistor for volume measurements during each trial. Twelve consecutive volume measurements at each test condition were recorded and used for analysis. **Results**: Incremental changes in VT were inconsistent across the ΔP ranges under all test conditions. VT changes for a 10 cm H_2O ΔP change ranged from a minimum of -0.08 mL to a maximum of 58.75 mL with a PR #5 and from -3.92 mL to 65.17 mL with a #8 ET. Consistent with our previous bench model, VT reaches a plateau prior to achieving maximum ΔP under certain combinations of frequency and Raw. **Conclusions**: Fixed increases in ΔP produce inconsistent changes in VT delivered from the 3100B in both test lung models. Exhaled VT reaches a plateau despite further increases in ΔP under certain combinations of f and Raw. In the absence of bedside VT monitoring, VT plateau can not be identified via ΔP monitoring feedback provided by the 3100B HFO. Clinical management of ventilation and acid/base balance may be delayed if effective increases in VT delivery are presumed to result from increased ΔP adjustments. Clinical study is warranted.

Sponsored Research - None



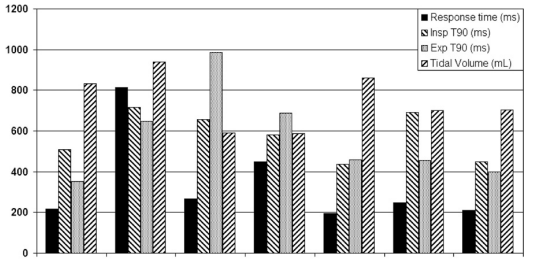
Representative P-V relationship comparing parabolic resistor #5 to #8.0 mm ID OET **679091**

OBJECTIVE MEASURES OF VENTILATOR PERFORMANCE USING THE PRESSURE SUPPORT MODE.

David M. Wheeler[2], Shannon E. Cook[1], Robert L. Chatburn[1]; [1]Respiratory Institute, Cleveland Clinic, Cleveland, OH; [2]Anesthesia Institute, Cleveland Clinic, Cleveland, OH

Pressure Support (PS) modes on different ventilators are designed with different operational specifications. Asynchrony can happen due to inappropriate thresholds for trigger, limit, and cycle, variables. The purpose of this study was to compare objective variables relevant to ventilator-patient synchrony and comfort in the pressure support mode with ICU ventilators. **METHODS:** Ventilators tested: Maquet Servo-i, Cardinal Health Avea and Vela, Hamilton G5, Dräger Evita XL, Puritan Bennett 7200 and 840. The ventilators were set in continuous spontaneous ventilation mode with pressure support = 5 cm H_2O and PEEP = 5 cm H_2O with default values for pressure rise time and cycle threshold. All were flow triggered at maximum sensitivity. They were connected to an ASL 5000 lung simulator (Ingmar Medical Inc.). The lung model was set with the following values: frequency = 15 breaths/minute, resistance = 3 cm H_2O/L/s, compliance = 60 mL/cm H_2O, sinusoidal effort with Pmax = 3.5 cm H_2O, 33% inspiration, 0% hold, 33% release, unassisted tidal volume = 209 mL. All variables were recorded with the ASL: trigger response time (in ms, from start of effort to return to baseline pressure), inspiratory and expiratory T90 (time to reach 90% of steady state inspiratory or expiratory pressure), patient work to trigger inspiration (mJ), peak inspiratory flow (mL/s), flow cycle threshold (% of peak flow), pressure drop during triggering (cm H_2O), tidal volume (mL). For each variable, mean values from 10 breaths were compared with one way ANOVA; $P < 0.001$ considered significant. **RESULTS:** The Figure shows major outcome variables and the ventilators differed significantly on all. Despite identical pressure settings, the ventilators delivered different tidal volumes (Vela highest, 547 mL; Avea lowest, 417). Trigger work was highest for the Vela (15.3 mJ) and lowest for the Evita XL (0.3). Peak flow was highest for the Vela (940 mL/s) and lowest for the G5 (592 mL/s). Cycling threshold was highest for the Servo i (37 %) and lowest for Avea (24 %). **CONCLUSIONS:** These results suggest that despite operating in the same mode and pressure settings, there was significant performance difference among these ventilators. We are conducting a further study to determine if there are subjective impressions of comfort that can be correlated with these objective measures. Studies like this may inform future design considerations.

Sponsored Research - None



679118

A PRELIMINARY COMPARISON OF DELIVERED TIDAL VOLUME AND ARDSNET RECOMMENDED TIDAL VOLUME AS DETERMINED BY IDEAL BODY WEIGHT IN MECHANICALLY VENTILATED PATIENTS.

Susan R. Whiddon, Randall Baker, Christen Adcock, Amanda Hadden, Robin Smith; Respiratory Therapy, Medical College of Georgia, Augusta, GA

Background: The first ARDSnet randomized controlled trial, demonstrated that patients receiving tidal volumes (Vt) of 6ml/kg experienced lower mortality compared to the group receiving tidal volumes of 12ml/kg. The tidal volumes delivered were based upon a calculation of ideal body weight (IBW) based on height. However, frequently there are no policies in place for using a tidal volume based upon a determination of ideal body weight. Therefore, many facilities do not have a specific protocol for determining a patient's ideal body weight, and ultimately, have no set method to determine an appropriate tidal volume. This study used a simple forearm measurement to estimate height in order to calculate each subject's IBW. Actual delivered volumes (ml/kg IBW) were compared with tidal volumes calculated to match the ARDSnet recommendation of 6 ml/kg IBW. Methods: After receiving IRB approval, a convenience sample of subjects was chosen from existing mechanically ventilated patients in the ICU at a community hospital in March, 2009. Subjects in the study included 20 adult ICU patients both male(n=15) and female(n=5), over 18 years of age receiving mechanical ventilation. Information collected included demographics data, delivered Vt, and mode of ventilation. Height was estimated using forearm length based upon a co-study that assessed height in recumbent adults. Ideal Body Weight was calculated using the Predicted Body Weight equation. Recommended Vt was based on IBW using ARDSnet recommendations of 6 mL/kg. Results: By comparing the recommended Vt based on the IBW measurement and the actual delivered Vt, we found that 40% of the patients were ventilated at tidal volumes of > 6ml/kg IBW, and 10% of the patients were being ventilated at tidal volumes of <6ml/kg. Conclusion: Forearm length is easily measured and can be integrated into the initial patient assessment. This study showed that 40% of patients are ventilated at higher volumes based on ARDSnet recommendations. The forearm measurement should be incorporated in the patient assessment to predict height in order to determine IBW, and therefore, deliver an appropriate Vt.

Sponsored Research - None

679787

REDUCED VENTILATOR LENGTH OF STAY (VLOS) THROUGH IMPLEMENTATION OF A SPONTANEOUS AWAKENING AND BREATHING TRIAL (SAT & SBT) WITH A MULTIDISCIPLINARY APPROACH.

Shane Blake[1], James Lamberti[1], Parul Shah[1], Monica Raich[1], Gail Bush[1], Jean Crow[1], Tom Arrowsmith[1], Dorothy Belkoski[2], Sonia Astle[2], Linda Schakenbach[2], Lavonia Thomas[2], Heather Russell[2], Jason Vourlekis[4], Christopher Michetti[3]; [1]Department of Respiratory Care Services, Inova Fairfax Hosptial, Falls Church, VA; [2]Critical Care and Neurosciences, Inova Fairfax Hospital, Falls Church, VA; [3]Trauma Services, Inova Fairfax Hospital, Falls Church, VA; [4]Critical Care, Inova Fairfax Hospital, Falls Church, VA

Background: Since 1997, our institution has implemented therapist-driven protocol for weaning from mechanical ventilation based on Ely et al (New Engl J of Med 1996; 335:1864-9). Results were initially favorable and were sustained. Refinements to this protocol have been implemented based on clinical evidence. For example, criteria for readiness to move to Spontaneous Breathing Trials (SBT) were modified based on the ACCP/AARC Guidelines (2001). In 2007, our institution noticed an increased time on ventilation (VLOS). Based on continuous monitoring of the weaning protocol, these aberrations were identified to be in relation to sedation use. This resulted in the inability to move individuals to SBT. Method: To address this disconnect between sedation and SBT, a multi-disciplinary team (Respiratory Therapist, Physician and Nurse) collaborated together to address the increased VLOS in relation to sedation. Based on the recent clinical trial of Girard et al (Lancet 2008; 371:126-134) a sedation protocol was established to include spontaneous awakening trials (SAT) and new criteria for SBT initiation. The team piloted this new protocol in a medical surgical ICU for up to 5 months before implementing house-wide (6 ICUs) to 122 adult critical care beds. Results: After implementing this protocol, the first quarter of 2009 showed a decrease in VLOS to 5.8 days. From 2007 through 2008 (2 years), the average VLOS was 6.9 days. We noticed similar results when comparing overall length of stay (LOS) of 15.4 days for 2008 (1 year) to that of the first quarter of 2009. The overall LOS decreased to 14.3 days. Conclusions: These results are preliminary but show a favorable trend in lowering VLOS and overall LOS. These results also show that there is an ability to duplicate the lowering of VLOS based on the methodology established by Girard et al (Lancet 2008). Our institution also was able to duplicate the multidisciplinary team approach to successful liberation from mechanical ventilation. There are also favorable financial outcomes with a linked protocol of sedation evaluation and SBT. Based on Dasta et al (Critical Care Med 2005), it has been projected that the incremental cost of mechanical ventilation in the ICU is $1,522/day. Based on our analysis, we projected a potential cost savings with the implementation of this new protocol.

Sponsored Research - None

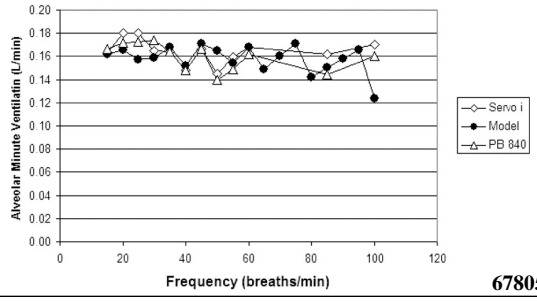
679871

MID FREQUENCY VENTILATION: OPTIMUM SETTINGS FOR NEONATES.

Robert L. Chatburn[1], Eduardo Mireles-Cabodevila[2]; [1]Respiratory Institute, Cleveland Clinic, Cleveland, OH; [2]Pulmonary and Critical Care Medicine, University of Arkansas for Medical Sciences, Little Rock, AR

We previously described Mid Frequency Ventilation (MFV) as a means for optimizing alveolar ventilation while minimizing the inspiratory pressure change during pressure controlled ventilation of adults with acute respiratory failure (Respir Care 2008;53:1669 –1677). This study expands the earlier study to include ventilation of neonates with respiratory distress syndrome (RDS). The purpose of the study was to compare the performance of actual ventilators with the mathematical model of MFV. Our specific hypothesis was that modern ventilators are capable of delivering the relatively higher frequencies suggested by MFV than those used conventionally. **METHODS:** We first developed an algorithm that seeks the optimum frequency using a required alveolar minute ventilation (AMV) prediction. The prediction was based a patient weight of 1.0 kg (J Clin Mon Comput 2009;23:93). The algorithm increases frequency and decreases tidal volume iteratively until AMV can no longer be sustained. The MFV mathematical model was set to resistance = 125 cm H_2O/L/s and compliance = 0. 5 mL/H_2O, dead space fraction = 0.45. The model performance was then compared to actual ventilators (Maquet Servo i and Puritan Bennett 840) using the same algorithm. The ventilators were connected to a lung simulator (ASL 5000, IngMar Medical Inc.) set to the same parameters as the math model, with no simulated patient effort. **RESULTS:** The ability of the model and the ventilators to maintain a target AMV of 0.16 L/min is shown in the Figure. The math model predicted an optimum frequency of 95 breaths/min and tidal volume of 4.4 mL. Both ventilators were able to sustain the target AMV at a setting of 100 breaths/min, due to a slight overshoot in the airway pressure waveform at the start of inspiration. Tidal volumes at this frequency were 4.6 mL (PB 840) and 4.7 mL (Servo i). **CONCLUSIONS:** This study shows that MFV offers theoretical advantages, based on patients' lung mechanics, compared to current practice. The optimum frequency in this study was higher and optimum tidal volume lower than the upper limit (6 mL/kg) of current recommendations for neonates with RDS (60/min and 6 mL/kg respectively; Semin Perinatol 30:192-199:192). Optimum tidal volume during MFV was much lower than actual values reported (8.4 mL) in a recent study (Pediatrics International 2007; 49:631–636). Furthermore, current generation ICU ventilators are capable of delivering MFV at the theoretical optimum values.

Sponsored Research - None



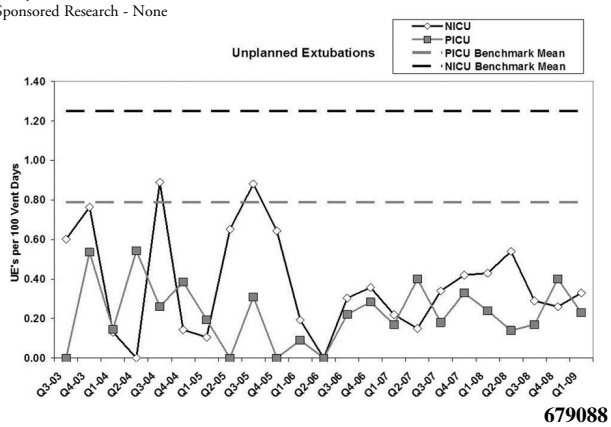
678052

UNPLANNED EXTUBATIONS (UE) IN NICU AND PICU AS A QUALITY MEASURE.

Dave N. Crotwell, John Salyer; Respiratory Care, Seattle Children's Hospital, Seattle, WA

Background: On-going tracking of UE is being used as a measure of clinical quality and patient safety in NICU and PICU populations. We report the methods and results of our program to measure and manage unplanned extubations. Methods: UE's are reported by bedside personnel via an electronic incident reporting system. For the first 3 months of its use, UE's reported in our NICU and PICU were compared to UE's measured by manual review of every ventilator flow sheet to establish the validity of the reporting system. Following this, UE's are tabulated for each quarter and indexed for each 100 ventilator days in each unit ([UE ÷ Ventilator Days] x 100). These rates are compared to published data and commercially available clinical benchmarking data. A mean benchmarking value was calculated by taking quarterly UE's for each reporting hospital in the benchmarking group for one year and calculating the mean UE rate for all hospitals. These findings are reported to the medical and nursing leadership of the various units. We report data for the period from 3rd quarter of 2003 to the 1st quarter 2009. Results: Results are displayed in the graph below. Conclusion/Discussion: In our NICU and PICU we utilize standard airway taping techniques (Loughead et al. Jt Comm J Qual Patient Saf 2008:34(3):164-70) as well as regularly scheduled airway security checks. We speculate that our low UE rate is a result of several factors. Our standardized taping method has been shown to result in fewer UE's. Our clinicians are very diligent in assessing airway security during ventilator system checks. Also, beginning in 2005 we experience increased and sustained success in recruiting of new RT's, which allowed us reduce our heavy reliance on agency staffing. Also, our PICU implemented a sedation management protocol in the beginning of 2007 and we suspect that this has also helped decrease the variability in our UE rates.

Sponsored Research - None



679088

EVIDENCE BASED INFANT TODDLER RESPIRATORY PROTOCOLS.

Thomas A. Seidensticker; Respiratory Care, Rush Copley Medical Center, Carol Stream, IL

Introduction: Infants and Toddlers admitted to the hospital for treatment of RSV/bronchiolitis are often placed on bronchodilator therapy as a mainstay treatment modality. A review of the literature found no evidence for the routine use of bronchodilators for this disease entity in this age group. Numerous studies have shown that outcomes for length of stay and number of days requiring supplemental oxygen were no different between infants treated with nebulized albuterol, racemic epinephrine or placebo (normal saline). Therefore, to better manage the use of bronchodilators as treatment modality in the RSV/bronchiolitis patient group,a bronchiolitis respiratory protocol utilizing a point system was implemented to classify infants into categories based on severity of symptoms:intensity of wheezing,depth of retractions,nasal flaring, tracheal tugging, and the amount of oxygen needed to maintain O2 sats above 92%. The patients with point totaling 0-2 received albuterol treatments only on an as-needed (prn) basis for documented wheezing. Since infants are obligate nose breathers,the copious nasal secretions which is the hallmark of RSV/bronchiolitis interfers with oxygenation and ventilation in this age group. Emphasis was shifted from bronchodilator therapy to clearing of nasal secretions by suctioning with acorn nasal aspirators or bulb syringes. Chest physical therapy was employed only for documented lung consolidation via chest xray, and automatically discontinued upon resolution of the condition. Results: A retrospective study of 37 patients admitted to the pediatric unit at Rush Copley Medical Center prior to the use of the respiratory bronchiolitis protocols were compared to 39 patients whose respiratory modalities were managed with the bronchiolitis clinical pathway. The ages of the two groups were statistically the same (7.2 months vs 7.7 months, p >0.05). There was no difference in length of stay (2.2 days vs 2.6 days, p > 0.05). However, there was a significant reduction in the average number of nebulizer treatments per admission, from 12.1 to 8.5 treatments. This reduction in the number of treatments per admission translated into a significant cost savings over the RSV season. The protocols were later expanded to all infants and toddlers who were admitted to the pediatric unit and placed on respiratory care modalities.

Sponsored Research - None

678395

HIGH FREQUENCY VENTILATOR (HFV) TIDAL VOLUME (TV) DISTRIBUTION TO INHOMOGENEOUS LUNGS IN A NEONATAL TEST LUNG MODEL.

Robert Gillette; Neonatology, Wilford Hall Medical Center, San Antonio, TX

BACKGROUND: Gas exchange with HFV is believed to depend on frequency (F) x TV^2. Distribution of TV between lung regions with inhomogeneous compliance (C) and resistance (R), common in severe disease, and its variation with F and pressure amplitude (ΔP), are not well studied. METHOD: A Sensormedics 3100A or Percussionaire Bronchotron HFV was connected to two 3.0 L calibration syringes used as rigid-container-model test lungs with C of 0.15-2.1 ml/cmH2O set by varying their volumes, via a 4 mm endotracheal tube, a 15 mm Y, and parabolic airway R's of 0-250 cmH2O/L/s in line with each lung. TV to each lung was measured with a Florian hot wire anemometer (Acutronic), varying F (keeping either ΔP or $FxTV^2$ constant) or varying ΔP (with F constant), at various C and R of each lung. Mean airway pressure (MAP) and ΔP were measured proximally and in each lung. RESULTS: With bilateral very low R, distribution of TV reflected the ratio of C between lungs over a wide range and all F's. TV distribution between lungs with equal high R (>200) was nearly equal, more so at higher F and more-equal C. With very unequal R (e.g. 5 vs 200) TV was more equally distributed at lower F if C was poor to moderate/equal bilaterally or inhomogeneous with R/C impedance mismatch, but if C was higher/equal, or unequal but R/C-matched, TV mostly went to the low-R side, independent of F and minimally reflecting C inequality. With low-moderate, equal to moderately-unequal R, and matching-sided unequal C, TV was more equally distributed at higher F and at more-equal C, as it was when lungs were mismatched for R and C but with moderately inhomogeneous R. Dependence of TV distribution on F was similar whether ΔP or $FxTV^2$ was held constant. Holding F constant while varying ΔP, TV was more evenly distributed at higher ΔP when inhomogeneity was mostly in C, and at lower ΔP if mainly R inequality. MAP and PA were always lower in lungs than proximal, and relative MAP and ΔP between lungs depended on R and C configurations and F. Results were similar for both ventilators. CONCLUSIONS: Distribution of TV between lungs in this physical model depended markedly on inhomogeneities of R and C. Dependence on F and PA varied with specific combinations of R and C. Electrical circuit analog theory approximated the findings. Speculatively these results may favor clinical use of higher F in early (low R, inhomogeneous C) premature lung disease and lower F with airway disease (highly-inhomogeneous R).

Sponsored Research - None

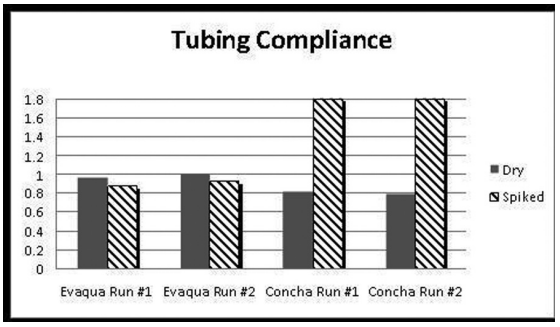
679258

NEONATAL MECHANICAL VENTILATOR TUBING COMPLIANCE, WHEN SHOULD CALCULATIONS BE PREFORMED?

Keith Hirst, Brian Walsh; Department of Respiratory Care, Childern's Hospital Boston, Boston, MA

BACKGROUND: Newer generation ventilators utilize a tubing compliance factor from the pre-use checkout process to determine effective tidal volumes. Sometimes this pre-use check is preformed in accordance to the manufacturers' recommendation; many times it is performed when the ventilator is turned around without water in the active humidification system. Additionally, many institutions have adopted the CDC recommendation for changing ventilator circuits PRN. This change in practice is supported by many departments as a cost saving initiative; however, from a performance perspective concerns have developed. We hypothesized that water in the chamber of two types of humidification systems as well as duration of use will not significantly affect the compliance factor of the ventilator circuits. METHOD: Two Servo-i ventilators were set up: one with a Concha III, one with Fisher Paykel 850 and a pre-use check was performed. For both humidification systems, a circuit compliance calculation was performed when the circuit was dry, filled with water at room temperature, then heated to 37C following one hour, three and seven days. Circuits were exposed to average ventilator settings of SIMV-PC RR-30 PIP-20, PEEP-5 and FIO2-.40. A Paired t test was used for statistical analysis. RESULTS: See figure 1. It should be noted that we had to clamp off the Concha bottle in order to get the Servo-i to calculate circuit compliance. Due to the fact that this is not how the Servo-i is operated in the clinical setting, we performed a hand calibration using a 150 mL calibrated syringe to 50 cmH2O and recorded the compliance factor. CONCLUSION: There was a statistically significant difference between the F&P dry versus wet; however it doesn't appear to be clinically significant unless your birth weight is < 1 kg. The Servo could not calculate the Concha system with the water bottle inline, which is very concerning as the compliance factor averages 1.0 mL/cmH2O difference between clamped and open to the water sources. This is clearly clinically significant for the entire neonatal population.

Sponsored Research - None



679317

COLLECTION OF EXHALED BREATH CONDENSATE IN MECHANICALLY VENTILATED PEDIATRIC PATIENTS.

Emily B. Martin[1,2], Amy L. Robinson[2], Roby Greenwald[3], Rigby R. Mark[1,2], Atul Vats[1,2]; [1]Pediatric Critical Care, Emory University, Atlanta, GA; [2]Children's Healthcare of Atlanta, Atlanta, GA; [3]Emory University School of Public Health, Atlanta, GA

Background: Collection and analysis of exhaled breath condensate (EBC) has become a rapidly growing area of study. Studies of EBC suggest that changes in pH, nitric oxide, and leukotriene levels correlate with airway inflammation. Studies in mechanically ventilated adult patients have demonstrated that EBC collection from the ventilator circuit is safe and produces samples adequate for analysis, although methods of collection vary. Collection of EBC from the ventilator circuit has been previously been described, but these methods often have limited analysis capability. Data using these techniques in pediatric patients is also limited. Method: We describe a method for collection of EBC from patients in a pediatric intensive care unit being mechanically ventilated using the Servo-i ventilator (Siemens) and RT236/RT240 Evaqua ventilator circuits (Fisher & Paykel). We use the RTube EBC collection device (RTube; Respiratory Research, Inc.) attached to the exhalation limb of the circuit at the wye connector. The mouthpiece is easily removed from the RTube, which was then adapted to the circuit using elbow connectors included with the RT240. The RTube's aluminum sleeve allows for collection at -4 to -20sC. Collection was performed for 20-40 minutes (depending on the patient's minute ventilation), resulting in 1-2 mL of EBC. Samples were frozen to -15sC after collection and then stored at -80sC prior to undergoing laboratory evaluation for pH, nitric oxide reaction products, cytokines, leukotrienes, ions (sodium, chloride, potassium). Results: EBC was collected successfully from 8 patients ages 7 months to 16 years. One additional collection from a 7 month old infant had to be stopped early due to patient agitation and desaturations, which was not felt to be related to the EBC collection. The other 8 patients tolerated collection well with no significant changes in cardiorespiratory status or end tidal CO2 measurements. Early data analysis from the 8 samples, compared to that obtained from spontaneously breathing patients, has shown similar levels of nitric oxide products, ions, and formic acid, but lower levels of ammonia. Conclusion: Collection of EBC from mechanically ventilated pediatric patients is safe and produces samples adequate for analysis by adapting the R tube collection device to the exhalation limb of the RT236 Evaqua ventilator circuit. Collection with the RTube allows for both storage and more extensive analysis of the collected EBC.

Sponsored Research - None

679417

IMPROVING A PEDIATRIC RESPIRATORY CARE CONSULT SERVICE FOR AIRWAY CLEARANCE: A FOUR YEAR REVIEW.

Kathleen Deakins, Timothy Myers, Mary Lou Drahnak, Marsha Rogers; Pediatric Respiratory Care, UniersityHospitals Rainbow Babies & Children's Hospital, Cleveland, OH

Introduction: The Pediatric Respiratory Care Consult Service for Airway Clearance is a clinical program designed to assist the physician in developing a Respiratory Care plan for airway clearance for the patient. From January 2005 to May 2009, 1,286 consults for airway clearance have been performed in pediatric patients. Cardiothoracic surgery patients were omitted from this population by request. Compliance with the four aspects of care have been addressed since the initiation of the program: performing initial consult within a specified time period (from the time it was ordered), notifying the physician about the respiratory plan of care, choosing the appropriate treatment using the airway clearance algorithm guideline, and follow up within 72 hours after therapy is started. The overall compliance rate was tracked since 2005 to determine whether therapists could meet these expectations. Since the beginning of program the compliance rate for all of these areas had been 70%. Methods/Intervention: In 2008, a performance improvement project was initiated with the intent to improve compliance with the four mechanisms of the consult service. In July 2008, an intervention including face-to-face education and a PowerPoint presentation was done to re-emphasize the program objectives. A written exam including case scenarios and program details was given to all therapists. A passing score of 75% was required by all therapists. A tracking mechanism was employed to remind therapists to schedule follow up within a specified time period. Division nursing staff and physician education was also completed. Results: 98% of therapists passed the ACT exam. Compliance has gradually improved from 62% in 2005 to 71% in 2008 and has averaged 80% compliance (241 consults) over the past eight months (October 2008-May 2009) following the intervention. Conclusion: The Respiratory Care Consult Service provides a valuable service to assist the physician in determining the appropriate ACT therapy for the patient. Education interventions and testing has helped achieve better compliance with its four primary goals.

Sponsored Research - None

679705

SHOULD THE FISHER PYKEL RT 236 INFANT CIRCUIT BE RE-TESTED AFTER HEATING UP TO COMPENSATE FOR POSSIBLE CHANGES IN TUBING COMPLIANCE?

Matt McNally; Respiratorry Care, Dartmouth Hitchcock Medical Center, Lebanon, NH

Background: When using the Servo I mechanical ventilator (Maquet Solna Sweeden) there are two options in measuring Tidal Volumes (VT) in the infant mode, proximal to the airway and calculated based on the circuit compliance factor. Our question was when using the internal method, does using a heated circuit over time change the compliance factor and, if it does, when would be the best time to retest the circuit? Methods: We tested the Fisher and Pykel RT 236 circuit (Auckland, New Zealand) on the Servo I mechanical ventilator and recorded the compliance factor at one hour, twelve hours, twenty four hours and twenty eight day intervals. We used twenty eight days because that is the time that we change our ventilator circuits at our institution. Results: The initial compliance factors were calculated between 0.99 ml/cmH2O and 1.01 ml/cmH2O. After one hour the factor increased to 1.05 ml/cmH2O and remained at 1.05 ml/cmH2o (+/- 0.01ml/cmH2O)consistantly until day twenty eight. Conclusions: Based on our findings, we would recommend retesting the circuit one hour after the circuit has been warmed since the compliance factor does not change significantly and not after that. Although 0.04 to 0.06 ml/cmH2O seems small, in relation to the VT of an <1000 gram infant can account for one third of their VT if not corrected.

Sponsored Research - None

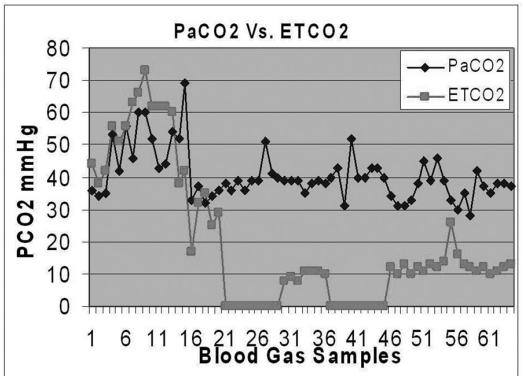
679709

CAPNOGRAPHIC MONITORING OF POST-OP NORWOOD STAGE 1 DURING EXTRACOPOREAL LIFE SUPPORT (ECLS).

Roy Ramirez, Sam Frens, John Cleary, James Cappon; Respiratory Care Services, CHOC Children's Hospital of Orange, Orange, CA

INTRODUCTION: Following Norwood Stage 1 surgical palliation of Hypoplastic Left Heart Syndrome (HLHS), pulmonary blood flow (Qp) is critically dependent on a synthetic shunt between the innominate artery systemic circulation and the ipsilateral pulmonary artery. By utilizing capnography in such patients and measuring end tidal CO2 (ETCO2), we can use Alveolar Minute Ventilation and Volumetric CO2 monitoring to determine if changes in CO2 elimination are due to ventilation or Qp alterations1. CASE SUMMARY: A term 3.1 kg neonate with prenatally-diagnosed HLHS underwent Norwood repair including a 3.5 mm "central" shunt (CS). Due to post-operative instability, the patient was placed on Veno-Arterial (V-A) ECLS, including restrictive band placement around the CS. Post-op day (POD) 2, the ETCO2 decreased to 0 mmHg (Fig.) with unchanged blood gas results, including normal PaCO2. Echocardiography demonstrated decreased CS flow. The restrictive band was removed and ETCO2 increased to10 mmHg for a few hours. On POD 3, a CT angiogram revealed absence of blood flow in the CS and proximal pulmonary arteries, with good pulmonary venous blood return. The patient was taken to the OR on POD 4 for CS thrombectomy, with subsequent modest improvement in ETCO2 to 12 mmHg. Subsequent ECLS weaning efforts were unsuccessful however, and ETCO2 remained extremely low, further raising the question of adequate Qp. The patient was taken to the cardiac cath lab POD 6, where diffuse thrombi within the shunt were noted and addressed. DISCUSSION: Capnography is useful in post-operative cardiac management, especially in cases with V-A ECLS support. Low or absent ETCO2 with a normal PaCO2 in the ECLS patient suggest a dramatically reduced Qp2; in this case, due to an occluded CS. V-A ECLS can both mask and support post-operative cardiac patients with the pathophysiological consequences of diminished or absent Qp.

Sponsored Research - None



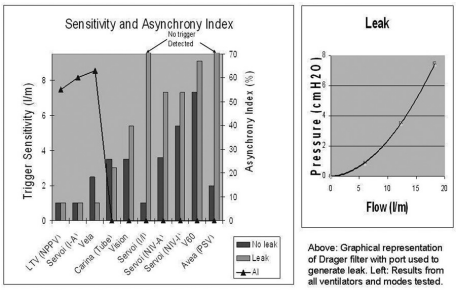
679775

TRIGGER SENSITIVITY OF NON-INVASIVE VENTILATORS IN A PEDIATRIC LUNG MODEL.

Craig D. Smallwood, Brian K. Walsh; Respiratory Care, Children's Hospital Boston, Boston, MA

Background: Non-invasive ventilation (NIV) has been used with increasing success in children and adults with moderate acute or chronic respiratory insufficiency. However, in the smaller pediatric patients (<20kg) many cannot trigger the ventilator and require mandatory rates which may elicit discomfort. The trigger sensitivity of current NIV devices may not be responsive enough to meet the requirements of these smaller patients requiring increase sedation and potentially invasive ventilation. In addition some ventilators have sufficient trigger sensitivity in a sealed system, but when a leak is present may auto-trigger and hyperventilate the patient. These concerns lead us to bench test several NIV and ICU ventilators to help determine which device may provide the best coordination of effort and support in our patient population. Methods: Six ventilators were tested: Respironcs Vision and V60, Draeger Carina, Viasys Avea and Vela, Maquet Servoi, and Pulmonetics LTV 1200. Following manufacture pre-use set-up, each ventilator was tested with an adult circuit duel limb (ICU ventilators) or single limb (NIV ventilators) circuit connected without a humidifier. An active servo lung (ASL 5000) was used to assess triggering of the previously listed ventilators. The lung model was set to attempt 15 bpm of ramping flow effort from 1 to 10 L/min. The flow at which the ventilator triggered 80% or more of the test breaths was deemed successful. This test was performed both with and without an external circuit leak. The number of breaths that triggered the ventilator was recorded. Asynchrony was observed and recorded and the asynchrony index (AI) was calculated for each ventilator. Results: Please see graph Conclusion: Presently, critical care ventilators are the most sensitive. However, in the setting of a moderate leak auto-triggering may outweigh the potential benefits of a more sensitive trigger. Further development of non-invasive ventilators is needed to meet the specific triggering requirements of pediatric patients in the presence of a leak.

Sponsored Research - None



Above: Graphical representation of Drager filter with port used to generate leak. Left: Results from all ventilators and modes tested.

NPPV = Non-invasive positive pressure ventilation, I/A = Invasive Adult Pressure Support, I/I = Invasive Infant Pressure Support, NIV-I = Non-invasive Infant Ventilation, NIV-A = Non-Invasive Adult Ventilation

679870

USE OF AN ANESTHESIA MACHINE FOR ISOFLURANE DELIVERY IN A PEDIATRIC INTENSIVE CARE UNIT.

Shawn Colborn, Michael Duff, Angela Hedgman, Patricia Achuff, Ann Marie Wallack, Susan Ferry, Richard Lin; Respiratory Care, The Children's Hospital of Philadelphia, Philadelphia, PA

Background: The use of isoflurane in the Pediatric Intensive Care Unit (PICU) is not a common practice. Cost of the drug, need for specialized equipment and training contribute to its infrequent use. Indications for isoflurane therapy outside of the operating room (OR) can include status asthmaticus, status epilepticus, and inability to maintain sedation with intravenous medications. Anesthetic delivery outside the OR requires the Respiratory Care Practioner (RCP) to operate under the auspices of an anesthesiologist. Currently, there are no critical care ventilators that have the ability to add a vaporizer to deliver volatile anesthetics. Now that older technology is outdated, anesthesia machines have become the only viable option. Incorporating a semi-closed circle breathing system into the practice of the PICU staff requires education and vigilance by a trained practioner. This presents new challenges for practioners who are not familiar with a circle breathing system. Methods: RCPs were trained on the use and functionality of the anesthesia system. The primary role of the RCP is to monitor the patient, adjust ventilator parameters and maintain the vaporizer according to orders from physicians in the Department of Anesthesia and Critical Care Medicine. Education sessions where held for staff who provide care for patients in the PICU. A 2 person check needs to be performed when any dose adjustments are made to the isoflurane settings. Results: There have been two patient incidents to date. One patient had fresh gas flowrates increased due to increasing oxygen requirements and the vaporizer emptied faster than expected. The anesthetic gas monitor alarmed appropriately and there was no harm to the patient. The second incident involved higher than desired nitric oxide concentrations. The desired dose was 10 ppm and the analyzed dose was 18 ppm. The situation was resolved by increasing the fresh gas flow. There have been no issues with CO2 rebreathing to date. Conclusions: RCPs can be trained to safely deliver isoflurane therapy under the direction of an Anesthesiologist. Introduction of a circle breathing system creates new challenges in critical care for the multi-disciplinary team.

Sponsored Research - None

679978

NITRIC OXIDE ADMINISTRATION VIA AN ANESTHESIA MACHINE BY RESPIRATORY THERAPIST IN THE PICU AND OPERATING ROOM.

Shawn Colborn[1], Natasha Fencl[1], Richard Lin[2]; [1]Respiratory Care, The Children's Hospital of Philadelphia, Philadelphia, PA; [2]Department of Anesthesia and Critical Care Medicine, The Children's Hospital of Philadelphia, Philadelphia, PA

Background: Nitric Oxide (NO) administration is an accepted therapy for patients with presumed or known pulmonary hypertension and can be used to help improve oxygenation. Current systems to deliver NO supplied by Ikaria (Clinton, NJ) utilize servo-controlled heated wire pneumotachs to adjust the flow of NO into the breathing gas. These systems were designed to administer NO in a breathing system that is "open". Use of NO with an anesthesia machine can be more challenging because the breathing system is "semi-closed" and recirculates gas in order to conserve inhalational anesthetics. Delivery of NO into this type of requires technical knowledge about the functionality and interactions of both systems. Methods: To better understand these interactions, we connected an Apollo anesthesia machine to a test lung, a NO delivery system and a source of carbon dioxide to evaluate recirculation in the system. CO2 was bled into the test lung connected to the anesthesia machine and the soda lime was removed to allow CO2 to recirculate. Fresh gas flowrates were increased until the inspiratory CO2 returned to 0 torr. The assumption was made that system was open thus bypasing the rebreathing loop. This test was repeated using the iNOVent® to test the behavior of NO in the system and the efficiency of soda lime. Results: See Table 1 Conclusions: Soda lime is an efficient absorber of CO2 and NO2, but not NO. FGF should exceed the patients minute ventilation or increased until desired inhaled NO concentrations are within desired limits. Low FGFs can create increased NO2 levels and NO levels in excess of 100 ppm causing the iNOVent® delivery system to shutdown. Limitations: We did not test the system using active humidification as it would be utilized in the PICU. Also, since our lung was not gas permeable, the levels of NO and NO2 seen in this model may be higher than what would be seen clinically.

Sponsored Research - None

FGF Calculator Reading	Soda lime position	NO Set	NO Analyzed	NO2 Analyzed
Efficient	Out	20 ppm	68 ppm	> 10 ppm
Efficient	In	20 ppm	58 ppm	3 ppm
2 x VE	In	20 ppm	22 ppm	< 1 ppm

680005

ELECTRICAL ACTIVITY OF THE DIAPHRAGM DURING EXTUBATION READINESS TESTING IN THE PEDIATRIC PATIENT.

Brian K. Walsh[1,2], Gerhard Wolf[2], Michael Green[2], John Arnold[2,1]; [1]Respiratory Care, Children's Hospital Boston, Boston, MA; [2]Critical Care, Children's Hospital Boston, Boston, MA

Introduction: Diaphragmatic function plays an important role in respiration and the patient's ability to coordinate with and liberate from mechanical ventilation. Diaphragmatic fatigue or ventilator induced diaphragm dysfunction may be primarily responsible for weaning or extubation failures. Investigators have proposed several strategies that attempt to predict extubation success, but none have been shown to be superior to individual expert clinical judgment. The present study was designed to characterize the electrical activity of the diaphragm during extubation readiness testing (ERT). Understanding whether diaphragmatic function is a predictor of extubation readiness or extubation failure could add substantial knowledge to the field of weaning pediatric patients with acute lung injury. Methods: All intubated and mechanically ventilated patients who are eligible for ERT between the age of one day and 18 years were considered eligible for this study. An ERT is a weaning challenge conducted on most patients without a cardiac or chronic respiratory disorders (neuromuscular, CF, etc,). In short, this test is conducted once the patient has plateau in their ventilation course (FIO2 < 0.5 and PEEP < 8) and is spontaneously breathing. They are switched to minimum PSV with a pressure set according to their ETT size and tested for a maximum of 2 hours. A pass or fail judgement is assigned based on objective measurements by the RT. All Edi, ventilatory parameters and spirometry measurements were recorded with the Servo-i ventilator. Prior to the ERT, a size appropriate multiple-array esophageal electrode (Edi catheter)was placed according to the manufacturer's recommendations and the ICU protocol. Four Edi measurements were taken. One measurement was recorded prior to the initiation of the ERT (Pre), one at an hour (H1) following the start of the ERT, one at two hours (H2) and one 30 minutes following extubation (Post) or return to prior mechanical ventilation support. Preliminary Results: 16 patients were enrolled from age 1 week to 17 years of age. See figure 1 for details of Edi during ERT. See figure 2 for details of Edi following extubation. Conclusion: Patients who passed the ERT increased their Edi from baseline more than those who failed did. The lack of response in electrical activity of the diaphragm may be attributed to over sedation. Interesting enough Edi may be an indication of extubation failure as well.

Sponsored Research - Maquet provided Edi monitoring supplies used in this research project.

Figure 1

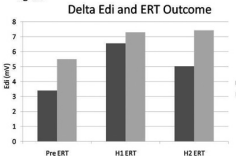
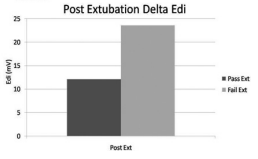


Figure 2



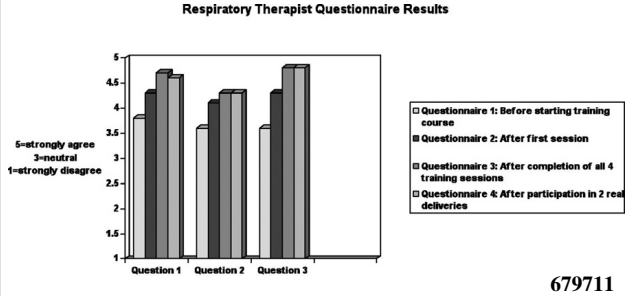
680024

TRAINING THE RESPIRATORY THERAPIST FOR A SPECIAL DELIVERY UNIT.

Leane Soorikian, Anne Ades; Children's Hospital of Philadelphia, Philadelphia, PA

BACKGROUND The Children's Hospital of Philadelphia opened a Special Delivery Unit in June 2008 for a high risk population of neonates. Respiratory therapists who would be caring for these neonates had no recent experience in delivery room resuscitations. A 16 hour training course was developed to help prepare them for this new experience. METHOD The training course consisted of seven didactic lectures on specific diagnoses, anticipating delivery room needs, special delivery room interventions outside of traditional Neonatal Resuscitation Program, and family interactions. Thirteen high fidelity simulations focused on diagnoses discussed in previous didactic lectures while incorporating Neonatal Resuscitation Program algorithms and reinforcing behavioral and teamwork skills. The training course was divided into four sessions. A Likert scale questionnaire was administered to respiratory therapists to assess comfort level in delivery room resuscitation. The questionnaire was administered before and after session one, after session four, and after participating in two real deliveries. RESULTS Ten respiratory therapists completed the course over four months. Prior to training, respiratory therapists were comfortable (score 3.8) participating in resuscitation of a normal newborn in the delivery room, comfortable (score 3.6) in resuscitation of neonates with congenital anomalies, and had a fair understanding (score 3.6) of their role in the delivery room. After the first session, the scores slightly improved to 4.3, 4.1 and 4.3. Post training course, respiratory therapists were very comfortable (score 4.7) in resuscitation of a normal newborn, very comfortable (score 4.3) participating in resuscitation of neonates with congenital anomalies, and had a good understanding (score 4.8) of their role in the delivery room. After two real deliveries there were minimal changes in respiratory therapist comfort level. CONCLUSION Increases in respiratory therapist comfort level were noted over the first three sessions but not impacted with actual delivery room experience. The simulation training and reinforced behavioral and teamwork skills adequately prepared the respiratory therapist for their role in the special delivery room.

Sponsored Research - None



679711

UTILIZATION OF INHALED NITRIC OXIDE (INO) AT A CHILDREN'S HOSPITAL.

John Salyer, Dave N. Crotwell; Respiratory Care, Seattle Children's Hospital, Seattle, WA

Background: iNO is a very costly intervention. We report a three years of data on the utilization of iNO in a pediatric hospital. Methods: Our hospital has 254 beds. ICU beds are as follows; PICU 16, NICU 19, CICU 16. Financial and administrative records were used to determine length of therapy in hours, number of patients treated, and location of therapy. Results: Results are described in the table below. Discussion: We have experienced a significant increase in the numbers of patients treated with iNO, which has resulted in a doubling of our iNO expense. This was most pronounced in the CICU population. There has also been a large increase in the length of therapy among NICU patients. Anecdotal reports from our clinical staff indicate that weaning of iNO is done very conservatively and there is a consensus that a more systematic approach to weaning iNO would help to reduce inappropriate utilization of the drug and thus reduce costs.

Sponsored Research - None

	2006	2007	2008	Forecast 2009	
	# Patients				% Change
CICU	31	41	57	72	132%
NICU	31	24	35	30	-3%
PICU	17	20	15	30	76%
Total	**79**	**85**	**107**	**132**	**67%**
	Total Hours of Treatment				
CICU	4,780	6,951	8,577	10,267	115%
NICU	3,098	1,964	4,487	4,848	56%
PICU	2,355	2,014	1,989	3,596	53%
Total	**10,232**	**10,929**	**15,053**	**18,710**	**83%**
	Mean Length of Treatment				
CICU	154	170	150	143	-8%
NICU	100	82	128	162	62%
PICU	139	101	133	120	-13%
Total	**130**	**129**	**141**	**142**	**9%**
	Total Costs				
CICU	$229,081	$381,216	$567,625	$625,763	173%
NICU	$210,688	$180,411	$311,641	$329,588	56%
PICU	$142,000	$201,630	$135,185	$211,097	49%
Total	**$581,769**	**$763,257**	**$1,014,451**	**$1,166,447**	**101%**

680183

PHYSIOLOGICAL BENEFITS OF A PULMONARY REHABILITATION PROGRAM.

Dave Burnett[1,2], Jane Burnett[2], Steve Burns[1,2]; [1]University of Central Missouri, Warrensburg, MO; [2]Summit Rehab, Lee's Summit, MO

Purpose: The purpose of this study was to determine the physiological benefits of a pulmonary rehabilitation program. This study examined the pre and post rehabilitation measures related to Endurance Training (ET) versus ET combined with Functional Strength Training (FT) in subjects with chronic obstructive pulmonary disease (COPD). Methods: Sixteen subjects were divided into two equal groups. Control group (n=8) consisted of ET only and experimental group (n=8) performed ET+FT. Subjects were selectively put into groups to facilitate a homogeneous pre-rehabilitation design. Mean ages in ET and ET+FT were (77 + 4) and (74 + 7) respectively. Both ET and ET+FT groups performed three functional strength tests; 1) Sit-to-Stand, 2) Lift-Carry, and 3) Stair Climb. Lift-Carry and Stair Climb tests were one minute and measured distance in feet and number of stairs climbed and descended. A physiological test on a cycle ergometer was performed on each subject pre and post rehabilitation during separate days from the functional strength tests. Measurements obtained during the physiological tests included maximum oxygen consumption (VO2), minute ventilation (VE), and maximum sustained watts. Rehabilitation took place twice a week x 8 weeks and progressed in intensity based on each subjects exercise tolerance measured by the Borg dyspnea scale. Subjects in the ET group participated in exercise on a treadmill, cycle ergometer, and an arm ergometer. In contrast the ET+FT group performed exercise training on a treadmill, cycle ergometer, and all three functional strength modalities including Sit-Stand, Lift-Carry, and Stair Climb. Exercise time for each group remained constant while the ET+FT group substituted FT exercise time for ET. Results: After 16 sessions subjects in the ET+FT group demonstrated a significant ($p < 0.05$) increase in Stair Climb (48 vs. 68 stairs) and Lift-Carry (109 vs. 146 feet). No significant differences were noted in the ET group during this study. Conclusion: Subjects diagnosed with COPD improve Stair Climb and Lift-Carry functional ability when functional strength training is introduced into their rehabilitation program design. Key words: respiratory therapy, muscle atrophy, pulmonary function tests

Sponsored Research - None

621450

EFFICACY AND TEST-RETEST RELIABILITY IN THE EPWORTH SLEEPINESS SCALE, A TOOL FOR ASSESSING DAYTIME SLEEPINESS.

Martine J. Eon, John Dziodzio; Pulmonary Medicine/ Critical Care Medicine, Maine Medical Center/ Maine Sleep Institute, Portland, ME

Background An important part of assessing patients for sleep disorders is an estimation of Excessive Daytime Sleepiness (EDS). Techniques used to assess EDS are cumbersome and expensive, and other subjective screening tools correlate poorly with objective measurements. The Epworth Sleepiness scale (ESS) was developed to overcome issues in prior techniques, and was validated with objective measures like sleep latency. In our practice, we have noted patients with abnormal ESS scores and normal sleep studies, as well as patients with normal ESS with sleep studies categorized as severe by elevated Apnea Hypopnea Index (AHI). The hypothesis is that the ESS is a reliable tool to predict EDS and in turn Sleep Disordered Breathing (SDB). Methods To estimate efficacy of ESS in identifying SDB, we studied relationships between ESS and AHI, mean sleep latency (MSL), and age. To validate ESS as a repeatable measure, we administered it to a random sample of 101 adult patients twice, with a few weeks between, during which no treatment was given. Correlations between the ESS and AHI, and between ESS and sleep latency were determined by linear regression and test-retest precision assessed by paired t-test. Fourteen subjects with potentially confounded data were excluded. These patients had a change in prescribed medications or the addition of Continuous Positive Airway Pressure (Cpap) therapy prior to the second ESS. Results Test-retest precision was examined via the differences in paired data. The mean difference ("bias") was 0.609, showing very little bias between pre and post data. The standard deviation (SD) of differences ("precision") was 3.46, 95% confidence interval (CI) 6.92, overall range 13.8, over half of the maximum ESS score of 24. The correlation coefficient (R2) from regression of pre and post scores was 0.552, implying the regression explains only 55% of the variation, with 45% unexplained. Regression of mean ESS on AHI provided R2= 0.0041, with only 0.41% of the variance due to the regression and 99.6% unexplained. Regression of mean ESS on MSL provided R2= 0.012, explaining only 1.2% of the variance with 98.8% unexplained. Conclusions ESS failed to show any clinically useful relationship with either MSL or AHI, two basic measures of sleep performance; and the test-retest precision failed to demonstrate clinical significance; therefore we reject the hypothesis of clinical usefulness.

Sponsored Research - None

671411

EVALUATION OF THE RESPIRONICS BIPAP® AUTO SV™ AND RESMED VPAP™ ADAPT SV TO LUNG SIMULATOR GENERATED CENTRAL AND OBSTRUCTIVE SLEEP APNEIC EPISODES.

Grant Drake, Dawn M. Alverson, Jody Lester; Respiratory Care, Boise State University, Boise, ID

Background: Recent developments in non-invasive positive pressure ventilation have led to the production of adaptive servo-ventilation devices that examine an individual's breathing characteristics and adjust pressure levels via a product specific algorithm. We evaluated two adaptive servo-ventilation devices, the Respironics BiPAP® auto SV™ and ResMed VPAP™ Adapt SV to lung simulator generated central and obstructive sleep apneic episodes. Methods: Each system was adjusted to the following settings: EPAP minimum 4 cmH2O, IPAP maximum 15 cmH2O, adaptive modes, 15 breaths per minute. Each system was tested using its own brand of ventilation circuit and face mask (Respironics Comfort Gel ™Full and Mirage Quattro). The masks were fitted to a Laerdal SimMan® version 2 mannequin and demonstrated minimal leak levels. The SimMan® was connected to a Hans Rudolph Electronic Breathing Simulator (HR 1101) which generated 15 normal breaths followed by central and obstructive apenic episodes. The lung simulator scripts were constructed with the following parameters: compliance 40 cmH2O, amplitude 20 cmH2O, resistance ramped from 5 to 200 L/sec during obstructive apnea simulation and compliance 40, amplitude 0 and resistance of 50 during central apnea simulation. Results: During simulated obstructive apnea the VPAP™ Adapt SV delivered an average pressure of 7.53 cmH2O and an average Vt of 299.7 ml. Max/Min pressures were 11.148 cmH2O and 5.104 cmH2O. The BiPAP® auto SV™ delivered an average pressure of 6.41 cmH2O with an average delivered Vt of 257.2 ml. Max/min pressures were 11.8 cmH2O and 3.18 cmH2O. During simulated central apnea the VPAP™ Adapt SV delivered an average pressure of 8.95 cmH2O and an average Vt of 354.4 ml. Max/min pressures were 14.5 cmH2O and 5.08 cmH2O . The BiPAP® auto SV™ delivered an average pressure of 7.04 cmH2O and average Vt of 280.06 ml. Max/Min pressures were 11.81 cmH2O and 3.22 cmH2O. Conclusion: Each system responded adequately to both types of apnea however, some differences were recognized. The VPAP™ Adapt SV has more clinician definable parameters and our obeservations were that it performed better in tests simulating central apenic episodes. We observed that the BiPAP® auto SV™ performed better during obstructive apenic episodes.Initially the BiPAP® auto SV™ demonstrated a long rise time and delivered smaller volumes when respiratory rate was set on "auto"; using a set rate of 15 alleviated this discrepancy.

Sponsored Research - None

678258

THE RELATIONSHIP BETWEEN THE MALLAMPATI SCORING SYSTEM, THE BERLIN QUESTIONNAIRE, AND THE EPWORTH SLEEPINESS SCALE.

Joshua F. Gonzales, Gregg Marshall, Chris Russian; Respiratory Care, Texas State University, San Marcos, TX

Background: The purpose of this study is to determine if there is a relationship between a person's Mallampati score and their scores on the Berlin Questionnaire and Epworth Sleepiness Scale. The Berlin Questionnaire and Epworth Sleepiness Scale are currently used as prescreening tools for persons who may suffer from sleep disorders. The Berlin Questionnaire (10 questions) is used to identify persons at risk for sleep apnea syndrome and the Epworth Sleepiness Scale (8 questions) is used to determine the level of a person's daytime sleepiness. The Mallampati Scoring System is an assessment of the anatomy of the oral cavity to predict the ease of intubation and is believed to interfere with airway patency while asleep. The relationship between the Mallampati Score System, Berlin Questionnaire, and Epworth Sleepiness Scale were analyzed. Research Question:What relationship exists between the Mallampati Scoring System, the Berlin Questionnaire, and the Epworth Sleepiness Scale? Methodology: Participants of the research (N=77) were required to complete both the Berlin Questionnaire and the Epworth Sleepiness Scale as truthfully as possible. After each was completed, the researcher assessed the participants Mallampati Score by examining the oral cavity. Results: The multiple regression analysis was conducted to determine the accuracy of the Berlin Questionnaire score and Mallampati score to predict the Epworth Sleepiness score. In addition a linear regression analysis was conducted to determine if the independent variable Mallampati Score could predict the Berlin Questionnaire score. The model summary and the ANOVA summary indicate the Berlin Questionnaire score and the Mallampati score are weak predictors of the Epworth Sleepiness score ($R2 = .017, R2adj = -.010, F(2,74) = .623, p > 0.05$). A review of the beta weights confirms that the Berlin and the Mallampati do not significantly contribute. (Table 1) The linear regression results indicate the Mallampati score is a weak and non-significant predictor of the Berlin Questionnaire score ($R2 = .026, R2adj = .013, F(1,75) = 2.022, p > 0.05$). Conclusion: Results of this pilot study reveal that the Mallampati Scoring System and the Berlin Questionnaire are not strong predictors of excessive daytime sleepiness as measured by the Epworth Sleepiness Scale results. In addition, the Mallampati score is not a strong predictor of the risk for sleep apnea as assessed by the Berlin Questionnaire.

Sponsored Research - None

Table 1 Coefficients for Model Summary

	B	Beta (β)	t	p	Bivariate r	Partial r
Berlin	.280	.123	1.054	.295	.127	.122
Mallampati	.022	.022	.189	.850	.042	.022

679056

ALPHA-1 ANTITRYPSIN DEFICIENCY TESTING AND EDUCATION AS COMPONENTS OF A PULMONARY REHABILITATION PROGRAM.

Valerie F. Naegele[1], James J. Barnett[2]; [1]Tri-City Medical Center, Oceanside, CA; [2]Mission Hospital, St Joseph Health System, Mission Viego, CA

Background: The hereditary disorder alpha-1 antitrypsin (AAT) deficiency, which may lead to severe respiratory disease, is underrecognized. The ATS has recommended that all symptomatic individuals with COPD are tested for AAT deficiency. Without diagnosis, individuals with AAT deficiency are unable to receive appropriate management and medication. In the course of their everyday provision of respiratory care, RTs are ideally placed to increase the numbers identified with AAT deficiency and provide education to those affected. Here we describe our pulmonary rehabilitation program, which includes AAT deficiency testing as an established component. Method: We run six pulmonary rehabilitation programs every year. Each program runs twice a week for 7 to 8 weeks. The foremost components of the program are exercise and education. The exercise element consists of low-impact, cardiovascular, and strength training, which progresses at each session. Educational topics include the causes and treatments of COPD and other restrictive lung disorders; managing chronic dyspnea on a daily basis — incorporating breathing, airway clearance, and relaxation techniques, stress and panic control, boosting the immune system, nutrition, sexuality, travel, and activities of daily living; appropriate use of bronchodilators, anti-inflammatories, inhalers/dry powder, nebulizers, oxygen, and CPAP; when to call the doctor; and end-of-life decisions. AAT deficiency and its implications are discussed, and testing is now offered to all individuals who attend our pulmonary rehabilitation program and Better Breathers' Clubs. Each patient tested is given a brochure about AAT deficiency. Results: From January to June 2009 we have tested 45 individuals from our pulmonary rehabilitation programs and Better Breathers' Clubs at Oceanside and Mission Viejo, CA. Two individuals positive for AAT deficiency (both with genotype PiSnull) and one heterozygote (carrier) with genotype PiMS were detected. Conclusions: The testing of individuals who attend pulmonary rehabilitation programs and Better Breathers' Clubs has resulted in the detection of individuals positive for AAT deficiency. The identification of these patients during pulmonary rehabilitation programs or Better Breathers' Clubs facilitates the early detection of AAT deficiency and thereby enables more effective management of patients with the disorder.

Sponsored Research - None

679674

POSITIVE AIRWAY PRESSURE (PAP) TREATMENT OF OBSTRUCTIVE SLEEP APNEA SYNDROME (OSAS): PRELIMINARY RESULTS OF A NON- ATTENDED AMBULATORY PROTOCOL.

Andrea Lanza[1], Sara Mariani[1], Lino Nobili[1], Giovanna Beretta[2], Maurizio Sommariva[2]; [1]Department of Neuroscience, Niguarda Hospital, Centre of Sleep Medicine, Milan, Italy; [2]Physical Therapy and Rehabilitation Centre, Niguarda Hospital, Milan, Italy

Backgrounds: Obstructive Sleep Apnea Syndrome (OSAS) occurs in about 4% of the adult population. OSAS increases the risk of road accidents, of coronary and cerebrovascular diseases. Therefore it is both medically and economically important to diagnose and treat OSAS patients. Positive Airways Pressure (PAP) is the cornerstone of therapy for OSAS however only 50% of patients use the prescribed device and about 30% of OSAS patients utilize PAP for less than 4 hours/night. Here we report the preliminary results of a non attended ambulatory protocol combined with an educational program aimed to increase the awareness on the benefits of PAP treatment and the ability to use PAP and interfaces. Patients and Methods: 65 consecutive patients: 54 M, 11 F; age 52.0 ± 11.6; Body Mass Index (BMI) 33.6 ± 8.0; Apnea-Hypopnea Index (AHI) 46.1 ± 23.4; Oxygen Desaturation Index (ODI) 42.9 ± 23.1; Mean SaO2 89.9 ± 4.4; Epworth Sleepiness Scale (ESS) score 10.2 ± 5.1. Diagnosis of OSAS was confirmed monitoring patients at home with a portable system including 6 channels: airflow, snoring, respiratory movements, SpO2, heart rate and body position. OSAS patients were assigned an Auto-CPAP treatment for four consecutive nights at home to determine the Continuous PAP optimal fixed pressure level. During the fifth night, monitored at home with a portable system, patients underwent CPAP treatment. Results: After the first night of CPAP treatment AHI was 5.5 ± 5.2, ODI 5.6 ± 5.7; mean SaO2 94.6 ± 2.0. Only three patient did not accept CPAP treatment. Five patients switched to a Bi-level and three to an Adaptive Servo Ventilation device. After one month of CPAP usage AHI was 4.7 ± 4.6, ODI 4.6 ± 4.7; mean SaO2 95.0 ± 1.7; ESS 4.9 ± 4.3; the amount of PAP utilization was 5.6 ± 1.9 hours/night. Only 14% of patients used PAP less than 4 hours/night. At the moment only 14 patients have reached 6 months of PAP treatment. In these patients AHI was 3.4 ± 3.1, ODI 3.3 ± 3.4; mean SaO2 95.9 ± 1.4; ESS 3.7 ± 2.9; the amount of PAP utilization was 5.9 ± 2.1. Conclusions: The current standards of practice for PAP titration in OSAS patients require overnight in-laboratory polysomnography, a costly and technically complex approach that presents scheduling difficulties considering the high demand. Our non attended PAP titration protocol seems to produce good results in terms of efficacy and compliance and at the same time it reduces the costs and the waiting list for treatment.

Sponsored Research - None

679681

CLINICAL OUTCOMES IN PATIENTS TREATED WITH THE VEST® VERSES CONVENTIONAL CHEST PHYSICAL THERAPY.

Peggy Reed-Watts[1], Darnetta Clinkscale[1], Marin Kollef[2,1], Kevin Lawrence[2,1], Kathleen Spihlman[1]; [1]Respiratory Care Services, Barnes-Jewish Hospital, St. Louis, MO; [2]Pulmonary and Critical Care Medicine, Washing University School of Medicine, St. Louis, MO

BACKGROUND: Conventional chest physical therapy (CPT) has become the standard to which all other bronchial hygiene techniques are compared. The objective of this investigation was to compare the clinical outcomes of hospitalized patients treated with The Vest® Airway Clearance System (the Vest®) vs. CPT. METHODS: Hospitalized patients prescribed CPT were randomized to receive therapy consisting of the Vest® or conventional CPT. The Vest® facilitates removal of secretions from the lungs utilizing an air pulse generator and an inflatable vest to create high frequency chest wall oscillation (HFCWO). The primary outcome measure was the number of hospital free days. Hospital free days are defined as the number of days free from hospitalization during the study enrollment period [30 days]. A patient satisfaction rating, as measured by using a comfort scale, was a secondary outcome measure. RESULTS: This is an interim analysis of an ongoing study. Ninety-eight patients completed the study so far. The Vest® group (n = 46) and the CPT group (n = 52) had no significant differences in their baseline characteristics at the time of entry into the study. There was no significant difference in the number of hospital free days between the Vest® group and the CPT group (18.7 ± 8.8 days vs. 19.8 ± 7.6 days, respectively; p = 0.50). There was also no significant difference in patient satisfaction ratings (2.1 ± 0.7 vs. 2.2 ± 0.7, respectively; p = 0.66). CONCLUSIONS: This interim analysis shows no statistical difference between the Vest® and CPT group when comparing primary outcomes of hospital free days and patient satisfaction.

Sponsored Research - This study was supported by Hill-Rom.

679717

THE USE OF FULL PSG MONITORING WITH A NOVEL OXYGEN CONSERVING DEVICE TO DETERMINE TRIGGERING AND OXYGENATION CAPABILITIES DURING SLEEP.

Bob McCoy[1], Todd Eiken[2], Brian Carlin[3], Ryan Diesem[1], Jason McCoy[1]; [1]Valley Inspired Products, Apple Valley, MN; [2]Mays & Associates, Brentwood, TN; [3]Division of Pulmonary and Critical Care Medicine, Drexel University School of Medicine, Pittsburgh, PA

Background: New portable oxygen delivery systems are becoming more widely available to improve clinical capabilities with lower overall expense. Concern related to the products' oxygen delivery capabilities with exercise and sleep have limited the full acceptance of these products as a single unit option. Clinicians encourage the use of a stationary or continuous flow unit during sleep. Some clinical studies have shown conserving devices employed by portable concentrators have the capability to oxygenate a patient. The purpose of this study was to monitor select oxygen patients with full PSG to determine breathing status while determining the oxygenation and triggering capabilities of a novel oxygen conserving device. Method: Study protocol was approved by an Investigational Review Board (IRB) and patient informed consents were obtained. Patients were screened with overnight oximetery to determine oxygenation on their existing home oxygen system and to screen for sleep disordered breathing. Eight patients were then tested in a sleep lab with full PSG monitoring of sleep and respiratory function. A novel OCD was connected to the PSG to monitor pulse delivery of the unit. The novel OCD had the capability to switch to continuous flow (CF) if a reduction in airflow caused the device to not trigger for 30 seconds. The device would then deliver one minute of CF oxygen and then switch back to a seek mode for oxygen conservation. If still no airflow was detected the device would switch to CF for another cycle. Results: All patients screened negative for desatruation on their home oxygen system. When tested in the lab, four of the patients showed multiple instances of sleep disordered breathing. This disorganized breathing was disruptive to their sleep hygiene with arousals, yet there were no significant desaturations. All patients were able to maintain oxygen saturation levels with the novel OCD yet, due to SDB, four of the patients routinely triggered the OCD's CF mode during the night. All patients felt the novel OCD was acceptable as an oxygen delivery system with sleep and none of the patients indicated that the device or pulse flow delivery was disruptive to their sleep. Conclusions: The novel OCD was able to maintain oxygenation for the eight patients tested without the device disturbing their sleep. Four of the patients' breathing patterns were not sufficient to trigger the device, but the CF mode back up was able to maintain adequate oxygen levels.

Sponsored Research - None

	TRT	TST	Base Sat %	Low Sat %	Min in CFO	% in CFO
CG	495	371	97	92	3	<1
JN	497	309	93	90	0	0
RO	481	345	98	92	50	14
PR	450	352	94	90	3	<1
DS	468	379	93	85	37	10
AU	381	289	94	89	78	27
CW	478	391	96	74	14	4
PB	477	417	96	86		

			# Breath Missed in Sleep Stage			
	ABPM	Missed Br	N1	N2	N3	REM
CG	17	38	-	19	-	19
JN	17	22	7	12	-	3
RO	16	257	-	82	-	175
PR	15	13	-	13	-	-
DS	18	781	180	414	156	31
AU	15	696	21	606	-	69
CW	15	169	18	47	-	104
PB	20	570	51	342	6	171

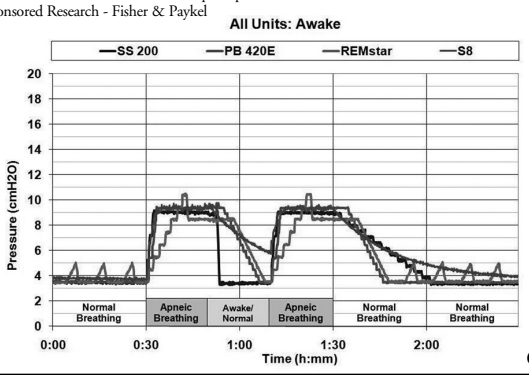
679795

A BENCH STUDY TO COMPARE PERFORMANCE CHARACTERISTICS OF AUTO-ADJUSTING CPAP UNITS IN RESPONSE TO AWAKE BREATHING.

Bob McCoy, Ryan Diesem; Valley Inspired Products, Apple Valley, MN

Background: Numerous bench studies have shown that Auto-Adjusting Continuous Positive Airway Pressure devices (APAPs) respond differently to identical breathing patterns. New APAP units are introduced to the market on a regular basis, many with additional features and benefits that may or may not impact device performance. The purpose of this bench test was to evaluate the performance of one APAP device with a feature the manufacturer claims responds to an aroused/awake patient by quickly decreasing therapy pressure. Unit performance was then compared to three other APAP units currently on the market to see how each APAP responded to the same breath pattern. Method: Four unique APAP devices (Fisher & Paykel SleepStyle 200; Puritan-Bennett GoodKnight 420E; ResMed S8 AutoSet Vantage; Respironics REMStar M-Series Auto) were tested on the bench using a Hans-Rudolph Series 1101 breathing simulator programmed with breathing patterns simulating a variety of sleep breath patterns (Normal, Apnea, and Awake). Each APAP device was set to deliver pressures between 4cmH2O and 20cmH2O. Each device was subjected to a 30 minute pre-conditioning using a Normal breathing pattern. Following pre-conditioning, an Apnea pattern was run for 20 minutes, followed by a three minute period of Awake breathing, 17 minutes of Normal breathing, 20 minutes of Apnea breathing, and then Normal breathing for the remainder of the test period. The pressure response by each APAP unit was recorded throughout the preconditioning and the duration of the test. The delivered pressures for each of the devices was then compared. Results: All units completed the bench test with no difficulties. All units exhibited unique pressure delivery responses to the breathing sequence. Three units showed a rapid pressure increase to the Apnea pattern. The SleepStyle 200 unit, the APAP device featuring an awake detection algorithm, rapidly decreased pressure during the Awake pattern; no other unit showed significant response during the same period. All units had unique methods of lowering therapy pressure during Normal breathing after event-related breath sequences. Conclusions: Each APAP had unique pressure responses to the same breathing pattern. A physician prescribing Auto-Adjust CPAP devices for a patient should be aware of product differences and be familiar with the unique capabilities and features of each device.

Sponsored Research - Fisher & Paykel



679839

THE EFFECTS OF A SLEEP DISORDERS CLINIC FOR THE TREATMENT OF PATIENTS WITH SLEEP DISORDERED BREATHING.

Brian W. Carlin[1,2], Lori Dorrycott[2], Lorie Smith[2], Mark Kegg[2], Spencer Carlin[2], Becky Rohosky[2]; [1]Pulmonary and Critical Care Medicine, Drexel University School of Medicine, Allegheny General Hospital, Pittsburgh, PA; [2]Lifeline Sleep Disorders Centers, Pittsburgh, PA

Background: Compliance with continuous positive airway pressure (CPAP) therapy is a significant problem in the management of patients with obstructive sleep apnea. This study was performed to determine the effects of a sleep disorders clinic staffed respiratory therapists in the management of patients who are having difficulty with compliance with CPAP therapy. Methods: Patients who were newly diagnosed with obstructive sleep apnea (OSA) and were started on CPAP therapy are contacted by phone during the first two weeks of therapy. Patients who are having difficulty with compliance with that therapy are then offered an appointment in the sleep disorders center. In some instances (n=17), the patient was referred to the sleep disorders center for an initial evaluation for symptoms suggestive of sleep disordered breathing. Each patient is seen and evaluated by the sleep disorders physician. A respiratory therapist with expertise in positive airway pressure therapy is in attendance during each visit. Decisions for alteration(s)in therapy are made by the physician and then instituted by the RT during that visit. Results: A total of 167 new patient visits during the months from May 2008-October 2008 were conducted. 150 patients were diagnosed with OSA and were having difficulty with CPAP use. Seventeen patients were referred for other reasons. The average age was 54(12) years with 79 men and 66 women. For those patients with OSA diagnosed (n=150),changes in the existing therapy were made in 135(90%) patients. These included: mask refit (23%), decrease in CPAP pressure (17%), retitration study ordered (16%), change to other positive airway pressure device (6%), cognitive behavioral therapy (10%), referral for oral appliance (5%), initiation of CPAP therapy (5%), and other (12%). All possible interventions (e.g. mask refit, CPAP pressure change, etc) are made during that office visit. Conclusions: For patients who are having difficulty with CPAP use, a sleep disorders clinic staffed by a physician and a respiratory therapist provides an effective means to evaluate the reason for the difficulty with use. A significant number of patients evaluated required changes made to their existing therapy which was performed at the time of that visit. The availability of the respiratory therapist allows for direct intervention of those changes assuring that the patient is offered the appropriate therapy as recommended by the sleep center physician.

Sponsored Research - None

680017

LEADING BY EXAMPLE-LEADING MICHIGAN HOSPITALS SMOKE-FREE CAMPUS INITIATIVE.

Laura Van Heest[1], Linda A. Thomas[2], Thomas Peterson[3], Karen Brown[4], Paige Hathaway[5]; [1]Respiratory Therapy, Saint Mary's Health Care, Grand Rapids, MI; [2]Tobacco Consultation Service, University of Michigan, Ann Arbor, MI; [3]Healthier Communities, Spectrum Health, Grand Rapids, MI; [4]Tobacco Section, Michigan Department of Community Health, Lansing, MI; [5]Michigan Health & Hospital Association, Lansing, MI

BACKGROUND: The Michigan Health & Hospital Association's (MHA) 2007 decision to challenge Michigan hospitals to implement a Smoke-Free Campus' (SFC) by January 1, 2008 teamed them with the Michigan Smoke-free Hospitals Grant (MSHG) and the Michigan Department of Community Health (MDCH). A 2006 survey found 84% of Michigan hospitals supported the SFC goal. METHOD: MHA created a website "Honor Roll" to promote those hospitals who participated. MSHG funded by MDCH and developed in 2000, provided training and an implementation CD toolkit. The CD provided timelines, signage examples, suggested task force members, and other tools to assist with SFC implementation. RESULTS: The overall goal of the initiative is to make Michigan healthier. It is through the hospital's leadership and example that they should begin in their "own back yards" by providing smoke-free environments for employees, medical staff, patients, and visitors. This policy encourages current smokers to quit, assistance to those trying to quit, and reduces exposure to secondhand-smoke for others. The campaign included two parallel tracks: An internal track with the MHA membership. This track included: training, tools, Michigan specific list-serve, the "Smoke-Free implementation CD," guides, webinars and workshops. An external track provided information to the public, legislature and initiative opinion leaders. CONCLUSION: Currently 90% of MHA members are SFC. An additional 6% are now working toward implementation of MHA Smoke-Free Campus initiative. A small percentage of hospitals have moved to a Tobacco-Free Workday. These hospitals do not allow employees to use tobacco at anytime during the workday. Employees must be free of tobacco smell on clothing and breath.

Sponsored Research - None

666460

DEVELOPMENT AND IMPLEMENTATION OF A RESPIRATORY CARE QUALITY IMPROVEMENT PROGRAM.

Susan Ferry, Karen B. Caslin, Mark Sheedy, Linda Napoli; Respiratory Care, The Children's Hospital of Philadelphia, Philadelphia, PA

BACKGROUND: Emphasis on organizational outcome data as indicator of performance coincident with outcome-based reimbursement by Centers for Medicare & Medicaid Services (CMS) and private insurers and the need to meet standards compliance goals in an environment of educated healthcare consumers drives the need to demonstrate better and safer patient care through quality improvement (QI) work. METHODS: A research respiratory therapist (RT) was reallocated responsibilities to include QI oversight for our 150 member department. The QI RT attended interdisciplinary QI and safety working groups to provide liaison to and representation of the Respiratory Care (RC) Department. Participation in organization-wide and interdisciplinary groups provided in situ education and orientation. RESULTS: An audit committee evolved into a QI working group in the RC department. The QI focus allowed group members more immediate and direct communication with quality professionals in other disciplines and provided stable membership allowing opportunity to gain insight and experience in the use of QI language and processes. Focus shifted from data collection to problem recognition and resolution. A large data collection tool for a national registry, the National Emergency Airway Registry (NEAR) became a RC-driven QI project examining provider and team performance during emergency airway placement. RC-specific QI indicators were developed. Staff met regularly to identify risk, define elements of surveillance, recommend improvements, devise communication and implementation strategies and review outcomes. Members worked ad hoc on projects defined by immediate risk identified from the electronic event reporting system (Safety Net, Marsh & McLennan 2006) but maintained large group membership. Improvements included identification and mitigation of a faulty Pharmacy distribution process which contributed to missed bronchodilator therapy. CONCLUSION: Quality improvement relies upon closed loop communication between those doing the QI work and those doing clinical work at the point of care. Active engagement by care providers in a quality improvement program can help create a culture of safety among staff, improve communication of quality improvement goals and findings to caregivers through their active participation in QI processes, provide input regarding feasibility for implementation at the bedside and provide peer resources for best practices for bedside staff based on QI initiatives.

Sponsored Research - None

668278

THE FISCAL IMPACT OF VARYING INTRADEPARTMENTAL COMMUNICATION METHODS.

Russell E. Graham, Michael Berstein, Adrianne Gentry; Respiratory Care, Memorial Hermann - Texas Medical Center, Houston, TX

Background: Joint Commission(TJC) Patient Safety Goal NPSG.02.05.01 requires that a structured shift "handoff communication" occur. TJC Standard LD.03.04.01 further addresses effective communication within the institution. The Respiratory Care Department (RC) at our facility has > 100 FTE's, and utilized a technique called "The 5 Minute Meeting", occurring at the beginning of each shift. The goal was to disseminate pertinent departmental communications, and was in addition to regular shift report between therapists. Logistically, the plan called for a brief meeting and then moved directly to shift report. Over time, this format eroded into the "20 minute meeting", wherein incoming staff would arrive late, and/or other extraneous factors would result in the meeting not starting (or ending) on time. Since individual report still needed to occur, end-of-shift overtime (EOSOT) began to increase due to the overlap. In addition, the lengthened report time became a staff dissatisfier, as the off going shift was delayed in departing the workplace. The amount of overtime was significant enough to warrant consideration for change, as well as the need to respond to staff satisfaction. Method: Retrospective review of payroll data. Results: EOSOT under the "5 Minute" plan accounted for 0.86 FTE's. Using midpoint salary data, this EOSOT was costing the department budget in excess of $50000/Yr. After careful planning, the format was dropped entirely, focusing on shift report instead. The shift supervisor would serve as the medium for intradepartmental communication. EOSOT decreased to 0.54 FTE (a 37% decrease) and was maintained for a period of 90 days. While intradepartmental communication was continued, staff satisfaction remained a consideration. After review, a limited version of the original format called "News You Can Use" was reinstituted on a twice weekly basis (once for each shift). Discussion: EOSOT under this method has risen slightly to 0.66 FTE, but is still 0.20 FTE below the original format (a 23% decrease overall). Staff satisfaction has improved, and it is evident that a formalized group method for departmental communication be kept in place. While budgetary constraints remain a very real consideration, our experience exhibits that payroll savings can be recognized by careful consideration and implementation of method.

Sponsored Research - None

668964

IMPLEMENTATION OF AN ADVANCED AIRWAY MANAGEMENT TRAINING PROGRAM WITHIN A MULTICENTER HEALTH CARE SYSTEM.

Russell E. Graham[1], Bobbie Melton[1], Joey Wilson[1], Adam Mullaly[1], Stanley Rhone[1], Tracy Green[2], Davide Cattano[3]; [1]Respiratory Care, Memorial Hermann - Texas Medical Center, Houston, TX; [2]Respiratory Care, Memorial Hermann - The Woodlands, The Woodlands, TX; [3]Anesthesiology, University of Texas - Houston, School of Medicine, Houston, TX

Background: Medical literature supports training Respiratory Therapists in placement of advanced airways in urgent/emergent situations when competent physician staff is unavailable or time delayed in arrival (1). Memorial Hermann Healthcare(MHHS), an 11-hospital system, consists of academic and non-academic facilities. The system has level I,II,and III trauma centers. Anesthesia support is not available in-house on a 24/7 basis at all facilities. This identified a need within the system to establish a structured advanced airway management training program. Discussion among Leadership identified an additional need for uniformity of education and training. Method: A task force was established, which included a physician champion, to evaluate available resources and desired educational/training objectives. This task force was charged with the responsibility of planning, organizing, and executing the training program. Results: A comprehensive didactic and simulation training program was established, including objective criteria for successful completion. Training occurs at the system's Level I trauma center, which is fully equipped with all necessary audiovisual equipment as well as a comprehensive patient simulator (SimMan®, Laerdal Medical, Wappingers Falls NY). The training and evaluation entails 14 hours of didactic instruction, 8 hours of comprehensive training/simulation, and 6 hours of testing/evaluation. This evaluation includes written and skills demonstration components. Program oversight is provided by a Board Certified Anesthesiologist who is a faculty member. Program instruction is provided entirely by a core of Registered Respiratory Therapists. Candidates who successfully complete the program are then returned to their respective facility for continued practical training in the Operating Room with Attending Anesthesiologists until the required minimum of advanced airway placements is completed. Annual retraining/recertification are also part of the program Discussion: To date, 10 individuals (8 RRT, 2 ACNP) have completed training, and are maintaining >90% success at placement of an advanced airway on the first attempt. No adverse events as a result of airway placement have been noted. These findings complement results found in medical literature. As first responders to "Code" situations in the hospital setting, trained Respiratory Therapists are fully capable of advanced airway management. (1) Respiratory Care 1999, 44(7):750-755

Sponsored Research - None

669195

RELATIONSHIP BETWEEN DAILY DOSING FREQUENCY, COMPLIANCE, HEALTHCARE RESOURCE USE, AND COSTS: EVIDENCE FROM THE TREATMENT OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD).

Edmond L. Toy[1], Nicolas U. Beaulieu[2], Joshua M. McHale[2], Timothy R. Welland[1], Craig A. Plauschinat[3], Andrine Swensen[3], Mei Sheng Duh[2]; [1]Analysis Group, Lakewood, CO; [2]Analysis Group, Boston, MA; [3]Novartis Pharmaceuticals Corporation, East Hanover, NJ

Background: Medication compliance has been shown to have a significant effect on healthcare resource use and associated costs. This study assessed the relationship between the daily dosing frequency (DDF) of COPD pharmacotherapies and treatment compliance and estimated the effect of compliance on healthcare resource use and costs. Methods: COPD patients were identified (ICD-9 491, 492, 493.2, and 496) using a health insurance claims database covering 8 million lives (1999-2006). Patients were stratified based on the recommended DDF (QD, BID, TID, QID) of their first COPD drug claim (index date) post COPD diagnosis. Continuous enrollment was required for 6 months prior to and 12 months after the index date. Compliance was measured using proportion of days covered (PDC). Healthcare resource use outcomes included inpatient days and medical visits (inpatient, outpatient, and emergency room). A multivariate regression model assessed the relationship between compliance and one-year healthcare resource use controlling for demographics, comorbidities, and baseline resource use. Unit health care costs were obtained from the 2005 Medical Expenditure Panel Survey data and adjusted to 2008 dollars using medical CPI data. The total costs were modeled by multiplying the unit costs by the healthcare resource use observed in the study. Results: Sample sizes ranged from 3,678 (QD) to 25,011 (BID). Compliance was strongly correlated with dosing frequency: PDC for QD, BID, TID, and QID patients were 43%, 37%, 30%, and 23%, respectively (all p<0.001 vs. QD). Multivariate analysis showed that one-year compliance was strongly correlated with healthcare resource use. For 1,000 COPD patients, a 5 percentage point increase in PDC reduced the number of inpatient visits by 33, hospital inpatient days by 186 days, and emergency room visits by 15; the estimated number of outpatient visits increased by 29 (p<0.001 for all comparisons). This increase in compliance yielded substantial cost savings from decreased healthcare resource use (see Table 1). Conclusion: COPD patients who initiated treatment with QD dosing had significantly higher compliance than those with more frequent dosings. Patients with higher compliance were found to incur fewer hospital- and emergency room-related visits. For a hypothetical cohort of 1,000 COPD patients, cost savings from increasing PDC (compliance) by 5 percentage points amount to about $300,000 per year, mostly from reduced hospital visits.

Sponsored Research - Novartis Pharmaceuticals Corporation, East Hanover, NJ

Table 1: The Effect of Increasing PDC on Predicted 12-Month Mean Healthcare Resource Use and Cost Based on 1,000 COPD Patients

	Resource Use			Cost		
Utilization	Baseline PDC	Baseline PDC + 5 Percentage Points	Difference	Baseline PDC	Baseline PDC + 5 Percentage Points	Difference
Number of Hospital Visits	1,275	1,243	-33	$11,635,099	$11,338,501	-$296,598
Inpatient Days	5,906	5,720	-186	--	--	--
Number of Outpatient Visits	16,981	17,010	29	$1,867,863	$1,871,082	$3,219
Number of ER Visits	817	802	-15	$412,658	$405,248	-$7,410
Notes:						
1. The average costs using MEPS data were $9,124 for a hospital visit, $110 for an outpatient visit, and $505 for an ER visit.						
2. Average cost per inpatient day was unavailable from MEPS.						

669204

TEAMBUILDING AS A CHANGE MANAGEMENT ACTIVITY IN RESPIRATORY CARE.

Douglas Orens, Robert L. Chatburn, James K. Stoller; Respiratory Therapy, Cleveland Clinic, Cleveland Heights, OH

BACKGROUND: Teamwork promotes enhanced outcomes in various businesses. In healthcare, organizational "silos" (e.g., departments not collaborating) can hinder teamwork. This study describes an intervention that fostered teamwork among 4 separate departments of respiratory care (RC) within a single hospital. **METHODS:** We conducted a situational analysis to identify organizational goals. Then we designed an intervention to create an RC scorecard. The metrics were defined collaboratively using a business review process in meetings with the 4 groups to define relevant outcomes in the categories of: Quality/Innovation, Service, Productivity, and Employee Engagement. Meetings were held for 7 weeks using facilitators from the hospital's quality improvement group. The employee engagement metric was developed by surveying the staff, asking which of the 12 Gallup Organization Employee Engagement questions were most relevant. Once selected, the staff was again surveyed to assess satisfaction on the 4 items. **RESULTS:** The situational analysis showed a primary strength was the availability of facilitators. The major weakness was the task of reversing the mindset of silos in all groups. The major opportunity was fostering teamwork and buy-in of the 4 RC groups. A major threat was the time commitment to collect and report the metrics. The goals for improvement were modeled on the features of a change–avid RC department (*Respir Care* 2008; 53:871-884). The core metrics developed and baseline values had both monthly and annual targets reported during monthly meetings. Results of the employee engagement survey (30% response rate) identified the 4 most relevant Gallup questions to be: (1) I know what is expected of me at work (2) I have sufficient equipment (3) my opinions count (4) my associates do quality work. Baseline agreement (target 100%) with these metrics was (1) 88%, (2) 35%, (3) 48%, and (4) 61%. Specific improvements observed in teamwork among the 4 RT departments included: sharing of educational resources, development of a cross-departmental float pool, committee to standardize policies/procedures. **CONCLUSIONS:** The results show that teamwork among 4 separate RC groups improved and that enhanced outcomes were achieved with a business review process. Based on this experience, we recommend consideration of this business review process as a teambuilding activity with clinical benefits.

Sponsored Research - None

673742

EFFECTIVE RETENTION STRATEGIES FOR CLINICAL [l#11#l]RESPIRATORY THERAPISTS.

Jefferson Hunter[2], Sarah Varekojis[1], F. Herbert Douce[1]; [1]Respiratory Therapy Division, The Ohio State University, Columbus, OH; [2]The Ohio State University Medical Center, Columbus, OH

Background: Workforce shortages continue to threaten the ability of hospitals to provide proper staffing to care for their patients. To retain existing therapists and reduce employee turnover, hospitals need to develop and initiate best practices related to retention. The purpose of this study was to identify what methods, strategies and ideas are perceived effective by both managers and clinicians in order to retain respiratory therapists. Methods: Two survey instruments were used for this study. One was distributed at a state-wide continuing education conference to respiratory therapists with clinical responsibilities. The other was administered on-line through Survey Monkey® to managers of respiratory therapy departments in Ohio. Surveys included various demographic questions as well as questions asking both groups to rate the effectiveness of 17 strategies for retention of clinical respiratory therapists. Data analysis included descriptive statistics as well as chi square and t-tests. Results: Survey response rates were 57% for the clinician survey and 59% for the manager survey. Managers and clinicians rated strategies in the compensation/perks and recognition/respect categories most similar, and there were a few differences in their ratings in the working conditions/environments category. Overall, managers rated 12 of the 17 strategies as effective and the clinicians rated 15 of the 17 as effective. Conclusions: The manager respondents to this survey had department retention rates higher than the state average, so it was felt that the perceptions of the managers are reflective of effective retention programs already in place. Suggestions for managers trying to develop effective retention programs include focusing on "paying professional fees", "providing bonus pay", "reimbursement of exam fees", "controlled workloads", "self-scheduling" and "priority work scheduling" as these were perceived as effective by clinicians and were rated higher by clinicians than managers.

Sponsored Research - None

677715

MOVING THE MOUNTAIN, A STATE SOCIETY'S LESSONS IN REGULATIONS AND CHANGE.

Terrence F. Smith[1], Bill Kiger[2], Connie Paladenech[2], Jill Saye[2], Daniel Grady[1], Susan Rinaldo Gallo[3], John Riggs[1]; [1]Respiratory Care, Mission Health System, Asheville, NC; [2]Respiratory Care, Novant Health, Winston Salem, NC; [3]Respiratory Care, Duke University Health System, Durham, NC

Problem: Last year,the NC Society notified AARC about a problem with the CMS survey of hospitals in NC.The issue involved surveyors citing a facility for failing to administer inhaled meds within the standard administration schedule(30-minute rule)even though the hospital had a written policy that permitted an extension of the timeframe. Method:The AARC conducted a survey of RT's across the country with respect to their hospitals policies and learned that the majority of those who responded had a written policy that permitted the delivery of inhaled meds up to 60 min.before or after the scheduled due time.Next,the AARC laid out the issues in a formal written paper to CMS,emphasizing that the 60-min.schedule was a generally accepted standard for the profession.CMS suggested that AARC develop a position statement.The position statement was approved by it's Board of Directors and endorsed by it's Board of Medical Advisors(BOMA).The statement stresses the need for facilities to establish policies for the safe and timely administration of inhaled meds for the individual facility and approved by the medical staff.The policies may differ from the standard meds schedule and time frames,but they may not exceed 60 mins before or after the scheduled meds delivery due time for meds prescribed at an interval greater than or equal to four hours.Last November,CMS had a conference call with its regional survey and certification staff responsible for the oversight of state surveyors.CMS indicated on the call that it found the AARC's position to be an acceptable standard of practice for the delivery of inhaled meds by RT's. A copy of the position statement and a list of BOMA were provided to regional staff,who in turn informed state surveyors during their monthly conference calls of CMS's acceptance of the standard. Results:RC departments now have a position statement on meds delivery procedures that are unique and requires different rules.It is essential that hospitals have their own policy/procedure on the books to support the AARC position paper.The position statement should be used as a reference for backing up the hospitals policy.Policy development should be proactive with involvement from physicians and medical directors with approval from the appropriate hospital committees.The paper issued by the AARC presents an argument as to why inhaled meds administered by RTs are delivered in a period that is often different from a hospital's standard administration schedule.

Sponsored Research - None

678945

THE USE OF A PROGRESSIVE PULMONARY PROTOCOL IN AN ONCOLOGIC INTENSIVE CARE UNIT.

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

Expanding the lungs and facilitating the removal of secretions have been proven to help prevent pulmonary complications arising during the post-operative period and those arising from immobility. In order to prevent lung complications, the importance of prophylactic and therapeutic respiratory modalities must be emphasized and utilized. EZ-PAP®, Acapella®, IPV, Metaneb®, and the Vest® are effective devices for mobilizing secretions and improving lung function. These modalities were used with a systematic approach to prevent and treat pulmonary complications arising in our ICU patient population. A progressive pulmonary protocol, that is patient driven, was initiated to minimize pulmonary complications in the ICU. Method: Upon patient admission to the ICU, or immediately following extubation, all non-ambulatory patients received EZ-PAP® and Acapella® QID, administered by the Respiratory Care Practitioner (RCP). The RCP performed a thorough patient assessment, including chest x-ray review and laboratory data, every shift and noted their findings. If any symptoms were present (see table below) during the patient's stay in the ICU, the treatment plan was advanced to Plan A) IPV or Metaneb® every 4 hours, or Plan B) the Vest® with EZ-PAP® every 4 hours. When selecting option A or B, the RCP considered the preferences of the patient along with which treatment plan would provide the greatest benefit to the patient. Once the patient had complete resolution of noted symptoms, as documented by chest x-ray and/or Fi02, the patient was graduated to EZ-PAP® and Acapella® treatments QID. If the patient remained symptom free for 72 hours, the frequency of the EZ-PAP® and Acapella® was decreased to BID. Results: The successful implementation of this pulmonary protocol within the ICU setting showed improvement in chest radiography (CXR) post therapy. Conclusions: Further studies to evaluate the protocol impact on ICU length of stay are warranted.

Sponsored Research - None

SYMPTOMS

1) Sp02 < 92%
2) New or worsening infiltrates on chest x-ray
3) Atelectasis
4) Inability to mobilize secretions
5) Ineffective cough
6) Increasing Fi02 requirement

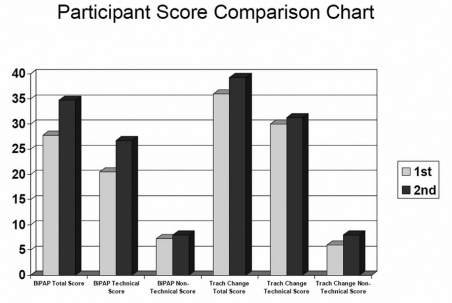
679188

HIGH FIDELITY SIMULATION TRAINING FOR THE NEW EMPLOYEE.

Patricia A. Achuff[1], Joseph Bolton[1], Lorraine Hough[1], Roberta L. Hales[2]; [1]Respiratory Care, The Children's Hospital of Philadelphia, Philadelphia, PA; [2]Center for Simulation, Advanced Education, and Innovation, The Children's Hospital of Philadelphia, Philadelphia, PA

Background: New employees in our respiratory care department have found BiPAP and tracheostomy tube emergencies the first stressful situations encountered in the clinical field. High fidelity simulation was used as an educational tool to increase self-confidence and improve perfomance of these skills. Method: Two scenarios, BiPAP decompensation episode and an emergency tracheostomy tube change, were trialed as part of orientation. A scale to evaluate participant perfomance, including technical and non-technical skills, was developed for both scenarios. Assessment was performed by an on-site observer with scripted facilitator debriefings. Their first session occurred in September, 2008, follow-up May, 2009. Total, technical, and non-technical scores were analyzed for both scenarios at each session. The BiPAP checklist included 21 items, 15 technical and 6 non-technical. The tracheostomy tube change checklist included 22 items, 18 technical and 4 non-technical. At each session, a Likert scale pre-survey was administered to assess confidence level for both scenarios. Level of clinical experience with BiPAP and tracheostomy tube emergencies was evaluated prior to each session. Results: Eight new employees participated in the program. Total, technical, and non-technical scores improved following initial training in both scenarios. All showed improvement in preparing the oxygen setup and adding it to the BiPAP circuit. Seven participants showed improvement in identification of patient decompensation, troubleshooting equipment, and titrating oxygen. In the second session, five participants failed to call the physician and four failed to document appropriately. After the second session, confidence improved by all with the highest change in setting up the BiPAP machine/interface and checking equipment with orders. In the tracheostomy tube scenario, all showed improvement in hyperextending the neck. Seven participants showed improvement in calling for help from others. In the second session, four participants did not attach a drainage sponge or replace supplies. After the second session, confidence improved by all with the highest change in identifying and locating emergency tracheostomy tube supplies. Conclusion: Simulation training increased confidence and perfomance scores in the absence of clinical experience in the tracheostomy tube scenario. Scores in the BiPAP scenario were higher due to simulation training and clinical experience.

Sponsored Research - None



679235

ANALYSIS OF CRITICAL INJURY PATIENTS AND RESPIRATORY CARE IN"5.12"WENCHUAN EARTHQUAKE.

Yongfang Zhou, Zongan Liang, Xiaodong Jin; West China Hospital of Sichuan University, Chengdu, China

Abstract body: Bankgroud: This study aimed to provide an overview of characteristic and regularity of mechanical ventilation, approach methods and decision of respiratory care in critically injured patients who were admitted to the West China Hospital of Sichuan University in the "5.12" Wenchuan earthquake. Methods: Retrospective analysis of the medical records of 127 critically injured earthquake patients.A total of 127 patients with earthquake related injures and illness admitted to ICU of our hospital were included and divided into two main groups: 1. Without mechanical ventilation n = 22, 2. With mechanical ventilation n = 105. Patients'demographic data, age, sex, original injury, basical disease, complications and length of mechanical ventilation were analyzed retrospectively. Results: In total 127 critical patients with earthquake related injures and illness: the rate of mechanical ventilation was 82.68%, and the mortality among these mechanically ventilated patients was 10.58%, while all critical patients without mechanical ventilation patients were cured. Multivariate logistic regression analysis revealed that chest injury, complications of pulmonary infection, sepsis, shock, renal failure were independent risk factors for them requiring mechanical ventilation; multivariate linear regression analysis revealed that chest injury, cervical trauma, cardiopulmonary diseases, lung infection, sepsis, shock and renal failure were risk factors of influencing mechanical ventilation time. Fifteen critical injury patients undergoing mechanical ventilation were admitted to ICU during 48-72 hours after the earthquake, and that peaked after 21 days,there were 72 critical patients and 44 patients undergoing mechanical ventilation in ICU. Conclusion: Large number of patients were continuously admitted to ICU from the third day that peaked during the third week after the major earthquake. Early reasonable deploy and use of respiratory therapy equipments, the rapid treatment of the critically injured victims, and preventing complications should be done to improve the success in curing rate as well as shorten the time of mechanical ventilation. Key words: earthquake, trauma patients, mechanical ventilation, respiratory care

Sponsored Research - None

679656

COST SAVINGS ASSOCIATED WITH THE IMPLEMENTATION OF ALTERNATIVE INHALED PULMONARY VASODILATOR THERAPY.

Christine Wong; Respiratory Therapy, St. Paul's Hospital, Vancouver, BC, Canada

Background: Since the FDA approval of inhaled nitric oxide in 1995, there have been escalating costs associated with medical grade inhaled nitric oxide administration. With costs rising, less expensive selective pulmonary vasodilators have been sought. Inhaled epoprostenol (flolan), which can be given through continuous nebulization, may be a viable alternative. It is important to note that no selective pulmonary vasodilator therapy has proven to reduce morbidity or mortality. No clinical difference in efficacy of inhaled nitric oxide vs. inhaled epoprostenol has been observed to date. Objective: To decrease overall costs associated with Respiratory Therapist-administered pulmonary vasodilators by 40%, via substituting inhaled epoprostenol for inhaled nitric oxide on approved cases. Method: Policies, protocols, and flow sheets were developed to allow for proper implementation of inhaled epoprostenol. Education of Respiratory Therapists, critical care nurses, and physicians was provided in order to ensure patient safety and promote good team dynamics within the ICU. Under physician approval, patients who presented with acute pulmonary hypertension and/or refractory hypoxemia were given inhaled epoprostenol as opposed to inhaled nitric oxide. Once the order for inhaled epoprostenol was provided, an administration protocol was utilized for the duration of the therapy. Where no order for inhaled epoprostenol was obtained, patients remained on inhaled nitric oxide. Results: When inhaled epoprostenol ($300 Canadian per 24 hours) was substituted for inhaled nitric oxide ($2280 Canadian per 24 hours) during a 16-month period a net savings of $293 040 Canadian was observed, an overall reduction of 40%. Costs per day for inhaled epoprostenol and inhaled nitric oxide therapy were calculated according to both drug and consumables used in a 24-hour period. No additional respiratory therapist hours were used with the implementation of inhaled epoprostenol. Cost savings were determined by calculating actual inhaled epoprostenol used vs. what it would have cost to administer inhaled nitric oxide for the same duration of time. Conclusion: Inhaled epoprostenol significantly reduces overall costs of inhaled pulmonary vasodilator therapy as compared to inhaled nitric oxide. Within our organization, additional savings would be possible if inhaled epoprostenol replaced nitric oxide in all appropriate cases.

Sponsored Research - None

679662

MISSED AEROSOLIZED MEDICATION DOSES– PROCESS OF DEVELOPING A BENCHMARK FOR MISSED MEDICATION DOSES.

Donna Clayton, Darnetta Clinkscale, Russ Wilner; Respiratory Care Services, Barnes-Jewish Hospital, St. Louis, MO

OBJECTIVE: Develop a common nomenclature for "missed medication doses", then determine the occurrence benchmark rate within a University Hospital Consortium (UHC) group. BACKGROUND: The Joint Commission (TJC) standards require assurance of adequate staffing to safely treat patients. Missed medication doses can be a proxy for assessing adequate staffing. CMS requires Pharmacy Services to oversee medication administration to assure safe patient care. Upon review of internal missed medication data, BJH's Medication Usage Safety Committee stated missed medication doses were unacceptable. The Committee requested we compare our performance to a professional benchmark. Insufficient published data was available. In 2008, a brief phone survey showed inconsistencies in definition, data collection, and reporting of missed doses. After review of CMS guidelines and the AARC recommendation regarding the definition of a missed dose, BJH opted to use the standard of 60 minutes. BJH categorized missed doses into operational (within RCS control, i.e., staffing, medication unavailable) and non-operational (beyond RCS control, i.e., patient unavailable, patient refusal). To develop a more robust benchmark, BJH administered an internet survey of UHC hospitals, using operational and non-operational definitions. 33 hospitals responded; 58% had an average bed size of 200-600. METHOD: RCS used CliniVision to determine baseline missed dose rates. Documented missed doses were calculated as a percent of total treatments administered to determine a miss rate. We reinstructed staff on proper documentation for missed doses, based on the newly-created definitions for operational and non-operational missed doses. RESULTS: Data from the UHC survey is presented in the image below. CONCLUSION: BJH performed similar to peers, with rates of 1.1% (operational) and 4.5% (non-operational). Many departments (44%) perform concurrent therapy, leading to a lower missed dose rate. As a profession, and to meet CMS and TJC requirements, departments must challenge themselves to achieve "zero" missed doses.

Sponsored Research - None

UHC SURVEY DATA

	% Yes	% No
Monitor Missed Doses	88	12
Perform Concurrent Therapy	44	56
Automated Medication Dispensing	89	11

Missed Dose Rate, Operational		Missed Dose Rate, Non-Operational	
%	# Respondents	%	# Respondents
1-2	19	0-2	6
3-5	3	> 2, up to 5	6
> 6	1	> 5	4

679771

RESPIRATORY CLINICAL LADDER IS KEY IN THE UTILIZATION OF EVIDENCE BASED RESPIRATORY CARE AND IMPROVED OUTCOMES.

Carol A. Agard; Respiratory Care, Queen's Medical Center, Honolulu, HI

BACKGROUND: To enhance our care delivery model and support changes to our evidence based practice, we developed a Respiratory Clinical Ladder as a method to implement practice changes. METHODS: The concept was developed by our leadership team, medical director and RCPs. Our Clinical Ladder (CL) proposal outlining objectives, requirements, timelines and costs associated with implementation, evaluation and maintenance was approved. The program includes two levels of advancement with a focus on performance improvement activities, proficiency of advanced skills and outcomes monitoring. Additional program requirements include length of employment, committee work, or obtaining an advance practice credential, continuing education credits and an above average performance appraisal rating. RESULTS: Over a four year period, eight staff or18% of eligible RCPs enrolled in the program. Four staff or 50% continued on to the advanced skill level. The primary reason for attrition was relocation. Projects to date that have shown positive outcomes are: Non Invasive Positive Pressure Ventilation success rate improved from 35% to 70%, implementation of neonatal high flow nasal cannula prevented the intubation and transfer of 48 neonates to a children's hospital, access to metabolic monitoring was improved by 215%, the RCP role with the Rapid Response Team was validated through a survey tool, and High Frequency Oscillation Ventilation a modality not offered previously by our department was provided safely for 19 patients meeting specific criteria. An outcomes review of these patients was completed and an abstract has been submitted to the AARC Open Forum in 2009. An abstract of the NPPV project was presented at an earlier AARC event. All projects have improved RCP and CL staff skill levels. CONCLUSION: Over this period the CL Program has been key in implementing and sustaining evidence based respiratory care. We have improved our care delivery model, positively impacted patient safety and outcomes, as well as demonstrated the value of a skilled RCP as a vital member of the health care team.

Sponsored Research - None

680001

TOBACCO USE AND DEPENDENCE: CLINICAL INTERVENTIONS AND THE RESPIRATORY THERAPIST.

Georgianna Sergakis[1], Crystal Alfred[1,2], Rachel Brown[1,2], NineEva Prentiss[1,2], Sarah M. Varekojis[1]; [1]Respiratory Therapy Division School of Allied Medical Professions, The Ohio State University, Columbus, OH; [2]Respiratory Therapy, OSU Medical Center, Columbus, OH

Background: Brief clinical interventions are effective to assist tobacco users in quitting and are recommended to all patients regardless of willingness to quit. All members of the multidisciplinary team, including the RT, should be involved in this process. The specific role of the RT in this endeavor has not been extensively examined. This study described RTs' knowledge of pharmacotherapy,tobacco dependence interventions, and the frequency of use of the Clinical Practice Guideline for Treating Tobacco Use and Dependence. This study also described RTs' confidence in providing counseling for tobacco use. Method: A survey was distributed to a convenience sample of approximately 575 RTs that attended a conference held in Columbus, Ohio. Descriptive statistics were employed to analyze results. Results:475 out of 575 conference attendees completed the questionnaire (82.6%). The mean age of the sample was 40.2 years (11.8) with an average of 15.5 years (10.8) of experience in the profession. Most (59%) of the participants were Registered Respiratory Therapists and 53.4% had an associate's degree. While the majority of participants (85%) felt that it is the RTs role and the majority (74.2%) agree that the hospital is a useful place to discuss tobacco use, only 37.8% of participants said they always ask patients about their smoking status. When asked about situations appropriate for counseling, only 35.3% of the sample stated they made it a point to discuss smoking with all patients that smoke. Participants had moderate knowledge of strategies for tobacco users unwilling to quit. Regarding pharmacotherapy knowledge, none of the participants could identify all of the recommended pharmacotherapies available. Almost half (43.3%) of participants were unable to name any recommended first-line pharmacotherapies. 76% felt confident in their ability to counsel tobacco users about quitting. Conclusions: The results of the study suggest that RTs are confident and willing, but lack knowledge of clinical practice guidelines and appropriate pharmacotherapy. Implementing training programs and infusing tobacco dependence education in RT educational programs, offering incentives, and promoting a responsibility of practice for RTs at the bedside will assist RTs in taking an active role in providing effective clinical interventions for tobacco dependence. This change in practice and culture would lead to decreased tobacco dependence and improved clinical outcomes.

Sponsored Research - None

679802

REDUCING LENGTH OF STAY AND IMPROVING NET MARGIN IN COPD PATIENTS.

Joy K. Hargett[1], John S. Sabo[1], Elizabeth Bearden[1], Mary Curnyn[1], Elena Ruocco[3], Patsy Sellers[2], Deborah Thompson[2]; [1]Respiratory Care, St. Luke's Episcopal Hospital, Houston, TX; [2]Division of Nursing, St. Luke's Episcopal Hospital, Houston, TX; [3]Center for Advanced Clinical Practice, St. Luke's Episcopal Hospital, Houston, TX

BACKGROUND: COPD patients represent challenges in cost of care and length of stay (LOS). METHOD: Facilitated by the Director of Respiratory Care, a team of RRT's, RN's, case managers, social workers, and pharmacists was developed to address these issues. We focused on streamlining performance and process improvement with physician input as required. We started with DRG 88 and development of a Pulmonary Unit. The Pulmonary Unit is the primary admission point for patients with COPD or other pulmonary issues and includes telemetry beds. A 6 hour training program was developed and taught by RRT's, advanced practice nurses, and pharmacists for unit employees (RN's, RN assistants, social workers, and case managers). A "pull" process which identified COPD patients early in the hospitalization facilitated a patient's admission to the pulmonary unit. The COPD pathway designed to provide quality yet efficient patient care was re-vitalized and instituted on newly admitted COPD patients. Input from the physicians included the development of a 60 second "walk test," patterned after the traditional 6 minute walk test. This procedure was designed to see how patients functioned in limited areas similar to the home environment. The Pulmonary unit opened in the late 2008. Due to patient census and bed availability, not all pulmonary patients are admitted to the pulmonary unit. RESULTS: In 2009, a comparison was made between DRG 88 patients admitted to the pulmonary unit and those who had been admitted elsewhere in the facility (non ICU patients only). With a comparable severity of illness defined by the MS DRG, patients admitted to the pulmonary unit had shortened LOS (5 %) and a considerable improvement in net margin (96%), as shown below. We attribute successes to caregiver training, focus on the pulmonary patient and improved practices, such as the pathway and earlier identified discharge needs. To solidify efforts, an advanced role for RRT's, the Respiratory Clinical Specialist was implemented in June 2009. Duties include facilitating /streamlining the care of COPD patients by defining appropriate care, early discharge needs identification, case managing frequently admitted patients, and discharge follow-ups. This role will be evaluated to see if our positive results can be hardwired into daily clinical practice. CONCLUSION: Process improvement, commitment by all vested parties, and use of a COPD pathway can help reduce LOS and improve net margin.

Sponsored Research - None

	January -April 2009	January -April 2009
Pulmonary Unit Admission	No	Yes
Sum of Total Cases	50	49
Average of Total LOS	4.70 Days	4.49 Days
Average Net Margin	($2207)	($77)
Average of MS DRG Weight	0.9430	0.9512

677820

THE USE OF A NEW OXYGEN DELIVERY DEVICE AND WIRELESS CLINICAL OXYGEN DOSE RECORDER FOR MONITORING PATIENTS USING SUPPLEMENTAL OXYGEN.

Brian W. Carlin[1,2], Chris Brehm[2], Victoria Behun[2], David Germeyer[2]; [1]Pulmonary and Critical Care Medicine, Allegheny General Hospital, Pittsburgh, PA; [2]Lifeline Pulmonary Rehabilitation Centers, Pittsburgh, PA

Background: Significant variability in the delivered dose of oxygen during both rest and exercise has been shown in patients who are oxygen dependent who are undergoing pulmonary rehabilitation. The objective of this study was to monitor patients undergoing pulmonary rehabilitation on their current oxygen device and a novel SmartDose device at rest and during exercise using a new wireless Clinical Oxygen Dose Recorder (CODR, Inspired Technologies, North Huntingdon, PA). Method: Nine patients underwent 6 minute walk testing using their prescribed oxygen dose and again, after a ten minute rest, using a SmartDose algorithm device. The SmartDose device automatically establishes the resting breath rate and increases the dose and flow rate (setting) with rises in respiratory rate during activity. The CODR wirelessly measures and trends the patient's respiratory rate, I:E ratio, SpO2, Heart rate, and oxygen dose delivered. If the resting oxygen saturation was below 88%, the oxygen flow rate was increased as necessary to maintain the resting saturation above 88%. During each walk, the respiratory parameters were continually recorded and Borg scores were taken at the 1 and 6 minute mark. In addition to SmartDose the other devices measured were HomeFill (Invacare, Elyria, Ohio), Chad Oximatic (Inova, Naples, FL), Airsep (Airsep, Buffalo, NY), Helios (Covidian, Boulder, CO) and continuous flow oxygen. Results: Three patients were unable to complete a full 6 minute walk (SpO2 <88%) with their current home device, however were able to complete the testing on the SmartDose device (SpO2 >88%). Four patients were titrated 2 settings lower on SmartDose (a 5th was titrated 1 setting below) and were able to complete their 6 min walk with an SpO2 > 88%. Six patients were able to maintain SpO2 levels from 1-7% higher than on their home device. All patients reported the same or lower Borg scores on the second walk using the SmartDose device. Conclusions: Current oxygen systems may fail to provide adequate dose delivery and oxygen saturation during exercise. This may impact the patient's conditioning during rehabilitation. The SmartDose device improved oxygen saturation, in some cases with lower settings, as well as walk duration in patients undergoing rehabilitation. The CODR device is a valuable tool for understanding device titration and patient performance during rehabilitation.

Sponsored Research - Study funded by Inspired Technologies, North Huntingdon, Pennsylvania

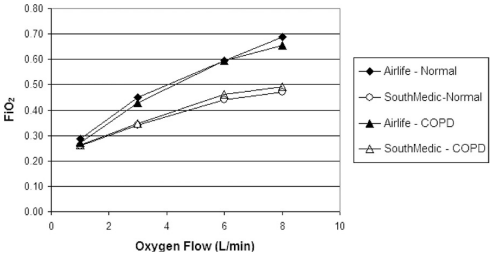
679997

EFFECTS OF LUNG MECHANICS ON OXYGEN DELIVERY USING SIMPLE OXYGEN MASKS.

Megan McKenney, Steven Zhou, Shannon E. Cook, Robert L. Chatburn; Respiratory Institute, Cleveland Clinic, Cleveland, OH

INTRODUCTION: Chronic obstructive pulmonary disease (COPD) is often treated with supplemental oxygen through an oxygen mask. The fraction of inspired oxygen (FiO_2) is estimated with a mathematical model that includes oxygen contribution from the device plus the patient's anatomic reservoir. The model assumes the reservoir is flushed with oxygen during the last portion of normal expiration when expiratory flow is zero – a potentially incorrect assumption for patients with COPD as expiratory flow may never be zero. The purpose of this study was to compare FiO_2 llevels in simulated normal and COPD adult patients using two different mask types, a simple and diffusing mask. Diffusing masks differ from simple masks in that they direct oxygen flow towards the nose and mouth by causing a vortex to form. We hypothesized that COPD lung mechanics would decrease FiO_2 levels and that the diffusing mask would result in lower FiO_2 levels than the simple mask due to its lack of a reservoir. **METHODS:** A lung simulator (ASL 5000 Ingmar Medical, Inc.) and a simulated head with nares was used to test one simple mask (SM, Cardinal Health Airlife, adult size) and one diffusing mask (DM, Southmedic OxyMask, Adult Size). Each mask was sealed around the face to represent optimal oxygenation conditions. A tube (100 mL dead space) connected the head to the simulator. Lung simulator settings: sinusoidal patient effort, 33% inspiration, closed loop control of tidal volume = 500 mL. For normal lung: frequency (F) = 12 breaths/min. compliance (C) = 100 mL/cmH2O, resistance (R) = 3 $cmH_2O/L/sec$. For COPD lung: F = 15/min, C = 85 mL/cmH_2O, R = 12 $cm H_2O/L/sec$. Oxygen flows were 5-9 L/min. Data were collected every 10 seconds for each experimental setup. Mean values (of 10 measurements) were compared with 2 way ANOVA. **RESULTS:**Mean values are shown in the Figure. All standard deviations were < 1%. FiO_2 for normal lung was higher at all flows than COPD ($P < 0.001$). FiO_2 was higher for the simple mask at all flows. **CONCLUSIONS:** These findings suggest that COPD lung mechanics decrease the amount of oxygen delivered with simple and diffuser oxygen masks. Despite the fact that both devices we evaluated are classified as simple oxygen masks, the newer design of the diffuser mask seems to result in less oxygen delivery than the conventional design. This study reinforces the idea that low flow oxygen therapy must be titrated to individual patient needs (eg using pulse oximetry).

Sponsored Research - None



677854

CLEAN MY R.I.D.E. (REDUCE INHALATION OF DIESEL EXHAUST) PHASE 1: ASSESSMENT OF DIESEL PARTICULATE EXPOSURE IN SCHOOL CHILDREN.

Kathleen Hernlen, Randall Baker, Emily Duncan, Jennifer Elliott, Chi Chi Ibeto, Sheena Jordan; Medical College of Georgia, Augusta, GA

Background: Between September 2006 and 2008 six children under 14 years of age residing in the Augusta, Georgia area were reported to have died from asthma. The asthma death rate in Richmond County (Augusta) was significantly higher than the state and national pediatric asthma death rates during this time. Approximately 22,000 students (66.61%) in the Richmond County school system are transported by bus each day. Buses at many of the schools in Richmond County have been observed idling while waiting for students to be dismissed from school. The Clean My R.I.D.E program was developed to reduce inhalation of diesel exhaust by school-aged children in Richmond County by raising awareness about increased exposure to environmental particulate during bus idling. Phase one of this study assessed the current exposure to environmental particulates with current bus policies in place. Method: We assessed particulate counts (<2 um) using a Met One 237B Portable Airborne Particle Counter. Counts were collected in the bus loading areas at five schools in Richmond County prior to, during, and after school dismissal. The counts were taken on three different days for each school during August and September, 2008. Results: Baseline counts varied for each day due to weather conditions, wind direction and velocity, and environmental conditions, such as the grass being mowed during or prior to school dismissal. Factors that contributed to increase peak counts included: amount of time buses and older model cars idled, number of buses arriving and departing, and the configuration of the bus loading zone. One school demonstrated a 153% increase above mean during bus loading. The configuration of this bus zone required students to walk through these particulates to board buses. In one case an idling car increased the < 2 um particulate count 684% from a mean of 127,390 particulates/minute to 1,000,000 particulates/minute. Conclusion: Bus idling increases exposure to respirable particulate, especially when the configuration of the bus zones requires that students walk through diesel exhaust. Grass should be mowed at times when students are not attending school. "No idling" policies should be adapted to decrease the amount of particulate to which children are exposed. The Richmond County Board of Education has now adapted a No Bus Idling Policy.

Sponsored Research - East Central Health District of Georgia

Results of Phase One

	DAY 1			DAY 2			DAY 3		
School	Loading Mean <2um	Highest Count <2um	% Change	Loading Mean <2um	Highest Count <2um	% Change	Loading Mean <2um	Highest Count <2um	% Change
A	219662	275269	25%	423374	528301	25%	194090	263648	36%
B	338922	827671	144%	121707	308257	153%	192435	266791	39%
C	193666	242106	25%	115624	136901	18%	359013	389566	8%
D	126966	141126	11%	123303	158103	28%	257352	382601	49%
E	447282	461862	3%	226656	291479	29%	140638	172756	23%

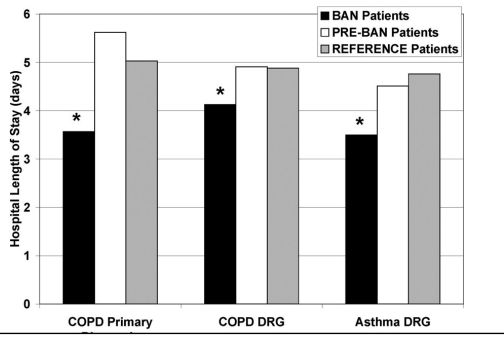
679739

IMPACT OF A BREATH ACTUATED NEBULIZER PERFORMANCE IMPROVEMENT ON HOSPITAL LENGTH OF STAY.

John S. Emberger[1], Joel M. Brown[1], Vinay Maheshwari[1,2], Lorraine Killian[1]; [1]Respiratory Care, Christiana Care Health System, Newark, DE; [2]Medicine, Christiana Care Health System, Newark, DE

BACKGROUND: Newer nebulizer technologies have been developed that may improve delivery of medications as well as shorten the duration of therapy time. We have been investigating ways that we can provide better care and eliminate concurrent respiratory therapy. A performance improvement project was approved by our Pharmacy and Therapeutics Committee, to evaluate performing one-on-one nebulizer therapy with a breath actuated nebulizer (Aeroeclipse® II, Monaghan Medical). We wanted to determine if timed breath actuated nebulizer (BAN) therapy impacted patient length of stay in the hospital. METHODS: We performed an IRB approved retrospective review of the following patient populations: 1) Patients in the BAN approved area that recieved 3 minute timed BAN treatments (BAN Patients) 2) Patients on standard nebulizers in the BAN approved area before the BAN project was initiated (PRE-BAN Patients) 3) Patients on a similar reference floor that used standard nebulizers (REFERENCE Patients). Primary end point was hospital length of stay. We excluded patients with invasive or non-invasive mechanical ventilation, tracheostomy and ICU visit. We analyzed characteristics such as: oxygen use, combination controller medication use and home bronchodilator use to determine if the populations are "like" patients. We identified each patient's primary diagnosis and DRG code for comparision analysis. RESULTS: We identified 365 BAN patients for inclusion. The BAN, PRE-BAN and REFERENCE patients had similar percentages of the "like" characteristics listed in the methods section. There was a similar distribution of patients with COPD DRG, Asthma DRG and COPD primary diagnosis in each of the three populations. See chart for hospital length of stay analysis. CONCLUSION: Bronchodilator treatment for patients with obstructive diseases such as Asthma and COPD have conventionally used standard small volume jet nebulizers. Our study compared the use of breath actuated nebulizers versus small volume nebulizers to evaluate the primary endpoint of hospital LOS in patients with COPD, Asthma, or both. Actual treatment time was 3 minutes or less which allowed respiratory staff to eliminate concurrent therapy. Treatment with BAN resulted in a statistically significant reduction in hospital LOS when compared to historical reference and concurrent reference patients with COPD and Asthma. Wider prospective studies to evaluate this therapy are needed.

Sponsored Research - None



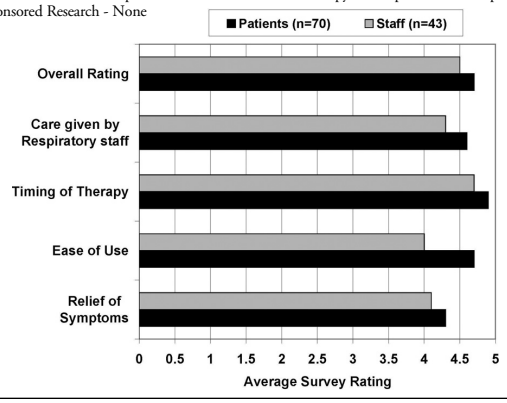
677654

STAFF AND PATIENT SATISFACTION WITH A BREATH ACTUATED NEBULIZER PERFORMANCE IMPROVEMENT.

John S. Emberger[1], Joel Brown[1], Vinay Maheshwari[1,2], Lorraine Killian[1]; [1]Respiratory Care, Christiana Care Health System, Newark, DE; [2]Medicine, Christiana Care Health System, Newark, DE

BACKGROUND: New advanced nebulizer designs have been developed to improve delivery of medications. Patients with chronic obstructive lung disease as well as Respiratory Care Practitioners are accustomed to standard nebulizers for medication therapy. A performance improvement project evaluating a breath actuated nebulizer (Aeroeclipse® II, Monaghan Medical) approved by our Pharmacy and Therapeutics Committee was performed at our hospital. We investigated if a breath actuated nebulizer (BAN) would improve the satisfaction of the patients and the respiratory staff for aspects of care associated with the nebulizer therapy. METHODS: An IRB approved retrospective review of the surveys from our BAN patients and surveys of the respiratory therapists who performed BAN therapy was conducted. All of the survey questions were in a Likert scale format: "On a scale of 1 to 5, 5 being the BAN was superior to standard nebulizer, 1 being BAN was inferior to the standard nebulizer". Rating categories included: Relief of symptoms, Ease of Use, Time of treatment, Care given by the respiratory therapist and Overall rating. RESULTS: There were 43 respiratory therapists surveyed about BAN therapy. There were 70 patients surveyed about BAN therapy. See chart for survey data. Patients were satisfied with the BAN therapy over standard nebulizer therapy averaging scores from 4.3 to 4.9 out of 5.0 for the aspects surveyed. Respiratory staff were satisfied with BAN therapy over standard nebulizer therapy with survey scores ranging from 4.0 to 4.7 out of 5.0 for the aspects surveyed. There were no survey results from patients or respiratory staff lower than a score of 3. CONCLUSION: Bronchodilator treatment for patients with obstructive diseases such as Asthma and COPD have conventionally used standard small volume nebulizers. Our study evaluated surveys for use of breath actuated nebulizers to assess the satisfaction of both patients and respiratory care staff. No surveys from staff or patients reflected preference of standard nebulizers. Patients and therapists were satisfied with BAN therapy in our performance improvement project.

Sponsored Research - None



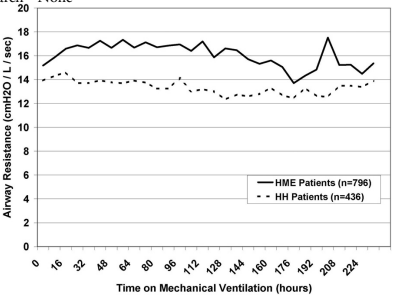
677977

AIRWAY RESISTANCE OVER TIME IN PATIENTS WITH HEAT AND MOISTURE EXCHANGERS AND HEATED HUMIDIFIERS.

John S. Emberger, Francis Gott, Joel M. Brown, Melani Murphy; Respiratory Care, Christiana Care Health System, Newark, DE

BACKGROUND: We instituted widespread use of heat and moisture exchangers (HME) last year at our hospital. We use criteria published by Branson et. al.[1] to determine heated humidifier (HH) versus HME use. We replace HME's three times per week, or PRN for secretions in the HME. Several articles have demonstrated an increase in airway resistance (Raw) due to endotracheal tube lumen reduction over time with use of HME's. We wanted to determine if there is a difference in Raw for our patients using HME's versus HH over time. METHODS: An IRB approved retrospective evaluation of all mechanically ventilated patients was performed. Data collected included: type of humidification, duration of mechanical ventilation, calculated Raw every 8 hours. Respiratory care staff performs a measurement of Raw every 8 hours, with a plateau manuver. We analyzed adult patients that used only HME's or only HH for the entire duration of mechanical ventilation from June 2008 to June 2009. We excluded patients that were switched from HME to HH and patients who were on a ventilator not capable of a square waveform for the Raw measurement. We analyzed Raw over time for patients on HME's or HH's for up to 10 days of use. RESULTS: We identified 796 patients that used HME's exclusively during the entire time on mechanical ventilation and were on a ventilator capable of a square flow waveform. We identified 436 patients that used HH exclusively for the entire duration of mechanical ventilation and were on a ventilator capable of a square flow waveform. We excluded 477 patients who were switched between HME and HH. There was a stable trend in the average Raw over time up to 10 days for both the HME and HH patients. HME Raw was consistently about 2 cmH2O/L/sec higher than HH Raw which is expected because resistance of the HME itself. CONCLUSIONS: At our hospital in over 700 patients, we have a stable Raw trend in patients using HME's for up to 10 days of use. We also note a stable Raw trend in over 400 patients using heated humidifiers for up to 10 days. Patients that meet our criteria for HME use do not show an increase in Raw for up to 10 days of use. REFERENCE: 1) Branson RD, Davis K, Campbell RS, Johnson DJ, Porembka DT. Humidification in the intensive care unit. Prospective study of a new protocol utilizing heated humidification and a hygroscopic condenser humidifier. Chest 1993;104(6):1800–1805.

Sponsored Research - None



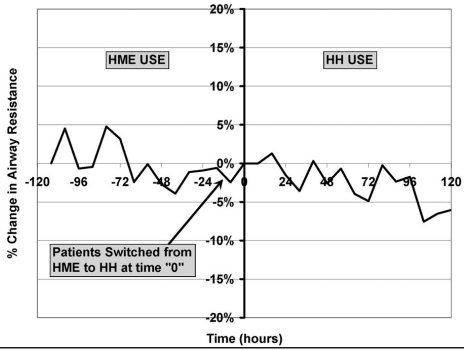
678863

ANALYSIS OF AIRWAY RESISTANCE AND SPUTUM CONSISTENCY FOR PATIENTS SWITCHED FROM HEAT AND MOISTURE EXCHANGER TO HEATED HUMIDIFIER.

John S. Emberger, Joel M. Brown, Francis Gott, Melani Murphy; Respiratory Care, Christiana Care Health System, Newark, DE

BACKGROUND: We instituted widespread use of heat and moisture exchangers (HME) last year at our hospital. We use criteria published by Branson et. al.[1] to determine heated humidifier (HH) versus HME use on mechanically ventilated patients. We replace HME's three times per week, or PRN for secretions in the HME. The most common criteria for HH is thick secretions for two sequential suctioning events. Several articles have demonstrated a reduced endotracheal tube lumen over time when using HME's. We wanted to examine Raw and sputum consistency over time, for patients that required a change from HME to HH based on our humidification criteria. METHODS: An IRB approved retrospective evaluation of all mechanically ventilated patients was performed. Data collected included: type of humidification, duration of mechanical ventilation, calculated Raw every 8 hours, documented sputum consistency. RCP's perform a measurement of Raw every 8 hours, with a plateau manuver. RCP's document sputum consistency. We included patients that were switched from HME to HH between June 2008 to June 2009. We excluded patients that were only on HME or HH and patients not on a ventilator capable of a square waveform for the Raw measurement. We analyzed Raw over time for up to 5 days on HME (prior to HH use) and up to 5 days on HH after switching from HME. RESULTS: We identified 477 patients who were switched from HME to HH. In the 5 days on HME (prior to switching to HH) there was ±4% variation in Raw. In the 5 days after switching to HH there was variation from +1% to -8% in Raw. See figure for percent change in Raw over time. Thick secretions were documented 33% of the time while patients were on HME, and 53% of the time while patients were on HH. No true documented tube occlusions occurred. CONCLUSIONS: At our hospital we evaluated over 400 patients who were switched from HME to HH based on humidification criteria. We did not observe increased Raw while on HME, even as criteria were met that required a switch to HH. We did not observe increased Raw while on HH despite a higher percentage of patients with thick secretions. Frequency of thick secretions does not appear to correlate with Raw. REFERENCE: 1) Branson RD, Davis K, Campbell RS, Johnson DJ, Porembka DT. Humidification in the intensive care unit. Prospective study of a new protocol utilizing heated humidification and a hygroscopic condenser humidifier. Chest 1993;104(6):1800–1805.

Sponsored Research - None



679704

DEVELOPMENT OF A RESPIRATORY THERAPY PROTOCOL FOR HIGH FLOW NASAL CANNULA IN THE BRONCHIOLITIS PATIENT.

Andrea K. Johnson, Christine Hartling, Julie Ballard; Respiratory Therapy, PCMC, Salt Lake City, UT

BACKGROUND: Primary Children's Medical Center (PCMC) is a 252-bed tertiary care facility located in Salt Lake City, Utah. PCMC admits approx 800 bronchiolitis patients (pts) a year. Our existing inpatient bronchiolitis collaborative practice guideline emphasizes nasopharyngeal suction (NPS), oxygenation and hydration as the mainstay care for bronchiolitis pts. It also utilizes a symptom-based bronchiolitis score (BS) that includes respiratory rate, breath sounds and retractions; each scored on a 0-3 scale. The total BS is used to assess respiratory distress (RD) and patient (pt) response to interventions. A sub-group of these pts don't respond to these therapies and stay in the moderate to severe bronchiolitis score range needing further management. We sought to develop a protocol that would allow for placement, weaning/escalation, and discontinuing High Flow Nasal Cannula (HFNC) for the treatment of this pt population. **METHOD:** All pts with a primary diagnosis of bronchiolitis with no co-morbidities under 24 months of age were included. If the patient's BS score was 6 or greater despite interventions then HFNC was initiated at a flow of 6 lpm and 100% Fio2. The pt was rescored after 30 minutes on HFNC. If the pt didn't demonstrate improvement in BS score, flow would be increased and the pt would be reassessed after 30 minutes. If the pt still did not improve then they would transition to nasal prong CPAP or intubation. If the BS decreased by 1 or more then the patient would remain on that liter flow and weaning of Fio2 would take place to maintain saturations 88% or greater. Once Fio2 was weaned to 40% then liter flow would be weaned by .5 lpm every 4 hours as long as BS remained 4 or less. Once at 2 lpm the pt was transitioned to a regular nasal cannula and weaned for sats 88% or greater. **RESULTS:** From December 1, 2008 to April 30, 2009 there were 75 pts that were placed on HFNC. 36 pts stayed on HFNC. 39 pts required further management with nasal prong CPAP and/or intubation. Min. hours on HFNC was 1.27 hours, Max 263.53 hours and avg. was 75.22 hours. **CONCLUSION:** The BS appears to be an easy, reliable tool to use for assessing RD and response to interventions in the bronchiolitis pts. Knowing that protocols have demonstrated success in pt management and improving treatment flow; we found that using a HFNC protocol demonstrated consistency on when to initiate pts, when to wean/escalate, and when to discontinue therapy.

Sponsored Research - None

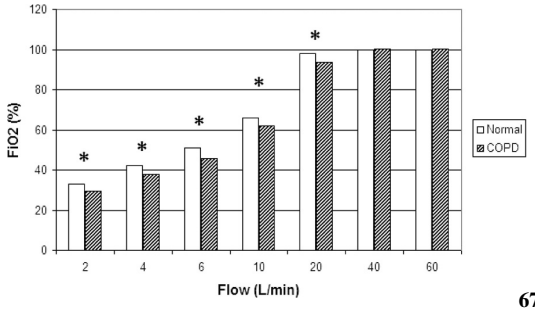
678085

EFFECTS OF LUNG MECHANICS ON OXYGEN DELIVERY WITH NASAL CANNULAE.

Steven Zhou, Shannon E. Cook, Megan McKenney, Robert L. Chatburn; Respiratory Institute, Cleveland Clinic, Cleveland, OH

The standard model for prescribing oxygen for chronic obstructive pulmonary disease (COPD) patients assumes the fraction of inspired oxygen (FiO_2) increases by 4% per L/min of oxygen delivered by nasal cannula (Respiratory Care Equipment 2nd ed, Lippincott, 1999:66). The model also assumes that a nasal "anatomic reservoir" (AR) is flushed with oxygen during the last portion of expiration when expiratory flow is zero. However, with COPD, expiratory flow may not be zero, thus reducing the FiO_2. The purpose of this study was to evaluate the effects of breathing patterns on FiO_2 and the sensitivity of oxygen delivery to the presence of an AR. We hypothesized that simulated FiO_2 would decrease with the COPD breathing pattern at lower flows and that FiO_2 would be the same at higher flows for both lung models. **METHODS:** A high flow cannula (Fisher & Paykel) and a low flow cannula (Airlife) were tested on an ASL 5000 lung simulator (Ingmar Medical, Inc) along with simulated nares. Cannula flow was 1-60 L/min. The lung simulator was set at sinusoidal patient effort, 33% inspiration with closed loop control of tidal volume = 500 mL. Simulator settings were normal lungs: compliance (C) = 100 mL/cm H_2O, resistance (R) = 3 cm H_2O/L/sec, frequency (F) = 12 breaths/min; COPD settings were: C = 85 mL/cm H_2O, R = 12 cm H_2O/L/sec, F = 15 breaths/min. Data were collected approximately every 10 seconds for each experimental setup. Mean values (of 10 measurements) for FiO_2 were compared with two-way ANOVA; P values <0.05 considered significant. **RESULTS:** Data are shown in figure. FiO_2 was less with COPD pattern for flows less than 40 L/min (P< 0.001). For normal lung, FiO_2 (%) = 4.5 + 24. For COPD, FiO_2 (%) = 4.1 + 21. **CONCLUSIONS:** Differences from normal breathing patterns caused by obstructive lung disease can make clinically important decreases in FiO_2 by nasal cannula. There may be approximately a 1 L/min increase in flow necessary to obtain the same FiO_2 for patients suffering from COPD compared to normal patients. Very high flows (40 or 60 L/min for either the normal or COPD lung model) can generate about 100% FiO_2.

Sponsored Research - None



678151

COMPARISON OF A VALVED-HOLDING CHAMBER(VHC)-FACEMASK/MOUTHPIECE WITH SMALL VOLUME NEBULIZER-FACEMASK (SVN-F) FOR BRONCHODILATOR DELIVERY.

Mary K. Hart, Erika Abmas, Rose Boehm, Grace Hernandez, Mark Millard; Baylor University Medical Center, Dallas, TX

Background: Aerosolized medications now represent the standard-of-care for asthma. A pressurized metered dose inhaler (pMDI) requires less time to deliver than SVN-F. We report a preliminary study to test the hypothesis that treatment by anti-static VHC-facemask (Aerochamber MAX Monaghan Medical Corp., Plattsburgh, NY, USA) is as effective as via nebulizer-facemask based on Forced Expiratory Volume one second (FEV1) and dyspnea responses. Method: 14 adult subjects diagnosed with asthma demonstrating a 200 ml FEV1 response to inhaled albuterol by spirometry were randomized to 5 treatment modalities using albuterol as the bronchodilator delivered: (1) 2-actuations by metered dose inhaler (pMDI)+VHC-mouthpiece (2) 4-actuations pMDI+VHC-mouthpiece (3) 2-actuations pMDI+VHC-facemask (4) 4-actuations pMDI+VHC-facemask (5) unit dose (2.5mg/3ml) ampule via small volume nebulizer-facemask. Spirometry(FEV1), heart rate, oxygen saturation, perceived work of breathing (BORG), and hand tremor were assessed prior to treatment, at 15 and 30 minutes post bronchodilator. Results: ANOVA of BORG scores improved at baseline ($p<0.05$) when compared to mean BORG scores at 15 or 30 minutes except with delivery method (5) SVN-F. Mean FEV1 at both 15 and 30 minutes post treatment were measurably higher than baseline values across treatment methods and corresponded well with BORG findings. Conclusions: Additional subjects must be studied to improve to statistical power. The improved patient dyspnea and shortened delivery time indicate that a pMDI albuterol treatment may be an acceptable clinical alternative to aerosol delivery via continuous small volume nebulizer with mask.

Sponsored Research - Research Funding provided by Monaghan Medical

678999

BACK PRESSURE COMPARISON IN THREE MEDICAL GAS DELIVERY SYSTEMS.

Tia Alton[1], Steve T. Polston[2], Kendra L. Sikes[3], In K. Kim[3]; [1]School of Medicine, University of Louisville, Louisville, KY; [2]Norton Healthcare, Inc, Louisville, KY; [3]Pediatric Emergency Medicine, University of Louisville, Louisville, KY

Oxygen is often administered to patients for various respiratory problems. Systems designed to deliver respiratory gas to patients are subject to back pressure as a result of resistance through the pathway. These back pressures have been anecdotally reported as being high enough to disconnect tubing from gas sources; possibly creating a situation that would be detrimental to the gas delivery systems. To evaluate this problem, we measured back pressures in three gas delivery systems for 100% oxygen at physiological temperature (37∞ C). Varying flow rates were used between 1-15 liters per minute (LPM) with four sizes of nasal cannulae; pediatric, infant, neonate, and premature. A U-tube manometer was used to measure the back pressure in 3 systems: Vapotherm® 2000i, Fisher-Paykel® MR850, and Salter®. The gas delivery circuit consisted of 100% oxygen gas flowing through a respiratory humidifier to a pediatric, infant, neonate, or premature nasal cannulae. Experiments were conducted with 100% oxygen at flow rates of 1 LPM, 2 LPM, 3 LPM, 4 LPM, 5 LPM, 10 LPM, and 15 LPM. For each experiment, three trials were conducted. The results showed that at 1-5 LPM flow rates, all three systems produced minimal back pressures (<25 cm H2O) with the pediatric nasal cannulae. At 1-5 LPM flow rates, the Fisher-Paykel® MR850 system produced minimal back pressures (<25 cm H2O) with the infant and premature cannulae. At 3-5 LPM flow rates, all three systems produced significant back pressures (>50 cm H2O) with the neonate cannulae. At 10 LPM and 15 LPM flow rates, all three systems produced significant back pressures (>50 cm H2O) with all four cannulae sizes. We concluded that flow rates of 10 LPM or 15 LPM produce significant back pressure with all 3 systems. When possible, pediatric sized cannulae should be used for flow rates of 1-5 LPM. For infant and premature cannulae, the Fisher-Paykel® MR850 generates minimal back pressure for flow rates of 1-5 LPM. Further modifications should be considered on neonate size cannulae to decrease back pressure.

Sponsored Research - None

679087

INHALED EPOPROSTENOL IN THE TREATMENT OF PULMONARY ARTERIAL HYPERTENSION.

Christina Pano[1], Frank Spexarth[1], Joe Hegge[2]; [1]Respiratory Therapy, St. Luke's Medical Center, Milwaukee, WI; [2]Carefusion, Lake Villa, IL

Background: Pulmonary Arterial Hypertension (PAH) is commonly associated in patients presenting with heart disease. Post-operative pulmonary hypertension may complicate cardiac failure leading to significant morbidity and mortality. In order to find a cost-effective way to treat PAH, Inhaled Epoprostenol (iEPO) was trialed on patients undergoing valvular heart surgery. Method: The Aeroneb Solo nebulizer was used to continuously deliver iEPO to sixteen patients during cardiac surgery from July 2008 until November 2008. [62.5% female (n=10), mean age 70.4] Patients were administered 40-66 ng/kg/min. of iEPO based on the institution's orderset. Data was collected to determine if there was a decrease in the systolic pulmonary artery pressures. Results: A decrease in PA pressures was seen in 93.3% of patients placed on iEPO. There was a mean decrease of 27 mmHg in PA pressures. One patient was discounted due to use of IABP and one patient had an increase in 5mmHg when placed on iEPO. There were no side effects noted. The cost of iEPO is an average of $20/hr compared to the cost of Nitric oxide at an average $132/hr. Conclusions: The iEPO showed a great clinical response in patients presenting with PAH. Previous attempts to deliver iEPO have been shown to be more labor intensive and expensive. The Aeroneb delivery system was able to effectively deliver the medication and allow for effective weaning. The medication and delivery mode were tolerated well with no complications. The iEPO has proven to be a cost-effective method of treating PAH in cardiac surgery patients.

Sponsored Research - None

Patient Dosing and Outcomes

Patient #	Type of Surgery	Dose (ng/kg/min)	PA Press. Before iEPO	PA Press. After iEPO
1	Mitral Valve Repair	59	33	30
2	Mitral Valve Replace	52	74	48
3	Aortic Valve Replace	50	62	40
4	Mitral Valve Repair	40	77	36
5	Mitral Valve Repair	40	52	48
6	Mitral Valve Repair	50	45	40
7	Aortic Valve Repair	50	51	38
8	Mitral Valve Repair	40	52	57
9	Mitral Valve Repair	50	63	IABP used
10	Aortic Valve Replace	50	60	39
11	Mitral Valve Repair	40	100	43
12	Aortic Valve Repair	50	108	40
13	Mitral Valve Replace	66	72	48
14	Mitral Valve Repair	40	45	40
15	Mitral and Aortic Valve Repair	50	56	40
16	Coronary Artery Bypass Graft	50	76	27

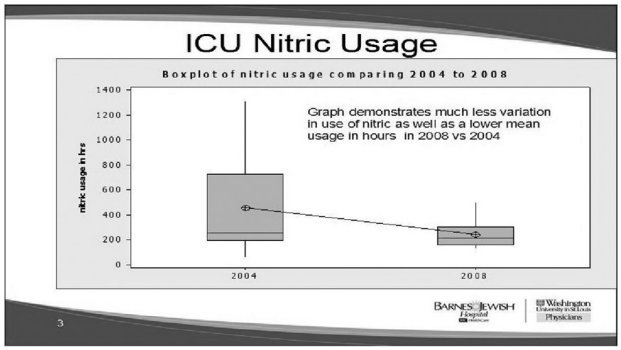
679264

IMPLEMENTATION OF A STANDARDIZED ORDER SET FOR THE APPROPRIATE USE OF INHALED PULMONARY VASODILATOR THERAPY.

Lisa Cracchiolo, Darnetta Clinkscale, Tiyonda Valentine-Cook; Barnes Jewish Hospital, St. Louis, MO, MO

Background: In 2004 a research study at our institution demonstrated that the mechanism of action of Epoprostenol (Flolan) is similar to inhaled nitric oxide, with minimal systemic side effects. Subsequently, the decision was made to create a process to assure appropriate and effective use of Nitric Oxide (NO). Nitric oxide has been approved by the FDA for use in term and near-term neonates with hypoxic respiratory failure, and had been used in the adult population for off label and investigative purposes. Inhaled Flolan is similar in its clinical effect and was felt to be an acceptable substitute in most clinical situations. Method: Inhaled Nitric Oxide was administered to patients per physician orders, prior to the process change. Initial steps in the improvement process included monitoring the usage, costs and outcomes of patients on inhaled nitric oxide by the Respiratory Care Services (RCS) department. In 2006, a standardized vasodilator order set was developed by a multi-disciplinary team. The team included: Respiratory Care Services, Pharmacy, Nursing, Critical Care Physicians as well as Chief Medical Officer (CMO). The order set was designed to identify specific attending physicians appointed by the CMO; who would have to approve the appropriate clinical use of inhaled nitric oxide on patients. The goal of implementation of an order set was to assure appropriate utilization of inhaled nitric oxide versus Flolan. Results: Comparison of the variation and mean hours of NO utilization; prior to the order set and after implementation are: much less variation indicated by smaller "whisker" on post-intervention graph and a decrease in mean hours billed at 421.6 hours during period 1 to 238.9 hours during period 2. This improvement approaches statistical significance with a p=.083. Conclusion: Inhaled Flolan has been shown to be equal to inhaled nitric oxide in its clinical effects, at a significantly reduced cost. With the development of a standardized vasodilator order set; we are able to safely and effectively administer clinically appropriate care while also reducing costs.

Sponsored Research - None



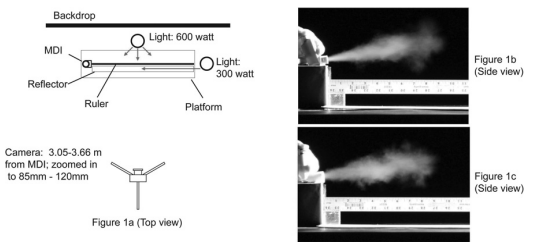
679940

CHARACTERIZATION OF THE HFA PMDI AEROSOL PLUME BY HIGH SPEED PHOTOGRAPHY.

Dirk von Hollen, Kurt Nikander; Respiratory Drug Delivery, Philips Respironics, Parsippany, NJ

The recent transition in pressurized metered dose inhalers (pMDIs) from chlorofluorocarbon (CFC) based propellants to newer hydrofluoroalkane (HFA) propellants has lead to significant changes in aerosol plume characteristics. We used high speed photographic methods to characterize the free air aerosol plume formation of two HFA pMDIs. A pMDI actuator was placed on a clear block with a ruler running away from the actuator in the direction of plume formation. A reflective strip was placed below the ruler, and a 600 watt light source above and behind the axis of plume formation, along with a 300 watt light source at the end of the ruler (Figure 1a). The camera (Casio Exilim Pro EX-F1, Casio America, Inc., Dover, NJ) was placed 3.05-3.66 m perpendicular to the ruler and focused to 85-120 mm from the ruler. [Figure 1] The two albuterol sulfate pMDIs (ProAir HFA, Teva Specialty Pharmaceuticals LLC, Horsham, PA and Proventil, Schering Corp., Kenilworth, NJ) were primed before 1st use, and shaken before each actuation. Upon actuation the camera was triggered, and 60 photos were taken during 1 s. Each pMDI was tested in triplicate. The photos were analyzed, and a marker line added to the image to denote the leading edge of the aerosol plume. The leading edge was defined as the point at which aerosol was visually detected on the photo. The velocity of the leading edge was also calculated at different timepoints. The photos showed that aerosols from both pMDIs were ejected at high velocity (Figure 1b & 1c). The plumes were seen to have a 'jet' phase early on, followed by a 'cloud' phase as the aerosol slowed. The plume leading edge for ProAir was 254 mm from the pMDI at 0.1 s and 460 mm at 0.3 s, and for Proventil was 223 mm at 0.1 s and 394 mm at 0.3 s. The plume leading edge mean velocity for ProAir was 2.47 m/s between 0.016 s and 0.1 s, and 0.9 m/s between 0.2 s to 0.3 s. For Proventil it was 1.98 m/s between 0.016 s and 0.1 s, and 0.74 m/s between 0.2 s to 0.3 s. The method described above provides information on the shape and velocity of aerosol plumes in free air. This method could be extended to provide information on pMDI aerosol plume formation inside a Valved Holding Chamber (VHC), which might help in the optimization of future VHC designs.

Sponsored Research - The authors are employees of Philips Respironics, which has supported this study by allowing authors to devote time and resources to its execution and publication.



679677

PREDICTING STUDENTS' PERFORMANCE ON THE CLINICAL SIMULATION EXAMINATIONS.

Arzu Ari, Douglas Gardenhire, Brent Murray, Lynda Goodfellow, Chip Zimmerman; Georgia State University, Atlanta, GA

Background: The success of a respiratory therapy (RT) student is often measured by his or her graduating from a RT program and successfully passing the National Board for Respiratory Care (NBRC) examinations. Although many RT students struggle in passing clinical simulation (CS) examinations given by the NBRC, to date there has been no published research on the predictability of RT students in passing CS examinations. The objective of this study was to determine the factors that are most accurate at predicting a student's performance for information gathering (IG) and decision making (DM) skills on the CS examinations. Method: A longitudinal database was created including a total of 47 students admitted to a 4-year RT program from 2007 through 2009. Independent variables of this study were the students' entering-GPA, exit-GPA, and their scores on the clinical examinations in their first and second year in the program. Pearson product-moment correlations and multiple regression analysis at a 0.05 level of significance were utilized for data analysis in this study. Results: Both students' exit-GPAs and their scores on the clinical exams at the end of their 1st year had a statistically significant positive relationship with their IG skills on the CS examination (p=0.005 and p=0.008, respectively). Also, students' DM skills had a significant positive relationship with students' exit-GPAs (p=0.001) and their scores on the clinical exams at the end of their 2nd year in the program (p=0.036). Exit-GPA was the solitary predictor of students' performance on the CS examinations and had a significant impact on students' ability to perform IG skills (p=0.007) and DM skills (p=0.008). Multiple regression analysis identified that exit-GPA accounted for 28.2% of the total variance (R2) on students' IG skills, whereas it was responsible for 27.6% of the total variation on students' DM skills on the CS examinations. Conclusion: This study determined that a student's exit-GPA will predict their performance at IG and DM on the CS examination. Also, clinical exams given to students at the end of their clinical rotations of 1st and 2nd year had a positive relationship to the students' IG and DM skills as determined by CS examinations. Therefore, consideration of these results can be helpful in re-enforcing a student's IG and DM skills in patient management and strengthen their ability to perform well on the CS examinations.

Sponsored Research - None

653177

COMMENCING, EXECUTING, AND SUCCEEDING AT TRANSITIONING RESPIRATORY THERAPISTS FROM ASSOCIATES TO BACHELOR'S DEGREE HOLDERS: A NEW WAVE IN RESPIRATORY CARE.

Abby Motz[1], Robert Wachenthaler[4], Cynthia White[2], Scott Pettinichi[3], Jenni Raake[1]; [1]The Heart Institute, Cincinnati Children's Hospital and Medical Center, Cincinnati, OH; [2]Pediatric Intensive Care, Cincinnati Children's Hospital and Medical Center, Cincinnati, OH; [3]Respiratory Care, Cincinnati Children's Hospital and Medical Center, Cincinnati, OH; [4]Transport Team, Cincinnati Children's Hospital and Medical Center, Cincinnati, OH

Background: Recruitment and retention of qualified respiratory therapists (RTs) is a concern for any respiratory care department. The Respiratory Care Division at our institution currently employs over one hundred and ninety therapists, all of which provide care in a variety of patient care settings. Our staffing needs are projected to grow over the next several years. To preserve and attract experienced therapists, we wanted to promote longevity within our institution. In doing so, our hospital offers a generous benefits package; this package includes a tuition reimbursement program. To increase recruitment and retention, our hospital partnered with a local university to offer qualified, experienced therapists an onsite Bachelor's degree program. Method: 16 applicants were accepted into the program, which offered core classes onsite. Tuition was paid for if applicants signed a retention contract for 3 years post graduation. A survey post graduation was conducted about the program and future career paths of all applicants. Results: There was 100% compliance from the applicants in completing the survey (See Table 1). Survey results indicated that 13 therapists obtained a bachelors degree. 2 therapists were still enrolled in classes at the time of submission and 1 therapist withdrew from the program. 3 graduates are now Clinical Managers, 4 graduates are now Clinical Educators, 1 graduate was promoted to Clinical Therapist III, and 1 graduate made a lateral transfer to another department. Conclusion: As a direct result of this program, RTs were able to continue their education and pursue career advancement. The program continues to grow with 26 therapists applying for the next cohort. Currently we have 20% our staff with Bachelor's Degrees, our departmental goal is 40%. Benefits to the institution included a guaranteed retention period of three years after graduation, and an opportunity to recruit new RTs interested in obtaining their baccalaureate degree.

Sponsored Research - None

Question	Answered "Yes"	Answered "No"	Answered "Other"
1. Do you feel it was beneficial that CCHMC paid for the **core** Bachelor's of Science classes up-front, instead of having to go through the tuition reimbursement program for **all** class?	87%	13%	
2. Do you feel like that the Division of Respiratory Care promotes a positive climate that enables individuals to further their education?	100%	0%	
3. Do you feel like having classes on CCHMC campus was beneficial?	94%	6%	
4. Did it make a big difference to you that the classes were on CCHMC campus in regards to deciding whether or not to initially enroll in the program?	67%	33%	
5. Do you think it was beneficial that some of the classes were offered online?	100%	0%	
6. Now that you have completed the Bachelor's of Science Degree Program, have you obtained a new or higher level position within the institution?	60%	40%	
7. Are you, or do you plan on enrolling in a Master's Degree Program now that you have completed the Bachelor's of Science Program?	6%	21%	Plan on enrolling-73%
Question	**Answered "26 months"**	**Answered "31 months"**	**Answered "still in classes"**
8. How many months did it take you to obtain your Bachelor's of Science Degree?	73%	13.5%	13.5%

(Table 1).

653987

IMPLEMENTING COMPUTERIZED PATIENT SIMULATIONS AS A MEASURE OF STUDENT LEARNING IN PATIENT MANAGEMENT.

Arzu Ari; Georgia State University, Atlanta, GA

Background: Computer simulations have been used widely since they were developed. Although many respiratory therapy (RT) programs implement computer simulations to train their students in patient management, the effect of computer simulations as a measure of patient management skills of RT students is unknown. The objective of this study was to determine the impact of computerized patient stimulations on students' information gathering and decision making skills. Method: A retrospective analysis of 29 RT students taking a pulmonary disease course at a Southeastern University was used in this study. The 5 computerized patient simulations (C&S Solutions Innovative Software Applications, Vincennes, IN) used in this study were congestive heart failure (CHF), acute respiratory distress syndrome (ARDS), myasthenia gravis, cystic fibrosis (CF), and near drowning. Students were assigned to take each computer simulation right after the specific disease was covered in class. The simulations and subsequent scorings occurred throughout the semester approximately once every three weeks. Scores were compared for each student before and after the computer simulations on different diseases were completed. A paired t-test and repeated measure analysis of variance were utilized for the statistical analysis of this study at a 0.05 level of significance. Results: The table below presents the means and standard deviations for the computerized patient simulations by disease. The results of this study showed that all of the post-computer simulation scores were significantly higher than the pre-computer simulation scores of RT students (p=0.001). Although computer simulations did not make a significant difference on students' information gathering skills (p=0.719) over time in this study, they did improve the students' decision making skills significantly (p=0.009). Conclusion: The use of computer simulations improves and reinforces RT students' learning patient management and effectively stimulates their decision making skills. Therefore, computerized patient simulations should be implemented more universally to benefit RT and other health care educational programs and be used as an objective and effective measure of student learning in patient management.

Sponsored Research - None

	CHF	ARDS	Myastenia Gravis	CF	Near Drowning
Pre	61.22 ± 20.4	51.47 ± 18.6	58.07 ± 19.8	63.84 ± 12.6	59.53 ± 11.3
Post	91.81 ± 7.1	88.56 ± 7.7	90.28 ± 7.9	93.32 ± 7.5	93.35 ± 6.2

654030

DISTANCE EDUCATION DELIVERY OF RESPIRATORY THERAPY: A COMPARISON OF TWO METHODS, SYNCHRONOUS(TRADITIONAL) VS ASYNCHRONOUS(ON-LINE).

Elisha L. Pueppka[1], Jill Sand[2]; [1]Good Samaritan Hospital, Kearney, NE; [2]Southeast Community College, Lincoln, NE

Background: The increase in longevity in the US population has brought about the need for more skilled health care professionals, of which Respiratory Therapists (RTs) play a major role. Many colleges/universities have attempted to address this issue by creating Distance Education Delivery Programs (DED). Two RT schools in Nebraska are utilizing different methods of DED to help with the need for RTs by either synchronous (traditional) or asynchronous (on-line) programs. The purpose of this study was to determine if there are any differences between DED methods of delivery in synchronous vs asynchronous from the perspective of graduates of each type of program. Method: Surveys that evaluated 22 variables of a DED RT program were sent to graduates of synchronous(GDEDS;n=7) and asynchronous(GDEDA;n=9). The surveys were completed and returned by 88% of the synchronous and 100% of asynchronous graduates. The survey sought to determine if there were differences in perceptions of clinical skills, critical thinking, and understanding of therapeutic modalities between the two types of methods. They were also asked to rate communication with program instructors,presentation,access to class materials, and overall ease of understanding materials presented for each method. Age, gender, and reason for choosing DED were also evaluated. Results: Most participants were female, GDEDS 67% and GDEDA 89%, between the ages of 18-25. NBRC credentials were, GDEDS 50% CRT and 50% RRT; and GDEDA 44% CRT and 56% RRT. The survey showed no appreciable differences between perceptions of graduates of either method. Open ended responses from GDEDA; felt like they were teaching themselves and needed more hands on experience, and GDEDS; clinical time made up for some lack of classroom information. Overall the consensus for choosing a DED RT program was convenience, finances, and no need for relocation. Conclusion: The two methods of delivery of Respiratory Therapy appear to produce graduates with similar skills and knowledge as well as to fulfill a need for therapists without sacrificing quality.

Sponsored Research - None

GDED Perceptions of Synchronous vs Asynchronous Programs

Variables	General RT Clinical Skills	ICU/Critical Care Clinical Skills	Understanding of A&P	Understanding of Therapeutic Modalities	Critical Thinking Skills	Overall Clinical Education	Consistency of Clinical Preceptors	General RT Knowledge	Communication with Instructors	Instructors Answer Questions in Timely Manner	Methods of Presentation of Class Material	Access to RT Materials	Ease of Understanding RT Materials
GDEDS, mean (SD)	4.6 (0.6)	4.5 (0.6)	3.5 (0.6)	3.7 (0.6)	4.0 (0.7)	4.0 (0.9)	4.5 (0.9)	3.8(1.0)	3.5 (1.0)	3.3 (1.0)	2.8 (0.7)	3.3 (1.0)	3.5 (0.8)
GDEDA, mean (SD)	4.3 (0.7)	4.1 (0.8)	4.1 (0.8)	4.0 (1.0)	4.1 (0.7)	4.3 (0.8)	3.9 (1.0)	3.9 (0.8)	4.1 (0.9)	4.1 (0.9)	3.9 (0.9)	4.1 (0.8)	4.1 (0.8)

658570

SIMULATION TECHNOLOGY USED TO INCREASE CLINICAL CONFIDENCE OF MALIGNANT HYPERTHERMIA DETECTION.

Joel M. Brown[1], Francis A. Gott[1], Megan Boyle[1], Charles Fort[2], John S. Emberger[1]; [1]Respiratory Care, Christiana Care Health System, Newark, DE; [2]Academic Affairs, Christiana Care Health System, Newark, DE

Background: Inhaled isoflurane is a vital therapy used for the management of status asthmaticus (SA) patients. Inhaled isoflurane is infrequently used since it is typically reserved for the most severe SA patients. A side effect of inhaled isoflurane is malignant hyperthermia (MH). Limited exposure to both isoflurane and MH lead to RCP's having difficulty maintaining the clinical confidence needed to provide this therapy. In a previous study we published evidence that demonstrated the use of set clinical objectives and a staff self assessment increases the clinical confidence of RCP's. In this study, we added the use of a simulation designed to present a patient with SA who develops MH. The purpose of this study was to assess the effect of using simulation on the RCP's self-reported clinical confidence in the detection of MH. Method: We provided 14 RCP's with formal education on the delivery of inhaled isoflurane via the Drager Apollo® Inhalation Anesthesia Machine and MH. Each RCP then received electronic references for self-learning. Three months later we resent the electronic references to the RCP's via e-mail. The RCP's were given a self assessment after receiving the formal education and electronic references. A simulation was designed to mimic a severe SA patient that would develop MH once the isoflurane was delivered. The Meti HPS® adult simulator was used for this study. After completing the simulation the RCP's were given the same self assessment. Two to eight weeks later the RCP's were then taken back for another simulation (different patient history and setting with the same outcomes). Self assessments were repeated before and after the 2nd VEST lab experience. The self assessment and case scenario were developed to include 9 objectives used during the formal education and were scored using the following 4-point Likert scale: 1 = unable to perform objective, 2 = able to perform objective with instruction, 3 = able to perform with a reference, 4 = able to perform objective. Results: Fourteen RCP's completed the formal education and the first VEST experience. Twelve completed the second VEST experience. None of the RCP's witnessed MH prior to this study. The RCP's clinical confidence increased for all 9 objectives. See attached Table#1 for additional data. Conclusion: Our results indicate that the use of the VEST lab can increase an RCP's confidence in their ability to detect MH during isoflurane delivery.

Sponsored Research - None

Self Assessment Scores

Self Assessment	Recognized the signs and symptoms of MH	Respond appropriately to the presence of MH	Overall Average Score
Post Formal Education	3.07	3.07	3.06
Post 1st Simulation	3.36	3.36	3.57
Pre 2nd Simulation	3.36	3.45	3.46
Post 2nd Simulation	3.64*	3.91*	3.79*

Table#1: This table depicts the average self assessment score for all participants of the study. *p= <0.05

660894

INTERACTIVE SIMULATIONS USED TO IMPROVE RCP COMPETENCE.

Joel M. Brown[1], Francis A. Gott[1], Megan D. Boyle[1], Chuck Fort[2], John S. Emberger[1]; [1]Respiratory Care, Christiana Care Health System, Newark, DE; [2]Academic Affairs, Christiana Care Health System, Newark, DE

Background: Inhaled isoflurane is a vital therapy used for the management of status asthmaticus (SA) patients. Isoflurane is infrequently used because it is typically reserved for the most severe SA patients. A side effect of inhaled isoflurane is malignant hyperthermis (MH). Limited exposure to both isoflurane and MH can hinder the RCP's ability to retain the clinical competence needed to recognize this hazard. In a previous study, we published evidence that demonstrated using set clinical objectives and a staff self assessment increased the clinical competence of RCP's. In this study, we added the use of a simulation designed to present a patient with SA who develops MH after inhaled isoflurane induction. Method: Fourteen RCP's received formal classroom education on the delivery of inhaled isoflurane via the Drager Apollo® Inhalation Anesthesia Machine (Apollo) and MH. Each RCP received electronic references for self-learning. Three months later we re-sent the electronic references via e-mail. We then randomly selected the RCP's to go to the VEST Center for the simulation. A simulation was designed to mimic a severe SA patient that would develop MH once the isoflurane was delivered. The Meti HPS® adult simulator was used for this study. Two to eight weeks later the RCP's were randomly selected for another simulation (different patient history and setting with the same outcomes). The performance of each RCP was observed and scored by 2 trained reviewers. The simulation included 12 clinical competencies that were developed to include the 9 objectives used during the formal education. The competencies were scored with the following 4 point Likert Scale: 1=unable to perform objective, 2=able to perform objective with instruction, 3=able to perform with a reference, 4=able to perform objective. Results: Fourteen RCP's completed formal education and the first simulation experience. Twelve RCP's attended the second VEST experience. None of the RCP's witnessed MH in a real life clinical environment. There was improvement in all 12 competencies and MH detection time improved. Four of the fourteen participants detected MH during the 1st VEST experience. All participants detected MH in the 2nd VEST experience. See Table #1 for additional data. Conclusion: The use of simulation technology can increase an RCP's clinical competence for the management of SA patients, use of the Apollo, and the detection of MH during isoflurane delivery.

Sponsored Research - None

Competency Results

VEST Experience	Competencies Focused on Apollo Set-Up	Competencies Focused on SA Management	Competencies Focused on MH Detection	Overall Competency Score	Overall MH Detection Time
1st VEST Lab Experience	2.83	3.93	2.04	2.83	4.45 Min.**
2nd VEST Lab Experience	3.67*	4.0*	3.89*	3.81*	3.24 Min.*

Table#1: This table depicts the average scores obtained by the participating RCP's.

*p=<0.05. **This number represents data collected from 4 out of the 14 RCP's

678837

PREPARING RESPIRATORY CARE STUDENTS FOR MASS CASUALTY.

Katie L. Walton[1,2], Teresa A. Volsko[2]; [1]Respiratory Care, Akron Children's Hospital, Akron, OH; [2]Health Professions, Youngstown State University, Youngstown, OH

BACKGROUND: In light of the recent natural and bioterrorist attacks there is a heightened awareness of the need for education and training of respiratory care students in disaster preparedness. The objective of this study was to determine the number of respiratory care programs that incorporate mass casualty training in the core respiratory care curriculum and to describe training characteristics for disaster preparedness. **METHODS:** After institutional review board approval, an anonymous online survey was conducted of all program directors from accredited entry and advanced level respiratory care programs. The three domains assessed in this survey were: (1) program demographics, (2) availability of designated equipment (safety and portable ventilators) for classroom demonstration and use, (3) characteristics of classroom instruction dedicated to mass casualty instruction. Survey results were entered into SPSS for analysis. Descriptive statics were used to report findings. **RESULTS:** Eight-four of the three hundred and fifty-five electronically distributed surveys were returned, yielding a 24% response rate. A majority of the respondents (85%) were from advanced level associate degree programs whose average class size ranges from 11- 20 students. Seventeen percent of the programs responding offered an average of 5 hours of didactic and lab training on designated stockpiled portable ventilators. Most programs (63%) used a skills assessment to document competency with ventilator instruction. The use of gloves, gowns and proper hand hygiene were taught by 95% of the respondents. Seventy-eight percent of participants addressed the function and use of the N95 filtering face mask, 49% of which had a mechanism to allow students laboratory practice with this device. Less than one quarter of the program directors reported classroom or laboratory instruction in the use of the elastomeric air-purifying respirator or the powered air-purifying respirator. Training videos and mass casualty scenario simulation learning tools were used by 93% of study participants. **CONCLUSIONS:** Respiratory care programs are incorporating disaster preparedness training into the curriculum. However, the resources available for classroom instruction and characteristics of classroom training vary.

Sponsored Research - None

673685

DISTRIBUTION OF THE COGNITIVE LEVELS OF THE 2010 NBRC WRE MATRIX AND OF THE MULTIPLE-CHOICE QUESTIONS IN FOUR RT BOOKS.

David Chang; Cardiorespiratory Care, University of South Alabama, Mobile, AL

BACKGROUND: The NBRC Written RRT Examination (WRE) uses three cognitive levels (Recall, Application, Analysis) as one of the criteria for item construction. According to the 2010 NBRC WRE matrix, the 100-item examination has the following distribution of cognitive levels: Recall (Re) 6%, Application (Ap) 15%, Analysis (An) 79%. This study compares the cognitive levels of the multiple-choice questions in the 2010 NBRC WRE and four RT books. METHOD: Four different types of RT books are used in this study. The abridged Bloom's taxonomy and the NBRC guidelines are used to determine the cognitive levels of the multiple-choice questions in one randomly selected chapter from each of the four RT books. Frequency count is used to compile and calculate the percentage of cognitive levels of multiple-choice questions. The RT books (year of publication) include one comprehensive textbook (Comp 2002) with 26 questions, one comprehensive workbook (Work 2009) with 67 questions, one exam review book (Review 2006) with 33 questions, and one mechanical ventilation textbook (Mech 2006) with 25 questions. RESULTS: The results are rounded to the whole percentage and the distributions of cognitive levels of the multiple-choice questions are: Comp 2002 (Re 65%, Ap 27%, An 8%); Work 2009 (Re 72%, Ap 18%, An 10%); Review 2006 (Re 39%, Ap 24%, An 36%); Mech 2006 (Re 76%, Ap 4%, An 20%). CONCLUSIONS: The cognitive level of the NBRC WRE is concentrated and skewed toward the Analysis level. Comparing to the 2010 NBRC WRE matrix, the multiple-choice questions in the selected chapters of the four RT books are deficient at the Analysis level. During the course of study and preparation for the NBRC WRE, RT faculty and students should not rely solely on the RT books. Supplement learning resources should be used to enhance the higher cognitive problem-solving skills.

Sponsored Research - None

Distribution of Cognitive Levels of Multiple-Choice Questions

Publication (year)	Recall	Application	Analysis
2010 NBRC WRE Matrix	6%	15%	79%
Comprehensive Textbook (2002)	65%	27%	8%
Comprehensive Workbook (2009)	72%	18%	10%
WRE Review (2006)	39%	24%	36%
Mech Vent Textbook (2006)	76%	4%	20%

675349

CRITICAL TASKS OF THE DATAARC ADULT NASAL CANNULA COMPETENCY: A SURVEY OF RESPIRATORY CARE EDUCATORS.

Patrick Evans[1,2], Kathy Jones-Boggs-Rye[2], Robert Kennedy[3]; [1]Respiratory Care Program, University of Arkansas for Medical Sciences, Texarkana, AR; [2]Department of Respiratory and Surgical Technologies, University of Arkansas for Medical Sciences, Little Rock, AR; [3]Nursing Scholarship and Research Center, University of Arkansas for Medical Sciences, Little Rock, AR

Background: Respiratory care students are educated to perform a variety of patient care procedures. Ensuring correct procedure competency, students are trained to follow task lists that guide procedure performance. DataArc (http://www.dataarc.ws/) published a comprehensive set of respiratory clinical competencies now in common use. This study examines what task items in the DataArc adult nasal cannula competency are considered critical to success by an ad hoc group of respiratory care educators and if group demographics influence selection of critical tasks. Method: Respiratory care educators attending "A Method of Evaluating Inter-rater Reliability" during 2007 AARC Summer Forum (N = 127) voluntarily participated in a mock preceptor training session. During the session educators completed surveys and competencies. A survey asked educators to identify which of the 28 task items on the DataArc Adult Nasal Cannula competency were critical for successful competency completion. Responses were examined as a whole and comparisons made with subgroups: college degree, years in Respiratory Care and Respiratory Care education, current role, educational setting, and whether they attended student clinical rotations. The results were evaluated using descriptive, Chi square and ANOVA quantitative statistical methods. Results: The study sample was not in 100% agreement on any task item as being critical for competency completion. All subgroup comparisons had degrees of difference but none were statistically significant. Rank ordering the task items revealed the highest agreement with "Verifies physician's order for appropriateness or evaluates procedure based on hospital protocol" at 95.2%. The lowest agreement was "Confirms patient and/or family understanding of the procedure" at 49.6%. The average agreement was 78% for 28 tasks. Conclusions: Participants lacked agreement about which items were critical in an adult nasal cannula competency. No demographic characteristic identified a specific group as being out of norm, indicating results were similar for all participants. Lack of agreement on the critical tasks of the adult nasal cannula competency indicates student assessment is based on educator preference and not accepted an standard of procedure performance. Further discussion is indicated to establish consensus about what task items should be designated critical and non-critical. Study results indicate other respiratory care competencies should be evaluated.

Sponsored Research - None

666597

CRITICAL THINKING ABILITY IN RESPIRATORY CARE STUDENTS AND ITS CORRELATION WITH AGE, EDUCATIONAL BACKGROUND, AND PERFORMANCE ON NATIONAL BOARD EXAMINATIONS.

Richard Wettstein, Robert Wilkins, Donna Gardner; UTHSCSA, San Antonio, TX

Critical thinking (CT) has been deemed an important characteristic to develop in respiratory care students. This study used the Watson-Glaser Critical Thinking Appraisal – Short Form to measure the CT ability of senior respiratory care students (n = 55) enrolled in a baccalaureate program. The Pearson Correlation was utilized to assess the potential relationships between CT score and age, and CT score and outcomes on the clinical simulation examination (CSE). Chi-Square was used to assess the potential association between CT score and the subjects' educational background. The study did not identify a significant relationship between CT score and age, or between CT score and outcomes on the CSE. A significant ($p<0.04$) positive association was found between a strong educational background in science and CT ability. This positive correlation between a strong background in science and CT ability might be useful in the student selection process for respiratory care programs. Key words: critical thinking, Watson-Glaser Critical Thinking Appraisal, educational background.

Sponsored Research - None

677997

SURVEY OF THE KNOWLEDGE AND CONFIDENCE OF RESPIRATORY THERAPY STUDENTS REGARDING TUBERCULOSIS.

Sandra T. Hinski, Lynda T. Goodfellow, Larry Bryant, Ralph Zimmerman; Respiratory Therapy, Georgia State University, Atlanta, GA

Background: Tuberculosis (TB) is a highly contagious disease. With respiratory therapists on the front-line in treating all types of respiratory conditions, it is imperative their knowledge regarding tuberculosis be accurate and wide-ranging in order to successfully treat patients, participate in transmission reduction education, as well as protect themselves from tuberculosis infection. Methods: Students enrolled in a bachelor degree RT program were surveyed prior to and following tuberculosis education to compare their knowledge and confidence regarding tuberculosis. The pre-TB education survey was administered to the first year RT class prior to any academic or clinical instruction. The post-TB education survey was administered after the same class had received one hour of TB education in lecture format and participated in approximately 64 hours of clinical education. Results: Pre-TB education surveyed student's average grade on questions that focused on their TB knowledge was 44.5% and the post-TB education surveyed students demonstrated improvement with an average score of 72.4%. Six choices ranging from no confidence to high confidence (A through F, respectively) were rated by each student. The respondents in the pre-TB education survey were generally confident (D 27.5%, E 10%, F 15%) that they could identify the need for airborne infection isolation precautions to prevent transmission of suspected of identified TB. The post-TB survey answers to the same question showed improved confidence (D 11.4%, E 28.6%, F 17.1%). Conclusions: Prior to program education regarding TB, none of the surveyed students had attended a lecture where TB was the primary focus. The post-TB education survey demonstrated all respondents had attended at least one TB focused lecture. At least three quarters of the instruction was given in lecture format (75% pre-TB education surveyed, 100% post-TB education surveyed). The RT student's overall level of knowledge regarding TB increased from the pre-TB education survey to the post-TB education survey and their responses indicated an improvement in confidence. Further research is needed to evaluate if surveying the knowledge and confidence of the RT student regarding TB can be used to make conclusions about a respiratory therapy program's effectiveness regarding TB education.

Sponsored Research - None

679205

COPING WITH LOSS AND DEATH AND DYING ISSUES OF RESPIRATORY CARE STUDENTS.

Thomas J. Stokes, Gregg Marshall, Christopher Russian; Respiratory Care, Texas State University, San Marcos, TX

Background: The objective of the project is to assess first-year respiratory care students perceptions of death and dying using the revised Collett-Lester Fear of Death and Dying Scale (CL-FODS) pre and post tests prior to their first instructional module (clinical rotation), and post-clinical Respiratory Care Practice I rotation (N=24). Assessment of pre, post-test, and post-clinical scores measuring death anxiety were measured and analyzed. Research Question: Will the use of the CL-FODS influence students' level of death anxiety in dealing with patient care as measured during pre and post clinical experience? **Methodology:** An enhancement grant proposal was approved for IRB exemption (ref # 5-12218). Since pre-clinical training takes place during the spring semester, prior to their initial clinical rotation, students were first given the CL-FODS pre-test prior to instruction via a didactic teaching module on Death and Dying issues and then given the post-test immediately after. Students then completed 160 clinical contact hours in a 5-week clinical summer rotation. Student perception was then reassessed in the form of a post-clinical test. The CL-FODS contains thirty-two test questions divided evenly asking students to assess their feelings of "Your Own Death", "Your Own Dying", and "The Dying of Others" using a 5-point Likert scale. The modified CL-FODS post-clinical instrument contained thirty-three questions, with the additional question asking if they had experianced a death and dying situation during their rotation. **Results:** Repeated mesures ANOVA was performed to examine the mean differences between the subjects from three different intervals and the f value reported (f = 0.844) indicated no significant differences between the means of pre-, post-, post-clinical CL-FODS test scores (p=0.437) **Conclusion:** The findings of the study shows that the exposure of students to death and dying didactic and clinical situations does not lead to an increased death anxiety score among respiratory therapy students. However, qualitative data did show empathy towards the patients, family members and other health care providers

Sponsored Research - None

Results of Analysis of Variance Comparing Differences Between Pre. Post, and Post-Clinical test Scores of CL-FODS

	Mean	Standard Deviation	N
Pre-Test	96.17	21.069	24
Post-Test	93.25	22.123	24
Post-Clinical Test	100.92	20.595	24
p.05 alpha			
$f = 0.844$			
$p = 0.437$			
power = .186			

679262

DISTANCE LEARNING AND THE INTERNET IN RESPIRATORY THERAPY EDUCATION.

Sarah Varekojis[1], Elbie Foote[2]; [1]Respiratory Therapy Division, The Ohio State University, Columbus, OH; [2]Respiratory Therapy Department, Cincinnati Children's Hospital Medical Center, Cincinnati, OH

BACKGROUND: Distance education may be able to at least partially address the continuing and increasing demand for respiratory therapists and the need for additional training as the field advances. OBJECTIVES: This study assesses current uses of distance education in respiratory therapy education, as well as the beliefs and opinions regarding appropriate use of distance education. The advantages of and barriers to distance education from the perspective of the educational program directors were examined. METHODS: An on-line survey instrument was designed to measure the various aspects of distance education in RT education. The survey was sent to 343 accredited RT educational programs that offered either advanced or entry-level preparation. RESULTS: The response rate was 39.6%. 52.1% of respondents indicated that some form of on-line education was utilized in the curriculum. Internet-facilitated and blended/hybrid courses were most common followed by exclusively on-line courses. The most common type of course offered as either internet facilitated, blended/hybrid or on-line was didactic only. The most common type of course offered as face-to-face was a clinical course (62%). Directors anticipate that each type of course offering will stay relatively the same, and they believed internet facilitated courses facilitate student success and accommodate varied learning styles and preferences. Many barriers to on-line education were identified, including inability to provide quality laboratory experiences and the increase in time for course implementation and maintenance. However, the respondents felt that on-line education provided the opportunity to make enhanced learning resources available to students and provided active learning. CONCLUSION: A clear preference for face-to-face and internet-facilitated courses was identified. The internet was identified as being useful for dissemination of information and for facilitating communication. However, respondents viewed the laboratory and clinical settings as hands-on environments that require supervision from instructors for demonstration of skill acquisition and problem solving. These results indicate that distance education plays an important role in respiratory therapy education, and that purely on-line courses might not be the best method for delivering much of the integral components of a respiratory therapy curriculum.

Sponsored Research - None

679594

VIBRATION RESPONSE IMAGING: A BEDSIDE LEARNING EXPERIENCE.

Quan M. Nguyen, Laura Withers, Clarence Finch, Jorge Rodriguez, Kristen J. Price; Respiratory Care, MD Anderson Cancer Center, Houston, TX

Background: Vibration Response Imaging (VRI) is a radiation-free and non-invasive imaging technology that uses pulmonary airflow to generate dynamic images of the lungs using an array (consisting of 36 individual acoustic sensors, similar to stethoscopes) placed on the patient's back. The sensors record the vibrations produced by airflow in the lungs and convert them into images. Using the same data, VRI is also able to determine graphically the Vibration Energy Distribution (VED) which represents the distribution of energy for the right and the left lungs into 3 different regions: upper, middle and lower. We conducted VRI studies in our intensive care unit to study the feasibility of the technique in critically ill cancer patients. Methods: VRI was performed in critically ill mechanically ventilated (MV) patients. The patients were chosen randomly, and also included those with non-uniform chest x-ray findings. The arrays were arranged on the bed by lifting the patients and, then lowering the patients on to the arrays with adjustments made as needed to ensure adequate contact with the array-sensors. Before positioning the arrays under the patient, the arrays were placed in a disposable positioning unit (DPU) in order to protect the patient's skin and decrease the risk of infection due to cross contamination. Results: VRI was performed in six patients. Each study included three to four separate images. The studies were done with the patient in semi-fowler's position in the first three cases. One of the studies performed in semi-fowler's position was done without a DPU. All studies performed with the patient in supine position had arrays placed in a DPU. In order to correlate airway pressure and flow, the GE Carestation ventilators were used along with the D-lite flow sensors. Conclusions: VRI can be performed in the MV patients in the ICU in any position with extreme care taken in order to optimize image quality. Appropriate positioning of the array of acoustic sensors under the patient requires careful adjustment during patient positioning in order to ensure adequate patient contact with the array sensors. The use of a DPU and its design are important considerations for optimum use of this technology since these factors can affect the quality of the images. Further studies are required to study the usefulness of VRI for real time assessment of lung function in critically ill patients on mechanical ventilation.

Sponsored Research - None

679866

WRITTEN VERBATIM IDENTIFIES ALTRUISTIC ATTITUDES IN RESPIRATORY CARE STUDENTS.

Kristen Whalen, David J. Plevak, Faith Zimmerman, Jeffrey Ward; Mayo Clinic, Rochester, MN

Background: In this time of economic recession, the financing of health care is becoming increasingly problematic. Charity care is an important resource for the needs of the poor and medically uninsured. Schools of Respiratory Care are initiating programs to introduce students to charity outreach. Three years ago, we initiated a course at the University of Minnesota/Mayo Clinic to engage respiratory therapy students in charity organizations in Rochester, Minnesota. Verbatim are written narratives of an experience. Reading verbatim can reveal personal attitudes, including attitudes toward altruism (1). We did this investigation to see if the students' verbatim provided us with information that was different from their teachers' assessment of their attitudes via classroom participation. Method: Students were required to commit 10 hours to community service. These services included health care, food distribution, listening and counseling, and shelter provision. Students wrote verbatim to assess time commitment, learning experience, and personal insight and attitudes. Three teachers were asked to assess 15 students' willingness to empathize or identify with the 'other' (rate 1-5, 5=most willing), and willingness to engage in 'foreign situations' based only on their classroom participation. One teacher was asked to objectively assess verbatim received from each student on 10 hours of charity service. Criteria for verbatim assessment were based on items in an 8-item Empathy Quotient. Spearman Rank Correlation was used to assess possible correlation between altruistic qualities evidenced in classroom and those identified on examination of written verbatim. Results: Although there was a trend in correlation between teachers' classroom perception of students' willingness to engage and identify with 'other' and their verbatim assessment, the relationship was not statistically significant ($r=0.369$, $p=1.7$). Conclusion: This investigation indicates that written verbatim are useful in identifying altruistic qualities in students experiencing charity service that may not be identified by classroom participation. Reference: Wakabayashi, A: Development of short forms of empathy quotient and systemizing quotient. Personality and Individual Differences, 41, 929-40. 2006

Sponsored Research - None

679804

MODEL OF THE RESPIRATORY SYSTEM WITH GAS EXCHANGE SIMULATION.

Jaroslav Marek, Karel Roubik; Faculty of Biomedical Engineering, Czech Technical University in Prague, Kladno, Czech Republic

Background: Models of the respiratory system are widely used in education, equipment testing and calibrations. They simulate mechanical parameters of the respiratory system but only a few of them can simulate gas exchange. The aim of the study is to design an educational mechanical model of the respiratory system of an adult human that is able to simulate gas exchange in the lungs and allows studying effects of ventilatory parameters changes upon the alveolar gas composition. **Method:** The main part of the model is represented by a 'metabolic unit' consisting of a propane-butane (PB) burner and a water cooler. Burning of PB assures oxygen consumption and CO_2 production. The analogous respiratory quotient for PB is RQ=0.6. The metabolic unit is encased in a rigid plexiglass chamber. Its volume of 137 liters yields an adiabatic compliance of 1 L/kPa which corresponds to the compliance of an adult respiratory system. Airway resistance may be adjusted using exchangeable parabolic resistances and anatomic dead space may be modified by attaching an extra volume to the input port of the model. For educational purposes, a respiratory monitor is placed between the model and a ventilator for V_T, f, MV, F_IO_2, C_{rs} and R_{aw} monitoring. Simulated alveolar gas is sampled from the chamber and alveolar F_AO_2 and F_ACO_2 are analyzed. **Results:** The model is able to simulate mechanical parameters of an adult respiratory system. C_{rs} measured by Veolar ventilator (Hamilton Medical, Rhäzüns, Switzerland) is 1.06 L/kPa. For physiological ventilatory parameters (V_T=500 mL, f=18 bpm), the steady alveolar F_AO_2 is 0.16. Hypoventilation leads to the PB flame extinguishment. **Conclusion:** The model allows students to study influence of ventilatory parameters upon the alveolar gas composition, to understand RQ, importance and effect of anatomic dead space, etc. The model is used for education at the Faculty of Biomedical Engineering, CTU in Prague. **Acknowledgment:** Supported by grant MSM 6840770012.

Sponsored Research - Supported by grant MSM 6840770012

679976

COMMENTS AND CONCERNS OF RESPIRATORY THERAPY PROGRAM DIRECTORS ON MOVE TO BACCALAUREATE DEGREE FOR ADVANCED PRACTITIONER ENTRY INTO THE PROFESSION.

Arthur B. Marshak[1], Robert L. Wilkins[2], Helen H. Marshak[1], Joyce W. Hopp[1], W. G. Nelson[3]; [1]Loma Linda University, Loma Linda, CA; [2]Respiratory Care, University of Texas Health Sciences Center at San Antonio, San Antonio, TX; [3]Administration, Kettering College of Medical Arts, Kettering, OH

Background: Respiratory Therapy Advanced Practitioner Program Directors are intimately involved in the education of practitioners to meet the future needs of the profession. A move toward making the baccalaureate degree as the minimum for entry into the profession brings Program Directors into the forefront of this issue. Method: Program Directors from CAAHEP accredited Advanced Practitioner programs completed an online survey assessing response to the movement among the allied health professions to raise the level of degree required for entry into these professions. These comments were then tabulated and organized according to themes. Results: Of the 325 CAAHEP Accredited Advanced Practitioner programs, responses were received from 158 Program Directors (48.6%). Of these, 105 (66.5%) provided input in the form of comments and concerns. The following nine themes emerged from an analysis of the content of their responses in decreasing order of frequency: 1. Advantages of Degree Change and Steps to Accomplish It (42.9%); 2. Workforce Issues (36.2%); 3. Ability of Program to Change Degree Offered (26.7%); 4. Contrast with Nursing and Other Allied Health Professions (19%); 5. Decreased Accessibility/Recruitment of Students (14.3%); 6. Concerns Regarding Continued Availability of the CRT (13.3%); 7.Patient Care Concerns (12.4%); 8. Increased Cost of Respiratory Therapy Education (5.7%); 9. Total Opposition to Change of Degree (2.9%). Conclusions: The Program Directors commented both positively and raised concerns about the potential move toward the baccalaureate degree. Respondents provided many suggestions in which the move could be made more palatable. Chief among them was the allowing of time for advance planning. Concerns were raised in the ability of 2-year institutions to offer a baccalaureate degree and whether there was a need within the profession to advance to that academic level. Overall, the comments were supportive of the idea, if given an adequate amount of time to accomplish it, and leadership from both CoARC and the AARC to shepherd the process.

Sponsored Research - None

680035

THE ROLE OF THE RESPIRATORY THERAPIST IN PLANNING A STATEWIDE TOBACCO SURVIVORS NETWORK.

Lawrence O. Bryant, Lynda T. Goodfellow; School of Health Professions, Georgia State University, Atlanta, GA

BACKGROUND: Lung cancer is a principal cause of deaths for both males and females in the United States. In Georgia, lung cancer accounts for 75% of all smoking-related cancer deaths. According to the American Cancer Society, 10,000 Georgians die every year from tobacco-related illnesses. Respiratory therapists can play a vital role in mobilizing the community to educate young people on the hazards of tobacco use. Empowering survivors, students, community partners, and educators to collectively communicate these hazards may play a significant role in tobacco control advocacy efforts. The aim of this study is to assess the role of the respiratory therapist in the planning and implementation and evaluation of a tobacco survivors network (TSN). **METHODS**: Area community based organizations agreed to attend a focus group in August 2008 to discuss strategies for recruiting survivors for a one-day training to help establish a tobacco survivors network in the state of Georgia. Respiratory Therapy (program faculty and student advocates) in collaboration with local community tobacco cessation organizations provided recommendations and suggestions that laid the ground-work for the formation of a survivors network. **RESULTS**: Fifty one survivors, family members, respiratory students, and friends of survivors were trained as volunteers (table 1). Three respiratory therapy student advocates applied for and received mini-grants to make presentations at area middle schools. These presentations were initiated by school administrators. Further evaluation of the project objectives reveal that students and survivors had an increased awareness of Georgia's tobacco problem after attending the training. This finding was reflected in the post-training evaluations. As a result, when asked if they thought differently about tobacco control, 92% of respondents noted that they did. Eleven respondents signed up to be part of our speaker's bureau, four of whom were cancer survivors. **CONCLUSION:** The formation of a Tobacco Survivors Network can lay the ground-work for both survivors and students to advocate for tobacco control and help prevent the initiation of smoking among youth.

Sponsored Research - None

Breakdown of Participants (n=51)

Classification	Number	Percentage
Tobacco Survivors	8	16
Students	23	46
Health Care Professionals	12	24
Family Members	4	8
Not Identified	3	6

609336

A NOVEL APPROACH TO MEASURING INTERRATER RELIABILITY AMONG CLINICAL INSTRUCTORS USING EVALUATION DATA FROM AN ONLINE STUDENT RECORD DATABASE.

Jonathan B. Waugh[1], Stephen P. Fracek[2]; [1]Clinical and Diagnostic Sciences, University of Alabama at Birmingham, Birmingham, AL; [2]DataArc, LLC, League City, TX

INTRODUCTION: Accreditation guidelines of the Committee on the Accreditation of Respiratory Care (CoARC) specify programs should be able to demonstrate interrater reliability among those individuals who perform evaluations on students, including in the clinical setting. The online student record database, DataArc, has a clinical affective evaluation (CAE) to survey student performance for clinical rotations and post-graduate employer survey (ES) compatible with the CoARC specifications. The CAE and ES include 7 questions that are nearly identical and therefore allow the opportunity to compare assessments of students done by multiple clinical instructors with an ES done by an employer approximately six months after graduation. The purpose of our investigation was to examine how clinical instructor ratings for these affective qualities compared with employer ratings. METHODS: De-identified survey data for 17 students were extracted from our clinical record database and formatted for comparative analysis using Pearson Correlation and a two-tailed t-test. The ES for each student (10 students had 1 ES, 7 had 2 ES) was compared to the CAEs for each student (ranging 15-20 CEAs per student). RESULTS: The table below shows several of the seven pairs of questions have moderately (0.4-0.7) positive correlations. CONCLUSIONS: This comparison may offer another way to document interrater reliability for accreditation purposes. While performance of procedural details may reasonably be expected to change over a period of months to a year, affective characteristics are typically more stable and therefore comparing ratings of student affective behaviors while in their program to their performance after graduation could help validate the clinical ratings. This is enhanced by the fact that the two groups of raters have different vested interests with respect to the students (instructors versus employers).

Sponsored Research - None

Question Pairs	Pearson Correlation	Significance of Correlation (p-value)
CAE Question 3 and ES Question 16	0.367	0.147
CAE Question 5 and ES Question 13	0.367	0.147
CAE Question 6 and ES Question 17	0.434	0.082
CAE Question 7 and ES Question 14	0.434	0.082
CAE Question 9 and ES Question 12	0.419	0.094
CAE Question 10 and ES Question 11	0.105	0.689
CAE Question 12 and ES Question 15	0.543*	0.024

*Correlation is significant at alpha level of 0.05 (2-tailed).

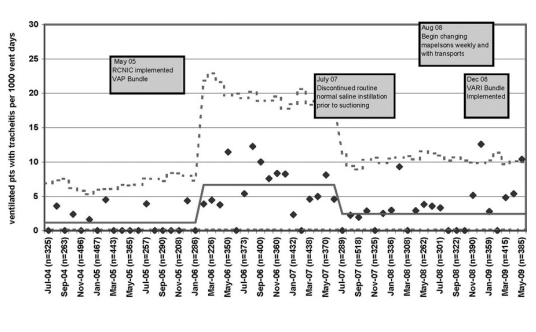
680401

REDUCING VENTILATOR ASSOCIATED RESPIRATORY INFECTIONS BY DISCONTINUING THE USE OF NORMAL SALINE DURING SUCTIONING IN THE NICU.

Rick L. Amato, Pattie G. Bondurant, Deborah A. Hershberger; Cincinnati Children's Hospital Medical Center, Cincinnati, OH

Introduction: We are a 59 bed, Level IIIC NICU with a patient population consisting of medical and surgical patients. In our quest to eliminate Ventilator Associated Pneumonia (VAP), we found that there was an increase in Ventilator Associated Respiratory Infections (VARI) that did not meet the criteria for VAP. Our goal to eliminate all ventilator associated infections, we developed a VAP bundle that brought our VAP rate down from 12.8 infections per 1000 ventilator days to 0.5 infections per 1000 ventilator days. One of the things we looked at was whether reducing the use of normal saline during routine suctioning would reduce our VARI rate. Methodology: We surveyed the nursing and respiratory therapy staff to gather information on their use of normal saline during routine suctioning. The survey revealed that 91% of bedside care givers routinely used normal saline to loosen secretions prior to suctioning. Their feelings were that the normal saline would thin out the secretions and thus enabling them to remove the most secretions per pass of the suction catheter. After an extensive literature search we found that there was very little published regarding the neonatal population. We found no evidence that the use of saline was helpful in thinning secretions but the use of saline could result in increased risk for infection. We started an education campaign for all care givers in the NICU on the effects of using normal saline during suctioning. Education centered on that normal saline would not thin out secretions and that normal saline could wash bacteria from the endotracheal tube into the lungs setting up an increase chance of infection. After completing the staff education, we re-surveyed the NICU staff on their use of normal saline during suctioning and found that 73% of the NICU staff indicated that they changed their practice regarding the use of normal saline during suctioning based on the evidence presented during the education. Results: Our VARI rate prior to discontinuing the use of normal saline during routine suctioning was 12 infections per 1000 ventilator days. After discontinuing the use of normal saline for 18 months, our VARI rates dropped to 3 infections per 1000 ventilator days and we have maintained that rate since December 2008. Conclusion: Discontinuing the use of normal saline during routine suctioning has had a positive out come in the reduction of ventilator associated respiratory infections in the NICU,

Sponsored Research - None



679791

HIGH FREQUENCY PERCUSSIVE VENTILATION CAN MIMIC AIRWAY PRESSURE RELEASE VENTILATION IN A TEST LUNG MODEL.

Faera L. Byerly[2], Kathy Short[1], Haithcock A. John[1], Alvis Page[3], Phillip Boysen[3], Bruce A. Cairns[2]; [1]Respiratory Care, UNC Hospitals, Chapel Hill, NC; [2]Department of Surgery, UNC Hospitals, Chapel Hill, NC; [3]Department of Anesthesia, UNC Hospitals, Chapel Hill, NC

Background: The VDR-4® high frequency percussive ventilator (HFPV) has been shown to be beneficial in the management of inhalation injury by improving secretion clearance while maintaining oxygenation and ventilation using lung protective strategies. Airway Pressure Release Ventilation (APRV) has been used with acute respiratory distress syndrome, with lower mean airway pressures (MAP) and fewer adverse hemodynamic effects when compared to conventional ventilation, yet secretion clearance for patients with inhalation injury could be problematic. We hypothesized that the HFPV could mimic the airway mechanics of APRV as determined by generating a similar MAP and total positive end expiratory pressure (PEEP) for a given inspiratory (I) time. Methods: An Ingmar Medical (Pittsburg, PA) dual adult test with Pneu View software was used to compare the HFPV to APRV at I times of 2, 3, 4, and 5 seconds at varying lung compliance and resistance (Rp20). Pressure control inverse ratio ventilation (PC-IRV) served as a control. Total PEEP and MAP were measured while controlling peak inspiratory pressure (PIP), PEEP, I time, and expiratory (E) time. Data was analyzed using ANOVA with significance $p < 0.05$. Results: Airway mechanics of HFPV compare favorably with APRV and seem quite similar at increasing I times. HFPV resulted in a lower MAP than APRV and PC-IRV at all I times ($p < 0.05$). While total PEEP in HFPV increased with increasing I times ($p < 0.05$), this effect was not observed in APRV and PC-IRV, but differences were not significant. These data suggest that HFPV and APRV can be quite similar other than the high frequency percussive breaths delivered by HFPV. For a given I time and peak inspiratory pressure, total PEEP and MAP delivered by these two modes of ventilation were similar at different lung compliance levels.

Sponsored Research - None

679807

A 2 YEAR RETROSPECTIVE REVIEW OF NONINVASIVE VENTILATION IN AN EMERGENCY DEPARTMENT SETTING.

J Brady Scott, Michael A. Gentile, Jhaymie L. Cappiello, Janice Thalman, Neil MacIntyre; Duke Medical Center, Durham, NC

Background: Noninvasive Ventilation (NIV) has been shown to be safe and effective in supporting Acute Respiratory Failure (ARF). The decision to use NIV in the emergency department (ED) is often a clinical choice based on assessment, vital signs, symptoms and available medical history. The successful use of NIV in this setting is dynamic and demands skilled practitioner support. Our Respiratory Care Department staffs our ED with a core group of practitioners. To assess our use of this practice, we reviewed a NIV database maintained by ED core team Respiratory Care Practitioners (RCP's). Methods: Following IRB approval, we reviewed our database between 1/2005 and 8/2007 for NIV patients that presented in ARF as defined by any three of the following: 1.Acute onset of moderate to severe SOB as determined by ED clinician from history and physical 2.Initial RR>25 3.SpO2<90% on RA 4.Need for supplemental O2 5.Chest X-ray consistent with pulmonary edema 6.ABG showing PaO2<60 mmHg or PaCO2>50 mmHg or pH < 7.3 Recorded data was then tabulated to determine average age of patient, degree of respiratory distress, length of NIV support, disposition, requisite intubation and noted complications. Results: 88 patients presented in ARF requiring NIV with an age of 61 ±13 years. On arrival, the room air pulse oximetry revealed a saturation of 84 ± 9%, respiratory rate of 30 ± 9. Initial blood gas values were: pH 7.26 ± 0.1 and PaCO2 66 ± 24. The average initial NIV settings were: Pinsp 15 ± 3, Pexp 7 ± 2 and a FiO2 of 0.55 ± 0.23. Average length of NIV usage was 3.9 ± 2.9 hours. 40% were admitted to an intensive care unit. 8% required subsequent intubation. The length of NIV usage for patients intubated was 2.6 ± 1.8 hours. All patients requiring intubation were in a critical care setting during NIV usage. No complications from NIV were noted as defined by loss of responsiveness, hypoxia, hemodynamic instability or emesis. The diagnoses and their presenting frequencies are as follows: Acute Pulmonary Edema 40, Asthma 19, COPD 17, Pneumonia 5, Sepsis, Malignant Effusions, Narcotic Overdose and Pulmonary Embolism 5. Conclusion: Our current practice for NIV in the ED appears safe and effective as determined by the lack of complications and low intubation rates for the presenting respiratory distress.

Sponsored Research - None

679915

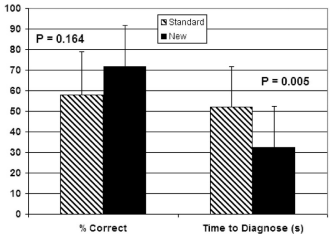
EVALUATION OF A NEW GRAPHICAL INTERFACE FOR MECHANICAL VENTILATION.

Rory Mullin, Shannon E. Cook, Robert L. Chatburn; Respiratory Institute, Cleveland Clinic, Cleveland, OH

BACKGROUND: Graphical interfaces are becoming more advanced with each new mechancial ventilator platform. However, accuracy and ease of use, based on ventilator graphics, are rarely studied (J Am Med Inform Assoc. 2006; 13: 635 and Resp Care. 2008; 53: 329). Hamilton Medical Inc. has developed a display that represents resistance and compliance graphically as a lung silhouette and key ventilatory parameters as a bar graph. We hypothesized that when using this newly developed ventilator display, compared to a conventional display, clinician volunteers would (1) require less time to make a diagnoses of current state, adverse event, and weaning status; (2) make diagnoses and evaluations of adverse events and weaning status more accurately, and; (3) report decreased subjective workloads while interpreting the simulated respiratory events. **METHODS:** The study was approved by the Cleveland Clinic Institutional Review board. Eleven clinicians participated and were asked to identify: normal, restrictive and obstructive lungs; occluded ET tube, right main stem intubation, pre spontaneous breathing trial (SBT), SBT in progress, and post-SBT. Both conventional and new graphic displays were represented using the Hamilton G5 ventilator simulation software (http://www.hamilton-medical.com/HAMILTON-G5.648.0.html). Mean values were compared with t-tests or Mann-Whitney Rank Sum tests; $P < 0.05$ considered significant. **RESULTS:** Results are shown in the Figure (bars = means, wiskers = standard deviations). There was no difference in diagnosis accuracy (58% ± 21% vs 72% ± 18% seconds) but the % correct identification of SBT was higher with the new display ($P = 0.009$). The time to correct diagnosis, across scenarios, was less with the new display (52 ± 19 vs 32 ± 17 seconds). There was no difference in task load index. **CONCLUSIONS:** Our results suggest that a larger sample size may reveal important differences in accuracy and timing of ventilation events between standard and new ventilator display options. However, even using the standard display the overall accuracy across scenarios was less than could be desired. These data may provide benchmarks for future educational initiatives and technological advancements.

Sponsored Research - None

	% Correct			Time to Diagnose (seconds)		
Scenario	Standard	New	Δ	Standard	New	Δ
Normal	91%	91%	0%	46	11	-34
Restrictive	55%	73%	18%	35	18	-17
Obstructive	55%	45%	-9%	42	31	-11
Occlusion	27%	64%	36%	94	55	-39
RM Intubation	64%	45%	-18%	64	60	-5
Pre SBT	82%	82%	0%	39	38	-1
SBT	36%	91%	55%	42	23	-20
Success SBT	55%	82%	27%	57	25	-32



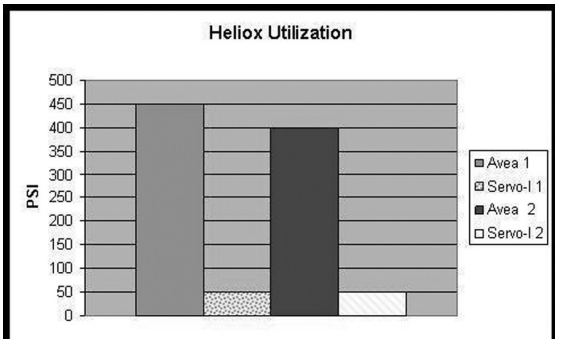
679952

HELIOX UTILIZATION BY TWO ICU VENTILATORS: A BENCH STUDY.

Daria Donelly, Brian K. Walsh; Respiratory Care, Childrens Hospital Boston, Boston, MA

Introduction: Heliox (He-O2) is often utilized to lower the work of breathing in patients with upper and lower airway obstruction. Its sole purpose is to lower the total density of any gas mixture. In patients with severe airway obstruction it is used as the driving gas of ventilators for non-invasive and invasive ventilation, but quickly becomes very labor intensive and expensive to maintain. In addition, helium is limited in supply. Newer generating ventilators have improved their blending capabilities to reduce waste. Traditionally we have used the Avea (Cardinal Health) to deliver our non-invasive and invasive heliox therapy. Recently we have acquired the Servo-i (Maquet) with heliox capabilities and decided to conduct a comparison bench study to guide our ventilator choice. Method: We bench tested and compared heliox consumption in two ventilators; the Viasys Avea and Maquet Servo-i. A 70/30 mixture was evaluated for tank duration over 1 hour. Both ventilators were set for Volume Control with a Vt 120 mL, frequency 15 bpm, (VE 1.8 L/M) and PEEP 5 cmH2O. Results: See Figure 1 Conclusion: The Maquet Servo-i utilizes less helium in comparison with the Avea. In our bench model the Servo-i saves an average of 893 liters of helium per hour or $203 per day. This equates to four tanks a day for the Avea and 5/8th of a tank for the Servo-i. If less heliox is consumed there will be less of a need to store and transport multiple tanks leading to labor cost reduction associated with the therapy. In addition, proper utilization of helium may add to the flexibility of the clinician.

Sponsored Research - None



679959

COMPARISON OF CAPNOGRAPHY DERIVED RESPIRATORY RATE ALARM FREQUENCY USING THE SARA ALGORITHM VERSUS A ESTABLISHED NON-ADAPTIVE RESPIRATORY RATE ALARM MANAGEMENT ALGORITHM IN BARIATRIC SURGICAL PATIENTS.

Steven Hockman[1], Troy Glembot[2], Kathleen Niebel[3]; [1]Department of Respiratory Care, Winchester Medical Center, Winchester, VA; [2]Department of Bariatric Surgery, Winchester Medical Center, Winchester, VA; [3]Department of Clinical Research, Oridion Capnography, Inc, Needham, MA

BACKGROUND: Obstructive Sleep Apnea and Obesity Hypoventilation Syndrome are common in severely obese patients and often exacerbated by sedatives and narcotics. At our institution, continuous capnography and pulse oximetry were mandated as a standard of care on the sub-acute Bariatric Unit. We tested if alarm frequencies from a conventional alarm (CONV) differed from the Smart Alarm for Respiratory Analysis (SARA), an FDA-cleared alarm management algorithm designed to improve alarm vigilance among the clinical staff by diminishing the frequency of clinically insignificant respiratory rate (RR) alarms caused by talking, snoring, and cardiogenic artifacts superimposed on the CO2 waveform. The purpose of this clinical evaluation is to determine if SARA reduces the frequency of clinically insignificant RR alarms. METHODS: The RR alarm frequencies for two alarm algorithms were compared sequentially in 24 participants with BMI ≥ 40 but less than 400 pounds (n = 12 per group) as part of an ongoing trial. Respiratory alarm frequency data and patient data (etCO2, RR, FiCO2, SpO2, PR) were collected using the Bernoulli® MSM central station wireless connected to bedside Capnostream™ 20 monitors (Oridion Capnography Inc.) on patients monitored more than seven hours. Capnographic RR alarm threshold settings were fixed in both groups at a High RR of 36 and a Low RR of 8. The Mann-Whitney U-test for non-parametric comparisons was used to compare the frequency of RR alarms in the two algorithm groups. RESULTS: Review of the patient parameter data and alarm event log indicated that no significant ventilation adverse events were missed in either RR alarm algorithm evaluation group. There was a highly significant difference between SARA and CONV for the High Alarm Frequency (U = 136, p< 0.001) but no significant difference between the CONV and SARA Low Alarm Frequency (U = 76.5, p≥0.05). CONCLUSIONS: When using capnography to monitor ventilation, the SARA alarm management algorithm triggered the High RR alarm significantly less frequently than the CONV for clinically insignificant events (false alarms) as noted by the corresponding patient data. The limitation of not being able to silence audible alarms did not allow for evaluation of RR alarm frequency with both algorithms in parallel and may have influenced the frequency of Low RR alarms by diminishing patient uninterrupted rest.

Sponsored Research - Oridion Capnography, Inc. funded data collection with a device donation to WMC.

Table 1 Summary of the Alarm Data within Each Alarm Algorithm Group

RR Alarm Algorithm	Median Duration of Data Collection	TIME RANGE (Hours)	Total Hours of Data	Total # High RR Alarms	Average # High RR/Patient	Average # High RR per Hour	Total # of Low RR Alarms	Average # Low RR/Patient	Average # Low RR per Hour
CONV	14.00	7-17	158.50	749.00	62.42	4.73	20.00	1.67	0.13
SARA	16.00	13-19	194.00	61.00	5.08	0.31	33.00	2.75	0.17

679982

COMPARISON OF FREQUENCIES DELIVERED DURING MANUAL VENTILATION WITH TWO T-PIECE RESUSCITATION DEVICES: A BENCH STUDY.

John T. Gallagher, Christopher M. Joyce, Kathleen M. Deakins; Pediatric Respiratory Care, University Hospitals, Rainbow Babies & Children's Hospital, Cleveland, OH

Introduction: The t-piece resuscitator (TPR) is a device used for manual ventilation of neonates in the delivery room, neonatal intensive care unit, and during patient transport. The TPR is beneficial for delivery of consistent ventilating pressures; but, a wide variance in caregiver initiated ventilation frequencies has been identified (Deakins, 2008). Recent advances in the design of the TPR have led to the addition of a metronome to aid in controlling the variation in caregiver-initiated frequencies. The purpose of this evaluation was to determine whether a TPR with metronome, the NeoPIP (Neoforce Group, Ivyland, PA), could reduce the variation in caregiver-initiated ventilation frequencies when compared to a TPR without a metronome; the NeoPuff (Fisher-Paykal, Aukland, New Zealand). **Methods**: 50 caregivers experienced in TPR from multiple disciplines including respiratory therapists, nurses, and physicians were selected to participate. The NeoPuff and the NeoPIP TPR's were driven by an 8 Lpm source gas and both were connected to an Infant Star test lung with a fixed compliance of 1 mL/cm H20. Caregivers were first directed to simulate manual ventilation with the TPR without a metronome at a frequency of 30 bpm. The caregiver was given 15 seconds to achieve a rhythm, then the frequency was recorded for 60 seconds. The NeoPIP, a TPR with metronome, was then introduced and explained. A frequency of 30 was set on the metronome and the test was repeated. Frequencies for both devices were hand-counted and recorded by the investigator while time was kept with a digital timer. **Results**: Data were recorded as actual values of breaths per minute at the end of the 60-second period. Paired t-tests were used to determine consistency and error in the data sets from each device. Statistical significance was set at p<0.001. The consistency of the TPR without metronome was 38.2 +/- 9.5 while the TPR with metronome was 30.4 +/- 1.7 (p< 0.001). Accuracy in achieving the targeted rates was determined by subtracting the targeted rate from the mean values from each device or +8.2 without metronome and +0.2 with metronome (p< 0.001). **Conclusions**: In this simulation of manual ventilation with a TPR, caregiver accuracy and consistency were both improved with the addition of a metronome.

Sponsored Research - None

679987

BENCH PROTOCOL TO DETERMINE HELIOX CONSUMPTION OF THE EVENT MEDICAL 'INSPIRATION LS' VENTILATOR.

Michael McPeck[1], Mark Grzeskowiak[1], Denise M. Rees[2]; [1]Respiratory Care, Long Beach Memorial Medical Center, Long Beach, CA; [2]Health Sciences, Santa Monica College, Santa Monica, CA

BACKGROUND. Heliox (HeO2) consumption considerably in excess of Vmin has been previously reported in some ventilators. Because our current ventilators were perceived by staff as consuming excessive HeO2, we developed a bench study protocol to evaluate HeO2 consumption and trialed it on an eVent Medical 'Inspiration LS' ventilator which was under consideration for purchase. METHODS. A trial unit from the manufacturer was connected to one side of a Michigan Instruments Dual Adult TTL set to provide 4 different impedance challenges for Resistance (RL) in cmH2O/L/sec and Compliance (CL) in L/cmH2O. Three different breathing patterns which resulted in a set Vmin of 7.2 L/min were studied: 'normal' (f=12,VT=0.600 L); 'rapid/shallow' (f=30,VT=0.240); and 'slow/deep' (f=6, VT=1.2) for RL/CL combinations of 5/20, 5/10, 20/20 and 20/10. The source gas was 80/20 HeOx in 159 cu ft "H" cylinders. Cylinder pressure (Pcyl) was read on an Ashcroft digital electronic pressure gauge (0-3000 psig, 0.5% resolution) that had been substituted for the mechanical cylinder pressure gauge of a Western Medica M1-280-P heliox regulator. Time '0' Pcyl reading was obtained prior to a 60 min timed period of ventilator operation at each of the 4 RL/CL challenges for each of the 3 breathing patterns and at 15 min intervals for 1 hr. Results were entered into a MS Excel spreadsheet and graphed to assure linearity. Pcyl at 60 mins was subtracted from Pcyl at time '0' to obtain the pressure drop (ΔPcyl) in one hr. ΔPcyl/hr was multiplied by 2.04 (80/20 HeOx 'H' cylinder factor) and divided by 60 to obtain Total HeO2 consumption in L/min which was compared to the set Vmin of 7.2 L/min for each of the RL/CL combinations and breathing patterns. RESULTS. Mean (±SD) Total HeO2 consumption for the normal, rapid/shallow, and slow/deep breathing patterns, respectively, was 6.96 ±0.14, 7.37 ±0.16 and 7.21 ±0.16 L/min; overall average Total HeO2 consumption was 7.18 ±0.222 L/min. CONCLUSIONS. (1) The bench protocol was easily conducted and challenged the ventilator under test with a range of breathing patterns and respiratory impedances in order to ascertain that any changes in HeO2 consumption were not due to Vmin setting changes. (2) The Inspiration LS ventilator did not appear to have any excess HeO2 consumption when operated with 80/20 heliox cylinder gas.

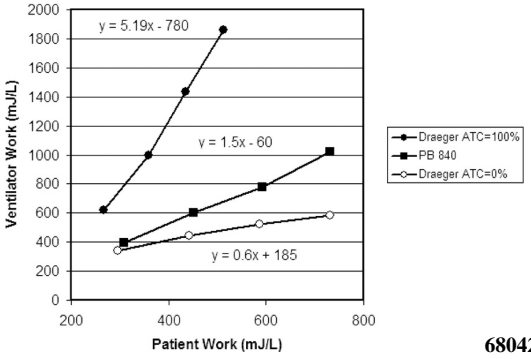
Sponsored Research - None

679996

COMPARISON OF TWO DIFFERENT PROPORTIONAL ASSIST VENTILATION ALGORITHMS.

Robert L. Chatburn[1], Jaimee L. Wear[2]; [1]Respiratory Institute, Cleveland Clinic, Cleveland, OH; [2]Medical Intensive Care Unit, Cleveland Clinic, Cleveland, OH

Proportional assist ventilation (PAV) was described in 1992 (Am Rev Respir Dis 1992;145:114). The first commercial version in the U.S. was Proportional Assist Ventilation Plus (PAV+) in 2008. In 2009 Proportional Pressure Support (PPS) became available. Both versions are based on the equation of motion for the respiratory system to support the patient's elastic and resistive loads during spontaneous breathing. For PPS the operator sets "volume assist" (VA, the supported elastance) and "flow assist" (FA, the supported resistance). For PAV+ the operator sets the % work supported and the ventilator selects VA and FA levels. The purpose of this study was to compare the operational characteristics of PAV+ and PPS with different simulated ventilatory patterns. METHODS: Breathing was modeled with an ASL 5000 lung simulator (IngMar Medical Inc.); patient effort set to sinusoidal, insp = 10%, hold = 0%, release = 10%. Modes tested were PAV+ (Puritan Bennett 840) and PPS (Dräger Evita XL). PAV+ was set to support 70% of the work of breathing. On the Evita XL, VA was set to 70% of the lung model elastance and FA was set to 70% of the model resistance. For PPS Automatic tube compensation was 100% or 0% for 8.0 ET tube. Experiment 1 (variable effort): Frequency (f) = 15 breaths/min, patient effort (Pmax) varied from 4 to 10 cm H2O, resistance (R) = 10 cm H2O,L/s, compliance (C) = 33.3 mL/cm H2O. Experiment 2 (variable C): Pmax = 6, R = 10, C varied from 33.3 to 39.3 (elastance = 10 to 25 cm H2O/mL). RESULTS: Experiment 1: Data are shown in the Figure. As Pmax varied from 4 to 10, tidal volume was 206 to 450 for PPS(ATC=0); 314 to 978 for PPS(ATC=100); 214 to 585 for PAV+. Experiment 2: The ratio of ventilator work/L to patient work/L increased with C; 1.0 to 1.4 for PPS(ATC=0); 2.5 to 5.4 for PPS(ATC=100) but remained constant at 1.7 for PAV+. Tidal volume increased with C; 294 to 360 for PPS(ATC=0); 488 to 776 for PPS(ATC=100); 390 to 399 for PAV+. CONCLUSIONS: Although conceptually the same mode, PPS and PAV+ have very different operating characteristics. Both PAV+ and PPS supports constant proportion of the patient's work. However, with PAV+ this work is preset with automatic monitoring of C and R and automatic adjustment of FA and VA which includes tube resistance compensation. PPS supports preset values of of R and C and has optional tube resistance compensation. FA and VA have to be manually adjusted to accommodate changing R and C (which have a large effect on tidal volume) as the patient's condition changes. Knowledge of these differences is critical for proper use.



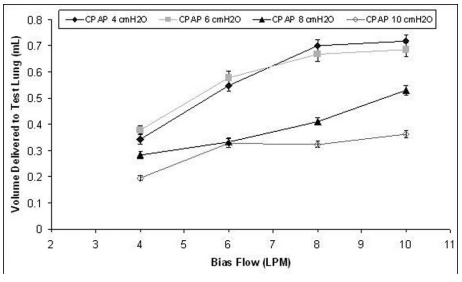
680429

THE MAGNITUDE OF VOLUME OSCILLATIONS DURING BUBBLE NASAL CONTINUOUS POSITIVE AIRWAY PRESSURE ARE AFFECTED BY THE CPAP LEVEL AND BIAS FLOW SETTING.

Jay Zignego[1], Robert M. DiBlasi[1], Dennis M. Tang[1], Risa K. Vanantwerp[2], Peter C. Richardson[1]; [1]Center for Developmental Therapeutics, Seattle Children's, Seattle, WA; [2]Bioengineering, University of Washington, Seattle, WA

BACKGROUND. Bubble continuous positive airway pressure (B-CPAP) is a form of non-invasive respiratory support that is commonly applied to spontaneously breathing infants with lung disease. Small amplitude, high-frequency airway pressure (PAW) oscillations are created by bubbles forming when gas exits through the water-seal column. Experimental data suggests that these pressure oscillations may enhance lung recruitment and gas mixing, similar to high-frequency ventilation in intubated subjects. However, the ventilation effects of B-CPAP have not been evaluated using a "leaky" nasal prongs interface. We designed a series of experiments to test the impact of different CPAP levels and bias flow settings on the delivered volume oscillations to an infant test lung model affixed with leaky nasal prongs during simulated B-CPAP. METHODS. In the first study, we placed an infant head model affixed with #2 Hudson nasal prongs within a plethysmograph and measured the leak at flows of 4,6,8, and 10 L/min at CPAP of 2,5,7,10, and 12 cmH2O. In the second study, we attached the head model and prongs to an infant mechanical lung model (C: 0.53 mL/cm H2O and R: 185 cmH2O/L/s) sealed within a plethysmograph. We measured pressure changes within the plethysmograph resulting from the test lung expanding during bubbling. We used the pressure changes and prelythsmograph calibration factor to calculate the volume oscillations delivered to the lung model during B-CPAP at flows of 4,6,8 and 10 L/min at CPAP of 4,6,8 and 10 cmH2O. RESULTS. The leak remained constant at each pressure, regardless of flow, yielding flow leaks of 1.54, 2.70, 3.22, 3.81, 4.21 L/min at CPAP of 2, 5, 7, 10 and 12 cmH2O respectively. The delivered volumes to the test lung can be seen in the figure below. The lower CPAP (4 and 6) settings resulting in greater pressure and volumes transmitted to the lung model at all flows, and at a bias flow of 4 L/min, CPAP of 10 cmH2O was unachievable due to 100% leak through prongs. CONCLUSIONS. Our findings suggest that volume oscillations created by bubbling increases when increasing the bubbler flow, and the prongs in the infant head model behave as a pressure dependent leak. This means the leak percentage is greatest at high CPAP settings and low bias flows, which is consistent with the finding that the delivered volume to the test lung is 50% greater at a CPAP of 4 than at 10 cmH2O when bias flow is set to 10 L/min.

Sponsored Research - None



680766