2017 Open Forum

Presented by

RESPIRATORY CARE

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The Open Forum at the AARC Congress 2017 is an unique opportunity for attendees to experience the results of scientific studies performed by their colleagues. Respiratory Care is proud to present this year's Open Forum. Once again, respiratory care professionals have stepped forward and analyzed the things they do with critical eyes. This year posters will be presented in one of 3 formats:

Editors' Choice – The top abstracts in 2017. On the first two days of the Congress the Editors' Choice posters will be displayed by the entrance to the Exhibit Hall. On the third day, each presenter will discuss their findings in a 8-minute slide presentation, which will be followed by a 5-minute question and answer period.

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

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

Open Forum Sessions

Wednesday, October 4

Poster Discussions #1
3:15 pm – 5:10 pm
Ventilators/Ventilation Part 1

Poster Discussions #2
3:15 pm – 5:10 pm
Sleep/Rehab/Diagnostics

Thursday, October 5

Poster Discussions #3
10:00 am – 11:55 am
Monitoring/Equipment/O_2 Therapy

Poster Discussions #4
10:00 am – 11:55 am
Aerosols/Drugs

Posters Only Day 1
11:30 am – 3:30 pm

Poster Discussions #5
12:30 pm – 2:25 pm
Education Part 1

Poster Discussions #6
12:30 pm – 2:25 pm
Neonatal/Pediatric Part 1

Poster Discussions #7
3:10 pm – 5:05 pm
Management

Poster Discussions #8
3:10 pm – 5:05 pm
Airways Care

Friday, October 6

Editors' Choice
9:30 am – 11:30 am
Top abstracts in 2017

Posters Only Day 2
10:00 am – 1:30 pm

Poster Discussions #9
12:30 pm – 2:25 pm
Ventilators/Ventilation Part 2

Poster Discussions #10
12:30 pm – 2:25 pm
Neonatal/Pediatric Part 2

Poster Discussions #11
3:15 pm – 5:10 pm
Education Part 2

Poster Discussions #12
3:15 pm – 5:10 pm
Asthma/Pulmonary Disease

See pages OF64-OF68 for Open Forum Author Index

2758521

A Comparative Analysis of Ideal Body Weight Methods for Pediatric Mechanical Ventilation.

Jeffrey R. Bilharz[1], Brian K. Walsh[1,2], Craig D. Smallwood[1,2]; [1]Respiratory Care, Boston Children's Hospital, Boston, MA; [2]Department of Anesthesia, Perioperative and Pain Medicine, Division of Critical Care Medicine, Boston Children's Hospital, Boston, MA

BACKGROUND Ideal body weight (IBW) of pediatric subjects receiving mechanical ventilation is essential for the accurate application of tidal volumes. Three methods are commonly used: McLaren-Read (a growth chart method), Moore (a growth chart method), and the Body Mass Index (BMI; indexed equation based on height) method. However, a universal method for determining ideal body weight in mechanically ventilated children is elusive. Therefore, we sought to compare each of the 3 methods with actual body weight (kg). METHODS A retrospective analysis of subjects aged 2 – 20 years and receiving invasive mechanical ventilation in the pediatric intensive care unit was conducted. Demographic data were recorded and IBW calculated according to established methods. Mean difference between each IBW method and actual body weight was calculated and a t-test was used to compare IBW calculations to actual. A difference >10% between actual body weight and IBW was defined as clinically significant. RESULTS A total of 59 subjects (n = 59 (55%) female) were analyzed. The mean weight difference (kg) between actual and calculated IBW was 1.076±13.998 (P = 0.675), 3.497±10.015 (P = 0.378) and 3.505±10.328 (P = 0.253) with mean percent differences (%) of 23.914, 17.084, 24.193 for McLaren-Read, Moore, and BMI methods respectively. The number (%) of subjects who would have a clinically significant error if the IBW was ignored was 36 (61.017%), 30 (54.545%), and 32 (54.237%) using McLaren-Read, Moore, and BMI methods respectively CONCLUSIONS This study has shown that a high percentage of pediatric subjects demonstrated a clinically important error between actual and IBW and that each method was significantly different. Furthermore, we noted variation in the mean difference between each of the three methods and actual body weight, highlighting the importance for a standard methodology to be utilized within and between institutions.

Sponsored Research - None

2741151

Evaluation of a Ventilator Bootcamp Improves the Knowledge and Skills Associated With Mechanical Ventilator Use During Inter-Facility Transport of Intubated Pediatric Patients.

Jennifer Walton[2], Diane K. Dunn[2], Nhi Haines[2], Ilana Heisler[3], Michael T. Bigham[4], Teresa A. Volsko[1]; [1]Nursing Administration, Akron Children's Hospital, AKron, OH; [2]Respiratory Care, Akron Children's Hospital, Akron, OH; [3]Respiratory Care, Rush University, Chicago, IL; [4]Critical Care Administration, Akron Children's Hospital, AKron, OH

Background: The American Academy of Pediatrics Section on Transport recommends use of portable ventilators during the transport of patients with advanced airways. Our inter-facility transport ventilator use for children with an advanced airway decreased 10% below the national benchmark. We sought to identify knowledge gaps and evaluate the effectiveness of a transport ventilator competency boot camp. **Methods:** Electronic health records (EHR) of children requiring ventilatory support during air and ground interfacility transport from 1/1/15 – 12/31/15 were reviewed to determine when manual ventilation was used in lieu of a portable ventilator. Simulations were constructed from scenarios where manual rather than mechanical ventilation was used. As a quality initiative, all registered respiratory therapists (RRT) trained in air and ground critical care transports participated. Demographic data were collected. Study interventions included three facilitated simulated scenarios using the LTV-1200. A low fidelity pediatric mannequin was attached to an ASL 5000 to simulate active breathing. Scenario scores were based on the participants' ability to correctly perform pre-use checks, select/optimize ventilator settings, set alarms and complete safety checks. The intervention, a 60 minute interactive education session was conducted between the pre-assessment and post-assessment. The pre-assessment, intervention and post-assessment were conducted 6 weeks apart. Deidentified completed assessments were placed in an envelope and a unique identifier assigned before sealing. Assessment scores were shared with staff after study completion. Descriptive statistics reported participant demographics. Paired T-tests compared pre and post assessments. Statistical significance was established at $p < 0.05$. **Results:** 172 EHR were reviewed. Manual ventilation was used more frequently in toddlers requiring pressure-control ventilation, then when volume control ventilation was ordered. NIV was rarely employed. 17 RRTs participated. 3(18%) were male. Most, 41% had between 6 and 9 years of longevity in the field and 5 years' experience with our transport team. Table 1 provides pre-post intervention results. **Conclusions:** Quality data were useful in identifying areas requiring knowledge and competency assessment. The assessments provided evidence of knowledge decay. Re-assessment results validated the need to conduct education and competency assessment at defined intervals.

Sponsored Research - None

Table1. Comparison of pre-and post-educational test score results, reported as a % correct. T-test results comparing pre- and post-intervention raw scores are reported for each scenario.

	Scenario 1 16 year old female with history of history of severe mental retardation and cerebral palsy.		Scenario 2 2 month old male infant with respiratory distress requiring pressure control ventilation		Scenario 3 10 year old male patient with a known seizure disorder requiring volume control ventilation	
	Pre	Post	Pre	Post	Pre	Post
Mean % Correct	54%	69%	55%	49%	60%	68%
Min % Correct	7%	13%	30%	13%	30%	43%
Max % Correct	87%	100%	93%	77%	97%	100%
SD	0.2	0.2	0.2	0.2	0.2	0.2
t-test p value	0.006		0.1		0.07	

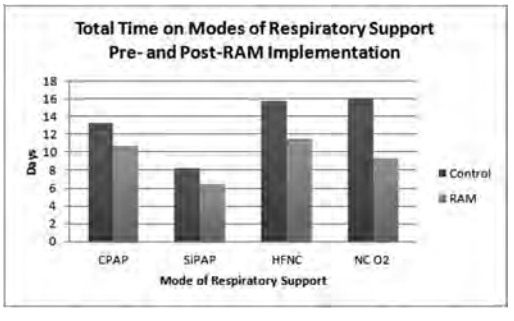
2744238

Comparison of the RAM Cannula to Conventional Bi-nasal Prongs in the Delivery of Noninvasive Respiratory Support to Very Low Birth Weight (VLBW) and Extremely Low Birth Weight (ELBW) Infants in the NICU.

Gail Drescher, Cathy W. Hughes; Washington Hospital Center, Washington, DC, DC

Background: Preterm LBW neonates are at high risk for pulmonary complications & the need for respiratory support. The Neotech RAM can deliver CPAP, NIV & HFNC & may provide better transmission of pressures than standard cannulas. There is no published clinical data comparing the RAM to other nasal prongs used for noninvasive respiratory support (NRS) in this patient population. Method: We conducted a prospective observational study of infants < 29 wks gestation & < 1500 g (n=36) born in our NICU & requiring NRS from 2014/15 during our initial implementation of the RAM & compared this data to an historic control group (n=45) from 2012/13. This study was approved by our IRB (2015-010). All preterm infants ≤32 weeks are immediately intubated at birth, given curosurf, then extubated to NRS under a standard protocol. We implemented the RAM as a new nasal interface for the delivery of all NRS in our NICU. This device replaced conventional short bi-nasal prongs & a separate device for HFNC. Demographic, baseline & clinical outcome data were collected. Outcomes were compared between the treatment (RAM; R) & control (standard prongs; C) groups using Student's *t* test or Wilcoxon Rank Sum for quantitative data, or chi-square for categorical information. Results:There were no significant differences between the C & R groups for gestational age (26+4 [C] v 26+6 [R] wks; $P = .44$), weight (898 [C] v 884 [R] g; $P = .71$), sex ($P = .40$), race ($P = .53$) Crib II scores (10 [C] v 10 [R]; $P = .86$), 5 min Apgar (7 [C] v 7 [R] $P = .40$), chorio ($P = .29$), rupture of membranes h ($P = .72$), c-section ($P > .99$), use of ante- or post-natal steroids($P > .99$ & $P > .99$, respectively), or hospital LOS ($P = .52$). There were no significant group differences in the development of pneumothorax ($P = .37$) or other comorbidities. There were no significant group differences in NRS settings, initial mode of ventilation (CPAP; $P = .64$), total invasive vent days ($P = .12$) or reintubations ($P = .50$). There were also no significant group differences in total days spent on NIV ($P = .33$) or HFNC ($P = .15$). However, there was a significant reduction in total days on respiratory support ($P = .006$), total NRS days ($P = .008$), CPAP days ($P = .008$) & supplemental NC O_2 use ($P = .01$). In addition, BPD rates ($P = .032$) & device-associated skin & mucosal breakdown ($P < .001$) were significantly lower post RAM. Conclusions: We found significantly reduced duration of respiratory support, BPD and pressure-ulcer rates post RAM in LBW infants.

Sponsored Research - None



2752930

Accuracy of Transcutaneous CO_2 Values Compared to Arterial and Capillary Blood Gases.

Laura L. Lambert[1], Melissa B. Baldwin[1], Cruz Velasco Gonzalez[2], Gary R. Lowe[1], Randy Willis[1]; [1]Respiratory Care Services, Arkansas Children's Hospital, Little Rock, AR; [2]Department of Pediatrics, University of Arkansas for Medical Sciences, Little Rock, AR

Introduction: Transcutaneous CO_2 monitors ($TCCO_2M$) are utilized to monitor a patient's respiratory status. Anecdotal information suggests that some subjects have very similar values when comparing CO_2 values obtained by $TCCO_2M$ to blood gas analysis, while others show extreme variability. A retrospective review of data from subjects in the Neonatal Intensive Care (NICU) at Arkansas Children's Hospital (ACH) was performed to determine how accurately the CO_2 values obtained from $TCCO_2M$ correlated to CO_2 values obtained by arterial blood gas (ABG) or capillary blood gas (CBG) analysis. The goal was to assess the agreement of each ABG and CBG with $TCCO_2M$ CO_2 levels in these subjects. **Methods:** This study was not deemed human subject testing by the local IRB. To determine if $TCCO_2M$ values correlated with ABG or CBG values, subjects' records were retrospectively reviewed between 7/1/14-1/31/16. Specific data collected included the $TCCO_2M$ value at time of blood gas procurement and the ABG or CBG CO_2 value. Agreement of pairs of methods (ABG vs. $TCCO_2M$ and CBG vs. $TCCO_2M$) were assessed with the Bland-Altman approach[1] with limits of agreement estimated with a mixed model[2] to account for serial measurements per subject. **Results:** A total of 912 comparisons on 54 subjects for ABG/$TCCO_2M$, and 307 comparisons on 34 subjects for CBG/$TCCO_2M$ were analyzed. The CO_2 ranges for ABG were 24-106 mmHg and $TCCO_2M$ were 27-133 mmHg. The CO_2 ranges for CBG were 29-108 mmHg and $TCCO_2M$ were 30-103 mmHg. For ABG/$TCCO_2M$ comparisons, the Pearson correlation coefficient was 0.82, the 95% Confidence Interval (0.80, 0.84) and a p-value of < .001. For CBG/$TCCO_2M$ comparisons, a Pearson correlation coefficient was 0.77, the 95% Confidence Interval (0.72, 0.81) and a p-value of < .001. For ABG/$TCCO_2M$, the estimated difference was -6.79 mmHg and a SD = 7.62. For CBG/$TCCO_2M$, the estimated difference was -1.61 mmHg and a SD = 7.64. **Conclusion:** Based on these data, CBG comparisons showed less variation and a slightly lower correlation with $TCCO_2M$ than did ABG comparisons. The primary purpose of this review was to determine if the $TCCO_2M$ readings were consistent enough to make accurate assessments of the patient's CO_2 status, thereby giving clinicians the ability to make a sound clinical judgment to change ventilator settings based on the readings. Due to the wide limit of agreement and no apparent consistent trends, the utility of relying on $TCCO_2M$ readings for this purpose is questionable.

Sponsored Research - None

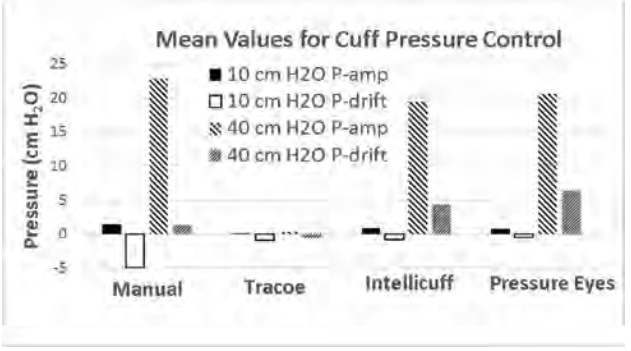
2757334

Laboratory Evaluation of Continuous Cuff Pressure Control Systems.

Sherry A. Babic, Marcy Pardee, Robert Chatburn; Cleveland Clinic, Cleveland, OH

BACKGROUND ETT Cuff inflation methods have been studied over the years, with no consensus as to the most consistent and reliable method of maintaining ETT cuff pressures (P_{cuff}). Continuous cuff pressure control devices ($CP_{cuff}C$) are available, but there are few data suggesting whether they are only necessary under high ventilatory pressure conditions or not. The purpose of this study was to evaluate 3 $CP_{cuff}C$ compared to a standard method of manual cuff inflation during simulated mechanical ventilation. **METHODS** This study involved 6 hr experimental runs at 2 ventilating pressures (20, 40 cm H_2O) with each of 4 methods: manual, Tracoe Smart Cuff Manager (Hersteller), Intellicuff standalone (Hamilton Medical), and Pressure Eyes (TUV Rheinland). An intubation mannequin (Laerdal) was intubated with an 8 mm id ETT and connected to a ventilator with the following settings: Mode: PC-CMV, f (bpm): 20, T_{insp} (s):1.0, PEEP (cm H_2O): 10, P_{insp} (cm H_2O): 20, 40. ETT balloon was connected to a 3-way stopcock. One port was connected to a pressure transducer and data acquisition system to log P_{cuff} values. Another port was used to adjust P_{cuff} via syringe or $CP_{cuff}C$. With each experimental run the ETT cuff was first inflated manually or via $CP_{cuff}C$. Data were recorded prior to start of ventilation, at 3 mins after ventilation began, and after 2, 4, and 6 hrs of ventilation. Mean airway pressure and mean maximum and minimum pressures were calculated for 10 consecutive breaths. **RESULTS** Data are shown below. The difference in P_{cuff} over time is represented by P-drift, while the difference in mean maximum and mean minimum P_{cuff} is represented by P-amp. The highest negative drift in P_{cuff} occurred with the manual method at 10 cm H_2O, and the highest positive drift occurred with the Pressure Eyes at 40 cm H_2O. P-amp was greatest with the manual method at both ventilating pressures. Higher ventilating pressures resulted in a higher P-amp for all devices except for the Tracoe. The Tracoe method had the lowest P-drift and P-amp at all ventilating pressures. **CONCLUSION** While the purpose of the $CP_{cuff}C$ is to maintain a target P_{cuff}, it appears that at higher ventilating pressures the actual P_{cuff} varies beyond that of the target pressure for some devices. Further studies are needed to determine if this variance contributes to tracheal wall damage, or increased incidence of VAP.

Sponsored Research - None



2758464

Increasing ARDS Severity by Berlin Definition Reflects Overall Illness Severity.

Richard Kallet[1], Michael S. Lipnick[2], Antonio Gomez[3]; [1]Respiratory Care Services, San Francisco General Hospital, San Francisco, CA; [2]Anesthesia, UCSF, San Francisco, CA; [3]Pulmonary & Critical Care Medicine, UCSF, San Francisco, CA

Background: The goal of the Berlin ARDS Definition Taskforce was to update the 1994 American-European Consensus Conference (AECC) criteria and, in part, to test its "predictive validity" for outcomes.[1] The major modification to the AECC was categorizing lung injury severity based upon the ratio of arterial oxygen tension-to inspired oxygen fraction (Pa_{O2}/Fi_{O2}). Because the focus of the taskforce was pulmonary-related variables, the influence of non-pulmonary variables was not explored. We inquired whether increasing ARDS severity by the Berlin definition coincided with increasing illness severity scores (APACHE II and SAPS II), and whether specific organ dysfunction associated with increased ARDS severity and mortality could be identified on the day of ARDS onset. **Methods:** The ZSFGH ARDS quality assurance data base was used; with 1,930 subjects meeting Berlin definition for ARDS between June 2002 and February 2017. Subjects were managed with the ARDS Net protocol. Statistical analysis included one-way ANOVA and Tukey post tests and Fisher Exact tests for mortality. Alpha was set at 0.05. **Results**: Mortality, APACHE II and SAPS II scores increased significantly with ARDS severity (Table). Impaired perfusion and renal function increased with ARDS severity. Average urine output was markedly lower than the minimum level deemed adequate (≥ 2.5 mL/Kg/h) for all Berlin categories. Liver function (total bilirubin), hematologic function (platelets) were within normal limits across categories. White blood cell count was slightly elevated (13.5-13.7) across categories. Age was not different (51±17, for all categories, P = 0.93). **Conclusion**: Mortality, illness severity and comorbidity signifiers increased with ARDS severity. Signifiers of hypotension and hypoperfusion (particularly renal dysfunction) are the most salient signs of organ dysfunction as ARDS severity increases. ARDS Definition Taskforce. Acute respiratory distress syndrome: the Berlin definition. JAMA 2012;307(23):2526-2533.

Sponsored Research - None

	Mild	Moderate	Severe	ANOVA
N	281	981	668	
Mortality	26%‡§	34%‡	50%	
APACHE II	19.1±8.0‡§	22.4±8.4‡	26.1±8.9	P<0.0001
SAPS II	42.9±16.5‡§	48.0±16.7‡	55.5±33.4	P<0.0001
MAP (mmHg)•	69±27‡§	63±21‡	58±20	P<0.0001
Base Deficit (mEq/dL)•	-4.3±6.8‡§	-5.5±7.3‡	-8.2±7.9	P<0.0001
Creatinine (mg/dL)•	1.45±1.32‡§	1.47±1.39†	1.71±1.62	P=0.002
BUN (mg/dL)	26±20‡	28±21†	32±25	P=0.0002
UO (mL/Kg/h)•	1.5±1.2	1.5±1.1	1.5±1.6	P=0.92

‡p<0.01 vs. severe, §p<0.01 vs. moderate, †p< 0.01 vs. severe,•most abnormal value. APACHE = acute physiology and chronic health evaluation, SAPS = simplified acute physiology score, MAP = mean arterial pressure, BUN = blood urea nitrogen, UO = urine output

2752810

Prevalence, Knowledge, Beliefs, and Attitude of Waterpipe (Hookah) Smoking among Health Care Student at a Southeastern Urban Research University.

Mohammed M. Alqahtani, Lynda Goodfellow, Gerald S. Zavorsky, Chip Zimmerman; Respiratory Therapy Department, Georgia State University, Atlanta, GA

Background: Waterpipe smoking is gaining in popularity as a form of smoking tobacco. There is a noticeable increase in Waterpipe smoking worldwide among young adults. There is a growing body of literature that indicates that college students may not be as knowledgeable as should be in making decisions about smoking waterpipes. **Purpose:** This study was performed to evaluate the prevalence, knowledge, attitudes and beliefs regarding waterpipe use among health care students. **Methods:** Participants in this study were chosen based on their readiness and willingness to participate. The questionnaire was distributed to graduate students through a link for a web-based survey. A paper copy was distributed in class to undergraduate students only. There were 319 health care students who participated in this study from the following specialities: nursing, physical therapy, respiratory therapy, occupational therapy and nutrition. Data were analyzed using descriptive statistics. **Results:** Respondents have used or tried waterpipe smoking before (n=156, 49%), while the majority of students who have not tried or used the waterpipe smoking (n=163, 51%). Students were able to identify health hazards that might result from hookah smoking, for example cancer (n=258, 80.9%), respiratory problems (n=308, 97%), cardiovascular impairments (n=202, 63%), hematological impairments (n= 98, 31%), harm during pregnancy (n=214, 67%), and diarrhea (n=37, 11.6%) as potential health hazard. This study showed that 187 students (58.6%) believed that cigarette smoking is more harmful than waterpipe smoking due to the false beliefs that they have. There was also general disagreement regarding students' attitudes and opinions about waterpipe smoking. Finally, this study showed the reasons why students engage in waterpipe smoking; for example, (n=241, 75.5%)of the students reported that the reason for waterpipe smoking is an increased opportunity to smoke a waterpipe in cafes, etc. Also, students said other reasons like the flavour of waterpipe itself (n=219, 68.7%), and utility of waterpipe in leisure & pleasure activities (n=217, 68%). **Conclusion**: This study showed that the prevalence of waterpipe smoking is common among students in health care especially in young adults. Further studies are needed to ask more students at different institutions. Finally, we recommended conducting educational campaigns to increase students' knowledge and awareness and to correct the wrongs beliefs and attitudes.

Sponsored Research - None

2758675

Perspectives from COPD Subjects on Long Term Oxygen Therapy (LTOT) Devices.

Hejab AlMutairi, Constance Mussa, David Vines; Caediopulmonary Sciences, Rush University, Chicago, IL

Introduction Oxygen therapy for COPD patients with severe hypoxemia requires the use of an oxygen delivery device that allows mobility. However, the characteristics of some of these devices may limit the freedom of individuals to be as physically active as they desire. Dissatisfaction with LTOT device due to limited mobility may negatively affect the perceived quality of life in individuals living with COPD. **Purpose** The aim of this study was to elucidate perceived limitations that COPD patients might encounter in using LTOT devices. **Methods** Qualitative analysis of 320 responses to an open-ended question from a previously deployed electronic survey designed to investigate the degree of impact that LTOT devices might have on COPD patients was performed using NVivo, a qualitative data analysis software package. Thematic analysis was performed to identify patterns and themes within the robust text-rich data from the open-ended survey question regarding the survey participants' experiences with their LTOT devices. Cluster analysis was also performed to highlight relationships between various concepts. **Results** Themes generated revealed that participants experienced decreased mobility resulting in feelings of decreased autonomy, isolation, and a perceived decrease in quality of life because of portable oxygen cylinders being perceived as heavy and cumbersome. Participants also described feelings of fear and anxiety due to insufficient support for breathing provided by pulse-dose POCs as well as portable oxygen cylinders that run out before they complete errands and other activities of daily living. Some participants also reported that they willingly pay for LOX systems out-of-pocket because of the mobility it affords, which in their perception, improves their quality of life. **Conclusion** Oxygen-dependent individuals with COPD and severe hypoxemia may be at risk of adverse outcomes associated with decreased mobility encouraged by unsatisfactory physical and technical characteristics of portable oxygen cylinders and concentrators.

Sponsored Research - None

2661203

Validation of the ProVent Score in a Trauma Population.

Dina Gomaa, Connor Wakefield, Dennis Hanseman, Richard D. Branson; University of Cincinnati, Cincinnati, OH

Background: The Prolonged Mechanical Ventilation Prognostic (ProVent) score was developed to predict 1-year mortality in subjects requiring ventilatory support. This score uses four readily obtained variables including age, need for dialysis, platelet count and need for vasopressors at day 21. The ProVent score is based primarily on data from subjects with medical illness. The goal of this study was to validate the ProVent score in a cohort of trauma patients, **METHODS:** After IRB approval for this retrospective analysis we reviewed data from the trauma registry at the University of Cincinnati. Patients who received 21 or more days of mechanical ventilation were identified. Manual review of medical records was undertaken to abstract relevant data including the four model variables at Day 21 of mechanical ventilation. Vital status at 1 year was confirmed by medical record or the social security death index. Logistic regressions examined the associations between the different variables and mortality. Model performance at 21+ days was assessed for discrimination by calculating the area under the receiver operating characteristic curve (AUC). **RESULTS:** During the period from February 2011 to December 2015, 1541 trauma patients were mechanically ventilated. A total of 99 patients were ventilated for > 21 days and were included in this study One-year mortality was 23% for 21+ days subjects. AUC using all four predictors was 0.781. Using age, platelets and vasopressors, without dialysis rendered a score of 0.774. Mortality rates based on the ProVent score 0-4 were 5% (2/37), 30%, (13/30) 30%, (4/14) 67.5%(2/3) and 100% (2/2). One third of subjects suffered a head injury but the addition of head injury to the score did not alter the predictive capability. **CONCLUSIONS:** The ProVent model was accurate in our cohort of trauma patients. This supports the use of the ProVent score across a range of patient populations and confirms the generalizability of the score. Further studies should explore the implications of adopting the model into routine use.

Sponsored Research - None

2715349

Dual-Lumen Circuit – An Alternative to Dual-Limb Patient Breathing Circuits.

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

BACKGROUND: Dual-limb (DL) circuits are standard gas delivery conduits from the ventilator to the patient. With intra-hospital transport outside of the ICU setting presenting a challenge and associated added risk to patients, minimizing any congestion including the array of tubing may be advantageous. We sought to decrease the tubing array of the DL circuit and evaluated compact coaxial-style or dual-lumen (DU) circuits. Depending on the design DU circuits occupy between 50-70% of the I.D. of the outer lumen. We wanted to know if compared to DL whether DU circuits compromised breath delivery to and from the patient. **METHODS:** Our benchmark was an Airlife OY1778 adult DL circuit (Carefusion, Yorba Linda, CA). For comparison we evaluated the following DU circuits: (A) Vital Signs VJNXXXXX Limb-O, (**Becton, Dickinson and Company,** Franklin Lakes, NJ), (B) Meridian Nexus #72000-75 Unilimb, (Medline Industries, Northfield, IL), (C) Intersurgical Uniflow #29016000, (Intersurgical, Inc. East Syracuse, NY), and (D) Hamilton #260206 coaxial (Hamilton Medical, Reno, NV). Each circuit was attached to a Hamilton G-5 ventilator in the (S)CMV mode with decelerating ramp waveform and the following range of set parameters: VT=220 mL - 820 mL, RR = 12, 16 and 20 BPM; PEEP=5 cmH_2O, I:E = 1:2, 1:1, 2:1. The patient end was connected by an 8.0 ETT to an ASL-5000 (IngMar Medical, Ltd, Pittsburgh, PA) with compliance and resistance = 20 and 50 mL/cmH_2O and 5 cmH_2O/L/sec respectively. Outcome measures for comparison included minute volume, Pawp, inspiratory Raw, expiratory Raw, inspiratory time constant (RCinsp), expiratory time constant (RCexp), and CL_{ST}. Data were analyzed with Excel Data Analysis Tool-Pack for MD ±SD with comparisons made to baseline using single factor ANOVA. **RESULTS:** The results illustrated in the Table below indicate that there was no statistically significant difference in measured outcome parameters between the standard DL and DU circuits. **DISCUSSION/CONCLUSIONS:** DU designed circuits (B), (C), and (D) feature a 'tube-within a tube'. The (A) circuit incorporates a flat sleeve that splits the single tube circuit in half. All DU circuits occupy significant internal space not seen with DL circuit design. This evaluation indicates that there was no breath delivery compromise as illustrated within the limitations of our study design.

Sponsored Research - None

	VE	Rinsp	Rexp	Rcinsp	Rcexp	Clstat	Pawp
MD	0.47	-0.36	-0.44	-0.002	0.05	-0.62	0.78
±SD	0.79	1.96	1.80	0.09	0.04	5.61	2.61
±2SD	1.59	3.93	3.60	0.19	0.09	11.21	5.23
p value =	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05

2718073

Early Extubation Following Cardiac Surgery.

Donna Tanner[1], Steven Insler[2], Bjoerrn Toennes[2], Greta Ziegman[1], Tim Sobol[3], Brittany Conley[1]; [1]Respiratory Therapy, Cleveland Clinic, Cleveland, OH; [2]Cardiothoracic Anesthesia, Cleveland Clinic, Cleveland, OH; [3]Heart and Vascular Institute, Cleveland Clinic, Cleveland, OH

Background: Prolonged intubation following cardiothoracic surgery can lead to a variety of complications that increase health care costs and extend the patient's length of stay. Early extubation (within 4 hours of arrival) should be the goal. **Methods**: During the year of 2016, 3,728 patients underwent coronary artery bypass surgery with or without cardiopulmonary bypass. A total of 1,040 were categorized into MVR, AVR, TVR, CABG and myectomy categories and evaluated for their extubation times from <2 hours, <4 hours, 4-6 hours, and >6 hours. Exclusion criteria for prolonged intubation and mechanical ventilation was documented open chest, devices (IABP, VAD, ECMO), inhaled epoprostenol, hypothermia, bleeding/coagulopathy, airway patency/protection, planned re-operative event, re-op due to unmentioned exclusion criteria, not following commands, CVA, cardiac arrest, hemodynamic instability, high doses of vasopressive/inotropic support, hypoxemia defined as Pa02<65 on .40 Fi02 and hypercarbia defined as PsC02>55. The patients were then categorized into the table of intubation hours and reasons of why not extubated (exclusion criteria). All patients were admitted to anesthesia and used a conventional protocol of wean to extubated criteria. Complication criteria evaluated was post-operative pneumonia, pulmonary thrombo emboli, pulmonary embolism and pleural effusion. **Results**: Demographic data, previous medical and cardiac history, preoperative medications and operative data was not reviewed in the study. The average extubation times among the surgeries demonstrated that procedurally myectomies were extubated sooner than TVR, MVR, AVR and CABG. AVR patients experienced the longest ventilator times of the study where 47.88% of patients were intubated greater than six hours. A rapid extubation of less than 4 hours listed AVR at 20.93%, TVR 16.87%, MVR 25.32%, Myectomy 35.21% and CABG 18.97%. Post-operative complications in the <2 hour intubated group exhibited one patient with a pulmonary thrombo emboli (1 patient of 518). Of the patients extubated within 2-4 hours of ICU arrival, 4 patients had documented pneumonia, 4 patients with pulmonary thrombo emboli and 22 with pleural effusions. **Conclusions:** The study shows that an early extubation protocol and initiative can be safely implemented in patients following cardiac surgery with or without cardiopulmonary bypass. **Disclosures**: All authors report no financial interests or potential conflicts of interest.

Sponsored Research - None

2722223

Hamilton H900 Heater With Dual-Limb Circuit: The Effect of Pressure Trigger vs Flow-Trigger on Circuit Temperature.

William R. Howard, Stephen Malinowski; Respiratory Care, Brigham and Women's Hospital, Boston, MA

INTRODUCTION: Heated wire circuit (HWC) humidification is designed to minimize or eliminate condensation during MV. The HWC has not been shown to eliminate rainout so it must be drained on occasion. This obligates the clinician to open the circuit and expose it to pathogens in the atmosphere. This is a necessity but also in contrast to VAP prevention recommendations. We wanted to evaluate an adjustable heater during MV using the optional methods of breath triggering and to identify intra-circuit temperature changes (the precursor to condensation formation). Considering that condensation forms when heated and humidified gas is cooled, we wanted to determine if gas flow interruptions from these triggering methods were variables affecting temperature stability. We measured circuit temperature during pressure triggering (PT) and compared it to flow triggering (FT). **METHODS:** A Hamilton G5 ventilator with dual limb H900 circuit (Hamilton Medical Inc., Reno, NV), was attached to a standard test lung using the following settings: minute ventilation = 8.0 L/m, I:E = 1:2, heater settings: chamber = 37°C, offset = 0°C or proximal temperature = 37°C, expiratory temperature increase = active; interventions - PT = 2 cm H_2O; FT = 3 L/m. There were six 5-minute tests, 1 each with PT and FT. Prior to each test there was a 15-minute period of heater stabilization. Temperature was recorded each second on the inspiratory side of the circuit wye and at the expiratory port using a TSI-4080 FA-Plus analyzer, (TSI, Inc. Shoreview, MN); data recorded on a removable flash drive. The data were analyzed with ANOVA using Excel Data Pak. **RESULTS:** 1,800 temperature measurements were collected. After leaving the heater chamber PT temperature decreased in 67% of the measurements ($p < 0.05$). In FT breaths, there was 0% occurrence of temperature decrease ($p > 0.05$). Circuit temperature at the inspiratory wye compared to the chamber temperature MD ±SD was PT = (0.08), ±1.11, (p > 0.05); FT = 0.73, ±0.62, (p > 0.05). Circuit temperature at the expiratory port compared to the chamber temperature MD ±SD was PT = (0.54), ±1.89, ($p < 0.05$); FT = 0.44, ±0.45, ($p > 0.05$). **DISCUSSION:** Temperature in the circuit is affected by breath triggering selection. Interruption of flow demonstrated a decrease in circuit temperature. FT resulted in temperature stability between the chamber outlet and expiratory port. FT has less time to cool compared to PT creating less potential for formation of condensation.

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	Inspiratory Circuit during Inspiration	Inspiratory Circuit during/after Exhalation	Expiratory Circuit during Inspiration	Expiratory Circuit during/after Exhalation
Pressure Trigger	+	x/x	x	+/x
Flow Trigger	+	x/+	x	+/+

TABLE 1 – Gas flow delivery comparing triggering method during mechanical ventilation breath delivery phase: + = Yes, x = No, +/+ = after exhalation bias flow continues, +/x = after exhalation no further gas flow.

2722819

The Effect of I:E Ratio on Circuit Temperature With Hamilton H900 Heater and Dual-Limb Circuit.

William R. Howard, Stephen Malinowski; Respiratory Care, Brigham and Women's Hospital, Boston, MA

INTRODUCTION: A consequence of humidifying with a heated wire circuit (HWC) is the occasional need to open it and drain condensation. Opening of the circuit interrupts ventilation and PEEP and breeches the recommendations for protecting against airborne pathogen exposure. To address condensation formation we considered that environmental temperature alters HWC gas temperature on its path from the heater chamber until exiting to atmosphere. We considered there were periods of flow stagnation which might allow cooling from the ambient surrounding. Therefore, we wanted to evaluate an adjustable heater's performance during flow and pressure triggered breaths (FT) and (PT) and determine if I:E ratio affected HWC gas temperature. **METHODS:** A Hamilton G5 ventilator with dual limb H900 circuit (Hamilton Medical Inc., Reno, NV), was attached to a standard test lung using the following settings: chamber heater settings = 37°C, circuit offset = 0°C (proximal temperature = 37°C), expiratory temperature increase function = active; minute ventilation = 8.0 L/m; interventions: PT = 2 cm H_2O, FT = 5 L/m; I:E = 1:2, 1:4, 1:1, 2:1. There were six 5-minute tests with PT and FT at each I:E. Prior to each test there was a 15 minute period of temperature stabilization. Temperature was measured at the inspiratory side of the circuit wye and immediately proximal to the expiratory port. Temperature was measured each second using a TSI-4080 FA-Plus analyzer, (TSI, Inc. Shoreview, MN and data recorded on a removal flash drive. The data were analyzed with ANOVA using Excel Data Pak. **RESULTS:** Temperature measurement data points collected = 4,862. The MD ±SD of delivered temperature compared to the end of the circuit for all I:E ratios was PT = -2.38°C, ±1.60°C, ($p < 0.05$); FT = +0.35°C, ± 1.59°C, ($p > 0.05$). Expiratory port circuit temperature decreased below 37 °C at 1:1 and 2:1 during inspiration with both PT and FT. **DISCUSSION:** We considered that environmental temperature alters circuit temperature on its path from the heater chamber prior to exiting to atmosphere. Two variables that influenced stability of circuit temperature were breath triggering and the I:E ratio. I:E of 1:2 and 1:4 exhibited significant temperature stability with FT. I:E = 1:1 and 2:1demonstrated temperature decline below set values with both PT and FT. Further study is necessary to determine if adjustable heaters avoid temperature decline at various minute volumes, I:E ratios, and breath triggering methods.

Sponsored Research - None

2726866

Hamilton H900 Adjustable Heater; Is Humidification Adequate Without Rainout?

William R. Howard, Stephen Malinowski; Respiratory Care, Brigham and Women's Hospital, Boston, MA

BACKGROUND: Factors that contribute to insufficient or excessive humidification during mechanical ventilation include internal patient circuit temperature and environmental conditions. This is demonstrated by either an apparently dry circuit or one with excessive rainout. While evaluating a new-to-market heater and proprietary dual-limb heated wire (HWC) we had mixed results of performance - until adjustments were identified to avoid rainout. We wanted to evaluate the system for water vapor delivery in the absence of visual condensation to determine whether AARC guidelines for mechanically ventilated patients of 33-44 mg H_2O/L were achieved under various configurations. **METHODS:** A G5 ventilator was assembled with an H900 heater and proprietary dual-limb HWC, (Hamilton Medical, Reno, NV), and connected to a test lung with CL = 20 mL/cmH_2O. Settings: VE ranged from 5.0-8.0 L/m, I:E = 1:2, 1:4, 1:1, 2:1; heater temperature = 36°C; offset = 1.5 °C which established a proximal temperature = 37.5°C; expiratory limb function = active; G5 flow triggering (FT) = 5 L/m. Elapsed time to consume or deliver 50 mL of sterile water in each test phase was recorded. H_2O vapor delivery was calculated as follows: Total gas flow = VE x 60 min/hour x number of hours to consume 50 mL + bias flow gas delivery(BF). BF = total test-phase time (hrs) x bias flow setting x 2 x % time of exhalation breath phase. BF was calculated for the I:E ratio in each test phase with the formula: Water vapor delivery = water consumed/Total gas flow = mg H_2O/Total gas flow. Data were analyzed with Excel Data Analysis Tool-Pack for MD ±SD with comparisons made to baseline using single factor ANOVA. **RESULTS:** Compared to AARC recommended guidelines of 44 mg H_2O/L, MD = 1.35 mg H_2O/L, ±SD 8.6 mg H_2O/L of water vapor was delivered without visible rainout in the patient circuit. In the absence of rainout opening of the circuit for drainage was not required. **DISCUSSION:** Ideally using HWC with MV should result in the delivery of sufficient humidity, the absence of accumulating condensation, and maintaining a closed circuit. This study demonstrated these aspects were achievable while delivering water vapor within the range of AARC recommendations without rainout occurring while evaluating an adjustable heater and HWC in a variety of MV configurations.

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2730464

A Comparison of Oxygen Consumption Between Proportional Assist Ventilation and Pressure Support Ventilation.

Terry L. Forrette[1], Patrick Greiffenstein[2], John B. Zamjahn[1]; [1]Cardiopulmonary Science, LSU Health, New Orleans, LA; [2]Surgery - Trauma/Critical Care, LSU Health, New Orleans, LA

Background: The work of breathing (WOB) is the energy expended during ventilation and can be expressed by measuring oxygen consumption (VO_2) during indirect calorimetry. Alternatively, WOB can be measured using proportional assist ventilation (PAV), a continuous spontaneous ventilation (CSV) mode. PAV targets a WOB load by proportionally assisting the patient's efforts. Unlike pressure support ventilation (PSV), PAV does not use a preset level of support pressure but adjusts the pressure based on the WOB measured by the ventilator. Furthermore, PAV has been shown to decrease mean airway pressure (MAP) and may be better tolerated than PSV. We sought to compare the WOB during PAV and PSV by measuring the difference in the VO_2 between these CSV modes. **Methods:** Eligible trauma ICU patients were randomly assigned to a SBT protocol using either PAV (30% support) or PSV (5 cm H_20 with 5 cm H_2O CPAP). An indirect calorimeter measured VO_2, VCO_2, RQ, and REE during periods of PAV or PSV. Patients who did not achieve steady-state conditions, covariance (CoVar) >10%, were withdrawn from the study. Additional data collected from the ventilator included RR, V_T, V_E and RSBI, along with HR and BP. After achieving steady-state, data were collected for 15 minutes. The patient was next switched to the other mode, either PAV or PSV, and data was again collected as previously described. Following this the patient was returned to the pre-SBT mode of ventilation per protocol. Student's paired t-test was used to compare continuous variables. **Results:** The comparison of VO_2 between PAV and PSV is shown in the table. A total of 42 patients were initially enrolled with 5 patients subsequently excluded due to non-steady-state conditions. The MAP for PAV (6.8 ± 0.34 cm H_2O) was significantly lower (P < 0.001) than that for PSV (7.3 ± 0.27 cm H_2O). No significant difference (P > 0.05) in VO_2 was observed between PAV (3.32 ± 0.86 mL/kg/min) and PSV (3.40 ± 0.71 mL/kg/min). Indirect calorimeter CoVars were equivalent during PAV and PSV. **Conclusion:** The VO_2 is similar between PAV and PSV resulting in a near normal value (~3.5 mL/kg/min) indicating that both modes were equally well tolerated. These findings may be attributable to the homogeneity and/or size of the study population. Future studies with a larger and more diverse population may show a difference in VO_2 between these modes.

Sponsored Research - None

Comparison of VO2 between PAV and PSV

	PAV	PSV	P value
VCO2 (mL/kg/min)	2.77 (0.65)	2.85 (0.61)	NS
VO2 (mL/kg/min)	3.32 (0.86)	3.40 (0.71)	NS
RQ (VCO/VO2)	0.85 (0.07)	0.84 (0.09)	NS
RR (breaths/min)	20 (4)	20 (4)	NS
VT (L)	0.460 (0.132)	0.458 (0.126)	NS
RSBI (RR/VT)	43 (18)	44 (17)	NS
MAP (cm H2O)	6.8 (0.34)	7.3 (0.27)	P < 0.001
MABP (mm Hg)	94 (11)	94 (12)	NS
HR (bpm)	88 (16)	88 (16)	NS
CoVar (%)	7.2 (2.3)	7.1 (2.4)	NS

Values are expressed as means +/- (SD). n = 37; NS = no significance at P > 0.05

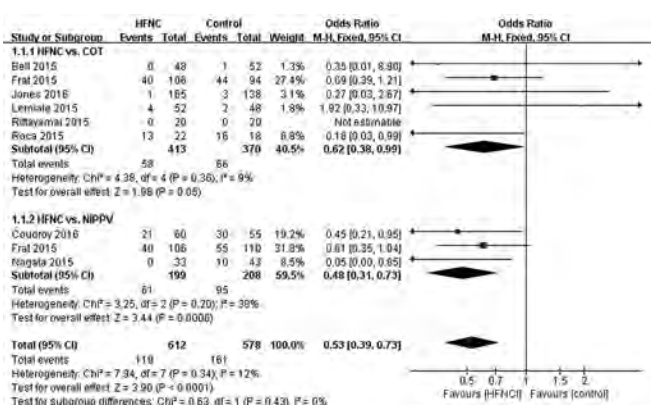
2748362

The Effect of High-Flow Nasal Cannula in Reducing Mortality and Rate of Endotracheal Intubation When Used Before Mechanical Ventilation Compared With Conventional Oxygen Therapy and Noninvasive Ventilation. A Systematic Review and Meta-Analysis.

Yuenan Ni, Jian Luo, Binmiao Liang, Zongan Liang; West China Hospital, Chengdu, China

Background: The effects of high flow nasal cannula (HFNC) on adult patients when used before mechanical ventilation (MV) are unclear. We aimed to determine the effectiveness of HFNC when used before MV by comparison to conventional oxygen therapy (COT) and noninvasive positive pressure ventilation (NIPPV). **Methods:** The Pubmed, Embase, Medline, Cochrane Central Register of Controlled Trials (CENTRAL) as well as the Information Sciences Institute (ISI) Web of Science were searched for all the controlled studies that compared HFNC with NIPPV and COT when used before MV in adult patients. The primary outcome was the rate of endotracheal intubation and the secondary outcomes were intensive care unit (ICU) mortality and length of ICU stay (ICU LOS). **Results:** Eight trials with a total of 1084 patients were pooled in our final studies. No significant heterogeneity was found in outcome measures. Compared both with COT and NIPPV, HFNC could reduce both of the ICU mortality (OR 0.47, 95% CI 0.24-0.93, P=0.03; OR 0.36, 95% CI 0.20-0.63, P=0.0004) and rate of endotracheal intubation (OR 0.62, 95% CI 0.38-0.99, P=0.05; OR 0.48, 95% CI 0.31-0.73, P=0.0006). As for the ICU LOS, we did not find any advantage of HFNC over COT or NIPPV. **Conclusions:** When used before MV, HFNC can improve the prognosis of patients compared both with the COT and NIPPV.

Sponsored Research - None



2755624

Low Driving Pressure: An Important and Safe Parameter for Lung Protective Ventilation and Weaning Especially for Patients With ARDS.

Cherian K. Paily[1], Richard Wunderink[2], Renee Touchton[1], Michelle Prickett[2]; [1]Respiratory Care, Northwestern Memorial Hospital, Chicago, IL, IL; [2]Pulmonary Medicine, Northwestern Memorial Hospital, Chicago, IL

Background: Safe and appropriate ventilator management plays a pivotal role in prevention of acute lung injury (ALI), acute respiratory distress syndrome (ARDS), and ventilator associated pneumonia (VAP). Significant mortality and morbidity are associated with VAP. Spontaneous awakening trials (SAT) and spontaneous breathing trials (SBT) are important parts of the weaning bundle. Lung protective strategies include low tidal volume (VT) ventilation to keep plateau pressures below 30 cwp, driving pressures below 15 cwp, and higher positive end expiratory pressures (PEEPs). Driving pressure is defined as the pressure difference between plateau pressure and PEEP. In order to maintain plateau pressures below 30 cwp, it is necessary to reduce the VT from the ideal 8- 10 ml/ kg to 7 - 6 ml/kg of predicted body weight. However, trying to keep plateau pressures <30 cwp with low tidal volume can lead to permissive hypercapnia allowing PaCO2 to be greater than normal. **Objective**: Plateau pressure is not the only determining factor that helps heal an injured lung and reduce or prevent ALI. It is also important to maintain driving pressures below 15 cwp. Higher driving pressures induce mechanical stress on the lungs, which is thought to induce ALI and ARDS. In order to achieve this goal, it may be necessary to increase the PEEP. For example, if a patient's plateau pressure is maintained at 28 cwp, and the PEEP is set at 5.0 cwp, the driving pressure (DP) will be 23 cwp, which can cause mechanical stress on patient's lungs. In this example, in order to keep DP at 15 cwp, it is necessary to increase PEEP to 13 cwp. **Project**: We looked more than 400 patients who were mechanically ventilated in our various ICUs, over a one year period. We looked at plateau pressures and driving pressures of all patients while they were on full ventilatory support, always attempting to use lung protective strategies and using VAP bundle to prevent ALI, ARDS and VAP. **Results**: We have found that more than 80% of patients whose driving pressures were at 15 cwp or less were weaned off mechanical ventilatory support within a week. But, those patients who had higher than normal plateau pressures and driving pressures were either trached, sent to long term facility, and or expired. **Conclusion**: It is very important to apply lung protective ventilation strategies, especially for patients with ARDS, using lower tidal volumes and higher PEEPs in order to maintain DP below 15 cwp for better outcomes.

Sponsored Research - None

2755710

Reducing Nuisance Ventilator Alarms in a Surgical and Neuroscience Intensive Care Unit.

Darren B. Lydon[1], Kathy Prairie[2], Chad Pezzano[1], Dan Thompson[4], Laura Mylott[3]; [1]Cardio-Respiratory Services, Albany Medical Center, GLENMONT, NY; [2]Critical Care, Vassar Medical Center, Poughkeepsie, NY; [3]Bouve College of Health Sciences, Northeastern University, Boston, MA; [4]Albany Medical Center, Albany, NY

Background: Ventilator alarms are among the most commonly occurring alarms in the ICU. Excessive alarms may lead to caregiver fatigue, inadvertent disregard of alarms, and poor patient outcomes. High respiratory rate, high and low minute ventilation were identified as the most commonly occurring alarm at our institution. The goal of this study was to decrease alarms by individualizing mechanical ventilator alarms. **Methods:** Ventilator alarm log data was collected for a two-week period for both the baseline study phase and intervention phase for all patients on Pressure Controlled Ventilation (PCV) and Pressure Support Ventilation (PSV). In the intervention phase, high respiratory rate alarms were increased to 15 breaths per minute above the actual rate, and low and high minute ventilation alarms settings were changed from 60% of observed to 50% of observed. A survey of bedside nursing was conducted to measure the perception of the frequency of nuisance alarms. Lastly ventilator occurrence reporting was examined for any alarm related adverse events. **Results:** There was a statistically significant reduction in the overall number of alarms the intervention phase for both patients who were on PCV and PSV ($P = 0.000$). Patients on PCV and PCV both had an overall alarm reduction, $P < 0.006$ and $P < 0.002$ respectively. No significant changes in the bedside nursing perception of nuisance alarms and no alarm related adverse event occurrences after the alarm changes were noted. **Conclusions:** The frequency of ventilator alarms was decreased because of changing ventilator alarm settings parameters without comprising patient safety. Though the bedside nursing survey showed no difference in the perception of nuisance alarms there was a trend towards nursing being more responsive to ventilator alarms. Further studies should be conducted to assess what optimal ventilator alarms settings would provide both patient safety and reduction of nuisance alarms.

Sponsored Research - None

Ventilator Alarm Data By Mode

Ventilator Mode	Alarm	Baseline Phase	Intervention Phase	Difference	95% CI	P-Value
		(# of alarms/hour/patient)				
ALL		(N=146)	(N=132)			
	RR.High	1.315	0.668	0.647	(0.294-1)	0.000
	Exp..Minute.Vent.Low	0.496	0.308	0.186	(0.041-0.335)	0.013
	Exp..Minute.Vent.High	0.522	0.336	0.186	(0.025-0.347)	0.023
	Overall	*2.333*	*1.312*	*1.021*	*(0.541-1.502)*	*0.000*
PSV		(N=99)	(N=62)			
	RR.High	1.342	0.711	0.631	(0.15-1.112)	0.011
	Exp..Minute.Vent.Low	0.508	0.247	0.261	(0.076-0.446)	0.006
	Exp..Minute.Vent.High	0.550	0.390	0.159	(-0.073-0.391)	0.176
	Overall	*2.400*	*1.349*	*1.051*	*(0.385-1.718)*	*0.002*
PC		(N=26)	(N=29)			
	RR.High	1.269	0.673	0.596	(-0.084-1.275)	0.084
	Exp..Minute.Vent.Low	0.501	0.296	0.205	(-0.036-0.445)	0.094
	Exp..Minute.Vent.High	0.561	0.277	0.285	(0.047-0.522)	0.020
	Overall	*2.330*	*1.246*	*1.085*	*(0.325-1.845)*	*0.006*

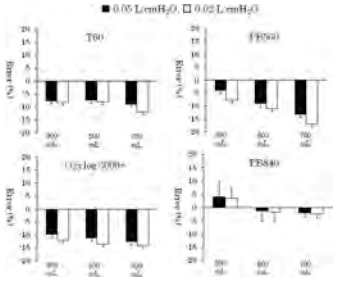
2757142

Evaluation of Compensatory Function for Compression Volume of Transport Ventilators: Bench Study.

Keisuke Morinishi[1], Yusuke Chikata[1], Jun Oto[2], Mutsuo Onodera[3], Masaji Nishimura[3]; [1]Medical Equipment Center, Tokushima University Hospital, Tokushima, Japan; [2]Emergency and Disaster Medicine, Tokushima University Hospital, Tokushima, Japan; [3]Critical Care and Emergency Medicine, Tokushima University Graduate School, Tokushima, Japan

Background: Mechanically ventilated patients frequently require ventilatory support during transport in hospital. Delivery of accurate tidal volume (V_T), PEEP, and F_IO_2 is crucial. Transport ventilators do not perform as well as ICU ventilators, while its performance has been improving. Some of them have compensatory function for compression volume. We evaluated its performance in bench study under various respiratory parameters. **Method:** We tested 3 transport ventilators (Monnal T60:T60, Puritan Bennett 560:PB560 and Oxylog3000+), and one ICU ventilator (Puritan Bennett 840:PB840) by using a TTL test lung (TTL model 1601, Michigan Instruments). All ventilators were tested in VC-CMV mode. V_T was set at 300, 500 and 700 mL with square flow waveform. PEEP was set at 5 and 10 cmH_2O and inspiratory time at 0.7, 1.0 and 1.5 s. With T60, PB560 and PB840, respiratory rate was at 10 breath/min. Oxylong3000+ was unable to set respiratory rate independently from V_T. F_IO_2 with T60 and PB840 were 0.21, 0.6 and 1.0. PB560 was set at only 0.21. F_IO_2 with Oxylog3000+ was available to set 0.4-1.0, it was set 0.4, 0.6 and 1.0. The compliance of the TTL test lung was adjusted to 0.05 and 0.02 L/cmH_2O and a resistance of 5 and 20 cmH_2O/L/s respectively. With T60 and PB840, compression volume was compensated with self-test procedures. PB560 has the fix value of compensatory function (2mL/10cmH_2O). Oxylog3000+ was not equipped with compensatory function. Each ventilator was connected to the TTL test lung via standard limb tubing. The pnemotachometer was connected between airway resister and the TTL test lung. We measured V_T for 1 minute and the last 3 breaths were extracted. Values were presented as percent error (Error (%) = 100 × (measured value –set value)/set value). **Results:** When V_T was 300 mL, Error (%) was below 10%. When V_T was above 500 mL, PB560 and Oxylog3000+ showed Error (%) greater than 10%. Error (%) with T60 and PB840 was below10% in all set V_T. Error (%) was greater at compliance of 0.02 L/cmH_2O than at 0.05 L/cmH_2O in all transport ventilators (Figure). Error (%) was greater at resistance of 20 cmH_2O/L/s than at 5 cmH_2O/L/s with all tested ventilators. As inspiratory time lengthened, Error (%) decreased. **Conclusions:** As V_T increased, Error (%) increased with the ventilators without compensatory function. We recommend the ventilators with compensatory function and/or monitoring respiratory status during transport. Sponsored Research-None.

Sponsored Research - None



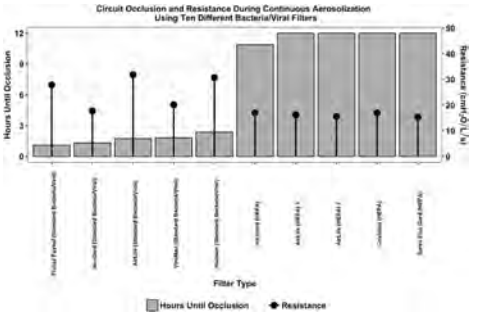
2757191

Circuit Occlusion and Resistance Across Standard Bacteria/Viral and HEPA Filters During Mechanical Ventilation With Continuous Aerosolization: A Bench Model.

Gabriel Costea[2], Justin Hotz[1,2], Russelle Cazares[2], Edward Guerrero[2], Leo Langga[1,2]; [1]Anesthesia Critical Care Medicine, Children's Hospital Los Angeles, Los Angeles, CA; [2]Respiratory Care, Children's Hospital Los Angeles, Los Angeles, CA

Background: During continuous aerosolization, bacteria filters are commonly placed between the expiratory limb of the circuit and the ventilator to protect the internal components from excessive fluid accumulation. Over time the filter may become saturated resulting in circuit occlusion alarms and elevated resistance. The duration of time until a filter becomes saturated may be affected by the make and model of the chosen bacteria filter. In this bench experiment we sought to compare different types of bacteria filters and report the time until a circuit occlusion alarm occurs, and the resistance of the system. **Methods:** An AVEA ventilator was set-up and calibrated with a heated/humidified Adult/Pediatric circuit that was attached to a standard test lung and placed in PC-AC: RR 20, 20/5, 40%. A vibrating mesh nebulizer was placed on the humidifier inlet proximal to the ventilator and provided a continuous nebulization of normal saline at a rate of 20ml/hr. Two bacteria filters of the same make/model per test were placed between the expiratory limb and the ventilator. Five standard bacteria/viral filters and five HEPA filters were tested in this fashion. A data logger was used to capture measured ventilator parameters as well as alarms at a rate of one sample per minute. The time in hours until a circuit occlusion alarm occurred was recorded as well as the median resistance for each testing sequence. If circuit occlusion had not already occurred then testing was terminated after 12 hours. **Results:** Hours until circuit occlusion alarm, and median resistance in cmH2O/L/s for each individual filter are shown in the Figure. When comparing the standard bacteria/viral filters with the HEPA filters as two groups, the mean duration until circuit occlusion alarm for the standard filters was 1.7 ± 0.5 hours and 11.8 ± 0.5 hours for the HEPA filters (independent t-test, $P < 0.001$). The mean resistance of the standard filters were 25.7 ± 6.4 cmH20/L/s and 16.2 ± 0.73 cmH20/L/s for the HEPA filters, $P < 0.05$. **Conclusion:** In a mechanically ventilated bench model during continuous aerosolization, HEPA filters maintain significantly lower resistance and run for a longer duration without circuit occlusion alarms than standard bacteria/viral filters.

Sponsored Research - None



2757406

The Effects of Alcohol, Drugs, and Smoking on Mechanical Ventilation Days in Patients With Thoracic Cage Trauma.

Robert B. Murray[1], Douglas S. Gardenhire[1], Samuel Shan[1], Gordon L. Warren[2]; [1]Department of Respiratory Therapy, Georgia State University, Atlanta, GA; [2]Department of Physical Therapy, Georgia State University, Atlanta, GA

Background: Thoracic injury is a leading cause of hospitalization and mortality in the United States (US). Patients with thoracic injuries incur a greater number of mechanical ventilation (MV) days and have a higher mortality. Alcohol, drugs, and smoking all increase the need for mechanical ventilation. Alcohol and drug abuse can lead to increase ventilator days due to complications and withdrawal. Smoking is also a leading cause of mortality in the U.S. Smoking leads to poor lung health and has been associated with an increase in ventilator days. The purpose of this study was to examine the effect of alcohol, drug, and smoking on mechanical ventilator days in motor vehicle accident patients. **Method:** The study was approved by the university IRB. A retrospective study using patient encounters (n=2542) from a level-one trauma center in Atlanta, Georgia between January 2011 and September 2015. Descriptive statistics and ANOVA were used to compare groups after categorization (thoracic injury or nonthoracic injury). In group comparisons of with or without thoracic injury was compared to the social factors alcohol, drug, or smoking. **Results:** Patients with nonthoracic injury that do not smoke were on MV (M=1.66; SD=6.49), compared to patients who smoke (M=1.42; SD=4.27) days. Patients with thoracic injury that do not smoke were on MV (M= 6.86; SD=12.52), compared to patients who smoke (M=5.25; SD=11.43) days. Patients with nonthoracic injury that do not use drugs were on MV (M=1.53; SD=6.00), compared to patients who use drugs (M=2.81; SD=7.44) days. Patients with thoracic injury that do not use drugs was on MV (M=6.40; SD=12.12), compared to patients who use drugs (M=8.34; SD=14.30) days. Patients who have nonthoracic injury that do not use alcohol was on MV (M=1.58; SD=6.24), compared to patients who use alcohol (M=2.03; SD=3.79) days. Patients with thoracic injury that do not use alcohol were on MV (M=6.48; SD=12.32), compared to patients who use alcohol (M=8.32; SD=12.76) days. Patients suffering thoracic cage injury spend more days on MV, (p=.000). No significant relationships exist among those that smoke, use drugs, or use alcohol (p=.155, p=.105, and p=.299) respectively. **Conclusion:** Overall patients suffering thoracic cage injury are on MV more days. Thoracic cage injury patients that smoke spend less days on MV while patients that use alcohol or drugs spend more days on MV. **Disclosures:** None; Sponsored Research-None

2757581

Effect of High Velocity Nasal Insufflation, a Form of High Flow Nasal Cannula, on Exhaled CO_2 in Adults With Normal Lung Function.

Tadashia J. Cooper, Michael W. Canfield, Jonathan B. Waugh; Cardiopulmonary Sciences, Samford University, Birmingham, AL

Background: High-flow nasal cannula (HFNC) is recognized as an oxygenation modality and it is purported to enhance spontaneous ventilation efficiency by flushing upper airway dead space of CO_2 during the expiratory phase. A form of HFNC termed high velocity nasal insufflation (HVNI) appears to enhance CO_2 flushing in computer modeling by increasing energy in the flow vortices (DOI: 10.4172/2161-105X.1000376). We tested the ability of different HVNI flows (10, 20, 30 and 40 L/min) to clear CO_2 from the anatomic reservoir at resting and tachypneic (24 bpm following metronome) respiratory frequencies. **Method:** This university IRB-approved project studied a group of 9 adults (aged 21-23 y, 5 females) with normal lung function (determined by FEV_1 and FVC and absence of symptoms) using a cross-over design with washout periods. Each participant experienced all levels of flow and respiratory frequency. Exhaled CO_2 was simultaneously measured at 3 sampling locations (nasal, oral and lower nasopharyngeal) via separate capnograph monitors (Capnostream 20, Medtronic Inc, Minneapolis, MN) with computerized data capture, which was analyzed for area under the breath curve (CO_2 pressure per time by breath). **Results:** The graph plots integrated CO_2 values (mm Hg●s●Breath^{-1}) as mean ± SD at each level of HVNI flow during normal, resting breathing. Using ANOVA with Student-Newman-Keuls post hoc test, the oral sample of CO_2 during 10 L/min of HVNI was different ($P < .001$) than the other 3 flows (also true for the total "summative" CO_2 values). The pharyngeal CO_2 value at HVNI flow of 10 L/min was different ($P = .034$) from the pharyngeal CO_2 values at 30 and 40 L/min HVNI flows. CO_2 values during tachypneic breathing showed similar trends for all sampling sites and the total CO_2, where the values at 10 L/min versus 20, 30 and 40 L/min were different ($P < .001$). **Conclusions:** These findings show that with HVNI, CO_2 was preferentially flushed via the oral cavity and values continued to decrease at all measured flows indicating a dose-response dilution effect. The nasal and pharyngeal CO_2 values were much lower with no differences at the higher flows (essentially zero for CO_2 values), suggesting that these areas were well flushed at these levels of flow. This information may be useful for guiding HFNC therapy and appears to support the aforementioned mathematical modeling findings. Further investigation is needed to quantify the airway flushing effect on ventilatory efficiency.

Sponsored Research - Vapotherm Inc.: Financial support of data collection and analysis, HVNI device and circuits and measurement equipment through a university administered grant.
Medtronic Inc.: Donated disposable filterlines for capnography monitors.

2757787

Association of Body Mass Index to Mechanical Ventilator Days of Traumatically Injured Patients: A Retrospective Study.

samuel s. shan, Douglas S. Gardenhire, Robert B. Murray, Gerald S. Zavorsky, Gordon L. Warren; Respiratory Therapy, Georgia State University, Atlanta, GA

Background: Obesity is a global healthcare issue that has doubled worldwide since 1980. Obesity leads to illnesses causing serious chronic conditions. Obesity is analyzed in chronic context, but the impact of obesity is less understood in acute conditions. Literature suggests obese critically ill patients do not exhibit worse outcomes when placed on mechanical ventilation (MV), apart from patients with BMI > 40 kg/m^2. There is limited data on the impact of obesity for patients who require MV due to an acute illness such as trauma. Our objective was to compare differences in BMI groups and duration on MV for patients who suffered trauma. **Methods:** Data was collected at a level-one trauma center located in Atlanta, GA, between January 2011 and September 2015. This retrospective study was approved by the university IRB and included only the patients that were intubated and admitted to the intensive care unit following a motor vehicle accident. Patients were categorized into five BMI groups: underweight (BMI < 18.5), normal weight (BMI of 18.5-24.9), overweight (BMI of 25-29.9), obese (BMI of 30-39.9), and morbidly obese (BMI of >40). Descriptive statistics and an analysis of covariance were used to compare the mean number of days that the patients were on a ventilator in the five BMI groups. **Results:** Nine hundred forty-four patients were included in the analyses: 4% of patients were underweight, 33% were of normal weight, 30% were overweight, 26% were obese, and 7% were morbidly obese. The mean (SD) number of days each group was on MV were: 23.4 (22.9), 12.1 (12.5), 11.5 (13.2), 15.3 (16.7), and 16.1 (16.0) days on the MV for underweight, normal weight, overweight, obese, and morbidly obese weight categories', respectively. Results were adjusted based on injury severity score and age. The underweight group spent more days on MV compared to the normal weight, overweight, and obese groups ($p < 0.03$). However, there was not a significant difference between the number of days spent on the MV between the underweight and morbidly obese groups ($p = 0.19$). Obese patients spent about 3 more days on MV compared to normal and overweight patients ($p = 0.042$). **Conclusion:** When patients suffer traumatic injuries and MV is required, BMI has a significant association to days spent on MV. Obese and underweight patients spend more time on MV compared to normal and overweight patients. **Disclosures:** None; Sponsored Research-None.

Sponsored Research - None

2758010

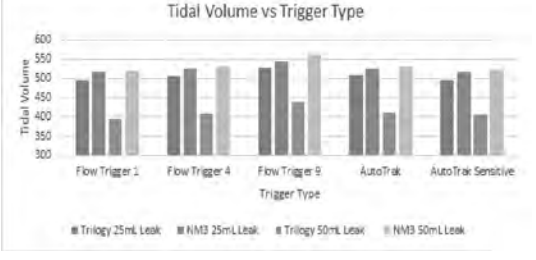
Trigger Effect On Delivered Tidal Volumes: A Bench Analysis.

James P. Keith II[1], Katlyn Burr[1], Joel M. Brown II[1], James Hertzog[2,3]; [1]Respiratory Care, Nemours, Wilmington, DE; [2]Division of Pediatric Critical Care Medicine, Nemours, Wilmington, DE; [3]Thomas Jefferson University, Philadelphia, PA

Background: The Trilogy 202© (V) is a portable ventilator used in various patient care environments. "Ventilator triggering designs have evolved such that the proportion of patient effort required to trigger is only a small fraction of the total effort expended to overcome inspiratory muscle load."[1] The V has 3 settings available for triggering: Flow Trigger, in which the settings range from 1-9 LPM, AutoTrak©, and AutoTrak Sensitive©. The aim of this study was to determine if trigger types had an influence on delivered VT with various leaks. **Methods:** All types of breath triggering available on the V were tested with a passive circuit that included a Respironics© Whisper Swivel as the exhalation valve. The V circuit was connected to a Michigan© Test Lung with a set compliance of .04 L/cmH20 and a parabolic resistor of RP 20 (20 cmH2O/L/sec). A Philips© NM3 was used to measure displayed volumes and pressures. V settings were; V-AC, VT 500mL, RR 10, Ti 1.0 s, PEEP 5. A Maquet Servo-I® ventilator was connected to the Michigan Test Lung to simulate spontaneous breathing. The Servo-I was set at a RR of 20, with a minimal VT to simulate triggering at the various trigger settings. All alarms were set at min/max or off to reduce nuisance. Values from three spontaneous breaths were taken from each setting and averaged. The leak was doubled and measurements and recording of all values was repeated. Values measured from the V were: exhaled tidal volume, PIP, leak, MAP and peak flow. Values measured from the NM3© were exhaled tidal volume, inhaled tidal volume, PIP, and MAP. **Results:** Tidal volume increased from the lowest average VT of 494mL on AutoTrak Sensitive, to 527mL on a flow trigger setting of 9LPM. When the leak was increased, the V under-reported the delivered tidal volumes by up to 29% when compared to measurements obtained from the NM3. See graph for more details. **Conclusions:** The V reported tidal volumes within its range of error, although the VT delivered increased as the flow required to trigger a breath increased. With increasing leak, the ventilator under-reported volume delivered, and delivered almost 130mL more than displayed, as recorded by the NM3. Further studies in this area must be done comparing passive versus active circuits to gain a better understanding of the trigger setting's relationship to displayed VT.

References: 1. Sassoon, C. **Triggering of the Ventilator in Patient-Ventilator Interactions**, *Respiratory Care,* January 2011, 56 (1) 39-51

Sponsored Research - None



This graph depicts the relationship between tidal volume and set trigger type.

2758476

The Effect of Smartphone Use on Children's Cervical Angle and Pulmonary Function.

Asma Alonazi[2], Waleed Almutairi[1], Gurinder Bains[3], Noha Daher[3], Rhonda Nelson[2], Abdullah Alismail[1]; [1]Cardiopulmonary Sciences, Loma Linda University, Redlands, CA; [2]Physical Therapy, Loma Linda University, Loma Linda, CA; [3]Allied Health Studies, Loma Linda University, Loma Linda, CA

Rationale: With the prolonged use of smartphones among children, increased health concerns regarding forward head posture (FHP) have been raised. Therefore, potential changes in spinal posture occur, which may affect the pulmonary function and respiratory muscle strength. The purpose of this study was to evaluate the changes in craniovertebral angles (CVA) and pulmonary function among boys and girls 8 to 13 years of age who use smartphones. Methods: A cross-sectional study was conducted on a sample of 50 healthy subjects (24 boys and 26 girls) with mean age 10.5 ± 1.6 years and mean body mass index (BMI) 18.6 ± 3.0 kg/m^2. Subjects were assigned to 2 groups based on their scores on the Smartphone Addiction Scale Short Version for Adolescents (SAS-SV): addicted group (score > 32, n=32) and non-addicted group (score ≤ to 32, n=18). The CVA of all participants was measured to evaluate the changes in the upper cervical spine. Forced vital capacity (FVC), forced expiratory volume in 1 second (FEV1), FEV1/FVC, peak expiratory flow (PEF), maximal voluntary ventilation (MVV), maximum inspiratory pressures (MIP), and maximum expiratory pressures (MEP) were measured to assess changes in pulmonary function. Results: An independent t-test showed a significant reduction in CVA measures of less than 50 degree between both groups, which indicates a larger FHP, in addicted boys (49.4 ±6.7; p=0.03) and addicted girls (47.3 ±6.3; p=0.02). In boys, FVC and FEV1 were significantly reduced in addicted versus non-addicted group (p=0.04 and p=0.05, respectively). Also, FEV6 showed a significant reduction in addicted compared to non-addicted boys (p=0.02) as well. MVV values were also reduced, but not significant, in addicted boys compared to non-addicted. In girls, the addicted group had significant reduction in MIP values vs non-addicted group (p=0.05). MEP values in the addicted boys and girls were also reduced but not significant compared to non-addicted groups. Conclusion: We conclude that frequent use of smartphones could negatively affect cervical posture that leads to FHP, as well as a decrease in respiratory function among children. A reduction in pulmonary function test has found to be associated with FHP possibly due to constant neck flexion while viewing the smartphone in the addicted group. Therefore, education on proper posture while using smartphones and prolonged usage effects are essential to children's postural and pulmonary function status.

Sponsored Research - None

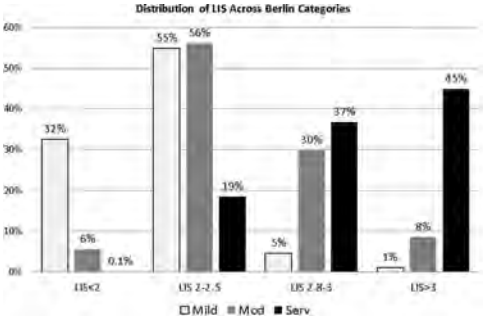
2758489

Comparing ARDS Severity: Berlin Definition vs Lung Injury Score.

Richard Kallet[1], Michael S. Lipnick[2], Antonio Gomez[3]; [1]Respiratory Care Services, San Francisco General Hospital, San Francisco, CA; [2]Anesthesia, UCSF, San Francisco, CA; [3]Pulmonary & Critical Care Medicine, UCSF, San Francisco, CA

Background: The Berlin ARDS Definition[1] categorizes lung injury severity based upon the ratio of arterial oxygen tension-to inspired oxygen fraction (Pa_{O2}/Fi_{O2}). In contrast, the Lung Injury Score (LIS) [2] judges the severity of acute lung injury on a 4-point scale encompassing 4 categories (chest radiograph, Pa_{O2}/Fi_{O2}, PEEP and chest compliance; a score ≥ 2.75 signifying ARDS. We reasoned that judging ARDS severity by Pa_{O2}/Fi_{O2} alone may result in overlap in severity between the 2 schemes. **Methods:** The ZSFGH ARDS quality assurance data base was used; with 1,930 subjects meeting Berlin definition for ARDS between June 2002 and February 2017. Subjects were managed with the ARDS Net protocol. LIS severity was categorized *pre hoc* as: Minimal (< 2), Mild (2-2.5), ARDS (2.8-3) and severe ARDS (> 3) based on ECMO criteria.[3] These distributions were compared across Berlin categories. This strategy was repeated for 3 PEEP categories (< 10, 10-15 and > 15 cmH_2O). **Results**: Berlin-defined mild ARDS was characterized predominantly by minimal (32%) and mild (55%) lung injury by LIS, whereas 19% of Berlin-defined severe ARDS was designated as mild lung injury by LIS. Considerable overlap occurred between Berlin-defined moderate and severe ARDS with LIS-defined ARDS (30% vs. 37% respectively). Seventy-four percent of Berlin-defined Mild ARDS had PEEP < 10 cmH_2O compared to 40 and 41% of Berlin-defined Moderate and Severe ARDS respectively. In contrast 25% of both Berlin-defined mild and moderate ARDS had PEEP set between 10-15 cmH_2O. A disproportionate share of LIS-defined severe ARDS (45%) and PEEP groupings of 10-15 cmH_2O (50%) and > 15 cmH_2O (10%) were encompassed by Berlin-defined severe ARDS. **Conclusion:** Berlin categories of ARDS severity reasonably approximate lung injury severity by LIS. However, considerable overlap in LIS and PEEP distribution occurs between Berlin-defined mild and moderate categories that may lead to underestimation of the true degree of lung injury. ARDS Definition Taskforce. Acute respiratory distress syndrome: the Berlin definition. JAMA 2012;307(23):2526-2533. Murray JF, et al. An expanded definition of the adult respiratory distress syndrome. Am Rev Respir Dis 1988138(3):720-723. Peek GJ, et al. Efficacy and economic assessment of conventional ventilatory support versus extracorporeal membrane oxygenation for severe adult respiratory failure(CESAR). Lancet 2009;374:1351-63.

Sponsored Research - None



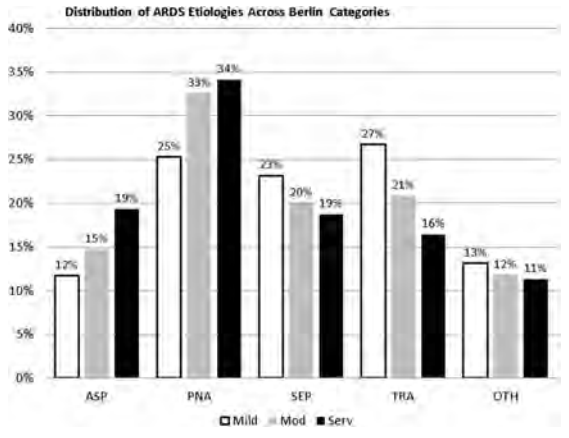
2758618

Representation of ARDS Etiologies Differs Across Berlin Definition Severity Classifications.

Richard H. Kallet[1], Michael S. Lipnick[2], Antonio Gomez[3]; [1]Respiratory Care Services, San Francisco General Hospital, San Francisco, CA; [2]Anesthesia, UCSF, San Francisco, CA; [3]Pulmonary and Critical Care Medicine, UCSF, San Francisco, CA

Background: The Berlin Taskforce's definition of ARDS was an iteration of the previous American-European Consensus Conference (AECC) criteria and refined the concept of "severity" based upon worsening oxygenation.[1] To our knowledge the distribution of ARDS etiologies across these oxygenation categories has not been an examined. Therefore, we used our hospital's ARDS quality assurance data base to investigate whether ARDS etiologies are evenly represented in mild, moderate and severe ARDS. **Methods:** Between June 2002 and February 2017, 1,930 subjects meeting the Berlin definition for ARDS were treated at SFGH. Each subject entered into the database was categorized according to the primary source of lung injury. Chi Square tests were used to compare the proportion of subjects with the same etiology across Berlin categories. Alpha was set at 0.05 **Results**: The percentage of aspiration (ASP) was significantly higher in severe compared to both mild (P=0.012) and moderate (P=0.038) ARDS. Likewise pneumonia (PNA) was more prevalent in moderate (P=0.012) and severe (P=0.007) compared to mild ARDS. In contrast, the percentage of trauma-associated ARDS steadily and significantly decreased as ARDS severity increased (mild vs moderate: P=0.041; mild vs. severe: P=0.0001 and moderate vs. severe: P=0.013). In addition, the proportion of both sepsis-associated and other causes of ARDS were not different across ARDS severity classifications. **Conclusion:** Each major category of ARDS etiology is not equally represented across classifications of ARDS severity as judged by oxygenation criteria used in the Berlin definition. 1. ARDS Definition Taskforce. Acute respiratory distress syndrome: the Berlin definition. JAMA 2012;307(23):2526-2533.

Sponsored Research - None



2720895

Influence of Personality and Disease Acceptance on Health-Related Quality of Life in COPD.

Aaron McColpin; California State University Channel Islands, Camarillo, CA

Background The purpose of this study was to examine the relationship between personality characteristics and the effect of disease acceptance on the Health-Related Quality of Life (HRQOL) in those with chronic obstructive pulmonary disease (COPD) who had been referred for pulmonary rehabilitation. **Methods** The study included a quantitative correlational research design to examine this relationship by using self-reporting questionnaires and functional data. This study design helped to correlate the effect of personality type and disease acceptance on the HRQOL. Hypotheses were tested using a correlation analysis and a meditated multiple regression. This study was approved by the Institutional Review Board of Maryville University (IRB No. 14-78). **Results** The study included 39 participants referred for pulmonary rehabilitation. The median age of the study participants was 74 years old. Of the participants, 56% (n = 22) were male and 44% (n = 17) were female. The median pack years smoked for participants was 40 pack years. The median years since disease diagnosis was 11 years. The mean FEV1% was 43% of predicted based upon age, gender, and ethnicity. The study found that there was a significant negative correlation between HRQOL and disease acceptance, r = -.42, p = .008. There was a significant negative correlation between HRQOL and neurosis, r = -4.3, p -.007. The study analysis found a statistically significant negative correlation between neurosis and disease acceptance, r = -4.3, p = .007. The study found that neurosis did mediate the relationship between HRQOL and disease acceptance. The analysis found that using a Spearman and Pearson correlation shows significance between the dependent variable HRQOL and the independent variables neurosis, r = -.428, p = .008, and disease acceptance, r = .416, p = .007. **Conclusion** A broad range of factors determines health-related quality of life in those with chronic respiratory disease. This study did find a correlation between personality characteristics affecting quality of life in those with COPD. Conflicts of interest: The author declare that they have no competing interests **Key Words:** COPD, Health-Related Quality of Life, HRQOL, Personality Type

Sponsored Research - None

2756920

The Tele-Pulmonary Rehabilitation Acceptance Scale (TPRAS): Development and Validation Study.

Abdullah Almojaibel[1], Nikki Munk[1], Michael Justiss[2], Tamilyn Bakas[3]; [1]School of Health and Rehabilitation Sciences, Indiana University, Indianapolis, IN; [2]School of Applied Health Sciences. OTD Program., Jacksonville University, Jacksonville, FL; [3]University of Cincinnati College of Nursing, Cincinnati, OH

Background: Using telehealth in pulmonary rehabilitation is a new field of health care practice. Therefore, to successfully implement a Tele-Pulmonary Rehabilitation program, determinants of acceptance need to be measured among potential users. The aim of this study was to develop a scale to measure health care practitioners' and patients' acceptance of using Tele-Pulmonary Rehabilitation. Method: The initial items pool included 36 items and was generated based on the Technology Acceptance Model (TAM). To establish content validity, it is recommended that at least five reviewers participate in the content validity assessment. Following IRB approval, nine experts were invited to evaluate the items' relevance to the domains' theoretical definitions using the modified Delphi process. To determine the level of agreement among raters, the Content Validity Index (CVI) was calculated first for each item as well as for the entire scale. Items with minimum Item Content Validity Index I-CVI of ≥ 0.78 were considered as valid. To establish face validity, seven health care practitioners and five patients were interviewed to provide feedback about the scales' clarity and ease of reading. Findings: In Round 1 of the evaluation, items with CVIs of ≥ 0.83 were arranged to create two scales, perceived usefulness (PU) and perceived ease of use (PEOU), based on reviewers' categorization. After Round 2, items with CVIs of ≥ 0.78 were included in the final versions of the scales. Based on the reviewers' feedback, the final items were divided into two scales (Table 1). Each scale included three subscales intended to measure two domains, (PU) or (PEOU), in addition to a scale to measure behavioral intension (BI) to use Tele-Pulmonary Rehabilitation. Conclusion: This study developed two scales with evidence of content and face validity. The first scale includes 13 items intended to measure Tele-Pulmonary Rehabilitation acceptance among patients attending pulmonary rehabilitation (PR) programs (Table1.A). The other scale includes 17 items intended to measure Tele-Pulmonary Rehabilitation acceptance among health care practitioners working in PR (Table 1.B). The two scales will service as valuable measurement tools to measure acceptance of using telehealth in pulmonary rehabilitation programs. The findings will inform decision makers for planning, training, and providing support aimed to improve telerehabilitation use. Disclosures: The authors have no conflict of interest.

Sponsored Research - None

2757429

Is It Plausible That Plain Packaging of Cigarettes Could Influence Adult Americans' Perception of Tobacco Products?

Teresa E. Davidson; Allied Health, Northern Kentucky University, Cold Spring, KY

Background Branding of tobacco products is a large portion of their appeal to consumers. Dissuading patients from using tobacco products and changing their perception of their safety is a role of the respiratory therapist. Could plain packaging influence the consumer? Plain packaging means that there is no branding on the package, color and font are standardized, and mandatory health warnings cover a specified percentage of the package. The purpose of this study is to determine if plain packaging of cigarettes could influence adult Americans' perception of tobacco products. **Method** This IRB approved study was performed on the Northern Kentucky University campus to determine if plain packaging could influence adult Americans' perception of tobacco products, thus inhibiting their desire to use smoke. A convenience sample of 63 participants, 33 current smokers, were asked to view a photograph of plain packaging and complete a survey, consisting of demographics and four questions pertaining to package attractiveness, perceived health risks, and the ease of quitting. **Results** Of the 33 current smokers, 61% to 91% intend to quit; 91.3% to 100% think that plain packaging is unattractive and 65% to 93% believe that there is some level of health risk associated with smoking. Between 48.2% and 82% of current smokers think plain packaging would make it easier to quit smoking. **Conclusion** The evidence indicates that the majority of current smokers find plain packaging unattractive and believe that there is some level of health risk associated with tobacco products that are plain packaged. A smaller subset feels that plain packaging would make it easier to quit smoking. This study is limited by the convenience sample format used and the small sample size; the results support the argument that plain packaging of tobacco products would influence adult Americans' perception of tobacco products and perhaps influence them in their decision to stop smoking. Plain packaging would be another weapon in the arsenal of respiratory therapists to influence their patients' behavioral choices and encourage them to live healthier lives. **Disclosures** Author discloses no conflict of interest nor has received any funding.

Sponsored Research - None

2757587

COPD Management and Role of the Nurse Coach: Increasing Referrals and Participation in Pulmonary Rehabilitation.

Carrie Hoover[1], Jessica Omann[2], Carol Upcraft[3]; [1]Nursing, College of St. Benedit/St. John's University, St. Joseph, MN; [2]Pulmonary Rehabilitation/Respiratory Care, St. Cloud Hospital, St. Cloud, MN; [3]Performance Improvement, St. Cloud Hospital, St. Cloud, MN

Background: Chronic obstructive pulmonary disease (COPD) remains a significant cause for hospitalization and with complex management issues upon discharge a significant portion are being re-admitted within 30-days of first hospitalization. The beneficial effects of pulmonary rehabilitation (PR) in the management of COPD is well documented but continues to be underutilized as an important management strategy to reduce hospital readmissions. Transitional care programs which include nurse coaches, have immerged to empower patients to manage their disease and facilitate transitions through multiple care environments. Little is known about the efficacy of such programs on referral and participation in PR and subsequent reductions in readmissions. **Method:** The aim of this study was to compare receipt of referral and participation in PR and 30-day readmission rates in patients with COPD who received a transitional care program with those who received a routine hospital discharge plan. The transitional care program included medication reconciliation and nurse coach visits in-hospital and in the home. Data was collected retrospectively from electronic health records and included 215 subjects (Mean age 71, 45% female), with 54 enrolled in the intervention group. **Results:** Results indicate subjects who received a transitional care program demonstrated higher rates of PR participation (22%; 4%; p=0.001) and received a greater number of referrals (57%; 14%, p=.007). There were no significant differences related to 30-day hospital readmissions (24%; 14%, p=.089) however subjects who participated in PR were less likely to experience an early readmission. **Conclusions:** Coordinated, interdisciplinary hospital initiated programs, which include a nurse coach, may facilitate PR referral and empower patients to attend PR. **Disclosures**: None

Sponsored Research - None

2758299

Students' Attitudes Towards Patient Smoking Status During Enrollment in a Pulmonary Rehabilitation Program.

Amanda G. Hale, Kevin Collins; Texas State University, San Marcos, TX

BACKGROUND: The harmful effects of nicotine products are well documented, especially cigarettes. Due to the addictive nature of nicotine, it is often difficult for people who smoke to quit successfully without the help of cessation education and pharmacological assistance. It is imperative that students understand how tobacco affects the body, their role in smoking interventions, and the role that pulmonary rehabilitation (PR) plays in smoking cessation. This study was performed to understand the attitudes of students in the healthcare fields associated with PR regarding enrollment into a PR program with patients who smoke. METHOD: After obtaining approval from the Texas State University Institutional Review Board (#2017469), an email was sent to two department chairs/deans of the colleges/universities from each of the healthcare professional groups that stated the purpose of the study and a request to forward the email to the student body. Colleges/universities which house these professions were asked to participate if they had a baccalaureate degree program, total student enrollment > 5,000, were a public university located in Texas. RESULTS: Results were obtained from a subject pool of 114 participants, the majority of which were from the fields of respiratory therapy (n = 58) and physical therapy (n = 51). Findings revealed that as age increased, students were less likely to allow patients who smoke to enroll in a PR program (18-22: 78.6% agree/strongly agree; 23-27: 65.5% agree/strongly agree; 28-32: 66.7% agree/strongly agree; 33-37: 62.5% agree/strongly agree; >37: 53.8% agree/strongly agree). Females were more likely to agree/strongly agree with allowing a patient who smokes to enroll in a PR program (72.5% > 47.8%). Students that are current smokers (75% agree/strongly agree) and those that quit 1-3 years ago (88.9% agree/strongly agree) were more likely to allow patients who smoke to enroll in a PR program. CONCLUSIONS: More research is needed to understand students' perceptions towards patient smoking status during enrollment in a PR program; however, this data suggests that those who were more likely to allow patients who smoke to enroll in a PR program were 18 to 22-year old females who previously smoked 1-3 years ago. DISCLOSURES: The authors have no conflicts of interest to this unfunded research.

Sponsored Research - None

2758492

Comparison of 6-min Walking Distance Test Due to Different Oxygen Conserving Devices.

Tetsuo Miyagawa[1], Tomomi Ichiba[2,1], Naoki Miyao[3]; [1]Division of Respiratory Care, Showa University, Graduate School of Nursing and Rehabilitation Sciences, Yokohama, Japan; [2]Department of Physical Therapy, Kyorin University, Faculty of Health Sciences, Titaka, Japan; [3]Division of Respiratory Medicine, Nippon Kokan Hospital, Kawasaki, Japan

Background : Problems of oxygen conserving devices up to now include (1) poor synchronism of the inspiratory trigger, (2) FIO_2 decreases as the respiratory rate increases, (3) waste of oxygen decreases compared with the constant flow, but FIO_2 also decreases, (4) discomfort is appeared in high pulse dose. The new SmartDoze® is developed to automatically adjust the oxygen pulse dose according to the breathing rate and is automatically reduced the flow rate at rest. We compared the conventional oxygen conserving devices with SmartDoze® in 6 minutes walking distance (6MWD) test. Methods: The subjects were 25 patients (75.2 ±5.9 y/o, %VC82.7±19.0%, FEV_1%42.3±19.5%, %$FEV_1$41.7±21.2%, PImax56.1±31.6cmH_2O, PEmax64.1 ± 24.4 cmH_2O) with chronic respiratory insufficiency, with 20 cases of COPD, 5 cases of interstitial pneumonia. We compared arterial blood gas, pulse oximetry, respiratory rate, heart rate, blood pressure, dyspnea and lower limb muscle fatigue due to Borg scale before and after the 6MWD test. Data analysis was performed by using software SPSS version17 and JMP version12, P values <0.05 were considered statistically significant. Results: The 6MWD by the conventional oxygen conserving was 289.6 ± 133m, and the 6MWD when using SmartDoze® was significantly improved to 314.1±123.9m (p <0.05). In addition, SmartDoze® significantly reduced desaturation, dyspnea and lower limb muscle fatigue by suppressing increase in respiration rate, increase in heart rate and increase in blood pressure (p <0.05~0.01). We also found that recovery of all parameters after 6MWD test was also faster with SmartDose® (p <0.05). Conclusions: SmartDoze® improves exercise tolerance, oxygenation and dyspnea by supplying an oxygen amount synchronized with an increase in respiratory rate at the time of exertion, and it seemed to be effective in pulmonary rehabilitation.

Sponsored Research - None

2758610

Evaluation and Analysis of an Effective Pulmonary Rehabilitation Education Program.

Rebecca K. Roper[1], Debbie Koehl[2]; [1]Indiana Respiratory Therapy Education Consortium, IU Health, Indianapolis, IN; [2]Pulmonary Rehabiliation, IU Health, Indianapolis, IN

Background: This study was conducted at the Pulmonary Rehabilitation (PR) program at IU Health Methodist Hospital in Indianapolis, Indiana. This program has approximately sixty new patients annually with varying pulmonary diagnoses. Along with effective exercise routines, it is important to have a comprehensive education program to facilitate patient disease management. This project is a part of a grant, to evaluate the current education program, analyze new teaching methods, and to enhance the impact that PR education programs have on the patient's knowledge and the management of their condition. **Methods:** A survey with seventeen questions, twelve Likert scale and five open ended questions, was created. It was given to each patient after each class to evaluate their ability to achieve the class objectives, identify what they liked about the class, and determine ideas for improvement. Each survey was completed anonymously then the results were recorded. Further analysis incorporated the use of a third party, unbiased participant who came in to evaluate classes, read the handout material, and watch the instructional videos. The data was collected from February to April 2017. **Results:** In total, there were 70 surveys completed which represented 10 out of the 12 total classes. Only 51% of the participants answered the open ended questions. Of those, 47% of the comments provided positive information and only 4% wrote negative comments and shared an idea for improvement. The data revealed key aspects of patient education that were lacking in appropriate patient understanding. They included how to complete proper breathing exercises, how to take daily inhaled medications appropriately, and how to eat a healthy diet. **Conclusion:** There is a need for patient education in all PR programs to ensure that patients are able to manage their disease effectively. In PR, education should be comprehensive and cover all aspects of daily health. An evaluation of any PR education program is essential to ensure that the patients are obtaining and retaining knowledge. The new additions to the program are to correct the learning gap, incorporate new instructional videos, visual models, and online educational tools. The study was limited due to the small number of surveys received and the small percentage of participants who answered the open ended questions.

Sponsored Research - None

2758658

The Response of Four Home CPAP Devices to 1-min and 15-min Power Failures: A Bench Study.

Kendra Clingerman, MiSol Salinas, Charlene Harper, Jody Lester; Respiratory Care, Boise State University, Boise, ID

Background: Continuous positive airway pressure (CPAP) devices are commonly used to treat obstructive sleep apnea (OSA). Patients with OSA use these devices at home as they sleep and need to be alerted if their CPAP malfunctions. Most CPAP devices are electrically powered and therefore impacted by power outages. The purpose of this bench study was to determine the response of four home CPAP devices during simulated one-minute and fifteen-minute power failures. Method: A Hans Rudolph Series 1101 Breathing Simulator (HR 1101) was calibrated and the following lung parameters were entered: Resistance 3 cmH2O/L/sec, Compliance 60 mL/cmH20, Rate 12 BPM, Amplitude 10 cmH20, Effort Slope 5, Percent Inhale 33, Target Volume 500 mL. The HR 1101 was attached with Hudson Corr-a-flex II 22mm tubing to an anatomical model that allowed for simulated breathing and placement of a face mask. A Respironics AF541 face mask (small) was placed on the model. We evaluated four CPAP devices: ResMed AirSense™ 10 AutoSet™, ResMed S9 AutoSet™for Her, Philips Respironics DreamStation, Fisher & Paykel ICON™+. When tested, each CPAP device was plugged into a General Electric power strip and the corresponding manufacturer-specific tubing was attached. No humidification was used. Each device was powered on and connected to the face mask. Ramp time was turned off when possible, CPAP pressure and other settings were left at their pre-set values. Appropriate mask seal was confirmed by the mask fit test or operator confirmation of minimal to no leak. Device display was set to pressure to confirm CPAP level and delivery consistency. The switch on the power strip was turned off at one- and fifteen-minute intervals. A timer was activated, when time elapsed, the power strip was turned on. We noted the response of the CPAP device to the power failure and to the restoration of power. Results: During simulated power outages of one and fifteen minutes, none of the CPAP devices responded with audible or visible alerts. When power was restored the ResMed AirSense™ and Fisher & Paykel ICON™+ Auto both resumed delivering CPAP at their previous settings. The ResMed S9 AutoSet ™ for Her and the Philips Respironics DreamStation both defaulted to the home screen without flow or CPAP. Conclusions: Therapists and patients should be attentive to the response of home CPAP machines during power failure situations. There are minimal fail safe mechanisms in place to account for power failure.

Disclosures: None

Sponsored Research - None

CPAP Device	Pressure Before Loss of Po	ring 1 and 15 minute outage Audible Alert	CPAP/Flow Delivered	Result When Power Was Restored
ResMed AirSense™ 10 AutoSet™	4 cmH2O	None	None	Auto re-start: 4 cmH20
ResMed S9 AutoSet™ for Her	10 cmH2O	None	None	No CPAP delivered without manual restart
Philips Respironics DreamStation	12 cmH20	None	None	No CPAP delivered without manual restart
Fisher & Paykel ICON™+ Auto	7 cmH20	None	None	Auto re-start: 7 cmH20

2755064

Neonatal Respiratory Therapy Staff Evaluation of Three Point-of-Care Blood Gas Analyzers.

David R. Beadles[1], Helen A. Christou[2], Terri E. Gorman[2], Keith R. Hirst[1], Jill N. Robinson[1]; [1]Newborn Respiratory, Brigham and Women's Hospital, Boston, MA; [2]Newborn Pediatric Medicine, Brigham and Women's Hospital, Boston, MA

BACKGROUND: Point of care testing is used in critical care settings to improve patient outcomes by reducing time to results. We performed a side by side by side bench evaluation of three current point of care blood gas analyzers for use in our NICU. The purpose of the evaluation was to have the staff select a new analyzer for validation and use in our NICU. **METHODS:** Three current blood gas analyzers used for point of care blood gas/electrolyte testing were procured for staff evaluation in a week long side by side by side evaluation. The analyzers evaluated were the Siemens' RAPIDPoint 500 (Malvern, PA), Radiometer ABL 90 FLEX (Brea, California) and the Instrumentation Laboratory GEM Premier 4000 (Bedford, MA). Staff ran left over samples from the NICU or Clinical Chemistry Department through the analyzers in order to evaluate them in real time. Samples included arterial, capillary, venous, arterial cord and venous cord samples. None of the results from the evaluated analyzers were used to make clinical decisions. Staff then filled out an evaluation form for each analyzer that they tested. The evaluation form was developed in-house. Staff rated each analyzer on a Likert scale of 1-5 (1= unsatisfactory, 5= excellent) on the following areas: user interface, software/touch screen, time to results, quality of results, ability to meet department needs, ability to troubleshoot, ease of use, clot removal, maintenance and on-site/clinical support. Results were then compiled and averaged with the analyzer receiving the overall highest score and ranking to be validated for use in our NICU. **RESULTS:** There are a total of 18 qualified NICU RTs that run blood gases in the NICU. Out of these, 10 (66.7%) provided feedback on the analyzers. Each analyzer received a total of 5 evaluations each that came from the 10 staff. The IL GEM 4000 received the overall highest scores and ranked 1st in 5 categories and tied for 1st in 2 categories with no other analyzer ranking more than 1st in 2 categories individually. **CONCLUSION:** Based on the results, the NICU RT staff felt that the IL GEM 4000 should be further validated for use in our NICU as a POC blood gas analyzer.

Sponsored Research - None

2756675

Validation of the Instrumentation Laboratory Gem Premier 4000 for Point-of-Care Testing in a Neonatal Intensive Care Unit.

David R. Beadles[1], Helen A. Christou[3], Terri E. Gorman[3], Keith R. Hirst[1], Pamela J. Wakefield[2]; [1]Newborn Respiratory, Brigham and Women's Hospital, Boston, MA; [2]Clinical Chemistry, Brigham and Women's Hospital, Boston, MA; [3]Pediatric Newborn Medicine, Brigham and Women's Hospital, Boston, MA

BACKGROUND: The use of point of care testing in a Neonatal ICU allows for faster turnaround times on test results, the ability to make clinical adjustments sooner on critically ill infants and allows for improved patient outcomes. Two Instrumentation Laboratory GEM Premier 4000 (Bedford, MA) were validated for use in our NICU as point of care testing devices for blood gas and electrolyte analysis. **METHOD:** Two IL GEM Premier 4000 analyzers were each validated using the following criteria: 1) Accuracy and Precision study of 20 consecutive runs of GEM System Evaluator (GSE) Level 1 (low) and Level 3 (high). 2) Reliability Study of GSE levels 1 (low), 2 (normal) and 3 (high) twice a day for 10 consecutive days. 3) PVP linearity study which included 5 levels of each analyte (pH, PCO2, PO2 and Lactate), 4 times each 4) Patient sample correlation in at least 40 samples. This correlation was performed between the Clinical Chemistry Department Siemens RAPIDLab 1240 blood gas analyzer (Malvern, PA) and the GEM Premier 4000. Twenty of the 40 samples were correlated for lactate using the Clinical Chemistry Department Roche Cobas 6000 (Indianapolis, IN). Validation criteria and acceptability limits were developed based on compliance with state and federal regulations and the institution's accrediting body and were approved by both the NICU and Chemistry medical directors before implementation Statistical analysis was done by using IL Performance Verification Software version 1.6.3. **RESULTS:** Results from the linearity study were within 5% of the best-fit line and within the ranges specified by the manufacturer. The patient correlation study between the GEM Premier 4000 analyzer and the Clinical Chemistry Department (Siemens 1240 and Roche Cobas 6000) analyzers showed close agreement as the correlation coefficients ranged from 0.979 –1.00 for all analytes tested. Bland–Altman plot revealed no increase in scatter of values over the range of blood gas values compared to scatter between different models of the predicate device and fell within the allowable errors for all values tested. Results from the precision and reliability studies were all within specified limits as determined by the manufacturer and clinical laboratories testing criteria. **CONCLUSION:** Our results support that the IL GEM 4000 analyzers are reliable, valid and suitable to operate in a NICU POC testing environment.

Sponsored Research - None

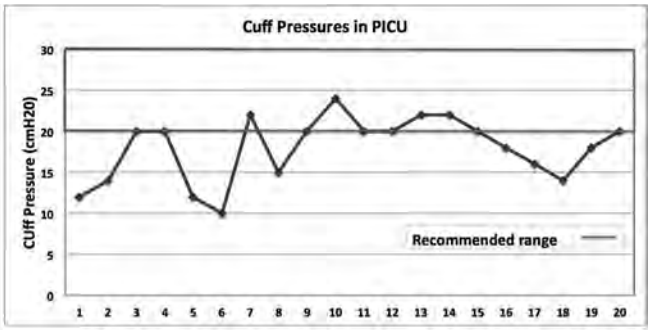
2757071

Incidence of Underinflation and Overinflation of Endotracheal Tube Cuffs in the PICU.

Sadie. Wiatrek, Crystal. Janes, Abdulaziz. Alsharifi, Robin. Rodriguez, Ruben D. Restrepo; Respiratory Care, UTHSCSA, San Antonio, TX

Background: The ETT cuff is designed to seal the space between the tube and the trachea, thus preventing aspiration of secretions into the lower part of the airway. While a cuff pressure >20 cmH20 has been recommended, several studies have reported that almost 50% of cuffs are overinflated (>25 to 30 cm H20). Overinflation and underinflation of the cuffs are associated with either trauma to the tracheal mucosa or microaspiration, respectively. Measurement of cuff pressure (CP) in intubated patients is inconsistently performed. While direct measurement with a manometer is the "gold standard" method, the minimal leak technique (MLT) is the method routinely used in ICUs. We have previously reported a high number of overinflation in adult intubated patients; however, limited reports address under and over inflation of the cuff in pediatric patients. The primary goal of this study was to assess cuff inflation pressures in patients admitted to a PICU in a university-affiliated institution. **Methods:** A prospective observational study at a 496-bed hospital, in San Antonio, Texas. A Posey, Arcadia cufflator was used to measure the cuff pressures from patients with cuffed ETT. Mean CP was calculated and compared to the recommended range (20-30 cm H20). **Results:** CP was measured in 20 intubated pediatric patients. The average ETT size was 4.5 mm. The mean CP was 14.96 (SD 3.93; range: 12-24). See figure 1. Underinflation (CP </= 20 cm H20) was present in 45% of the cuffs, while overinflation (CP >30 cm H20) was not detected in any cuff analyzed. There was no significant difference noted between CP obtained from patients who were in PICU ≥1 week (18.27 cmH20) vs. < I week (17.56 cmH20) (p=0.6). **Conclusion:** In this group of pediatric patients, the routine once-a-shift MLT measurement was associated with a significant number of underinflated cuffs. The results also suggest that the MLT should not be used in place of manometric measurement of CP. A further evaluation needs to determine the potential impact of a possible microaspiration on the respiratory outcomes of intubated and mechanically ventilated pediatric patients.

Sponsored Research - None



2758288

Evaluation of the Accuracy of Tidal Volume, PIP and PEEP Using a Novel T-piece Resuscitator for Pediatric And Adult Patients.

Chad E. Weagraff, Kathleen Deakins; Pediatric Respiratory Care, UH Rainbow Babies & Children's, Chardon, OH

BACKGROUND: Hyperventilation from high tidal volume (Vt) or respiratory rate increases intrathoracic pressure, reduces right heart function and cardiac output during resuscitation.[1] Breath sizes are dependent on size of the bag, flow rate, (flow inflating bag) and the size of caregiver's hands. Reducing variability in volumes may help reduce hyperventilation. A novel pediatric-adult resuscitation device: the Resusa-Tee T-piece Resuscitator (Mercury Medical, Clearwater, FL) provides consistent pressure and tidal volume for pediatric to adult patients when applied at suggested respiratory rate, I: E and flow rate. The purpose of this study is to validate the consistency of measured and estimated tidal volumes, PIP and PEEP delivery for use in resuscitation. METHODS: A Resusa-Tee T-piece Resuscitator circuit was attached to a 1L Drager test lung (Drager Medical Telford, PA). Using an I:E ratio of 1:2 at flow rates of 5 (f 20/min) 17 (f 20/min) and 22 lpm (f 12/min), tidal volume (Vt), PIP and PEEP were recorded from a pediatric-adult flow sensor attached to a NICO monitor (Respironics, Wallingford, CT) every two minutes for 15 minutes at each setting. Caregiver I:E and RR were analyzed for consistency at each level. Tidal volume, PIP and PEEP were analyzed using paired t-test with a significance level set at p<0.01. RESULTS: There was no statistically significant difference in measured parameters using the device at a stable I:E and frequency. Mean values and standard deviations at each setting are displayed in the table below. CONCLUSION: Precise tidal volumes, PIP and PEEP are accomplished using a pediatric resuscitator at a stable I:E and frequency. If used as intended, t-piece resuscitation in pediatric and adult patients may provide consistent tidal volume delivery that may impact resuscitation efforts by stabilizing and controlling the volume component that contributes to hyperventilation during resuscitation. [1] Henlin, T Michalek P, Tyll T, Hinds JD, Dobias M. Oxygenation, ventilation and airway management in and out of hospital cardiac arrest: a review. Bio Med Internat 2014: doi.org/10.114=55/2014/37861

Sponsored Research - None

Measured Vt, PIP and PEEP

Mean values and (standard deviations)	Tidal volume	PIP	PEEP
Flow rate 5 LPM Frequency 20 bpm = Vt70	61.8 mL (10.2184) p=0.2384	9.5467 cm H2O (0.2438) p=1.0000	4.8333 cm H2O (0.1234) p=1.0000
Flow rate 17 LPM Frequency 20 bpm = Vt 280	256.22 mL (0.3253) p=07747	16.9567 cm H2O (0.2599) p=1.0000	4.9867 cm H2O (0.513) p=1.0000
Flow rate 22 LPM Frequency 12 bpm 545.5 mL (94.2871) p=0.4228	545.5 mL (94.2871) p=04228	22.4 cm H2O (1.60) p=0.9989	5.123 cm H2O (0.2838) p=1.0000

2758375

Compliance of Hand Hygiene Policies in the Neonatal Intensive Care Unit Among Health Care Providers.

Christina N. Truitt, David Chang; University of South Alabama, Mobile, AL

BACKGROUND: Proper hand hygiene is the simplest and most effective way to prevent hospital-acquired infections. Health care providers (HCPs) are the most common vehicle for the transmission of pathogens in the hospital. The objective of this study was to assess the compliance of hand hygiene policies in the neonatal intensive care unit (NICU) among HCPs. **METHOD:** IRB approval was obtained before the study. This observational study was done on HCPs who had direct contact with the patients in the NICU. The researcher sat at the charting area and covertly observed the compliance rate of hand hygiene based on the hospital policies - using alcohol-based sanitizer or antiseptic soap and water before and after patient contact. Each HCP was observed before and after patient contact and the hand hygiene procedures were recorded. **RESULTS:** Thirty-three HCPs were observed entering patient rooms in the NICU and making direct patient contacts. Three HCPs were excluded from data analysis because one of the two instances (before / after patient contact) of hand hygiene procedure was not observed for various reasons. The remaining 30 HCPs included in the data analysis were: 2 physicians (MD), 7 respiratory therapists (RT), 17 nurses (RN), and 4 radiology technicians (XR). The hand hygiene technique was rated as "compliance" when the HCP performed both hand hygiene procedures (before and after). They were rated as "not compliance" if one of the two hand hygiene procedures was not performed. Percent compliance was calculated by dividing the number of compliance by the number of HCP in each respective professions. A bar graph was used to summarize the compliance rate among these 4 groups of HCPs. **RESULTS:** In this study, the percentages of hand hygiene compliance in the NICU for MD, RT, RN, and XR were 100%, 86%, 53%, and 25%, respectively (Figure 1). **CONCLUSIONS:** Infection control is important for the hospital population, especially in the NICU when the neonates are most vulnerable. Based on the results of this study, there was a wide range of compliance in following the hospital hand hygiene policies. The infection control personnel should continue to monitor the compliance of hand hygiene policies among all HCPs. Limitations in this study included small sample size in the MD and XR groups. Additionally, non-compliace did not imply a persistent habit among these HCPs included in the data analysis.

Sponsored Research - None

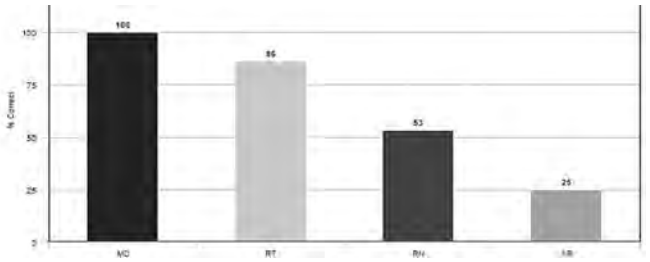


Figure 1 Percent compliance of hand hygiene policies in the NICU among 4 groups of health care providers

2758418

Additional Oxygen Flow Via Nasal Cannula During Bag Mask Ventilation Does Not Increase Airway Pressure in the Trachea: A Simulation Study for Apneic Oxygenation.

Natalie Napolitano[1], Amanda Lutz[1], Cheryl Dominick[1], Joseph McDonough[1], Vinay M. Nadkarni[2], Akira Nishisaki[2]; [1]Respiratory Care Department, The Children's Hospital of Philadelphia, Philadelphia, PA; [2]Division of Anesthesia and Critical Care Medicine, The Children's Hospital of Philadelphia, Philadelphia, PA

Background: Apneic oxygenation is the delivery of oxygen to the patient during the apneic phase of the intubation procedure to prevent oxygen desaturation. In children, this apneic oxygenation process is delivered by initiating oxygen flow via the nasal cannula during bag mask ventilation, and continue it throughout the apneic time. However, there has been a concern that the additional oxygen flow during bag mask ventilation might provide unnecessary high peak inspiratory pressure (PIP) during this mask ventilation. We hypothesized the PIP in the trachea were higher than the targeted PIP in both healthy and diseased patients during bag mask ventilation with additional oxygen flow via nasal cannula in a simulated infant, pediatric, and adult patient. **Methods:** A bench study using the ASL 5000 Active Servo Lung Precision Simulator (Ingmar, Pittsburgh, PA) connected to Laerdal airway models and programmed using lung models to simulate a 5kg infant, 25kg pediatric, and 80kg adult patient with a healthy and diseased lung condition (Table 1). Bag mask ventilation was provided by an experienced respiratory therapist (RT) with a flow or self-inflation bag with a manometer connected to the bag. RT provided bag mask ventilation for 1 minute at a targeted PIP (25cm H2O for infants, 30 cmH2O for pediatric and adult) with age appropriate rate (30/min for infants, 20/min for pediatric and adult). We added additional nasal cannula flow (5L/min for infant, 10L/min for pediatric, 15L/min for adult) via nasal cannula. We measured both tracheal and bag-mask airway pressure using a Fleisch pneumotachometer, and data were analyzed with the PowerLab (ADInstruments, Colorado Springs, CO). **Results:** Tracheal pressure was significantly lower than targeted PIP in all models ($p<0.05$) except adult diseased model where measured tracheal pressure was similar to targeted PIP ($p=0.27$). **Conclusion:** Application of oxygen flow via nasal cannula during bag mask ventilation with self- or flow-inflating system does not result in increased airway pressure in the trachea.

Sponsored Research - None

Targeted Bag Mask ventilation parameters

Patient Model	Compliance (mL/cmH2O)	Resistance (cmH2O/L/s)	Rate (bpm)	PIP (cmH2O)	PEEP (cmH2O)
Infant-normal	8	40	30	25	5
Infant-diseased	4	50	30	25	5
Pediatric-normal	40	20	20	30	5
Pediatric-diseased	20	20	20	30	5
Adult-normal	60	5	15	30	5
Adult-diseased	33	15in/25out	15	30	5

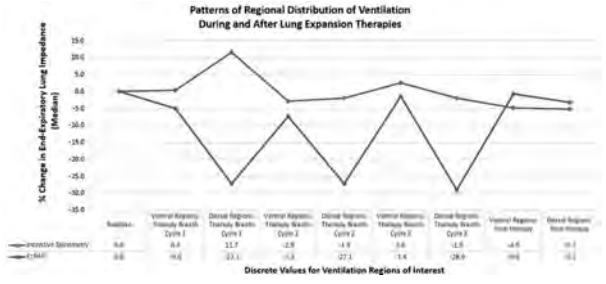
2758679

A Descriptive Observational Pilot Study Comparing Regional Distribution of Ventilation During Lung Expansion Therapy in Adult Human Subjects.

Daniel D. Rowley, Thomas M. Malinowski, Ashley Charles, Daniel U. Gochenour; University of Virginia Medical Center, Charlottesville, VA

BACKGROUND: Lung expansion therapy (LET) is utilized to promote alveolar ventilation and reduce risks of pulmonary complications. Patterns of regional lung ventilation measured with Electrical Impedance Tomography (EIT) during I.S. and EzPAP LET have not been described. The primary purpose of this study was to determine if there is a difference in regional distribution of ventilation between I.S. and EzPAP LET among adult healthy subjects and wheter these changes are maintained after LET. **METHODS:** This was an IRB approved randomized controlled descriptive observational study. Thirty adult healthy subjects (57% male; n = 17/30) between ages 22-62 (38±12) and BMI = 26.5(24,30) were randomly allocated to receive IS (n=15) or EzPAP (n=15) LET after obtaining informed consent. Subjects were connected to EIT (PulmoVista 500, Draeger) and provided with LET instructions before therapy. Five minutes of eupneic ventilation with EIT monitoring was used to establish baseline end-expiratory lung impedance (EELI). Subjects were instructed to take 10 breaths through their assigned LET device, followed by a 60 second rest period. The cycle was repeated two more times. IS subjects were coached to inhale to a nomogram targeted inspiratory capacity. EzPAP subjects were coached to exhale naturally against 15cmH_2O expiratory pressure. Five minutes of eupneic ventilation followed the last LET breath cycle. Subjects were monitored for relative ventral and dorsal EELI changes (dEELI) during and after LET. Descriptive data are presented as frequency(%), mean±SD, and Median(IQR) as appropriate. Mann-Whitney U was applied to evaluate dEELI between groups. Alpha = .05. **RESULTS:** There are no statistically significant differences in relative changes in ventral distribution of ventilation when comparing IS to EzPAP LET during Breath Cycles 1 (P=1.0), 2 (P=.81), 3 (P=.44), and post-therapy (P=.74)). Statistically significant difference was detected for dorsal dEELI during Breath Cycles 1 (P = .026) and 2 (P =.029), favoring IS. At the completion of 5 minutes of eupneic breathing, there was no post-therapy difference in dorsal dEELI for either form of LET (P=.90) (See Graph). **CONCLUSION**: Changes in EzPAP dEELI imply a greater loss in lung volume in dorsal regions of the lung during LET when compared to IS. These LETs did not sustain lung recruitment in healthy subjects. Future studies should explore whether patients at risk for lung volume loss demonstrate similar dEELI patterns.

Sponsored Research - Draeger provided EIT equipment and training support to study investigators for this study.



2728660

Carinal F_{IO2} - Comparing Oxymask to Non-Rebreather and Simple Masks at 10 and 15 L/min With Increasing Minute Ventilation.

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

BACKGROUND: Numerous products are available to provide low flow O_2 therapy. These range from a nasal cannula to a non-rebreather mask. The OxyMask is designed to replace these multiple low flow O_2 devices. The manufacturer claims that the OxyMask is the only one available delivering 24 to 90% oxygen. Multiple claimed benefits include comfort, patient access, and replacement of multiple low flow devices – allowing inventory reduction of additional masks. Although studied in healthy volunteers at normal tidal breathing,[i] we wanted to know if F_{iO2} with this mask was comparable to a non-rebreather and simple masks at increasing minute ventilation. **METHODS:** Low flow mask performance was evaluated by measuring carinal F_{iO2} with the following devices: (A) AirLife 001362 3 non-rebreather mask having (3ea) 1-way valves, (Carefusion, Yorba Linda, CA), (B) AirLife 001361 simple mask, (Carefusion, Yorba Linda, CA), (C) OxyMask OM-1125-8, (Southmedic, Inc., Barrie, ON). Flowrate was delivered at 10 and 15 L/m during the 3 product evaluations. Individually the masks were attached to a LifeForm LF03699U adult airway management trainer, (Nasco, Fort Atkinson, Wisconsin), connected to an ASL 5000 breathing simulator, (IngMar Medical Ltd, Pittsburgh, PA). Spontaneous breathing mode was programmed for 220 – 820 mL for a predicted VT to simulate 100 – 300 lb patients, RR = 15 and 20 BPM. Carinal F_{iO2} was measured using an Analytical Industries AII-2000M oxygen analyzer, (Analytical Industries, Pomona, CA). F_{iO2} was recorded after stabilization at each setting for a total of 60 measurements. The data were analyzed using ANOVA and paired t-tests with $p < 0.05$ considered significant. **RESULTS:** Carinal F_{iO2} results are illustrated in the graph below. Mask (C) consistently delivered less F_{iO2} in all tests compared to masks (A) and (B). The MD (±SD) between (A) and (C) was 11.6%, ±3.5%, ($p < 0.05$). The MD (±SD) between (B) and (C) was 11.9%, ±6.0%, ($p < 0.05$). **DISCUSSION:** Our results demonstrate a significant decrease in inspired oxygen concentration of mask (C) compared to masks (A) and (B). Although mask (C) is claimed to offer tangible benefits caution is recommended when expecting high levels of oxygen delivery during increasing minute volume. It might also be argued that compared to a patient's baseline MV, F_{iO2} may not be consistent as MV changes. [i] Paul J, Hangan, Hajgato J. The OxyMask development and performance in healthy volunteers. Med Devices (Auckl). 2009; 2: 9–17.

Sponsored Research - None

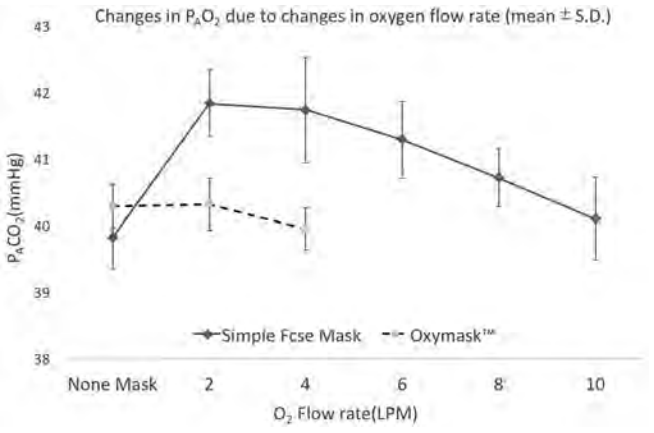
2754136

Oxygen Flow and the Rebreathing of CO_2 in Oxygen Simple Masks and Oxymasks.

Kazuto Aishima; Clinical engineering, Yokohama Municipal Citizen's Hospital, Yokohama, Japan

Background When using oxygen simple masks, rebreathing of exhaled carbon dioxide occurs with the oxygen flow rate less than 5 Lpm. The open face mask such as Oxymask™ claims to prevent rebreathing of CO_2 at low oxygen flow rate, however, it has not been quantified. We investigated the oxygen flow rates on those oxygen masks, and their effect on rebreathing of CO_2 by measuring the partial pressures of carbon dioxide in the alveoli (P_ACO_2). **Method** 2 types of oxygen masks; the simple oxygen mask and the Oxymask™ were evaluated on iStan, the human patient simulator (CAE healthcare, U.S.). The tidal volume of 700 mL and 14 bpm were used. Carbon dioxide production was set to 200 mL/min in the simulator. We measured the P_ACO_2 level with no mask, with a simple oxygen mask, and with an Oxymask™. Oxygen flow was increased from 2, 4, 6, 8, to 10 Lpm on no mask and with the simple oxygen mask. Flow of 2 and 4 Lpm were used on the Oxymask™. **Result** P_ACO_2 elevated to 2.01mmHg with 2 Lpm oxygen on simple oxygen mask ($P<0.001$). P_ACO_2 gradually decreased when oxygen flow was increased. P_ACO_2 significantly elevated with oxygen flow less than 8 Lpm in simple oxygen mask. At 2 Lpm ($p=0.875$) or 4 Lpm($P=0.101$) on Oxymask™, the P_ACO_2 did not increase. **Discussion** We considered that rebreathing induced carbon dioxide elevation in the alveoli. In normal patient condition, hypercapnea leads to tachypnea and dyspnea. Thus, use of simple oxygen mask with flow less than 6 Lpm could cause tachypnea and dyspnea. On the other hand, Oxymask™ was effective in maintaining P_ACO_2 with flow less than 4 Lpm. Therefore, using Oxymask™ would benefit chronic CO_2 retainers or when low flow nasal cannula is not an option. **Conclusion** Oxymask™ did not cause the rebreathing of exhaled CO_2 at low flow oxygen while simple oxygen mask caused an increase in CO_2 level with flow less than 6 Lpm.

Sponsored Research - None



2756692

Comparison of Condensation Between Continuous and Intermittent High Flow Nasal Cannula Therapy.

Amanda Coleman, David Chang; University of South Alabama, Mobile, AL

BACKGROUND: High flow nasal cannula (HFNC) therapy is commonly used to support inadequate oxygenation and ventilation. It may be used continuously or intermittently depending on the patient condition and treatment plan. The amount of condensation is affected by various factors (e.g., oxygen flowrate, continuous or intermittent therapy). This study was done to compare the amount of condensation between continuous and intermittent HFNC therapy at different oxygen flowrates. **METHOD:** A complete HFNC set up was used for each of the 9 experimental trials. The 6-hour trials included 3 oxygen flowrates for 3 HFNC applications. The oxygen flowrates used were 40, 50, and 60 L/min. The three HFNC applications were (1) continuous flow with no interruptions; (2) intermittent flow with two 30- minute interruptions but no circuit breaks until the end; and (3) intermittent flow with two 30-minute interruptions with circuit breaks. The large bore heated tubing, HFNC prongs, and condensation reservoir were weighed before, during, and after each trial with a calibrated gram scale balance. The ambient temperatures were recorded. Equipment and supplies were given 30 minutes to adjust to the ambient temperature prior to beginning the trials. The HFNC humidifier was warmed to 37 degrees. Due to the sample size, a descriptive method was used to analyze the data. **RESULTS:** The ambient temperatures ranged from 18.1 to 23.5 degrees Celsius during the 9 trials. Figure 1 shows the amounts of condensation for these 9 trials. At a flowrate of 40 L/min (left group), the accumulated condensation for continuous flow, intermittent flow without a circuit break, and intermittent flow with circuit breaks were 75.7 g, 89.9 g, and 105.8 g, respectively. At a flowrate of 50 L/min (middle group), the accumulated condensation were 83.0 g, 87.3 g, and 99.9 g, respectively. At a flowrate of 60 L/min (right group), the accumulated condensation measured 123.0 g, 129.3 g, and 123.1 g, respectively. **CONCLUSIONS:** The limitation of this study included the ambient temperature as it might have an effect on the amount of condensation. During the 6-hour HFNC therapy trials, condensation increased with intermittent usage over continuous usage at flow rates of 40, 50, and 60 L/min. Additionally, accumulated condensation increased as HFNC flowrates increased. During HFNC therapy, frequent interruptions should be avoided. Furthermore, the lowest appropriate flow for the patient should be used during HFNC therapy.

Sponsored Research - Fisher & Paykel donated the HFNC circuits and the University of South Alabama Childrens and Women Hospital provided the HFNC equipment for this study.

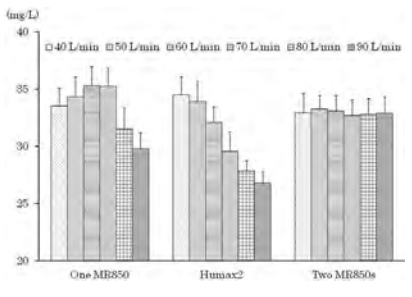
2757125

Very-High-Flow Nasal Cannula Therapy on Humidification in Adult Lung Models.

Yusuke Chikata[1], Keisuke Morinishi[1], Jun Oto[2], Mutsuo Onodera[3], Masaji Nishimura[3]; [1]Medical Equipment Center, Tokushima University Hospital, Tokushima, Japan; [2]Emergency and Disaster Medicine, Tokushima University Hospital, Tokushima, Japan; [3]Critical Care and Emergency Medicine, Tokushima University Graduate School, Tokushima, Japan

Background: High-flow nasal cannula therapy (HFNCT) is widely used for patients with respiratory failure. In a bench study for adults, we previously evaluated humidification performance under various respiratory parameters. Recently, very-HFNCT (gas flow of 60-100L/min) was reported and it generated higher positive airway pressure with an associated decrease in breathing frequency. However humidification performance of very-HFNCT has not been clarified. We evaluated humidification during very-HFNCT in various respiratory parameters. **Method:** We evaluated three types of heated humidifier system (one MR850, Humax2 and two MR850s). MR850 is pass-over type, and Humax2 is type of porous hollow fiber membrane consisting of polyethylene. Two MR850s were connected in parallel with 22mm Y-piece. Gas flow was set at 40-90 L/min in increments of 10 L/min. Heated humidifiers were set in invasive mode (40°C/–3) with MR850, vapor temperature was set at 39°C with Humax2. Spontaneous breathing (SB) was simulated using a mechanical ventilator and a TTL test lung (TTL model 1601, Michigan Instruments). We made two holes in polyvinyl chloride cylinder to simulate external nares. The external nares were connected to the TTL test lung via a standard ventilator circuit. One-way valves prevented mixing of inspired and expired gases. Compliance of the TTL test lung was 0.05 L/cmH_2O and resistance was 5 cmH_2O/L/s. With decelerating flow waveform, simulated tidal volume (V_T) was set at 300, 500, and 700 mL, breathing frequency at 10 and 20 breath/min, and inspiratory time at 1.0 s. For each experimental setting, we allowed at least 15 minutes for stabilization. Absolute humidity (AH) of inspired gas downstream of the external nares were measured using a hygrometer for 1min and results for the last 3 breaths were extracted. All experiments were performed in an air-conditioned room. **Results:** Figure shows AH of three humidifier systems. With one MR850, at gas flow above 80 L/min, AH decreased as gas flow increased. With the Humax2, as gas flow increased, AH decreased. With two MR850s, AH was constant regardless of HFNCT gas flow. As breathing frequencies increased, AH increased in all systems. **Conclusions:** We evaluated performance of humidification during very-HFNCT with bench study. With conventional heated humidifiers, humidification was not adequate under very high flow gas. We should be careful to use very-HFNCT with conventional heated humidifiers. Sponsored Research-None

Sponsored Research - None



2758181

Accuracy of Standard-Flow and Low-Flow Oxygen Flow Meters in Circulation at Mayo Clinic Rochester.

Christopher Acker[1], Kari Kalthoff[1], Salahudiin Abdullahi[1], Omar Mohamed[1], Onur Demirci[2]; [1]Mayo Clinic School of Health Sciences, Rochester, MN; [2]Anesthesiology, Mayo Clinic, Rochester, MN

Background: Gas flowmeters are used every day in the hospital with the assumption of accuracy. This study aimed to assess accuracy of oxygen flowmeters used in the adult and pediatric populations and compare accuracy between brands. Method: Using a calibrated flow analyzer (TSI Certifier® FA Low Flow Module), standard-flow (SF) and low-flow (LF) flowmeters in circulation at Mayo Clinic in Rochester, MN, were tested. All were compensated Thorpe tube oxygen flowmeters. SF flowmeters had a maximum marking at 15 LPM and LF flowmeters had a maximum marking at 3 LPM. For safety purposes, oxygen wall outlets at Mayo Clinic - Rochester are pressurized to approximately 55 psi. As the flowmeters are manufactured for use at 50 psi, all flows were tested both with an in-line pressure meter at 50 psi and without. For the SF flowmeters, 1, 3, 5, and 10 LPM were tested. For the LF flowmeters, 0.25, 0.5, 0.75, and 1 LPM were tested. The flowmeter brand was also recorded. Results: 205 SF flowmeters and 25 LF flowmeters were tested. 2 SF flowmeters were excluded; one was leaky and one only went up to 8 LPM. Of the 203 SF flowmeters, 183 were Ohmeda brand, 15 were Western Medica, and 5 were Timeter. 24 of the 25 LF flowmeters tested were Ohmeda and 1 was Timeter, which was excluded as it was considered to be very low-flow. Using a student T-test, the set flow was compared to the analyzed flow. With a p-value of 0.05, SF flowmeters showed a statistically significant difference for all flows, except at 10 LPM with the pressure meter at 50 psi. The LF flowmeters were all significantly different except for 0.5 LPM at 50 psi. To compare the accuracy of SF flowmeter brands, a two-sample T-test was done. Western Medica and Timeter flowmeters were combined into one group (Other; n=20) and compared to the Ohmeda flowmeters (n=183). There was a statistically significant difference between the types at 3, 5, and 10 LPM, but not at 1 LPM. At 3, 5, and 10 LPM, the Ohmeda flowmeters were more accurate at 50 psi and less accurate without the pressure meter. Similarly, 20 new and 163 in-use Ohmeda flowmeters were compared. At 10 LPM and 50 psi, there was a significant difference (p-value <0.0001), with the new flowmeters being more accurate. All other new vs. in-use comparisons were insignificant. Conclusions: Overall, the flowmeters were statistically inaccurate and the Ohmeda brand produced a slightly lower flow, however the clinical significance of these findings is uncertain. Disclosures: None.

Sponsored Research - None

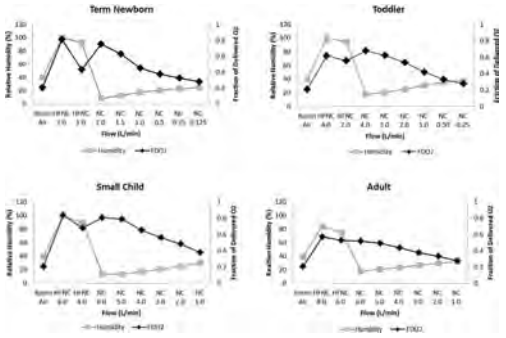
2758224

Evaluation of Oxygen and Humidity With Humidified and Non-Humidified Nasal Cannula Oxygen Delivery Devices.

Joseph D. Zimmerman, Robert M. DiBlasi, David N. Crotwell; Respiratory Care, Seattle Children's Hospital, Seattle, WA

INTRODUCTION: The level of humidity and fraction of delivered oxygen (F_DO_2) between heated high flow nasal cannula (HHFNC) and standard O_2 nasal cannula (non-humidified) may be important factors to consider in the HFNC weaning process, especially when transitioning from HHFNC to O_2 cannula. We conducted a study to test the hypothesis that there were no differences in humidity and F_DO_2 at different flows between HHFNC and standard oxygen cannula in spontaneously breathing airway/lung models. **METHODS:** 3D anatomic airway models for a term newborn (4 kg), Toddler (10 kg), Small Child (20 kg), and Adult (70 kg) were attached to a spontaneously breathing lung model with normal mechanics (Ingmar ASL 5000, Ingmar Medical). A series of one-way valves were placed in series to prevent re-breathing of exhaled humidity and oxygen from the lung model. Relative humidity was measured with a hygrometer (Fisher Scientific) and F_DO_2 signal was obtained from within the lung model at different HFNC (Vapotherm, Precision flow) and O_2 cannula settings. Data were compared between HHFNC and similar O_2 cannula flows using a T-test. ANOVA with Tukey post-hoc was used to compare differences in data between all flows and devices tested within the different lung models. Significance was determined *a prior* as $P<0.05$. **RESULTS** Humidity was greater ($P<0.05$) and F_DO2 was not different between HHFNC and O_2 cannula at similar flows for all conditions tested (see Figure). Reductions in F_DO_2 were observed with reducing HFNC and O_2 cannula flows. Relative humidity levels increased closer to the ambient humidity level in the lab with reductions in O_2 cannula flows. **DISCUSSION/CONCLUSION:** This is the first study to describe the relative flow dependent effects on air entrainment and consequent oxygen delivery and humidity to the lungs across a range of HHFNC and O_2 cannula settings in neonatal and pediatric 3D airway models. These findings may be important for patients at risk for airway desiccation. In patients that do not require significant supplemental O_2 support, weaning directly from HFNC to room air may result in considerably higher humidity levels than being supported with standard O_2 cannula. These data may help to guide development of HFNC weaning strategies in pediatrics.

Sponsored Research - None



2758511

Cardio-Effectiveness of High Flow Nasal Cannula Among Subjects During Pulmonary Rehabilitation.

An-Chi Chang[2], Tien-Pei Fang[2,3], Tsung-Ming Yang[4,2], Yan-Huey Chen[1], Meng-Jer Hsiah[4], Hui-Ling Lin[4,2]; [1]Respiratory Therapy, Chang Gung University, Taoyuan, Taiwan; [2]Respiratory Therapy, Chiayi Chang Gung Memorial Hospital, Chiayi, Taiwan; [3]Respiratory Therapy, Chang Gung University of Science and Technology, Chiayi, Taiwan; [4]Pulmonology & Critical Care, Chiayi Chang Gung Memorial Hospital, Chiayi, Taiwan

Backgrounds: Studies have shown that high flow nasal cannula (HFNC) could provide a higher oxygen gas flow with stable concentration when using heated and humidified gas, resulting in improved therapeutic tolerance and effects. The exercise training for patients with COPD improved their intensity, endurance, and duration of exercise. This randomized trial armed to compare the cardio effect of HFNC to nasal cannula (NC) conjoining therapy during exercise training as part of pulmonary rehabilitation program. **Methods:** Stable COPD patients participating in a pulmonary rehabilitation program in the Chang Gung Memorial Hospital, were recruited and randomized to either HFCN (3 L/min O_2 mixing in (approximately FiO_2 22%) at 50 L/min) or NC (at 3 L/min) for oxygen therapy from Sep 2016 - Feb 2017. The 40 minutes of exercise training in the program included 5 minutes of warm up, 10 minutes of fixed bicycle at 10-20 watts, and then increasing to 10-40 watts at 30 minutes by patients' tolerance, following 5 minutes of cooling down. Prior and during the exercise program, participants were required to complete the COPD assessment test (CAT) and modified Medical Research Council (mMRC) dyspnea scale. Noninvasive hemodynamic monitoring by the PhysioFlow™ (NeuMeDx Inc, French) included cardiac output and stroke volume, and tissue oxygenation measurements by a near-infrared spectroscopy (Artinis Medical System, Netherlands) included tissue saturation index (TSI) and oxyhemoglobin (O_2Hb) of quadriceps. Statistical analyses were conducted with Paired-T test and Students-T test, and $P < .05$ was considered statistically significant. **Results:** The table below demonstrated comparisons of patients' demographic and exercise performance post-training between groups. Twelve male COPD participants aged 74.0±8.3 (mean±SD) for NC and 69.7±10.8 for HFNC. The dyspnea scores from both groups were similar prior to exercise. The TSI was significantly greater with HFNC therapy (9.77±6.90 vs. 0.31±5.56 for NC, $P=.026$). The TSI is an absolute measure of oxygenated hemoglobin which presents local micro- oxygenation status. Values of cardio output, stroke volume, and O_2Hb were greater with higher flow nasal cannula therapy comparing to NC, yet no statistical significant was reached. **Conclusion:** Short term supplementary oxygen therapy by high flow nasal cannula during exercise as part of pulmonary rehabilitation yielded higher quadriceps tissue oxygenation than conventional nasal cannula.

Sponsored Research - This research was funded by the Ministry of Science and Technology. Republic of China (ID: 105-2314-B-182-041)

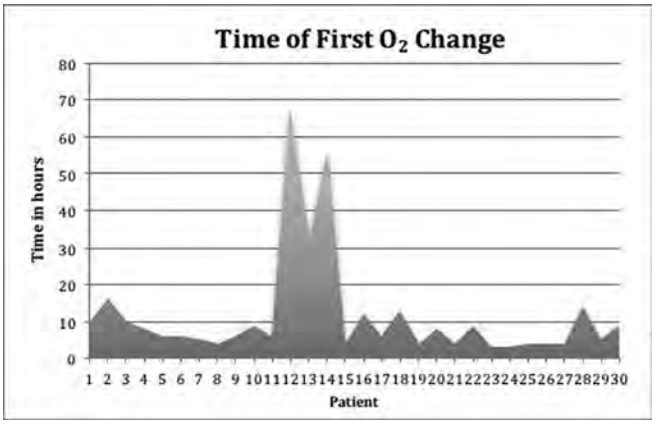
2758602

Are Oxygen Weaning Protocols Used Consistently? A Follow Up Study.

Sylvia. Cuevas, Kate. Heng, Varsha. Prakash, Jay. Wang, Ruben D. Restrepo; Respiratory Care, UTHSCSA, San Antonio, TX

Background: Oxygen weaning protocols are designed to aid the clinician on the titration of oxygen therapy. Following the correct weaning protocol is essential in the outcome of patient care since hyperoxemia is associated with weel known adverse effects. Two years ago we had reported a significant delay in oxygen weaning in a medical ICU. The goal of this study was to follow up and determine if there is better adherence to the existing oxygen weaning protocol. **Methods**: Retrospective chart review of patients >18 years of age recently admitted to a medical ICU in an academic-affiliated institution. Demographic information, vital signs, arterial blood gases, ventilator parameters upon admission to ICU (FiO_2, VT, PEEP), and oxygen weaning parameters were collected. The PaO_2/FiO_2, time it took to change FiO_2 after meeting oxygen weaning parameters, and percent change in the FIO_2 were calculated and used for analysis. SPSS 22.0 was used to calculate all descriptive statistics. **Results**: Data was collected from 30 patients admitted to a MICU (Jan-Apr 2017). The most common SpO_2 parameter used in the ICU to start weaning O_2 in the ICU was 92%. The average FiO_2 administered to these patients was was 39.6% (24%-100%). The majority of patients in this sample had adequate oxygenation (PaO2:99.3 mm Hg; SaO_2 95.1%) upon admission to the ICU. Although in nearly half of the patients RTs decreased the FiO2 after meeting patietns met weaning criteria, it took an average of 12.8 (±16.4) hours to make the first change in FiO2 in this group of patients (range: 3 to 68 hours). **Conclusion**: Closer monitoring and adjustment of oxygen therapy should be considered essential in patient care. Our results demonstrates no change in the practice of weaning oxygen in this ICU. Thus, continued reinforcement of the importance of the weaning protocol is required in this ICU.

Sponsored Research - None



2758609

A Retrospective Chart Review of Mean SpO_2 and Its Effect on Mean Ventilator Days.

Susan E. Gole, Robert L. Chatburn, Vince Roberts, Mahdu Sasidhar; Respiratory Care, the Cleveland Clinic, Concord, OH

Background: There are few published data that suggest a direct relationship between oxygenation level and outcomes of mechanical ventilation. Indeed, the well known ARDS.net study showing an association between tidal volume dosage and mortality showed that patients with higher oxygenation had higher mortality. The primary purpose of this pilot study was to determine if basic outcomes of mechanical ventilation are associated with oxygenation status. Specifically, our hypothesis is that patients with adequate oxygenation (SpO_2 of 88-95%) have a higher success rate for first attempt at weaning (spontaneous breathing trial, SBT) and the shorter mean duration of ventilation compared to patients with high oxgenation (SpO_2 > 95%). **Methods:** This study was deemed exempt by our Institutional Review Board. Data were collected from the electronic health record (EMR) for patients ventilated during the last six months of 2016. Representative values for the following variables were taken from a point in time 24 hours before the first SBT: SpO_2 (oxygen saturation as measured with a pulse oximeter, tidal volume/kg ideal body weight, FiO_2 (fraction of inspired oxygen) and PEEP (positive end expiratory pressure). In addition, the following data were recorded for each patient: success or failure of first SBT and total number of ventilator hours. Percentages of SBT success were compared with Chi-Square and mean ventilator hours were compared with t-test ($P < 0.05$ significant). **Results:** There were 152 patients in the study. There were 35 patients (23%) with SaO_2 in the adequate oxygenation range and 117 patients (77%) in the high oxygenation range. Of the patients with adequate oxygenation, 63% had successful first time SBT's compared to 65% in the high oxygenation group. Neither of these differences were statistically significant, but the power was only 0.04. **Conclusion:** This small pilot study failed to indicate that oxygenation status was associated with any difference in the high level outcomes of SBT success or duration of ventilation. Limitations of the study are due mainly to a small sample size and sampling only one point in time during the patient's treatment.

Sponsored Research - None

2758696

High-Flow Nasal Cannula in Pediatric Patients: An Exploratory Survey of Clinical Practice.

Andrew G. Miller[1], Michael A. Gentile[2], Lisa Tyler[1], Natalie Napolitano[1]; [1]Respiratory Therapy, The Children's Hospital of Philadelphia, Philadelphia, PA; [2]Pediatric Critical Care Medicine, Duke University Medical Center, Durham, NC

Background: High-flow nasal cannula (HFNC) use has greatly increased in recent years. In non-neonatal pediatric patients, there are limited data available to guide HFNC use and as a result clinical practice may vary significantly. In particular, what defines HFNC, how to set flow rate, and aerosolized medication delivery are areas in which more research is needed. We designed a survey administered to practicing Respiratory Therapists to evaluate current HFNC practices in pediatric patients. **Methods**: A survey instrument was designed by the authors and posted on the AARConnect online social media platform neonatal/pediatric, management, and help line sections. The survey was approved by the AARC board of directors and approved by the Children's Hospital of Philadelphia's IRB. **Results:** There were 33 total responses, 32 (97%) of whom used HFNC. The majority were from tertiary/academic centers, with 89 ± 94 (mean ±SD) total pediatric beds and 22 ± 27 PICU beds. HFNC was used in the emergency department (79%), regular floors (61%), step-down or intermediate care (73%), and ICU (91%). HFNC was used in patients with bronchiolitis (91%), asthma (69%), pneumonia (75%), ARDS (38%), and post-operatively (31%). HFNC was defined as any heated gas delivered via nasal cannula (49%), heated gas delivered via nasal cannula at flow greater or equal to the patient's inspiratory demand (33%), above pre-defined thresholds (9%), or other (9%). Initial flow was set per provider orders (38%), RT protocol (25%), weight based (19%), age based (16%), and other (2%). Flow was adjusted based on vital signs (47%), RT protocol (25%), provider order (25%) or other (3%). For patients failing HFNC, noninvasive ventilation (59%) was the most popular intervention, followed by CPAP (28%), intubation (9%) and other (4%). 24 (75%) of respondents delivered aerosolized medications, with beta$_2$ agonists (96%), mucolytics (46%), and corticosteroids (58%) being most frequent. A vibrating mesh nebulizer was used by 88% of respondents with 75% placing the nebulizer on the dry side of the heater with 8% reducing HFNC flow during therapy. **Conclusion:** For our respondents, there was no consensus on what defines HFNC, how to set initial flow rate, or make adjustments. Failure of HFNC resulted in escalation to NIV or CPAP for 87% of respondents. Aerosols were delivered by 75% of respondents, predominantly by vibrating mesh nebulizer placed on the dry side of the heater.

Sponsored Research - None

2701587

Bench Study Comparison of Vibrating Mesh Technology Used In-Line With Standard and Modified Vapotherm Circuits.

Joel M. Brown II[1], Paul O'Brien[1], Mike Treut[1], James Hertzog[2,3]; [1]Respiratory Care and Sleep Medicine, Nemours - A.I. duPont Hospital for Children, Wilmington, DE; [2]Division of Pediatric Critical Care Medicine, Nemours - A.I. duPont Hospital for Children, Wilmington, DE; [3]Thomas Jefferson University, Philadelphia, PA

Background: High flow nasal cannula (HFNC) therapy has become a more frequently used oxygen device for the pediatric patient population. Often HFNC is used in unison with vibrating mesh technology (VMT) to deliver aerosolized medications. In this bench study, we evaluated medication delivery via VMT using a Standard HFNC circuits and a Modified HFNC circuit. **Methods**: We conducted a bench study using Michigan Instruments TTL® with a Servo-i® used to drive negative inspiratory flow of 15LPM to simulate spontaneous breathing (PIP=20, Peep=5, RR=20, ITime=0.7). The Vapotherm® Precision Flow® (PF) was used as our HFNC device. Simulated artificial nares were utilized for this study and the cannula was sized to assure that less than 50% of the nares were occluded (Peds/ Adult Small). The Aerogen® Solo was used as the VMT for this study. For the Standard Circuit we used the PF Low Flow circuit with the VMT at the distal end of the circuit using a Vapotherm® Aeroneb Aerosol Adapter. For the Modified circuit trial, we used a PF Low Flow Nitric Oxide circuit with the VMT placed in line where the nitric oxide injector module is typically placed. We nebulized a dose of albuterol (5mg/ml with 2ml's NSS) for each trial and collected the aerosol in a filter to determine the concentration of the drug. A new filter was used for each trial. The mean percent inhaled dose of albuterol (MID%) and mean inhaled mass were measured via spectrophotometry. We used three different flow rates (2LPM, 4LPM and 8LPM) and performed five trials for each circuit. **Results:** When combining PF with VMT, the most efficient delivery method was VMT in line with the Modified circuit at the flow setting of 2LPM. Lower Liter flows deliver higher concentrations of drug. The MID% observed for the Standard circuit was as follows; 7.1 ± 0.5 at 2LPM, 3.6 ± 0.3 at 4LPM, and 1.5 ± 0.2 at 8LPM. The MID% observed for the Modified circuit was as follows; 9.7 ± 0.8 at 2LPM, 4.7 ± 0.7 at 4LPM, and 2.3 ± 0.1 at 8LPM. See graph for mean inhaled mass (mg) data. **Conclusion:** As healthcare institutions continue to strive to find the best combination of inhaled aerosol therapy delivery and HFNC, careful consideration must be made when determining the location of your VMT nebulizer. The use of a Modified circuit with VMT technology produced a higher drug concentration then the Standard circuit. Additional studies must be performed to assess the clinical impact of these findings.

Sponsored Research - This study was an Aerogen sponsor research project. Funding was provided to cover supply cost, wages for time of study, and education support. None of the authors are employed by Aerogen.

2748798

Impact of Filtered HMEs on Aerosol Delivery and Airway Resistance in a Simulated Mechanically Ventilated Adult Lung Model.

Arzu Ari, Fahad H. Al Enazi, Mohammed M. Alqahtani, James B. Fink; Georgia State University, Atlanta, GA

Background: The purpose of this study is to determine the impact of filtered HMEs on aerosol delivery efficiency and airway resistance (Raw) with delivery of an aerosolized bronchodilator using jet (JN) and mesh nebulizers (MN) during mechanical ventilation. **Methods:** A ventilator (Galileo, Hamilton) was attached to a model simulating an intubated (8.0 mm ID ETT) adult (Vt 500 mL, RR 15/min, PEEP 5 cm cmH_2O, Inspiratory Flow 50 L/min) with a collecting filter (Respirgard II, Vital Signs, Totowa, WJ) distal to the bronchi attached to a test lung through a heated humidifier (Fisher&Paykel) simulating exhaled humidity (37°C, 100% relative humidity). Two filter HMEs were tested (n=5): (1) ThermoFlo Filter™ (ARC Medical) and (2) PALL Ultipor (PALL Medical). Each filter HME placed between the ventilator and ETT and allowed to acclimate to the exhaled heated humidity for 30 min with airway resistance ($cmH_20/l/s$) taken from the ventilator display at 0, 10, 20 and 30 min after HME placement and each of 4 aerosol treatments. Albuterol sulfate (2.5 mg/3mL) was administered with JN (MistyMax10, Airlife) and MN (Aerogen Solo, Aerogen) positioned in the inspiratory limb at the Y adapter (n=5 with each filter type). Drug was eluted from collecting filter and measured using UV spectrophotometry (276 nm). The Mann-Whitney U test was used for data analysis ($p<0.05$). **Results:** The table shows mean (± SD) percent dose delivered and Raw. Aerosol delivery through both filters was similar and less than 0.5%. No significant difference was found in % of dose delivered across the four treatments given by JN and MN using the ThermoFlo™ Filter (p=0.98 and p=0.99, respectively) and the Pall Ultipor (p=0.69 and p=0.98, respectively). Airway resistance was similar with JN (p=0.63) and MN (p=0.11) using the ThermoFlo™ Filter. With the Pall Ultipor, changes in Raw was similar with JN (p=0.13) but Raw increased with MN after treatment (p=0.005). Changes in resistance pre- and post-treatments were similar with both Filter HMEs. **Conclusion:** Filtered HMEs allowed less than 0.5% of aerosol drug to reach the airway. Our findings support recommendations that filtered HMEs should not be placed between nebulizers and patient airways.

Sponsored Research - This study was founded by ARC Medical.

	THERMOFLO FILTER HME		PALL ULTIPOR	
Measuring Aerosol Deposition	Jet Nebulizer	Mesh Nebulizer	Jet Nebulizer	Mesh Nebulizer
1st treatment	.59±.13%	.47±.11%	.45±.09%	.43±.23%
2nd treatment	.40±.13%	.46±.09%	.39±.08%	.43±.16%
3rd treatment	.41±.14%	.48±.04%	.421±.10%	.40±.27%
4th treatment	.43±.12%	.47±0.8%	.40±.03%	.39±.04%
p value	.98	.99	.69	.98
Measuring Raw (cmH2O/l/s)				
Before treatment	20.75±4.42	21.75±0.50	19.50±0.57	16.25±0.50
After treatemnt	22.00±2.16	22.75±0.96	20.50±1.00	17.75±0.50
p value	.63	.11	.13	.005

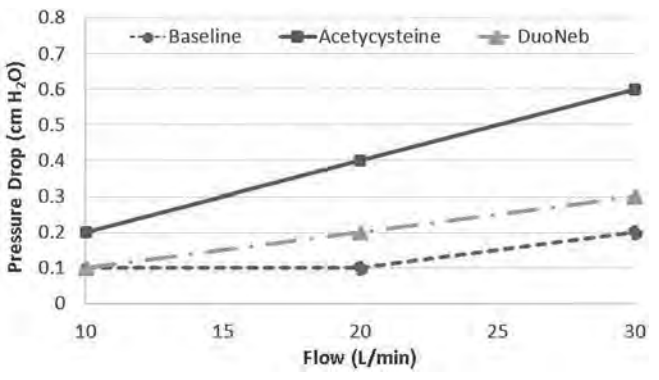
2748820

Determination of Filter Change Schedules During Intermittent Nebulization of Acetylcysteine and Duoneb.

Jenny Y. Gan, Robert L. Chatburn; Respiratory Institute, Cleveland Clinic, Cleveland, OH

Nebulization of medication during mechanical ventilation has been used for decades. There are informal recommendations regarding filter use in the expiratory limb of the ventilator circuit to protect the exhalation manifold and the need to change them regularly. However, while there are studies of the effects of humidification and nebulization on an expiratory filter, there appears to be no prior research on the specific timing of filter changes, particularly for nebulized Acetylcysteine and Duoneb. The purpose of this study was to determine an appropriate filter replacement schedule for continuous nebulization of Acetylcysteine and Duoneb during mechanical ventilation. Specifically, we sought to determine the filter weight change, measured end expiratory airway pressure (PEEP), and expiratory lung pressure (totaPEEP) as a function of nebulization time during mechanical ventilation of a lung model. **METHODS**: A Puritan Bennett 840 ventilator was connected to a QuickLung (IngMar Medical Inc.) lung simulator with compliance = 50 mL/ cm H_2O, resistance = 20 cm H_2O/(L/sec). Ventilator settings: Mode = VC-CMVs, Frequency = 18/min, V_T = 450 mL, Flow = 35 L/min, PEEP 5 cmH_2O. An Aerogen nebulizer was placed between the simulator and the exhalation manifold. Flow and pressure were measured with a Hans-Rudolph Pneumotach and amplifier. Nebulized drugs: 4 mL Duoneb (0.5 mL Ipratropium Bromide, 3 mg Albuterol Sulfate), 4 mL 0.9% NaCl, and 4 mL Acetylcysteine. Normal 0.9% Saline was also nebulized as a control. Measurements of weight, pressure drop across the filter (flow = 10, 20 and 30 L/min), totalPEEP, and measured airway PEEP were made at 30 minute intervals over 2 hours of nebulization. **RESULTS**: The filters gained weight linearly ranging from 0.1 (DuoNeb) to 0.5 (saline) to 1.0 (acetylcysteine) grams/treatment. Resistance after the fourth treatment increased above baseline (Figure). There was no change in measured airway PEEP or totalPEEP. **CONCLUSION**: Nebulization of 4 mL aliquots at 30 minute intervals over 2 hours results in clinically unimportant increases in filter resistance and therefore does not result in inadvertent airway PEEP or lung totalPEEP. There is no need for regular expiratory filter changes.

Sponsored Research - None



2753317

Effect of Circuit Size on Aerosol Delivery in a Pediatric Mechanical Ventilation Model.

Randy Willis[1], Ariel Berlinski[2]; [1]Respiratory Care Services, Arkansas Children's Hospital, Little Rock, AR; [2]Department of Pulmonary Medicine, University of Arkansas for Medical Sciences, UAMS, AR

Introduction: Children undergoing mechanical ventilation frequently receive nebulized therapy. The size of the ventilator circuit is generally chosen based on age/ tidal volume criteria. There is an area of overlap where either the infant or the adult circuit could be used. In addition, position and type of the nebulizer has been proven to influence aerosol delivery. We speculate that the use of an infant circuit will decrease aerosol delivery. **Methods:** Four new units of a vibrating mesh nebulizer (VM) and a jet nebulizer (JN) (6 L/min oxygen) were loaded with albuterol (2.5mg/3ml) and studied when placed between the expiratory limb and the Y-piece (Y), and before the humidifier (V) in a pediatric ventilator model (servo-I, PRVC mode, tidal volume 100 ml, breathing frequency 20/min, PEEP 5 cm H2O, FiO2 0.4, IT 0.75 seconds). The circuit was connected in series to a 4.0 cuffed ETT, deposition filter and a lung model. A neonatal (ID 11 mm/ 0.91 m long), and an adult (ID 22 mm/1.83 m long) heated wired system were tested. Albuterol concentration was measured with spectrophotometry at 276 nm. The variation between circuits was calculated as [(filter dose for each placement with adult circuit – filter dose with neonatal circuit)/filter dose with adult circuit*100. **Results:** See table. **Conclusion:** Changing from an adult to a neonatal circuit results in an increase in aerosol delivered dose when the aerosol generator was placed before the Y-piece.

Sponsored Research - None

Adult and Pediatric Circuit Comparisons

	JN@Y	VM@Y	JN@Y	VM@Y
Variation (%)	39 ± 17	37 ± 34	4 ± 28	48 ± 78
P value	0.02	0.04	0.43	0.18
Expressed as mean ± SD				

2755940

Taming the Hungry Beast: Protocol for Effective Management of Inhaled Nitric Oxide (iNO) Utilization in Pediatric Populations.

Lindsey Borock[2], Heidi Flori[1], Gabe Owens[3], Robert Schumacher[4], Samir Gadepalli[5], Chris Dickinson[6], Kenneth Bandy[2], Ronald Dechert[2]; [1]Associate Professor of Pediatrics and Communicable Diseases, Medical School, Pediatrics-Intensive Care, Michigan Medicine, C.S. Mott Children's Hospital, Ann Arbor, MI; [2]Respiratory Care, Michigan Medicine, C.S. Mott Children's Hospital, Ann Arbor, MI; [3]Associate Professor of Pediatrics and Communicable Diseases, Medical School, Pediatrics-Cardiology, Michigan Medicine, C.S. Mott Children's Hospital, Ann Arbor, MI; [4]Professor of Pediatrics and Communicable Diseases, Medical School, Pediatrics-Neonatal/Perinatal, Michigan Medicine, C.S. Mott Children's Hospital, Ann Arbor, MI; [5]Clinical Lecturer in Surgery, Medical School, Pediatric Surgery Section, Michigan Medicine, C.S. Mott Children's Hospital, Ann Arbor, MI; [6]Chief Clinical Officer of the C S Mott Children's Hospital and the Von Voigtlander Women's Hospital University of Michigan Hospital, Pediatrics-Gastroenterology, Michigan Medicine, C.S. Mott Children's Hospital, Ann Arbor, MI

Introduction: Inhaled Nitric Oxide (iNO) is a potent vasodilator that has shown decreases in pulmonary artery pressures in neonatal studies (NINOS trial). Though effective in reducing pulmonary artery pressures, randomized controlled trials have not demonstrated improved clinical outcomes (ICU/hospital survival). Nonetheless, the use of iNO as a therapeutic adjunct has dramatically expanded in all patient populations since FDA approval for clinical use in 2001. The purpose of this study is to report on our single center progress after implementing of a respiratory therapist (RT) driven clinical Practice Guideline (CPG) to decrease the iNO utilization Methods: Between January and March 2016, a group composed of administrative leadership, medical leadership from each user division and Respiratory Care leadership convened to develop a simple, non-restrictive CPG that targeted improved management of iNO in our pediatric and neonatal cohorts. The CPG was approved and implemented in April 2016. Each of the medical leads (service chiefs) provided education to their service to integrate the CPG into clinical practice. Respiratory Care staff were educated on expectations of a daily discussion regarding the ability to titrate iNO until the therapy was discontinued. To facilitate reinforcement of the CPG, Respiratory Care along with approval from IRB, worked with our electronic medical record (EMR) staff to develop embedded documentation that could be easily completed by staff and pulled for weekly reports to each service. These steps were completed between April and July 2016. Results: Following implementation of the CPG, we observed a 22% (>5000 hours) aggregate reduction in the use of our iNO over the first 12 months of CPG managed practice. Figure one illustrates the iNO usage in each ICU from March 2016 (prior to CPG implementation) until February 2017. Conclusions: Implementation of a hospital-wide CPG along with daily discussion of titration amongst the multidisciplinary team was associated with a radical decrease in usage throughout the ICUs. It has taken agreement on all levels through the hospital and in-depth education amongst medical providers and Respiratory Care. Encouraging bedside therapists to actively participate in an RT-driven inquiry of the medical providers to confirm and document daily continued need for iNO can greatly assist in improved accountability and help to achieve a significant reduction in iNO hours.

Sponsored Research - None

2756985

Laboratory Evaluation of a New Continuous Nebulizer to Shorten Treatment Times for Patients Requiring Bronchodilation Therapy.

Judy Schloss[1], Jolyon P. Mitchell[2]; [1]University of Minnesota Medical Center, Minneapolis, MN; [2]Jolyon Mitchell Inhaler Consulting Services Inc., London, ON, Canada

Background: A continuously operating nebulizer can be an appropriate clinical option when the focus of the therapy is to minimize treatment time. The present study describes the laboratory evaluation of a new continuous jet nebulizer for the delivery of a combination short-acting beta-agonist and anticholinergic bronchodilator widely prescribed for patients with COPD and asthma. **Methods**: Each nebulizer in its group (n=4) was operated with medical air supplied at 8L/min with a 3-mL fill of albuterol sulfate (3-mg) and ipratropium bromide (0.5-mg). The following nebulizer types were evaluated: (a) New continuous nebulizer (CONT) [Monaghan Medical Corp.]; (b) Sidestream† disposable (SS) [Philips Respironics]; (c) NebuTech† HDN† (HDN) [Salter]; (d) AirLife† Misty Fast† (MF) [Carefusion]. The mouthpiece of the nebulizer-on-test was connected to a breathing simulator [ASL 5000, IngMar Medical] set to simulate adult tidal breathing (tidal volume = 600cc, 10 breaths/min, 1:2 inspiratory:expiratory ratio). A bacterial filter at the mouthpiece collected the aerosolized droplets. The nebulizer was allowed to operate until sputter while filters were changed after every minute of runtime. An HPLC UV-VIS spectrophotometric assay was undertaken for each active pharmaceutical ingredient (API). Droplet size distribution analysis was undertaken with a saline fill, in parallel measurements (n=5 replicates) using a laser diffractometer (LD) [Malvern Spraytec]. **Results**: Table 1 contains a summary of the key performance metrics. (mean ± S.D.) Treatment times for the CONT nebulizer were comparable with those of the other nebulizers. Output rate was relatively high and comparable with that for the NebuTech† HDN†. However, fine droplet mass < 4.7 aerodynamic diameter ($FDM_{<4.7\mu m}$), indicative of potential capability for penetration of medication to the airways of the lungs, was significantly greater than any other nebulizer for both API components. [1-way ANOVA, $p < 0.001$] **Conclusions:** The new nebulizer offers the clinician additional choice when short treatment times are a priority. Disclosure: J Schloss participates in Monaghan Medical's (MMC) Speaker Bureau. J Mitchell is a consultant to MMC.

Sponsored Research - None

Nebulizer	LD	Breathing Simulation				
	Normal Saline	Both APIs	Albuterol Sulfate (1.0 mg/ml)		Ipratropium Bromide (0.16 mg/3ml)	
	FDF<4.7μm (%)	Treatment Time (min)	FDM<4.7μm (μg)	Output Rate (μg/min)	FDM<4.7μm (μg)	Output Rate (μg/min)
CONT	85.9±1.5	4.1	259±10	76	59±2	17
SS	75.0±0.6	5.1	187±10	42	42±2	9
HDN	44.3±1.6	2.4	109±11	82	21±2	16
MF	62.7±1.7	2.9	166±15	66	34±4	13

2757651

Breath-Actuated Jet Nebulizer and Aerosol Delivery During Mechanical Ventilation.

Ann D. Cuccia[1], Gerald C. Smaldone[2]; [1]Respiratory Care Program, School of Health Technology and Management, State University of New York at Stony Brook, Stony Brook, NY; [2]Division of Pulmonary, Critical Care and Sleep Medicine, State University of New York at Stony Brook, Stony Brook, NY

Background Aerosol delivery to patients requiring mechanical ventilation is uncontrolled. Commercial devices that operate continuously fail to adjust to breathing pattern. Breath-actuated devices rely on the ventilator for breath actuation. However, for jet nebulizers, nebulizer flow and pressure provided by the ventilator are not standardized (McPeck M, et.al. *Respiratory Care.* 1993;38(8)) and, for mesh and jet technology, the nebulizer and/or ventilator may not provide breath-actuation at all (e.g. Maquet SERVO-U®). We designed an efficient breath-actuated jet nebulizer that operates independently of the ventilator, increasing control of drug delivery. Methods An InspiRx mini-neb was modified with several unique design innovations including: a small bowl, high airflow, an independent breath-actuation circuit, a tubing reservoir and insertion of aerosol distal to the Y piece. In vitro testing was performed on a circuit using short and long duty cycles (0.16-0.44). Two mL of radiolabeled saline was nebulized in continuous and breath-actuated modes. Drug output (inhaled mass (IM)) and mass balance were measured. Results During continuous operation, IM averaged 8.3%. With breath actuation, IM (mean ± SD) ranged from 26.3% ± 5.28 (duty cycle 0.16) to 42.3% ± 9.6 (duty cycle 0.37 ± 0.06). Conclusion InspiRx mini-neb drug delivery exceeded previously reported values for continuous nebulization from our laboratory for many commercial nebulizers (e.g. 5-20%, with similar duty cycles). Nebulizer delivery from our group has been reported to vary seven-fold with marked sensitivity to duty cycle (O'Riordan TG, et.al. *Am Rev Respir Dis.* 1992;145(5)). With breath actuation, the mini-neb system limited variation to 1.6-fold enhancing control of dose to the intubated patient. The mini-neb jet nebulizer system is efficient, inexpensive and disposable. It overcomes major problems inherent in aerosol delivery during mechanical ventilation, including; lack of ventilator standards for aerosol generation, effects of changes in breathing pattern, cost of materials and cleaning or replacing mesh devices.

Sponsored Research - Supported in part by InspiRx

2757881

Effect of Nebulizer Type, Delivery Interface and Flow on Aerosol Drug Delivery to a Spontaneously Breathing Pediatric Lung Model.

Arzu Ari, James B. Fink; Georgia State University, Atlanta, GA

Background: Different types of nebulizers, delivery interfaces and flow rates are used to deliver aerosolized medications to children. The purpose of this study is to determine the effect of nebulizer type, delivery interface and flow rate on aerosol drug delivery to a spontaneously breathing pediatric lung model. **Methodology:** A teaching manikin head was attached to a sinusoidal pump via a collecting filter at the bronchi to simulate a spontaneously breathing child (Vt: 250 mL, RR: 20 bpm and Ti: 1 sec) Albuterol sulfate was nebulized with the Mini Heart Low-Flow (MHLF, Westmed), Mistymax 10 (MM10, Cardinal Health) and Aerogen Solo (AS, Aerogen) nebulizers using low flow nasal cannula (LFNC, Hudson), high flow nasal cannula (HFNC, Fisher&Paykel), face mask (FM, Hudson) and mouthpiece (MP, Cardinal Health). Each device and interface were tested at appropriate flows as shown in the table below (n=3). Drug was eluted from the filter and analyzed by spectrophotometry. Descriptive statistics, Kruskal Wallis, Wilcoxon Sum rank, and Mann- Whitney U tests were used for data analysis. p<0.05 was considered statistically significant. **Results:** Table shows percent of nominal dose delivered (mean±SD) distal to the trachea with each device and interface across flow rates tested. Increasing flow rate with LFNC and HFNC decreased aerosol delivery with AS and MHLF with both LFNC and HFNC. At 6 lpm aerosol delivery with the mouthpiece was greater than other interfaces tested with all nebs. Delivery efficiency of nebulizers is significantly different in HFNC, FM, and MP (p<0.05). No statistical difference was found between AS and MHLF using LFNC (p>0.05). **Conclusion:** Type of nebulizer, delivery interface and flow rate used in the treatment of children affect aerosol drug delivery.

Sponsored Research - None

Interfaces	Low Flow Nasal Cannula (LFNC)			High Flow Nasal Cannula (HFNC)		Face Mask (FM)	Mouthpiced (MP)
Flow Rates	2 lpm	4 lpm	6 lpm	4 lpm	6 lpm	6 lpm	6 lpm
AS	3.38±0.3%	2.41±0.3%	1.87±0.2%	8.00±0.12%	5.09±0.2%	11.26±1.9%	29.67±1.1%
MHLF	3.07±0.4%	2.05±0.9%	1.64±0.1%	4.40±0.6%	2.74±0.3%	5.88±1.1%	7.04±10.5%
MM10			1.49±0.5%		2.11±0.2%	5.76±0.1%	6.67±0.2%

AS: Aerogen Solo Mesh Nebulizer, MHLF: Mini Heart Low Flow Jet Nebulizer, MM10: Mistymax 10 Jet Nebulizer.

2757900

Aerosol Drug Delivery With Jet and Mesh Nebulizers Using Filtered and Nonfiltered Heat Moisture Exchangers.

Arzu Ari, James Fink; Georgia State University, Atlanta, GA

Background: The purpose of this study is to quantify aerosol drug delivery with jet (JN) and mesh (MN) nebulizers using filtered and nonfiltered heat moisture exchangers (HMEs). **Methods:** A ventilator (Galileo, Hamilton) was attached to a model simulating an intubated (8.0 mm ID ETT) adult (Vt 500 mL, RR 15/min, PEEP 5 cmH_2O, Inspiratory Flow 50 L/min) with a collecting filter (Respirgard II, Vital Signs, Totowa, WJ) distal to the bronchi attached to a test lung through a heated humidifier (Fisher&Paykel) simulating exhaled humidity (37°C, 100% relative humidity). Nonfiltered HME (ThermoFlo™, ARC Medical) and filtered HMEs (ThermoFlo™ Filter, ARC Medical and PALL Ultipor, PALL Medical) were allowed to acclimate to the exhaled heated humidity for 30 min. Albuterol sulfate (2.5 mg/3mL) was administered with JN (MistyMax10, Airlife) and MN (Aerogen Solo, Aerogen) placed between HME and ETT (n=4). Drug was eluted from collecting filter and measured using UV spectrophotometry (276 nm). **Results:** The table shows mean (± SD) percent dose delivered. Aerosol delivery through both filtered HMEs was similar while aerosol deposition was greater with the nonfiltered HME was greater than filtered HMEs. There is a significant difference in the percent of dose delivered by JN and MN using the ThermoFlo ™ ($p<0.05$) the ThermoFlo™ Filter ($p<0.05$) and the Pall Ultipor ($p<0.05$). **Conclusion:** Delivery efficiency was similar to controls with both nonfiltered and filtered HMEs, with JN less than MN.

Sponsored Research - None

HMEs	Nonfiltered HME (ThermoFlo)		Filtered HME (ThermoFlo Filter)		Filtered HME (Pall Ultipor)		Control	
Nebulizers	Jet Nebulizer	Mesh Nebulizer	Jet Nebulizer	Mesh Nebulizer	Jet Nebulizer	Mesh Nebulizer	Jet Nebulizer	Mesh Nebulizer
Inhaled Mass (mcg)	86.5±26.6	193±56.8	72.7±12.1	118.9±40.7	66.7±11.0	97.6±30.9	93.9±11.2	131±33.7
Inhaled Mass Percent (%)	3.5±1.0	7.7±0.59	2.9±0.5	5.7±0.3	2.7±0.4	5.3±0.2	3.7±0.4	5.8±0.8

2758180

The Impact of Nebulizer and Mask on Aerosol Deposition in Children Receiving Noninvasive Ventilation: An In Vitro Study.

Malak Alshlowi, James B. Fink, Arzu Ari; Georgia State University, Atlanta, GA

Background: Selecting optimal aerosol device and interface of noninvasive ventilation (NIV) to children is a challenge. The purpose of this study is to measure the delivery efficiency of two nebulizers with three interfaces in a simulated spontaneously breathing pediatric lung model. **Methods:** A ventilator (Trilogy 202, Philips) with single limb circuit (S/T mode, inspiratory pressure: 6 cmH_2O, expiratory pressure: 8 cmH_2O, respiratory rate: 30 and I:E ratio 1:2) was connected to a pediatric upper airway manikin via the standard oronasal mask (AF 541, Respironics), the oronasal mask with nose cushion (AF541, Respironics) and the nasal mask (PN 831 Respironics). A collecting filter placed between the bronchi and a passive test lung (QuickLung, Ingmar Medical) with compliance of 20 mL/cmH_2O and resistance of 20 cmH_2O/L/s. Albuterol sulfate (2.5mg/3 ml) was administered with jet (Micro Mist, Hudson RCI, Temecula, CA) and mesh (Aerogen Solo, Aerogen Ltd, Galway, Ireland) nebulizers during noninvasive ventilation (n=5). Drug was eluted from filters and analyzed with spectrophotometry (276 nm). Descriptive statistics, Kruskal Wallis one way analysis of variance and Mann Whitney U test were used for data analysis ($p<0.05$). **Results:** The table below shows inhaled mass and inhaled dose % delivered (mean±SD) distal to the trachea. The mesh nebulizer delivered significantly more drug than the jet nebulizer with the standard oronasal mask ($p=0.0001$), the oronasal mask with nose cushion ($p=0.0001$) and nasal mask ($p=0.047$). Aerosol deposition with the standard oronasal mask was more than the oronasal mask with nose cushion and the nasal mask using both jet and mesh nebulizers. **Conclusion:** Type of nebulizer and masks had an impact on aerosol drug delivery to this simulated passive pediatric lung model receiving noninvasive ventilation.

Sponsored Research - None

Nebulizers	Mesh Nebulizer			Jet Nebulizer		
Masks	Standard Oronasal Mask	Oronasal Mask with Nose Cushion	Nasal Mask	Standard Oronasal Mask	Oronasal Mask with Nose Cushion	Nasal Mask
Inhaled Mass (mcg)	506.5±61.9	437.6±38.4	52.2±29	193.2±15.8	135.2±27.2	21±5.5
Inhaled Dose Percent (%)	20.3±2.5	17.5±1.5	2.0±1.1	7.7±0.6	5.4±1.1	0.8±0.2

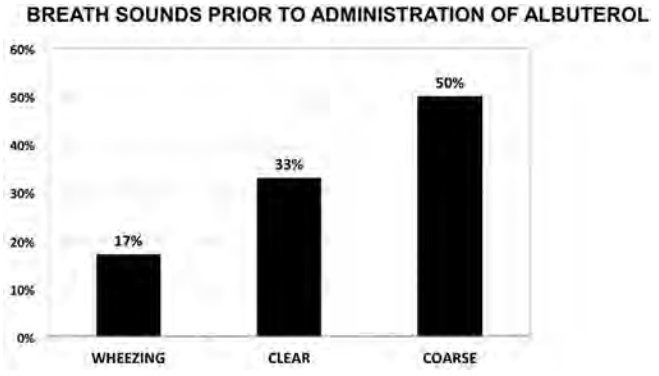
2758187

Albuterol: A Useful But Often Unnecessarily Ordered Bronchodilator.

Abdulaziz. Alzahrani, Christopher. Molina, Jessica. E. Estrada, Lisseth. Guzman, Vanessa. M. Payen, Ruben D. Restrepo; Respiratory Care, UTHSCSA, San Antonio, TX

Background. Albuterol (ALB) is the most commonly administered short-acting bronchodilator. Its main indication is to release bronchospasm, which is typically confirmed on auscultation by the presence of wheezing. Although a relatively safe medication, indiscriminate use of ALB could be associated with unwanted side effects, add unnecessary time to therapy and overall cost to respiratory care departments. The aim of this study was to evaluate ALB utilization in one hospitalization area. **Methods**: A retrospective review of electronic medical records (EMR) of patients admitted to a medical ward at a university-affiliated, 496 bed hospital, in San Antonio, Texas. Patients who received ALB during their hospitalization between January and April of 2017 were selected for the study. Demographic information, history of COPD and asthma, admission diagnosis, use of bronchodilators, frequency of administration, and auscultatory findings were recorded. **Results:** A total of 63 EMRS were reviewed for the study. ALB and ALB plus ipratropium were ordered for 66% and 16% of the patients, respectively. ALB was administered Q6H in almost half of the patients. Over 75% of the patients receiving ALB did not have a history or diagnosis of obstructive pulmonary diseases. Yet, before treatment administration only 17% of patients had wheezes upon auscultation, 33% had clear breath sounds, while the remaining reported "coarse" breath sounds. **Conclusion:** According to the results of this study, the great majority of patients admitted to this hospital area received frequent doses of albuterol despite not having a history of obstructive airway disease or auscultation to support its use. A more strict protocol for ALB administration may dramatically decrease the misuse of this important medication.

Sponsored Research - None



2758254

Implementation of a Critical Asthma Algorithm.

Daria Donelly[1], Karyn E. Reinhardt[1], Danielle Dwyer[2]; [1]Respiratory Care, Boston Childrens Hospital, Boston, MA; [2]Medicine Critical Care, Boston Childrens Hospital, Boston, MA

Background: Asthma is a chronic inflammatory disorder of the airways characterized by an obstruction of airflow. Childhood asthma is the most common serious chronic disease in children. Since pediatric asthma continues to be a focus of attention by medical specialists, using a common systematic approach for the management of asthma can considerably improve outcomes. Boston Children's Hospital (BCH) developed a focus group that implemented the Hospital Asthma Severity Score (HASS) to expedite patient triaging, initiation of appropriate treatment and weaning of therapy. The Medicine Critical Care Program adopted SCAMP® (Standardized Clinical Assessment and Management Plan) methodology to standardize the management of critical asthma by providing a pathway utilizing the HASS with recommendations for escalation and de-escalation of care for patients who are > 2 years of age that start on continuous aerosolized albuterol. **Methods:** The goals of the SCAMP® committee were to reduce time to Q2hr and Q4hr albuterol treatments and hospital length of stay (LOS). Critical Asthma SCAMP® meetings, attended by a multidisciplinary group, were held monthly for development and review of process/results. There was education for implementation of the algorithm and discussions were built into patient rounds. **Results:** The pre-SCAMP® group consisting of 150 patients were evaluated with an average time to Q2 albuterol treatments of 21.6 hours, time to Q4 45.9 hours and hospital LOS 63.8 hours. For the second iteration of the SCAMP® 181 patients were included. The results for this iteration resulted in an average time to Q2 albuterol treatments of 12.8 hours, time to Q4 20.9 hours and hospital LOS 42 hours. **Conclusions:** There was both a statistical and clinical significance in the reduction of time to Q2, Q4 and LOS. A satisfaction survey was completed by the bedside clinicians and results indicated empowerment and job satisfaction with implementation of the algorithm. In particular, clinicians felt it was not only a good guide for decision making but it was an easy process to follow. SCAMP® is a registered trademark of IRCDA

Sponsored Research - IRCDA provided analysis of the data collection.

Results of the Critical Asthma Algorithm

	11S Pre-SCAMP® (N=150)	11S Iteration 2 (N=181)
Time to Q2	21.6 (13.5-32.3)	12.8 (8.0-22.0)
Time to Q4	45.9 (34.3-68.0)	20.9 (11.9-32.2)
Hospital LOS	63.8 (45.6-87.8)	42 (27.0-69.0)

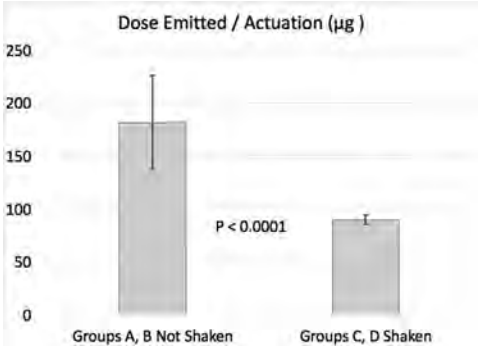
2758497

Impact on Emitted Dose of Albuterol HFA pMDI With Shaking and Not Shaking Between Actuations.

Mark S. Siobal[1], Patricia Dailey[2], James Fink[3], Myrna Dolovich[4]; [1]Respiratory Therapy Program, Skyline College, San Bruno, CA; [2]Aerogen Ltd., Chicago, IL; [3]Aerogen Pharma Corp., San Mateo, CA; [4]Medicine, McMaster University, Hamilton, ON, Canada

Background: A previous study reported that shaking or not shaking HFA formulation of freshly primed pressurized metered dose inhalers (pMDIs) between puffs within 60 seconds had a small effect on dose emitted per actuation (Fink JB, Dhand R, et al. Am J Respir Crit Care Med 1999;159:63–68). During lab exercise experiments at Aerosol School (Class of 2016, McMaster University, Hamilton ON, Canada), large differences in dose emitted from pMDIs were measured. We explored whether not shaking the pMDI prior to each actuation was the cause. **Methods:** Four groups of participants (A, B, C, D) conducted measurements of dose emitted from pMDI canisters of Ventolin HFA (GlaxoSmithKline, Research Triangle Park, NC). As per the manufacturers recommendation, the pMDI canisters were shaken and primed with 4 actuations prior to use. For each run, two 90 µg/puff actuations were sprayed into a filter collection apparatus at 30 second intervals. The collection apparatus was then washed with 10mL of 0.1 N HCl solvent. One mL of eluted solution was analyzed three times with UV-Vis Spectrophotometry (GENESYS 10S, Thermo Fisher Scientific, Waltham MA) at 276 nm to determine drug mass. Unpaired t-test was applied with p<0.05 level of significance. **Results:** After the data were analyzed it was determined that some participants (Groups A and B) shook the pMDI canisters before each run but did not shake the canisters between each actuation., while others (Groups C and D) shook the pMDI canisters between each run and between each actuation. The emitted drug mass in µg (mean ± SD) of albuterol per actuation measured for Groups A and B (n=7) was 181.1 ± 44.2 versus Groups C and D (n=7) was 89.3 ± 4.3 (p<0.0001, unpaired t-test). **Conclusion**: Obtaining reproducible measurements of emitted drug mass from pMDIs requires familiarity and practice with lab techniques. Accurate dose emitted from Ventolin HFA pMDIs is dependent on adequate agitation and shaking between actuations even if the time between actuations is of short duration (30 second intervals).

Sponsored Research - None



2758514

In Vitro Comparison of Aerosol Delivery Efficiency of Vibrating Mesh Nebulizers With Different Shapes of T-Adaptors During Adult Mechanical Ventilation.

Hui-Ling Lin[1,3], Yu-Yao Kao[2], Eric Y.T. Chen[2]; [1]Respiratory Therapy, Chang Gung University, Taoyuan, Taiwan; [2]MicroBase Technology Corp., Taoyuan, Taiwan; [3]Respiratory Therapy, Chiayi Chang Gung Memorial Hospital, Chiayi, Taiwan

Background: Successful delivery of aerosolized medication within mechanical ventilation (MV) necessitates an efficient vibrating mesh nebulizer connected to a well-designed T-adaptor that is subsequently conjoined to the inlet of a heated humidifier in a closed ventilator circuit. However, many traditional T-adaptors suffer from significant aerosol impaction, thus reducing drug delivery efficacy. This study compared aerosol drug delivery outcome between conventional and reengineered T-adaptors when fitted with different vibrating mesh nebulizers during adult MV. **Methods**: A ventilator (*Puritan Bennet* 760) was set to adult parameters (600 mL, 16 breathes/min, PEEP 5 cmH_2O) and connected via an endotracheal tube with a filter to a passive test lung. A unit dose of Ventolin (5.0 mg/2.5 mL, *GSK*) was individually added to Aerogen Solo (Aerogen; MMAD of 3.8 µm), MicroBase mechanical ventilator nebulizer plus (µMVN+; MicroBase, Taiwan) 4.0 (median mass aerodynamic diameter (MMAD) of 4.0 µm), µMVN+3.0 (MMAD of 3.0 µm), or µMVN+2.0 (MMAD of 2.0 µm) which was then connected to either Aerogen T-adaptor (Aerogen) or MBTC T-adaptor (internal volume 120 mL, MicroBase Corp, Taiwan) placed at inlet of a heated humidifier (Fisher & Paykel). Drug captured on the filter was eluted and analyzed with a spectrophotometer (U-2900, Hitachi Corp) at wavelengths 276 nm for Ventolin. **Results:** Figure 1 showed inhaled dose % by vibrating mesh nebulizers with different T-adaptors. The use of MBTC T-adaptor increased inhaled dose (%) of Aerogen Solo (23.77±2.72) when compared with existing Aerogen T-adaptor (18.87±2.49%; p=0.009). The inhaled dose (%) of µMVN+ 4.0 with MBTC T-adaptor (22.19±1.87%; mean±SD) has exceeded that of the Aerogen T-adaptor (15.63±1.40%) (p<0.001). Moreover, smaller particle size generated by µMVN+ 3.0 and µMVN+ 2.0 (with MBTC adaptor) has demonstrated significant greater dose (26.51±1.78% vs. 30.04±0.63%) than Aerogen Solo with Aerogen T-adaptor (18.87±2.49% vs. 23.77±2.7%, p<0.001) correspondingly. **Conclusions:** The newly designed larger volume MBTC T-adaptor with nebulizers generating smaller MMADs enhanced aerosol drug delivery efficacy possibly through reducing aerosol impaction and condensation within T-adaptor during nebulization in a ventilator system.

Sponsored Research - None

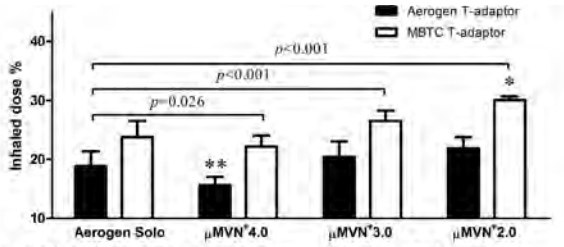


Figure 1, Inhaled dose % of vibrating mesh nebulizers with different T-adaptors
*Inhaled dose % of µMVN+2.0 was significantly higher than others with MBTC T-adaptor (p<0.001)
**Inhaled dose % of µMVN+4.0 was significantly lower than others with Aerogen T-adaptor (p<0.001)

2758694

A Bench Study of Inhaled Nitric Oxide Delivery During Intrapulmonary Percussive Ventilation and Mechanical Ventilation.

Kendall Williams, Maria Madden; Respiratory Care, University of Maryland Medical Center, Easton, MD

Introduction: Inhaled nitric oxide (NO) is currently FDA approved for pulmonary hypertension in the neonatal population. However, it is used widely off label for patients with hypoxic respiratory failure (HRF) and acute respiratory distress syndrome (ARDS). Inhaled nitric oxide is a selective pulmonary vasodilator that improves ventilation–perfusion matching at low doses in patients with acute respiratory failure. Potentially improving oxygenation and lowering pulmonary vascular resistance. Intrapulmonary percussive ventilation (IPV) is a therapy that provides secretion clearance and lung expansion. Patients that are placed on Nitric Oxide for various reasons may benefit in using IPV while on mechanical ventilation but has not been tested. Methods: We configured a ventilator circuit with a test lung to test various configurations. Delivered NO, NO2 and inspired oxygen (FIO2) were measured using electrochemical and galvanic analyzers at the recommended site and second sample line closer to the endotracheal tube. The first configuration recommended and is standard of setting the NO module on the dry side of the inspiratory limb of the circuit. The IPV inline interface was placed in line and a test lung was connected. The second configuration is similar to the first one but we added a one-way valve prior to the phasitron when connecting to the inline interface. With each configuration, the pulse frequency was adjusted from 100 to 300 cycles per minute. Results: The first configuration with a set NO of 20 ppm only measured 0.4 ppm as being delivered. The second configuration with a set NO of 20 ppm measured 20-23 ppm with the NO2 remaining in normal parameters (0.1-0.2 ppm). Conclusion: The combination of inhaled nitric oxide and IPV with mechanical ventilation does allow a stable delivery of nitric oxide. Therefore, we conclude that the use of IPV and NO may be significantly beneficial to aid in the increase alveolar ventilation in patients with respiratory failure.

Sponsored Research - None

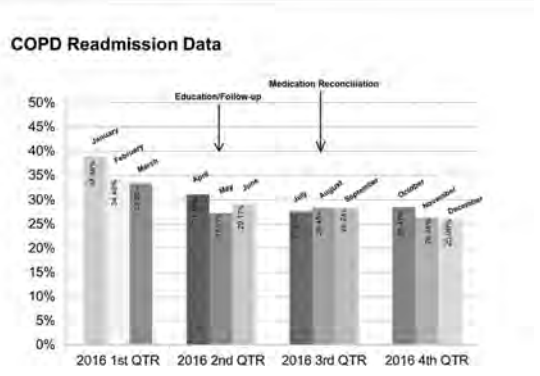
2733384

High Readmission Rates on 3C for COPD.

Jessica Goforth[1], Irfan Budhani[2]; [1]Respiratory Therapy, St. Elizabeth Healthcare, Cold Spring, KY; [2]St. Elizabeth Healthcare, Edgewood, KY

We conducted a quality improvement process to determine the effect of increased respiratory therapy involvement with our COPD patients to help decrease COPD readmissions. Our baseline data showed two root causes: the lack of consistency in COPD education and incorrect medications. A pilot was completed by respiratory therapy to see if we could impact readmissions. COPD patients were identified upon admission, a case manager and respiratory therapist followed each patient daily. COPD education was instructed upon admission and it was re-addressed prior to discharge by the RT. One-on-one communication was utilized at the bedside to provide education and answer any questions. Medication reconciliation was completed on each patient. Respiratory provided education materials that included a COPD booklet and a symptom management card with a sticker affixed to the back of the card with the patients appropriate medications. Focused education decreased the readmission rate by over 4%. Medication reconciliation decreased it by another 1%. Each quarter during the pilot, the COPD readmissions decreased (see graph below). Our results showed a 12.9% decrease in COPD readmissions during the pilot. Some of the identified causes for COPD readmissions with the group were their co-morbidities: anemia, gastrointestinal bleeds, urinary tract infections, or congestive heart failure. According to an article in The New England Journal of Medicine, a study showed that a majority of their COPD readmissions have been caused by conditions other than a re-exacerbation of COPD.1 In the first quarter, the summary of cost per readmissions was $159,907.50. By the end of fourth quarter, the summary of cost decreased to $97,721.25. Providing COPD education and medication reconciliation has been proven beneficial to both the hospital and the patients when respiratory therapy is involved in the education and training. 1. Stephen F. Jencks, M.D., M.P.H., Mark V. Williams, M.D., and Eric A. Coleman, M.D., M.P.H. (2009). Rehospitalizations among Patients in the Medicare Fee-for-Service Program. 1418-1428. Table 2. http://www.nejm.org/doi/full/10.1056/NEJMsa0803563#t=articleTop

Sponsored Research - None



2744424

Development and Implementation of a Public-Health Grant by Respiratory Therapists to Educate an Inner City Population about Chronic Lung Disease.

Gail Drescher[1], Cherise Harrington[2], Eric Kriner[1], Edward A. Palmer[1]; [1]Washington Hospital Center, Washington, DC, DC; [2]Public Health, George Washington Univeristy, DC, DC

Background:There are significant threats to public health in inner city environments. In DC, both asthma & COPD disproportionately affect minority populations, & individuals from lower socio-economic backgrounds. To address these health disparities, we wrote & executed a 1-year grant for the DC DOH to educate an inner-city population about chronic lung disease. Methods: The DC Campaign for Respiratory Health was the first program in the US to use a multi-framework approach that included city-wide screenings, & the use of faith-based institutions with training of lay-health ministers (LHAs) to disseminate information on COPD & asthma. MWHC's RT department partnered with several organizations (COPD FDN, Leadership Council for Healthy Communities & GW SPH) to link medical expertise & community churches, in order to reach a significant cross-section of DC residents. We established a core working group to write material, along with an advisory group comprised of lay- & professional community members to vet information & methods. We created original material & conducted 3 train-the-trainer sessions for 25 identified LHAs from a variety of faith-based institutions. The LHAs then conducted 3-6 workshops (WS) for their congregants on asthma &/or COPD, with a goal to reach 1775 participants. We then compared changes in asthma/COPD knowledge pre- vs post-WS using chi-square, & conducted a process evaluation to review program development. We also conducted city-wide asthma/COPD screens at various community health fairs. MWHC IRB approval: 2016-283. Results: We obtained 14% & 12% response rates from WS participants for demographic surveys (n=341) & pre/post knowledge tests (n=303), respectively. Our LHA-lead WS reached >2500 individuals, with a majority of participants being age 60-70+ (64.4%), female (73.9%) & AA, & 55.4% having a high-school diploma or some college. We found significant pre- vs post-WS improvements for both asthma & COPD topics in general disease knowledge (P<.001), causes (P<.001), triggers (P<.001), & treatment (P<.001). All LHA's reported their WS "went well" (100%), material was adequate (100%) and they felt knowledgeable about CLD (100%). We screened 303 DC residents for asthma/COPD at local events, which fell short of our 500 target. Conclusion: Our WS initiative was able to reach a substantial number of DC residents, & improved disease-related knowledge. Using community health fairs was not as effective in obtaining an adequate number of screens.

Sponsored Research - Our institution received grant money from the District of Columbia Department of Health to create and implement this grant for DC residents.

2745242

Exploring the Critical Thinking Skills of Respiratory Care Students and Faculty.

Bshayer R. Alhamad[1], Genevieve Pinto Zipp[2]; [1]Respiratory Therapy Program, King Saud bin Abdulaziz University for Health Sciences, Al Ahsa, Saudi Arabia; [2]Department of Interprofesstional Health Sciences and Health Administration, Seton Hall University, South Orange, NJ

Background: Given the complexities and interdependencies that exist among today's healthcare professionals in providing patient-centered care, respiratory therapists must be highly skilled critical thinkers. Faculty members are expected to assist students in developing their ability to acquire knowledge and think critically. However, few studies have assessed the critical thinking of respiratory care (RC) students, with none, to our knowledge, assessing that of RC faculty who mentor students. Thus, the purpose of this study was to assess the overall critical thinking skill level of both RC students and faculty, investigate whether RC faculty members have stronger overall critical thinking skills than RC students, and determine RC student and faculty perceptions regarding what critical thinking is and how it develops. **Method:** Directors of all accredited U.S. RC education programs were emailed a request to participate and forward the study's letter of solicitation to their current RC students and faculty via snowball sampling. The online survey consisted of two sections: (1) demographic and three open-ended questions and (2) the Health Sciences Reasoning Test (HSRT) to assess participants' critical thinking skill level. Descriptive statistics and the independent sample *t*-test were used for data analysis ($p < 0.05$). Institutional Review Board (IRB) approval was obtained. **Results:** Twenty-two students and 20 faculty members completed the HSRT. Overall critical thinking scores showed a moderate level of critical thinking in the student group (17.81 ± 4.19) and a strong level in the faculty group (21.65 ± 5.41). Faculty had statistically significant stronger overall critical thinking scores than students ($p = .007$). Qualitative data demonstrated participants's use of themes identified in the literature to define critical thinking and indicated the role that faculty members play in promoting students' critical thinking and educational strategies that foster students' critical thinking. **Conclusions:** While RC students and faculty demonstrated an ability to think critically, faculty demonstrated stronger overall critical thinking skills than students. In light of these findings, the road to developing strong critical thinking in RC students is partially paved; thus, it is imperative for RC programs and faculty to further develop RC students' critical thinking skills to the advanced levels recommended to meet the competencies specified by the 2015 and Beyond report.

Sponsored Research - None

2750837

Is Simulation an Adequate Substitute for Clinical Experience?

Emily Scicchitano, Kimberly Group, Gina Civettini, Phillip Stark; Respiratory Care, Penn State University Hershey Medical Center, Palmyra, PA

Introduction Managing complex medical airway emergencies is one of the most challenging aspects for the Respiratory Care practitioner. In the past, proficiency could only be obtained with years of experience. In newer therapists, this experience may be lacking or even non-existent. We were concerned that this lack of experience in managing airway emergencies could lead to poor performance and jeopardize patient safety. Our solution was to invest in a vigorous simulation component into our orientation process. Although we felt we were making qualitative improvements to the orientation process, we still wanted to see if there was a measurable, quantitative component to our investment in simulation. **Method** Our facility performs yearly competencies in managing complex medical airway emergencies. Each year, these scenarios are changed, but essential clinical objectives remain the same. As part of our redesigned orientation process, we had all newer therapists with less than 2 years experience complete the simulation training of all past emergency airway scenarios. This placed all 65 therapists in our study at the same training level. We then created a new airway emergency simulation that was unknown to all participants. We compared times to reach clinical objectives to that of the participant's years of clinical experience. **Data** The entire sample was subdivided into 5 study groups based upon years of clinical experience. Time measurements (**minutes: seconds**) were collected for the obtainment of each clinical objective. The standard deviations (**STDEV**) were calculated for the entire group as a whole. **Conclusion** We anticipated our more experienced therapists to outperform our lesser experienced ones and a much larger standard of deviation. However, the results showed no significant difference in performance based upon years of clinical experience. Critical thinking, appropriate interventions and swiftness of action are all key components in managing airway emergencies. Our findings suggest that simulation training is an effective technique that may effectively substitute for years of experience in this specific area of expertise. As many of our new hires are new graduates, we will continue to invest in extensive simulation training for these therapists to improve patient safety and good outcomes.

Sponsored Research - None

	<2 yrs (n=15)	2-4 yrs (n=12)	5-9 yrs (n=12)	10-20 yrs (n=11)	>20 yrs (n=15)	STDEV (n=65)
Checks for Respiration	0:22	0:31	0:25	0:31	0:36	0:06
Requests Code Cart	2:41	1:53	1:41	1:43	2:34	0:29
Acquired SpO2	6:32	5:54	6:17	6:56	5:29	0:33
Ventilates Lower Airway	6:58	5:05	5:13	6:44	6:29	0:52
Acquires EtCO2	8:12	7:05	6:56	8:17	7:49	0:37

2752878

Importance of Multifaceted Education for Respiratory Therapists Performing Low Volume, High Acuity Procedures.

Andrea L. Forman; Respiratory Care, University of Colorado Hospital, Aurora, CO

Background: Dangers associated with low volume, high acuity therapies conducted by respiratory therapists in the acute care setting prove the need for effective educational intervention. This study was conducted to assess the efficacy of multifaceted, evidence-based educational workshops by evaluating the pre-existent and post-intervention knowledge base of three low volume, high acuity therapies conducted by therapists at the University of Colorado Hospital in Aurora, CO. **Method:** Thirty intensive care unit (ICU) trained registered respiratory therapists went through multifaceted education workshops on the theory, assessment and management of capnography during cardiopulmonary resuscitation (CPR), high frequency oscillation and airway pressure release ventilation (APRV). A pre-test and post-test were distributed to all participants to evaluate baseline knowledge and retainment of theory and skill post education. An evaluation was completed immediately following each session to measure confidence levels in conducting these therapies. **Results:** There was a significant improvement in therapist skill, knowledge and confidence while performing these low volume, high acuity interventions. The mean pre-test score for capnography during CPR was 74% with a range of 50%-100%. The mean post-test score was 99% with a range of 83-100%. The evaluations revealed that 100% of participants felt more confident in the understanding of the relationship between capnography and the physiological relevance it has during CPR. The mean pre-test score for high frequency oscillation initiation and management was 74% with a range of 50%-83%. The mean post-test score was 91% with a range of 75-100%. The evaluations revealed that 94% felt more confident in the management and care of patients on high frequency oscillation. The mean pre-test score for the initiation and management of patients on APRV was 70% with a range of 50%-88%. The mean post-test score was 95% with a range of 88%-100%. The evaluations showed that 96% felt more confident in the management of these patients. **Conclusion:** Multifaceted, evidence-based educational workshops have proved effective in improving the skill, knowledge and confidence of therapists conducting low volume, high acuity therapies. **Disclosures:** I currently work at University of Colorado Hospital, Aurora CO as the clinical educator for the Respiratory Care Department. I am also a key opinion leader for Aerogen.

Sponsored Research - None

2755436

2017 Outcomes of the Respiratory Therapy (RT) Student Led *Breathe-Zy* Community Education Program.

Kimberly Bennion[1], Rachael Chappell[2]; [1]Corporate Respiratory Care, Intermountain Healthcare, SLC, UT; [2]Respiratory Therapy, Weber State University, Ogden, UT

Background: A community education program was implemented in 1995 to raise lung health awareness among school-aged students. Key elements include an overview of chest anatomy & physiology, asthma pathophysiology, interactive exercises & bovine/porcine lung dissection given in 2.5-3 hours. When legislators failed to pass e-cigarette legislation, we sought to educate Utah's youth regarding the impact of any form of inhalant on lung health. Volunteers attend training sessions. An RT student is annually assigned to lead the project & be mentored by the program's creator. Duties include: contacting schools & after-school programs to schedule courses, coordinating volunteers & providing oversight at sessions. **Method:** Five courses were completed January - April, 2017 with 62 elementary, 72 middle & 47 middle tested as high school students entering the program. Pre- & post-assessment exams were completed & were tailored for elementary, middle & high school abilities. **Results:** Pre- & post-program assessment exam outcomes are reported in Table One. **Conclusion**: Comparative test results were not as improved as previous years. Several variables may have contributed to this. Elementary students have historically been fifth & sixth graders; however, some participants were as young as 2nd grade. One group of 9th grade students (technically middle school students in Utah) were given the high school exam. Not all students attended the full course. Students under the high school totals took the exam prior to the completion of the final session & prior to the lead instructor's approval. It is our impression these factors did not significantly change our hypothesis that students do gain knowledge after taking the course as reflected in the reported outcomes where elementary & middle school students doubled & almost doubled post-test accuracy. We have appreciated an increase in: 1) youth & adult awareness of the impact of tobacco on lung and overall health, 2) awareness of RT as a profession, 3) RT value as key members of the healthcare & community teams, 4) students engagement in the profession & AARC/USRC initiatives, and 5) an opportunity for RT students to be mentored as leaders. It is our impression that forming strong community partnerships will prove imperative to our profession. The USRC is a relatively small state society when compared with many other states. However, when RTs unite with key objectives clearly defined & offer a high quality product, we can make a difference.

Sponsored Research - None

Table One: 2017 Breathe-zy Program Pre- & Post-Program Exam Outcomes

School Type	Students #	Total Exam Questions #	Total # Students X Possible Correct Answers #	Pre-Program Exam Accuracy # (%)	Post-Program Exam Accuracy # (%)	Pre- versus Post-Program Accuracy Improvement %
Elementary	62	11	682	221 (32)	221 (32)	83
Middle School	72	14	1008	94 (9)	94 (9)	94
High School	47	17	799	367 (46)*	367 (49)*	8

*All 47 students reported under high school outcomes were actually middle school students; wrong pre- & post-exams were given. Probably accounts for minimal % improvement.

2755945

Reassessing the Respiratory Therapist's Effectiveness in Managing a Pre-existing Surgical Airway Emergency.

Phillip Stark, Emily Scicchitano, Ashley Grim, Jennifer Erkinger, Gina Civettini; Respiratory Care, Penn State University Hershey Medical Center, Palmyra, PA

Background In 2015, we designed a simulation competency that tested and measured our therapists' response times in managing a surgical airway emergency. Our response times were longer than we had anticipated and we saw an opportunity for improvement. In 2017, we designed another simulation with a different scenario but identical objectives. We wished to see if any significant improvement in performance had occurred. **Method** An emergent surgical airway scenario was designed as our department's yearly competency. The scenario was that of an emergent surgical airway management for a patient with a complete upper airway obstruction. Specific clinical objectives were determined and time measured for their obtainment. The participants had no prior knowledge of the scenario or its clinical objectives. All competencies were video recorded for debriefing purposes and time stamping. Comparisons were then made between the year 2015 and 2017. **Results** Five common clinical objectives were pre-determined and time measured for their obtainment. We compared the 2015 times to the newer 2017 times The percentage change was than derived. **Conclusion** There was a significant improvement in times. During a resuscitation effort, even a moderate improvement in time can greatly affect outcomes. We feel these improvements have substantial clinical significance. The un-measurable variables in these studies were the scenarios themselves. Most participants felt the more recent scenario was the more challenging and may have hindered their response times. Overall, we were pleased that simulation identified areas of clinical vulnerability and provide the tools necessary for improvement.

Sponsored Research - None

Clinical Objective	2015 (n=69) minutes: seconds	2017 (n=77) minutes: seconds	Percentage Change
Checks for respiration	1:12	0:58	24% improvement
Requests Code Cart	3:34	2:27	45% improvement
Acquires SpO2	7:45	6:13	24% improvement
Performs Lower Airway Ventilation	7:28	6:08	21% improvement
Acquires EtCO2	8:38	7:56	14% improvement

2756280

Factors That Influence Respiratory Therapy Graduates' Membership in the American Association for Respiratory Care.

Crystal L. Dunlevy, Kelsey Gallagher, Nicholas Harrison, Sydney Lahre, Haley Pohl; School of Health & Rehabilitation Sciences, The Ohio State University, Columbus, OH

Background: Historically, health professions including nursing and physical therapy have experienced difficulty in persuading new graduates to join their professional organizations. Similarly, many respiratory therapy students do not convert their memberships from student to active when they graduate. This study was designed to determine why graduates of accredited Respiratory Therapy (RT) programs chose not to convert their AARC membership from student to active upon graduation. **Methods:** The authors designed a survey based on a review of the literature and distributed it to AARC executives, RT department managers and RT program faculty to review for content validity. The survey received IRB approval under exempt review. 421 directors of accredited respiratory care programs were contacted via email and asked to distribute the link to the survey to their 2016 graduates, along with an invitation to participate. At the end of data collection, ten participants were randomly selected to receive a $20 Amazon gift card for completion of the survey. Demographic and survey response data was collected and reported in aggregate form. Respondents ranked barriers to conversion from student to active membership. Participants also listed reasons that would compel them to join the AARC. Survey results were reported using descriptive statistics. **Results:** The response rate was 171. The majority of respondents were female (77%), graduates of associate's degree programs (60%), aged 20-29 (58%), employed in adult critical care (56%), and had been student members of the AARC (77%). 61% of 2016 RT graduates who responded to the survey did not convert to active AARC membership when they graduated. 86% of respondents ranked cost as their first or second reason for not converting to active membership. The majority of respondents were aware of at least one membership benefit, but most were not aware of all benefits to active membership. The majority of respondents (77%) reported that they would convert to active members if fees were lower and/or if they were aware of the benefits associated with membership. **Conclusions:** The AARC may wish to consider reviewing and revising their membership fee structure, as well as new marketing strategies that will inform RT students about the benefits of membership and the importance of being involved in their professional organization.

Sponsored Research - None

2756297

Communication of Career Pathways Through Associate Degree Program Websites: A Baseline Assessment.

Jenny Vargas, Ellen A. Becker; Respiratory Care, Rush University, Chicago, IL

BACKGROUND: The American Association for Respiratory Care sponsored a series of conferences that addressed the competency of the future workforce of respiratory therapists (RTs). Based on the findings from those conferences, several initiatives emerged that support RTs earning bachelor's (BS) degrees. The objective of this study was to identify the ways that associate degree programs communicate career pathways towards a bachelor's degree on their program websites. **METHODS:** This cross-sectional observational study used a random sample of 100 of the 362 associate degree programs approved in 2015 by the Commission on Accreditation for Respiratory Care. Data was collected from three specific categories; demographic data, BS completion information, and the location of information on the program webpage. In addition to the program name, location, and degree granted, the presence of any statement related to earning a BS degree, articulation agreements, transfer credits and any links for BS completion were recorded. The descriptive statistics in this study were reported as total numbers and percentages. **RESULTS:** Of the100 programs in the sample, 89 offered unique website information for the associate degree program and were used in the following analyses. Only 39 (43.8%) program websites had any content related to BS degrees with 15 (16.9%) referring to a RT BS degree. A total of 13 (14.6%) program websites included BS articulation agreements, and only 16 (18%) identified college transfer courses for a BS degree. When present, information more often appeared on the RT program webpage (69.2%) vs. college webpage and more often (53.8%) in a subfolder than on the program homepage. **CONCLUSION:** A minority of associate degree programs communicate career pathway information to their prospective and current students through program websites. An informative website would make the path more transparent for entry-level students to meet their future educational needs as their careers progress. **DISCLOSURES:** None to report.

Sponsored Research - None

2756569

A Simplified Model for Improving Fidelity of Simulators – Simulation of CO_2 Production.

Muzna Khan[1], Nicole Ribeiro-Marques[2], William E. Whitehead[2], Jose D. Rojas[1]; [1]Respiratory Care, UTMB, Galveston, TX; [2]Anesthesiology, UTMB, Galveston, TX

Background: High-fidelity simulation is invaluable for teaching critical thinking in high acuity scenarios. Simulators come in varying degrees of fidelity with some having the potential to provide exhaled CO2; however, there is a paucity of a relatively simple and accessible methods to provide adjustable realistic end-tidal CO2. Clinically, waveform capnography is an important monitor to assess mechanical ventilation, patients in respiratory distress, cardiac arrest and shock. The goal of this project was to develop a simplified model of CO2 simulation that would not only enable training of clinicians (RT, medical students, residents) in the uses of capnography, but also to provide a tool for the in vitro testing of emerging technologies. Method: We integrated an ASL 5000 (Ingmar Medical, Pittsburgh, PA) with an in-line CO2 simulator. The simulator was modeled, with minor modifications, as described previously (Smallwood et al., Resp Care 61(3):354 (2016)). The simulator was placed in series between an airway management trainer and the ASL. In this configuration the simulator could be adjusted to provide varying levels of CO2 production. End-tidal CO2 was measured with an Avea ventilator equipped with a capnography module. Results: The CO2 production simulator was configured to provide 3 to 11% CO2 at flows of 4 to 6 liters per minute into the gas mixing reservoir (Figure 1a). For a given CO2 production, the minute ventilation generated by the ASL resulted in predicted changes in end-tidal CO2. Initially the gas flow to the simulator was set such the CO2 was 42 mmHg in the reservoir. The initial minute volume of the ASL was set at 6.0 L/min (rate =12; tidal volume 0.45 L) which resulted in an EtCO2 of 37 mmHg. The ASL was connected to the Avea in the CPAP/PSV mode with 5 cm H2O pressure support and 5 cm H2O PEEP. Increasing the frequency of the ASL resulted in an increase in minute volume and subsequent decrease in EtCO2. Decreasing the rate resulted in similar reproducible results. Conclusion: We describe a robust and inexpensive CO2 simulation model that can easily be incorporated into various airway management trainers or full-body simulators for the use of capnography training or testing of emerging and high acuity technologies. This model can provide changes in the end-tidal CO2 that can be used as a surrogate of clinical changes of a simulated scenario. In future studies we plan to use the model for in vitro testing of jet ventilation during surgery.

Sponsored Research - None

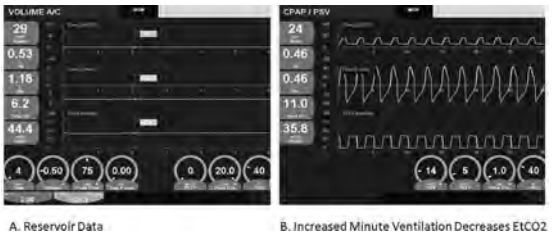


Figure 1. Left panel: Initial CO2 value and flow into simulator reservoir. Capnometer from the Avea was placed in-line with simulator reservoir. Scalar indicates a flow of 4.5 L/min and PCO2 of 43 mm Hg (5.6% CO2). Right panel: An example of an ASL-driven patient simulator connected to the Avea using CPAP/PSV, where changes in etCO2 are reflected by changes in minute ventilation.

2756653

Interprofessional Education Simulations for Healthcare Students Using High Fidelity Manikins.

Deborah A. Patten, Gina Fieler, Karen Leek; Allied Health, Northern Kentucky University, Highland Heights, KY

Background Working together as a healthcare team is one of the five core competencies of the Institute of Medicine's, *Crossing the Quality Chasm: A New Health System for the 21st* [1]. Interprofessional Education (IPE) in college curricula provides a foundation for learning how to work effectively as a team. Simulation based education (SBE) has been a pillar in respiratory care education from arterial arms to complex computerized lung simulators. Combining IPE and SBE gives students the chance to engage with each other at the patient bedside in a safe, practice setting. This project describes how IPE using SBE has been regularly added to course activities among nursing, radiologic science and respiratory care students. 1. Institute of Medicine. Health Professions Education: A Bridge to Quality. Washington, DC: National Academies Press; 2003. Methods Nursing, radiologic science and respiratory care faculty created patient scenarios involving all three disciplines. Objectives and interventions were identified. Students' classtime was designated to the *sim lab.* Students were invited to be either participant or observer. Participants were sequestered until start of scenario. Observers watched via video feed in debrief room. Faculty started the simulation with a patient report. Students cared for 'patient' until faculty identified its end. Debrief session followed. Evaluation survey consisted of 7 Likert Scale questions and two open comments. IRB approval was obtained. Results There were 49 nursing, 27 respiratory and 17 radiologic science students who returned surveys (*n*= 93). The majority of the students, 92.5% (*n=86*), said it was a worthwhile educational experience. 94.5% (*n=88*) said they either strongly agreed or agreed that it was realistic. When asked if it was challenging, 95.7% (*n=89*) agreed or strongly agreed. Regarding faculty direct involvement, 97.8% (*n=91*) agreed or strongly agreed. Positive open comments were: hands on learning, effective teamwork and communication, and observation of other discipline's roles. Conclusion IPE using SBE with high fidelity manikins is a meaningful educational activity for nursing, radiologic science and respiratory care students. Future needs include survey development with IPE core competencies. Although faculty and student schedules present challenges to adding IPE - SBE regularly in curriculum, the overall positive learning is well worth the efforts. Disclosure: this project will be presented at the 2017 AARC Summer Forum.

Sponsored Research - None

2756670

Student Attitude Toward Interprofessional Education: Impact of an Interactive Collaborative Activity.

Debra Kasel[1], Sandra Turkelson[2], Diane Gronefeld[1]; [1]Allied Health, Northern Kentucky University, Highland Heights, KY; [2]Nursing, Northern Kentucky University, Highland Heights, KY

BACKGROUND: Interprofessional education (IPE) can be defined as having two or more professionals learn from, with, or about each other to promote collaboration and impact quality of patient care. It is believed this type of learning experience will change students understanding of each profession's roles and responsibilities, while impacting mutual respect between healthcare students in the learning environment. The purpose of this study was to determine if participation in an interactive collaborative activity changed healthcare student's attitude toward interprofessional education. METHOD: After receiving permission from the IRB Committee, students enrolled in the second year of a health care program participated in an interactive case study that included group discussion. The students were from nursing, radiologic science, and respiratory care programs. Qualitative and quantitative data included: pre-survey, intervention, post-survey, and notecards. The survey was based on IPE literature and questions modified for healthcare students. RESULTS: A total of 63 responses were analyzed. Student t-test was performed. The survey results showed significant changes in student's attitude toward IPE (p=0.015) and the IPE learning setting (p< 0.001). Note cards were independently reviewed by two researchers who both identified two common themes. Student participants indicated they: Learned the roles of health care disciplines involved in the discussion Recognized the value of teamwork and collaboration. CONCLUSIONS: Students believe that IPE is a beneficial aspect of their educational process and found the activity enhanced their understanding of the roles of various healthcare professionals.

Sponsored Research - None

2757551

Dissemination of Clinical Protocol Information by Flowchart versus Text Description.
Daphne Graham, Robert L. Chatburn; Respiratory Institute, Cleveland Clinic, Cleveland, OH

BACKGROUND In the Respiratory Care field (and in other professions), new information, such as clinical practice protocols, is presented in various formats to both students and practitioners. However, understanding and using different presentation formats may be affected by learning style. The purpose of the study is to determine if a procedure for ventilator management is more successfully disseminated to respiratory care students using two different learning styles: a graphic flowchart and a text description. Primary hypothesis: There is no difference in test scores when using a flowchart vs a text description. Secondary hypothesis: Study participants tested with their preferred learning style (concordant group) will score higher than those who were not (discordant group). **METHODS** This study was deemed exempt by the Institutional Review Board. Thirteen students from the respiratory care program at Youngstown State University were randomly given a ventilator weaning protocol in the form of either a graphic flowchart or text description. Eight of the 13 participants received the flowchart and the rest received the text format. They were given 15 minutes to study this material and then given a written test, using their study material as an aid. Mean scores for flowchart vs text and concordant vs discordant groups were compared with t-tests ($P < 0.5$ significant). **RESULTS** The mean score for flowchart group (75%) was not different from text group (82%; $P = 0.53$) but power was only 0.05. The mean score for the concordant group (86%) was higher than the discordant group (65%, $P = 0.03$). **CONCLUSIONS** A larger sample size is required to adequately determine if moderately complex information about ventilator weaning is, in general, better disseminated as a flowchart or as a text description. However, this study supports the hypothesis that performance on a test of the information may be enhanced by catering to individual learning styles.
Sponsored Research - None

2757684

Healthcare Professional Students' Perceptions Toward Interprofessional Education.
Bandar M. Faqihi, Douglas S. Gardenhire, Ralph D. Zimmerman, Robert B. Murray; Respiratory Therapy, Georgia State University, Atlanta, GA

Background: The interaction among various health care teams using an Interprofessional Education (IPE) approach has received recognition as one of the most effective methods of improving the delivery of healthcare services. Perception and attitude of students toward IPE are challenges to implementation. The aim was to evaluate students' perceptions toward IPE. **Method:** The study was approved by the university IRB. Data were collected through a descriptive survey using the Readiness for Interprofessional Learning Scale (RIPLS). The survey consisted of 19 items, 5-point Likert scale and grouped into four sub-scales; teamwork and collaboration, negative professional identity, positive professional identity, and roles and responsibilities. The survey was administered to a convenience sample of undergraduate and graduate students who were enrolled in nursing, respiratory therapy, nutrition, physical therapy, and occupational therapy programs at an urban research university. **Results:** The number of participants totaled two hundred and fifty (n= 250) students. Physical therapy students accounted for 29.2%; followed by nursing students 28.8%; respiratory therapy students 26.4%; nutrition students 8.4%; and occupational therapy students 7.2%. Female participants accounted for 71.6% of all participants while male participants accounted for 28.4%. Over half of the participants are graduate degree students while 44.4% are undergraduate degree students. Almost one third of participants reported previous IPE experience and two third of participants reported no previous IPE experience. The study findings revealed that participants have positive perception and more agreement toward IPE (M = 81.10, ± 8.16 out of 95 points). The study showed an insignificant correlation between age and RIPLS total scores, negative professional identity, positive professional identity, and roles & responsibilities. There was only a significant negative correlation ($r_s = -0.176$; $P = 0.008$) between students' age and the teamwork & collaboration subscale. Moreover, the study findings revealed that gender and previous IPE experience have no significant effect on students' perception toward IPE. **Conclusions:** Results indicate that healthcare professional students value interprofessional education and have good perception toward it. Further studies with higher number of participants from various disciplines and level of education are recommended. **Disclosures:** None; Sponsored Research-None
Sponsored Research - None

2757818

Electronic Cigarettes: Does Safer Mean Safe? Respiratory Care Students' Perceptions.
Kelsey Whitford; Allied Health, Northern Kentucky University, Independence, KY

Background: An electronic cigarette is a small, battery powered cigarette shaped device used to deliver nicotine through a vapor to simulate the experience of smoking. Electronic cigarettes were successfully commercialized in 2003. There is limited research on all aspects of electronic cigarettes; the benefits or lack thereof, the harm they could potentially cause if used for an extended period, and the types and levels of carcinogens in them. The purpose of this study was to determine how knowledgeable senior students in a baccalaureate respiratory care program were on the safety of electronic cigarettes versus what the current research shows. **Methods:** An IRB approved survey was sent via password protected email to senior students in a baccalaureate respiratory care program at Northern Kentucky University, graduation date May, 2017. Students answered questions on use, perceptions, chemical makeup and health safety. **Results:** The survey was completed by 13 students. The majority of participants felt that they were moderately knowledgeable on electronic cigarettes. A significant portion (73%) believed that electronic cigarettes are safer for people to use in place of conventional cigarettes. 54% of participants said they would recommend use of electronic cigarettes to cut back or to quit smoking. All participants felt that there was not enough safety information on the boxes of electronic cigarettes to fully disclose the risks of use. **Conclusion:** The participants knew that electronic cigarettes were less addicting than conventional cigarettes, as literature supports. They did not, however, recognize the possible health risks of electronic cigarettes. Further education is needed at the academic level on electronic cigarettes. Further research is needed to adequately find ways to prepare new graduates on the ever-growing use of electronic cigarettes.
Sponsored Research - None

2715352

Safety of Heated Humidification Devices Used With Tracheostomies.

Denise Willis[1], Antonio Igbokidi[1], Brandi Whitaker[2], Dennis E. Schellhase[2]; [1]Arkansas Children's Hospital, Little Rock, AR; [2]Department of Pediatrics, University of Arkansas for Medical Sciences, Little Rock, AR

Background Tracheostomy and ventilator dependent children typically utilize heated humidifiers. Following an accidental death in the home related to the water contents of an unsecured humidifier spilling into the tracheostomy, education was provided to caregivers of children with a tracheostomy regarding placement and securement of the heated humidifier. It was recommended that the humidifier is secured to prevent inadvertent tipping over and that the device is placed at a level below the child to avoid water chamber contents and circuit condensation from entering the tracheostomy. Caregivers were later surveyed to assess knowledge and understanding of the education provided and to ensure the recommended changes were made. This study was approved by the IRB. **Methods** Caregivers of children followed in the Pulmonary clinic who have a tracheostomy and require home mechanical ventilation were contacted by telephone and invited to participate in a voluntary survey. There were 17 questions regarding usage, location, securement method, risks, barriers and circuit condensation. Participants were also invited to submit electronic photographs of their humidifier device for educational purposes. **Results** Caregivers of 59 children were contacted and 43 (73%) completed the survey. The majority of respondents, 86%, reported that the humidifier is secured. Of those with a secured device, 51% reported the humidifier is mounted on a pole while 33% stated it is on a bedside table and 16% noted other methods. The humidifier was reported to be placed below the child by 86%, the same level for 9%, above the child in 2% and 2% were not sure. Twenty-one percent stated they were not informed of the risks of unsecured devices while 13% stated they were not told of the risks of placing the humidifier above the child. Tubing condensation is drained back into the humidifier chamber by 58%. Forty-six percent reported that water had entered the tracheostomy in the past. The vast majority, 93%, reported no barriers to proper location and securement. **Conclusions** There is a discrepancy between recommended and actual practices for heated humidification devices in the home by caregivers including placement, securement, and circuit condensation. As a result, additional education and training materials were provided to caregivers as well as nursing and respiratory staff. Education has also been incorporated as part of the initial tracheostomy education and training provided to caregivers.

Sponsored Research - None

2752914

Conversion From Nebulizer Therapy to MDI Therapy in a Pediatric Pre-Operative Care Unit.

Amber N. Edge[1], Amy M. Litton[1], Jennifer R. Cockerham[2], Randy Willis[1], Gary R. Lowe[1]; [1]Respiratory Care Services, Arkansas Children's Hospital, Little Rock, AR; [2]Strategic Planning, Arkansas Children's Hospital, Little Rock, AR

Background: Bronchodilator therapy at this institution is usually performed using metered dose inhalers (MDI). One area that had not adopted this practice was in the pre-operative care unit for patients being prepared for surgery. Bronchodilator therapy was given to patients pre-operatively who had a history of reactive airway disease. Research has shown that bronchodilator via nebulizer or meter dose inhaler (MDI) were equally effective. A quality improvement project was undertaken to facilitate a change in bronchodilator therapy from nebulizer to MDI in the pre-operative care unit. **Methods:** The project was exempt from review by the local IRB. Initially, data were collected over a 10 week period to document the actual amount of time it took to deliver bronchodilator therapy via nebulizer in the pre-op setting. Interdepartmental discussions between the pre-op supervisory staff, chief anesthesiologist, pharmacy and respiratory care took place to address the logistics of changing bronchodilator administration from nebulizer to MDI. After a consensus was reached to convert to MDI administration, the test of change was implemented by revising the pre-op order set to include bronchodilator therapy via MDI, and educating all pre-operative nurses and the anesthesiologists regarding the order set change to include MDI. Administration times were then recorded for the delivery of bronchodilator therapy via MDI over a 12 week period of time after the test of change. **Results:** Actual treatment time decreased from a mean of 10:44 ± 2:20 minutes administering bronchodilator therapy via nebulizer (pre-test of change) to 5:16 ± 1:42 minutes administering MDI. This represented a 51% reduction in the average time to give a bronchodilator via MDI vs nebulizer in the pre-operative care unit. This also resulted in $650 in financial savings per year for RT time spent in treatment administration. **Conclusion:** This project involved multiple disciplines coordinating together in order to achieve a successful outcome. It also addressed the institution's operational goals of improving quality of care and financial management. Converting from nebulizer to MDI improved the efficiency of giving a bronchodilator in the pre-operative setting. Although the financial impact was small, the primary outcome of saving time for the patient, family, and staff was achieved. This change improved the overall flow of the patient from the pre-operative care unit into the surgical suite.

Sponsored Research - None

2752927

Cost Savings Associated With the Implementation of a Beta-Agonist/Airway Clearance Protocol in a Pediatric Intensive Care Unit.

Gary R. Lowe[1], Randy Willis[1], Mark J. Heulitt[2]; [1]Respiratory Care Services, Arkansas Children's Hospital, Little Rock, AR; [2]Spence and Becky Wilson Baptist Children's Hospital, Memphis, TN

Introduction: Based on previous work documenting reductions in therapy modalities, ventilator days, and length of stay (LOS) following the implementation of a therapist-driven β-Agonist/Airway Clearance (β-A/AC) protocol compared to physician-driven orders in a pediatric intensive care unit (PICU), a review of cost and time savings was undertaken to determine the financial impact of this intervention.[1] **Methods:** This study was not deemed human subject testing by the local IRB. Respiratory care charges for PICU subjects with acute respiratory failure (ICD-9 codes 518.81, 518.51, 518.84 and 518.53) were obtained for Oct 2012-Mar 2013 (Group 1-physician-driven orders) and Oct 2013-Mar 2014 (Group 2-therapist-driven protocol). There were 152 subjects in Group 1 and 171 subjects in Group 2 which met the inclusion criteria. Savings were categorized as follows: β-agonist interventions (aerosol and MDI), airway clearance interventions (chest physiotherapy and IPV), ventilator days, and LOS. Time savings were calculated using a standardized benchmark. As previously noted, there were no statistically significant differences in mean age, gender and mean weighted daily acuity; or for pediatric index of mortality 2, pediatric index of mortality 2 rate of mortality, pediatric risk of mortality 3 probability of death, and pediatric risk of mortality 3 scores.[1] **Results:** In Group 2, there were decreases of 24.1% in time spent performing β-Agonist interventions (net savings of 250 hours), 6.3% for airway clearance interventions (net savings of 167 hours), and 9.8% days of ventilation (net savings of 348 hours). During the 6 month post intervention time, a total of 764 hours in therapist time was saved. This resulted in salary savings of $24,000. Also noted was a 23% decrease in β-agonist charges, a 7% decrease in airway clearance charges, and an 11% decrease in ventilator charges for the patient. This resulted in a total savings in patient charges of $284,355. In Group 2, LOS decreased to 7.4 days from 8.3 days in Group 1 for a net decrease of 11%. This equated to a savings of $314,844 for an ICU room daily charge compared to a non-ICU room daily charge. **Conclusion:** In our institution, implementation of a therapist-driven β-A/AC protocol resulted in a reduction in therapist time of 764.3 hours (0.7 full time equivalent). A total of $599,199 was saved in patient charges. This provides further evidence in the value of promoting and implementing therapist-driven protocols.

Sponsored Research - None

2753334

Implementation of a High-Flow Nasal Cannula Algorithm in Infants Admitted With Bronchiolitis.

Gary R. Lowe[1], Tammy Arick[1], Randy Willis[1], Ariel Berlinski[1,2]; [1]Respiratory Care Services, Arkansas Children's Hospital, Little Rock, AR; [2]Dept. of Pediatrics, Section of Pulmonary Medicine, University of Arkansas for Medical Sciences, Little Rock, AR

Background: Oxygen administration by high flow nasal cannula (HFNC) is widely used at our institution to treat hypoxemia outside the Intensive Care Unit. A new algorithm was developed, and instituted to provide greater consistency in the use of HFNC. The old algorithm had loose weaning instructions and did not include specific regular nasal cannula (NC). The algorithm consisted of five specific phases: initiation, stabilization, weaning HFNC support, transition to regular nasal cannula, and weaning to room air. A retrospective review was performed as part of a quality improvement initiative to determine the algorithm's impact on several variables. **Methods:** This study was not deemed human subject research by the local IRB. Data were collected from 11/01/2016 to 01/31/2017on all subjects without comorbidities (1 – 20 month old) hospitalized with the diagnosis of bronchiolitis and receiving HFNC. Subjects were excluded if directly admitted to an intensive care unit. A total of 141 subjects were included, with 43 using the old algorithm (OLD) and 98 subjects using the new algorithm (NEW). **Results:** Results are expressed as medians. No significant differences in age (0.45y vs 0.46y), gender (58% vs 56% male), or weight (7.6 kg vs 7.5 kg) between OLD and NEW were noted (p = 0.82, 0.86, and 0.89; respectively). Also, no significant differences in maximal flows (6 vs 6 L/min), escalation of care episodes (2 vs 9), or medical emergency team calls (10 vs 14) were noted (p = 0.51, 0.50, and 0.34, respectively). Subjects on the NEW algorithm spent 41.8 hours on HFNC, 13.6 hours on regular NC and total oxygen time of 59.3 hours. Subjects on the OLD algorithm spent 48.3 hours on HFNC, 17.6 hours on regular NC and total oxygen time of 67.8 hours (p = 0.38, **0.03**, and 0.10; respectively). Length of stay was 84.8, and 87.7 for the NEW and OLD group respectively h, (p = 0.15). **Conclusion:** The use of a NEW algorithm resulted in a shorter time on regular NC. Although other outcomes also improved, the changes did not reach statistical significance. We plan to evaluate 2017-2018 bronchiolitis season to increase our sample size.

Sponsored Research - None

2754238

Creative Approaches to Improving Provider Compliance of Clinical Care Guidelines.

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

Background: Clinical care guidelines (CCGs) provide evidence-based disease management with better patient outcomes at a lower cost. Clinical care guidelines alone have been found to have a limited effect on changing provider behavior. Many of the barriers associated with provider compliance are related to awareness, familiarity, agreement, self-efficiency, and outcome expectancy. The focus of this project was to increase aligning care with our institution's revised guidelines. **Methods**: In December of 2015 our institution modified the bronchiolitis CCG to better align with the American Academy of Pediatrics 2014 recommendations. A multidisciplinary team formed to brainstorm interventions for disseminating the changes. Intentional marketing strategies were developed, including a catchy slogan to focus on desired practice changes. Health care providers were asked to sign an agreement stating they would practice within the guideline. A near real-time dashboard was developed to provide trends in therapies, diagnostic testing, and length of stay (LOS) for each of the various patient care areas. Each of the unit key stakeholders were encouraged to review the dashboard to track trends, outcomes, and share progress with their teams. **Results**: A retrospective review was completed of patients aged 1 to 24 months who were admitted between December - April with a primary or secondary diagnosis of bronchiolitis. Patients who were admitted to an intensive care unit were excluded from the cohort. The baseline period included data from December 1, 2013 through April 30, 2015 and the post intervention period was from December 1, 2015 through April 25, 2017. In post intervention 65% of providers and 50% of nurses/respiratory therapists signed the agreement. Bronchodilator utilization decreased from 19% to 10%, chest x-ray from 24% to 14% and respiratory viral panel from 13% to 9%. The balancing measures used were LOS, admitted patients requiring intensive care services, and patients with a recidivism for bronchiolitis within 7 days. There was no significant change in any of the balancing measures. **Conclusion:** Successful implementation of clinical care guidelines can be achieved through alignment with a national organization's recommendations; a comprehensive marketing strategy with a catchy slogan to increase awareness; a dashboard to track near real-time outcome metrics; and an agreement asking health care providers to commit to an identified standard of best practice.

Sponsored Research - None

2755263

Impact of Driving Pressures in Conventional Mechanical Ventilation in Pediatric ARDS.

Herng Lee Tan, Judith Ju-Ming Wong, Yi-Jyun Ma, Tsee Foong Loh, Jan Hau Lee; Pediatric Subspecialties, KK Women's and Children's Hospital, Singapore, Singapore

Background: Mechanical ventilation (MV) strategies that use lower driving pressures (ΔP) can improve survival in patients with ARDS. There are limited data in this area in pediatric ARDS. We hypothesize that pediatric ARDS patients exposed to higher ΔP in the first 7 days of ARDS have lower survival. Methods: After local IRB approval, we conducted a retrospective study of children admitted to the pediatric intensive care unit (PICU) with ARDS as defined by the Pediatric Acute Lung Injury Consensus Conference criteria. MV data for the first 7 days of ARDS were collected and analyzed. ΔP was defined as PIP-PEEP for patients on conventional MV (PC-IMV and VC-IMV) for that day. Categorical data were presented as counts (percentages) and compared using Chi-square tests. Continuous data were presented as medians (interquartile ranges) and compared using Mann-Whitney U tests. Our primary outcome was PICU mortality. Logistic regression, adjusting for oxygenation index (OI) and cumulative number of conventional MV days in the first 7 days of ADRS was conducted to investigate the impact of ΔP on mortality. Results: We identified a total of 111 children with ARDS who required MV from 2010 to 2014. Median age of included patients was 41.6 months (11.2, 117.1). The most common precipitating factor for ARDS was respiratory [78 (70.0%)]. Median OI and OSI on day 1 was 13.6 (8.8, 19.3) and 11.5 (8.2, 16.2) respectively. Median duration of MV and PICU length of stay was 8.0 days (3.3, 20.3) and 9.0 days (4.3, 21.0) respectively. On day 1, modes of MV were PC-IMV 62/111 (55.8%), VC-IMV 2/111 (1.8%), APRV 37/111 (33.3%), and HFOV 1/111 (< 0.1%). In the first 7 days, there was a total of 227/694 (32.7%) conventional MV days. Overall median ΔP was 15.0 (11.0, 17.0) cm H_2O. Median ΔP of non-survivors were higher compared to survivors [15.0 (12.5, 17.5) vs. 13.0 (10.0, 16.3); p=0.047]. However, in multivariate analysis, ΔP was not associated with mortality (Table 1). Conclusions: ΔP in the first 7 days of ARDS was not associated with mortality in children with ARDS.

Sponsored Research - None

Table 1. Multivariate logistic regression analysis

	Unadjusted analysis			Adjusted analysis*		
	OR	95%CI	P value	aOR	95%CI	P value
ΔP	1.16	1.01, 1.31	0.030	1.09	0.95, 1.26	0.212
Cumulative MV days	0.79	0.66, 0.95	0.014	0.86	0.66, 1.11	0.242
OI	1.06	1.01, 1.12	0.015	1.07	1.00, 1.14	0.047

*Adjusted for OI and cumulative number of MV days
OR: odds ratio; CI: confidence interval; aOR: adjusted OR

2757790

Consistency of Tidal Volume Delivery for Pediatric Patients Using the Astral 150 Ventilator.

Nancy Johnson, Kathleen Deakins; Peds Respiratory, UHHS RBC Case, Medina, OH

Background: Transitioning infants and children to portable ventilators is occuring earlier in the course of care. The Astral Ventilator provides ventilatory support for neonates and pediatric patients of all sizes. Accurate tidal volumes are required to stabilize ventilation, especially in smaller patients. The purpose of this study is to determine if ventilator and flow sensor-measured tidal volumes provides accurate estimation of tidal volume delivery in pediatric patients. **Methods:** An Air*Life* (CareFusion, Yorba Linda, CA) isothermal dual limb 1.7 m breathing circuit was connected to the Astral 150 ventilator (ResMed, San Diego CA). The "learn circuit" calibration was completed and the circuit was connected to a BC Biomedical, LS-20001 Infant Lung Simulator with a set lung compliance of 5 ml/cm H_2O and a resistance of 5L/sec at settings: VC-SIMV, frequency 20 bpm, Ti 0.6 seconds, PS 7, Rise 200, Square Flow and FiO_2 21%, Tidal Volumes 50, 100, 150 and 200 ml. Expired tidal volumes were recorded from display on the ventilator and the NICO™ respiratory mechanics monitor's pediatric flow sensor (placed proximal to the patient wye), at one minute intervals for 10 minutes at each Vt setting. Distal and proximal exhaled tidal volumes were compared using a paired t-test with a statistical significance set at p=0.001 **Results:** Tidal volumes measured with a proximal flow sensor were higher than those measured at the ventilator. However, there was no statistically significant difference between proximal or distal exhaled tidal volumes in three of the pediatric ventilator volume settings. Mean values and standard deviations for proximal and distal settings are shown in the table. **Conclusion:** Distal measurement of tidal volumes on the Astral 150 ventilator provides adequate estimation of most delivered tidal volumes in pediatric patients. Because the ventilator-displayed tidal volume is accurate, external proximal flow sensor is not necessary for precise estimation of tidal volumes in smaller patients.

Sponsored Research - None

Proximal and Distral Mean Values and Standard Deviations

	Mean Vt ml/kh (Standard Deviation)	P value
50 ml	42.5 (6.56)	0.3440
100 ml	87 (8.49)	0.2952
150 ml	135.5 (0.71)	0.0219
200 ml	179.5 (10.61)	0.0782

2758058

A Pediatric Bench Analysis: Flow Output From a Portable Acute Care Ventilator to a RAM Cannula.

Katlyn Burr[1], Angela Stump[1], Thomas Blackson[4], Joseph Ciarlo[4], Lori Boylan[4], James Hertzog[2,3]; [1]Respiratory Care, Nemours, Newark, DE; [2]Division of Pediatric Critical Care Medicine, Nemours, Wilmington, DE; [3]Thomas Jefferson University, Philadelphia, PA; [4]Respiratory Care Education, Christiana Care Health System, Newark, DE

Background: High Flow Nasal Cannula (HFNC) and Nasal Continuous Positive Airway Pressure (nCPAP) are frequently used modalities of support for the hospitalized neonatal population. 73% of infants in Neonatal Intensive Care Units (NICUs) are placed on HFNC[1]. The mean total hospital length of stay for technology-dependent versus nontechnology-dependent neonates is 108.6 and 25.7 days[2]. Use of HFNC in the home setting is challenging and not compatible with activities of daily living. The Trilogy 202© ventilator in conjunction with a RAM Cannula® (RC) has been used to address these challenges. Flow is generated via set CPAP levels but flow output using this technique has not been studied. **Purpose:** To evaluate the inter-relationships among set CPAP level, delivered flows, and RC size. **Method:** A Trilogy ventilator (V), (Phillips) was used to generate CPAP levels of 4 through 8 cm H2O, adjusted in 1 cm H_2O increments, to (7) sizes of RC (micro–large) to determine the effect of CPAP setting and cannula size on flow generation through each cannula. Flow measurement was made using a CO2SMO monitor (Novametrix) placed between the V and the RC cannula with and without the Respironics Whisper Swivel valve (WS). The average of 100 data collection points was used for analysis for each line item. **Results:** For RC sizes micro – infant, the flow delivered was reduced ≥ 60% from the control. For RC sizes small – large, the flow delivered was reduced ≥ 20% from the control. The reduction in flow was increased with the addition of a WS in the circuit. **Conclusions:** There is a significant reduction in flow output from the V at every level of CPAP when the RC is connected, p< 0.05. The orifice resistance created by the RC maintains pressure levels ±1cm H_2O without the WS and ± 2.5 cm H_2O with the WS inserted. There is a direct relationship between flow generated and RC size at each CPAP setting. Further studies should be done related to this support modality to ensure its efficacy and safety. **References:** 1. Mcqueen, M., Rojas, J., Sun, SC., et al "Safety and Long Term Outcomes with High Flow Nasal Cannula Therapy in Neonatology: A Large Retrospective Cohort Study." *Journal of Pulmonary & Respiratory Medicine* 04.06 (2014): 10.4172/2161-105X.1000216 2. Toly, Boebel, V., Musil, C., Bieda, A., Barnett, K., Dowling, A., and Sattar, A. "Neonates and Infants Discharged Home Dependent on Medical Technology." *Advances in Neonatal Care* 16.5 (2016): 379-89. 10.1097/ANC.0000000000000314

Sponsored Research - None

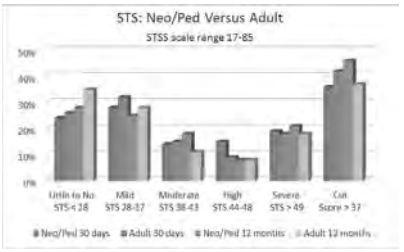
2758077

Does Working With Children Create More Secondary Traumtic Stress For Respiratory Therapists?

Katlyn Burr[1], Paul O'Brien[1], Joel M. Brown II[1], James Hertzog[2,3]; [1]Respiratory Care, Nemours, Newark, DE; [2]Division of Pediatric Critical Care Medicine, Nemours, Wilmington, DE; [3]Thomas Jefferson University, Philadelphia, PA

Background: Secondary traumatic stress (STS) has been studied in various populations. Unlike other health professions, Respiratory Therapists (RTs) work a variety of patient care populations on a daily basis. Often these environments are conducive to stress. The prevalence of stress within the field of Respiratory Care has been studied minimally even though RTs are exposed to traumatic events. The Secondary Traumatic Stress Scale (STSS) is a 17-item instrument designed to measure intrusion, avoidance, and arousal symptoms associated with indirect exposure to traumatic events via one's professional relationships with traumatized clients[1].We evaluated the prevalence of secondary stress related to the workplace of RTs and compared neonatal and pediatric workers to their adult care counterparts. **Method:** The STSS and a series of demographic questions were placed in an IRB approved survey tool. The survey was also approved by the AARC for list serve submission. The study was placed on the following AARC Connect Specialty sections for voluntary enrollment: Management, Long-term Care, Adult and Neonatal-Pediatric. The survey was open for 32 days. Individual results were analyzed based on a sliding scale and cut score to indicate STS prevalence. **Results:** 201 survey responses were received, 67 (33.3%) from neontal/pediatric RTs and 134 (66.6%) from adult care RTs. For self-reported STS questions in the last 30 days more adult care respondents had none to moderate STS, while neonatal/pediatric respondents had more high to severe STS. For self-reported STS questions in the last 12 months more adult care respondents had none to mild STS, while neonatal/pediatric respondents had more moderate to severe STS symptoms. Using a cut score (STS > 37), stress was more prevalent overall for adult caregivers at 30 days but was more prevalent neonatal/pediatric providers at 12 months. **Conclusion:** There is a clear difference in the prevalence of STS in the adult versus neonatal/pediatric care environments. Adult care providers have higher STS scores within 30 days while those providing care in the neonatal and pediatric population experience higher STS scores within the last 12 months. Based on the results of this survey, further studies must be performed to identify root cause of STS in each patient care environment. **References:** 1. Bride, B.E., et al. (2004). Development and validation of the Secondary Traumatic Stress Scale. *Research on Social Work Practice, 14,* 27-35.

Sponsored Research - None



This graph shows the scored results from the STSS questionare and compares the responses (n=201) based on work environment (neonatal/pediatirc versus adult care).

2758084

Reduction of Chronic Lung Disease Rates With the Implementation of Bubble CPAP in the NICU: A 10 Year Comparison Study.

Kevin Johnson, James Kluzak, Tricia Miller, Jeanne Li, Steven Barkley; Santa Barbara Cottage Children's Medical Center, Santa Barbara, CA

Background: Bubble continuous positive airway pressure (bCPAP) administration in preterm infants has shown to be an effective therapy for the reduced incidence of chronic lung disease (CLD) internationally. For this study, CLD was defined as a patient who requires oxygen at postmenstrual age (PMA) of 36 weeks. **Method:** The study population comprised of infants with birth weights between 401 to 1500 grams or 22 to 31 weeks of gestation, all of whom were born at Santa Barbara Cottage Children's Medical Center's NICU and were discharged to home or foster care. Comparisons were made based on data that was collected 5 years pre implementation of bCPAP (November 1, 2006 – October 31, 2011) and 5 years post implementation of bCPAP (November 1, 2011 – October 31, 2016). Data compiled by the California Perinatal Quality Care Collaborative (CPQCC) is also compared from 135 NICU's in the state of California, and the incidence of CLD during this 10 year period. **Results:** Results from this study (table 1) show an 18.12 % incidence rate of CLD pre bCPAP implementation. After the implementation of bCPAP rates of CLD decreased to 5.56%. A Chi square test revealed a significant reduction in the rates of CLD pre bCPAP compared to post bCPAP implementation at our facility (p = 0.01102). CPQCC data revealed a marked improvement in CLD outcomes from the fourth quartile to the first. **Conclusions:** Since the implementation of bCPAP there have been significant decreases in the incidence of CLD at our facility. These outcomes may be due to avoiding intubation, early bCPAP implementation, frequent and close monitoring of the patient on bCPAP, and an extraordinary team of dedicated health care professionals.

Sponsored Research - None

Comparing the incidence rates of CLD pre and post bCPAP implementation

	pre bCPAP	post bCPAP	p value	test
number of patients	138	90		
CLD	25 (18.12%)	5 (5.56%)	0.01102	chi-square test

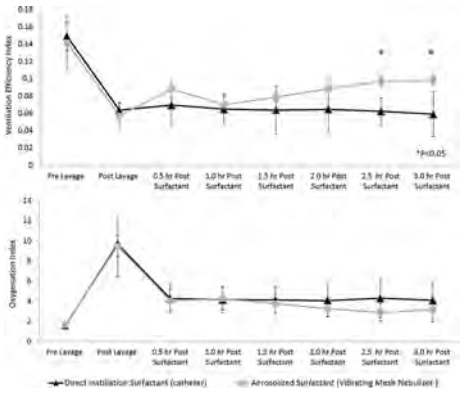
2758124

Physiologic Effects of Aerosolized Surfactant Using a Breath-Synchronized Mesh Nebulizer in Surfactant-Deficient Rabbits.

Rob DiBlasi[2], Kellie Micheletti[1], Maia Chan[1], Joseph Zimmerman[2], Colin Telfer[3], Jim Fink[3]; [1]Developmental Therapeutics, seattlechildrens.org, Seattle, WA; [2]Respiratory Therapy, Seattle Childrens Hospital, Seattle, WA; [3]Aerogen Pharma, San Mateo, CA

BACKGROUND: Surfactant replacement incorporates liquid bolus instillation via endotracheal tube (ETT) or catheter that may result in clinical deterioration. Aerosolized surfactant delivery has generated conflicting data related to efficacy, attributed to the nebulizer, particle size, breath synchronization and surfactant used. We hypothesized similar effects with instillation and aerosolization with a novel breath-actuated vibrating mesh nebulizer (VMN). **METHODS**: New Zealand rabbits (1.55 ± 0.19 kg) were sedated, anesthetized, intubated, with saline lavage washout to PaO_2<75 torr on FiO_2 0.5, on assist-control volume guarantee ventilation. Subjects were randomized to receive 108 mg/kg bovine surfactant with instillation via ETT (n=5) or aerosol with a breath-synchronized VMN (Aerogen Pharma, San Mateo, US) (n=5). Gas exchange and ventilation parameters were recorded every 30 minutes for 3 h post administration. Unpaired T-test was used to compare (mean±SD) differences in physiologic outcomes at each interval; P<0.05 was significant. **RESULTS:** Oxygenation index (OI) (P=0.91) and ventilation efficiency index (VEI [3800/PIP*rate*$PaCO_2$]) were similar post-washout (P=0.48) and post-administration for 2h (Figure). Bradycardia with/out hypotension was observed during 3/5 instillations (60%) but not with aerosol. OI, dynamic compliance, pH, $PaCO_2$, PaO_2, RR, HR and BP were similar between groups at each 30 min interval. PIP was lower (22±0.89 vs 25±1.11; P=0.02) at 3 h and VEI was higher at 2.5 h (P=0.009) and 3 h (P=0.035)(Figure) with aerosol. **DISCUSSION/CONCLUSION:** Our study is the first to show similar physiologic effects with identical surfactant doses between aerosol and direct instillation, with less hemodynamic compromise with aerosol. Breath-synchronized VMN has potential as a safe, effective and economical alternative to instillation.

Sponsored Research - This research was funded by Aerogen Pharma



2758229

Comparison of End-Tidal and Arterial CO_2 in Preterm Infants Receiving Surfactant Therapy.

Hsin-Ju Lin[1,2], Ching-Tzu Huang[1,2], Hsiu-Feng Hsiao[1], Ming-Chou Chiang[3,4], Mei-Jy Jeng[2,5]; [1]Respiratory Therapy, Chang Gung Memorial Hospital, Taoyuan, Taiwan; [2]Institute of Emergency and Critical Care Medicine, National Yang-Ming University, Taipei, Taiwan; [3]Division of Neonatology, Department of Pediatrics, Chang Gung Memorial Hospital, Taoyuan, Taiwan; [4]Chang Gung University College of Medicine, Taoyuan, Taiwan; [5]Department of Pediatrics, Children's Medical Center, Taipei Veterans General Hospital, Taipei, Taiwan

Background: Noninvasive and accurate monitoring arterial carbon dioxide ($PaCO_2$) is important for very low birth weight (VLBW, <1500 gm) infants. There were conflict data regarding the use of end-tidal carbon dioxide ($PetCO_2$) measurement in VLBW infants. The aim of this study was to evaluate the effect of different dead space to tidal volume ratio on the correlation between $PetCO_2$ and $PaCO_2$ in ventilated preterm infants with respiratory distress syndrome (RDS). **Methods:** This single center, prospective, nonrandomized, consecutive enrollment study was approved by the Institutional Review Board of Chang Gung Memorial Hospital (CGMH), Taiwan. During the period between May 2013 and December 2014, preterm infants with RDS and treated with surfactant were enrolled. Simultaneous $PetCO_2$ and $PaCO_2$ pairs were obtained from ventilated neonates who were monitored by mainstream capnography. **Results:** A sum of 102 $PetCO_2$ and $PaCO_2$ pairs from 34 neonates was analyzed. There was a moderate correlation (r =0.613; P < 0.01) between $PetCO_2$ and $PaCO_2$ values. The difference between $PaCO_2$ and $PetCO_2$ was 6.3 mmHg for VLBW group, 5.6 mmHg for non-VLBW group. The correlation was better in the post-surfactant treatment group (r = 0.7; P<0.01), compared to the pre-surfactant treatment group (r = 0.39). The sub-analysis of $PaCO_2$ (mmHg) and $PetCO_2$ (mmHg) data by using dead space to tidal volume ratio (V_D/V_T) were 38.3 and 33.9 respectively when the V_D/V_T was less than 30%, and were 44 and 31 respectively when V_D/V_T was greater than 30%. Differences between $PaCO_2$ and $PetCO_2$ were 4.4±5 (mean ± SD) when V_D/V_T was <30% versus 12.7±7.7 when V_D/V_T was >30%. The correlation coefficient was 0.063 when the V_D/V_T >30% and was 0.853 when V_D/V_T was < 30 % (P<0.01). **Conclusions:** In preterm infants with RDS and having lower dead space to tidal volume ratio or after surfactant treatment, $PetCO_2$ can be useful for continuous and accurate monitoring $PaCO_2$ levels.

Sponsored Research - CMRPG3D1021; from Chang Gung Memorial Hospital

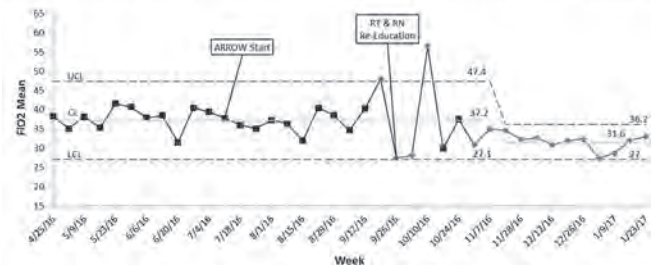
2758276

Avoid Risk Remember Oxygen Wean: A Quality Improvement Project to Wean Oxygen in Mechanically Ventilated Pediatric Patients.

Lee D. Murphy[1], Natalie Szczypiorski[1], Acrista J. Hole[2], Courtney M. Rowan[1], Samer Abu-Sultaneh[1]; [1]Section of Pediatric Critical Care Medicine, Department of Pediatrics, Indiana University School of Medicine and Riley Hospital for Children at Indiana University Health, Indianapolis, IN; [2]Section of Respiratory Care, Riley Hospital for Children at Indiana University Health, Indianapolis, IN

Introduction Hyperoxemia has detrimental effects including oxidative stress leading to tissue damage, decreased cerebral perfusion pressure, and pulmonary over-circulation in patients with congenital heart disease. Additionally, recent consensus guidelines incorporate the use of oxygen saturation index (OSI) for the diagnosis of pediatric acute respiratory distress syndrome. However, OSI is only valid if the oxygen saturation (SpO_2) is ≤ 97%. In the Pediatric ICU (PICU), patients are often treated with supplemental oxygen despite SpO_2 > 97%. The aim of this quality improvement project is to wean the fraction of inspired oxygen (FiO_2) down to a maximum of 0.3 if SpO_2 is > 97%. We hypothesized that implementation of an interprofessional team quality initiative will decrease the use of high FiO_2 when the SpO_2 is > 97%. **Methods** We conducted project ARROW (Avoid Risk Remember Oxygen Wean) for all mechanically ventilated patients in our PICU starting July 2016. This quality improvement project was exempted by the IRB. Interprofessional team members (nurses, respiratory therapists, and physicians) were asked to wean FiO_2 to a maximum of 0.3 if SpO_2 > 97%. Team education included a power point presentation and fliers conveying the danger of hyperoxemia. Down-facing arrows with the reminder to wean FiO_2 were placed on every room monitor. Prior to implementing ARROW, 3 months of baseline data was collected. FiO_2 and SpO_2 were randomly collected twice weekly for every patient on invasive mechanical ventilation. This data collection continued after implementation of ARROW in July. Baseline data was compared to data after starting project ARROW. QI Macro program was used to generate control charts of protocol compliance and the ventilator variables. **Results** Between April 2016 and January 2017, we obtained 595 ventilator data points. The protocol compliance was 73% at the beginning of the project and improved to 86% after nursing and respiratory therapist re-education. After project implementation the mean FiO_2 decreased from 0.37 to 0.32 (Fig 1) and the percentage of patients with SpO_2 of 100% decreased from 56% to 29%. **Conclusion** An interprofessional quality improvement project can lead to a decrease in the fraction of inspired oxygen in mechanically ventilated pediatric patients. **Disclosures** The authors have no disclosures. Sponsored Research - None

Figure 1: Control chart for mean fraction of oxygen (FiO2) used for ventilated patients



2746800

Identification of Trends in the Communication of Prescriber Orders Associated With Mechanical Ventilation.

Peter Betit, Kevin Bullock, Barry Grenier, Brian K. Walsh; Respiratory Care, Boston Children's Hospital, Boston, MA

Background: Regulatory agencies have established standards regarding prescriber orders for medications and other therapies, but there is limited information regarding orders for mechanical ventilation (MV). We sought to understand the elements associated with an order for MV, how the order is conveyed to a respiratory therapist (RT), and how aspects of MV management are executed. Methods: A survey of the quality and safety of MV was developed and distributed to RTs. One survey domain was related to the composition and communication of prescriber orders for MV, and also elements of safety, quality, and alarm management. Results: There were 327 RTs, mainly from urban (55%) non-profit hospitals (59%), that responded to the survey of which 258(79%) completed the domain focused on MV orders. 66% of the respondents indicated that some form of protocols and orders are entered for initiating and modifying MV (Table 1). The communication of orders was mainly by page, phone, or other verbal communication (56%), followed by alerts from the EMR routed to a RT's phone or other device (18%). The frequency of checking orders was predominantly with each MV safety check (56%), with remaining responses of 22%, 12%, and 10% for frequencies of once, twice, and three times per shift respectively. The majority of respondents indicated that prescriber orders were not required for MV alarms or extubation. There was an equal split of responses regarding who is allowed to make ordered MV changes; RTs only or RT only, but single parameters (e.g. F_IO_2) by RN. Equally, participants indicated that MV goals and intended changes would be more efficiently communicated with protocols or guidelines or by allowing trained and competent RTs to determine goals and execute a strategy. Conclusions: These survey results indicate that orders for MV consist of a combination of protocols and individually prescribed settings, which are then verbally or electronically communicated to RTs, and periodically reviewed. The results provide some insight into MV orders and suggest a universal approach is lacking. There is language in state and national regulations that support the use of clinical practice guidelines in improving care, and these survey results seem to reinforce that model. Surveys of this nature may assist in the development of standards and help build consensus amongst stakeholders.
Sponsored Research - None

Table 1. Responses to survey question, How is initiation, changes, or modifications for MV ordered in your ICU?

Responders N (%)	Option
125 (48%)	A mixture of protocol and individual orders.
75 (29%)	Each change in settings ordered.
24 (9%)	Protocol w/goals ordered; all requirements to execute & achieve established goals.
24 (9%)	Goals ordered; adjustments left to the discretion of RT.
12 (5%)	Protocol ordered; includes all required information for execution.

2754375

Efficacy of PEP Devices in Self-Management In Patients With COPD.

Kun Ta Lee[1,3], Ya Fan Liu[4], Chien Ling Su[1,2], Wen Te Liu[1,2], Kang yun Lee[1,3], Ling Ling Chiang[2]; [1]Chest Medicine, Taipei Medical University- Shuang Ho Hospital, New Taipei City, Taiwan; [2]School of Respiratory Therapy, Taipei Medical University, Taipei, Taiwan; [3]College of Medicine, Taipei Medical University, Taipei, Taiwan; [4]Parochial Chunghsing hospital, New Taipei City, Taiwan

Background: Chronic Obstructive Pulmonary Disease (COPD), is a preventive and reversible disease, characterized by airflow limitation and progressive airway and systemic inflammation. Treatment on stable COPD includes pulmonary rehabilitation, purse-lip breathing, and pharmacologic therapy, but there are limitations on performance of dyspnea reduction. The study is aimed to determine the efficacy of application of Positive Expiratory Pressure (PEP) and Oscillating Positive Expiratory Pressure (OPEP) on Quality of Life (QoL), degree of dyspnea and exercise tolerance compare with pulmonary rehabilitation. **Methods:** This is a prospective, randomized control trial study. Twenty-four COPD patients were recruited and devided into three groups after received eight-week pulmonary rehabilitation(PR). Control group continued PR for the following 8 weeks; Participants in PEP group use PEP if dyspnea in a daily 20-min walking for following 8 weeks; Subjects in OPEP receive the same PEP therapy and received OPEP therapy in daily bronchial hygiene f for following 8 weeks. The modified Medical Respiration Council (mMRC), COPD assessment test (CAT), StGeorge's Respiratory Questionnaire (SGRQ) and Six-Minute Walking Test(6MWT) were measured at baseline, 8 weeks and 16weeks. Home diary was record to monitor compliance. **Results:** There were no significant difference between-group during study period for SGRQ, CAT and pre-6MWT borg scale, but SGRQ-symptom(46.6±17.1 v.s. 19.8±16.4, p=0.011), and impact(34.1±24.2 v.s. 21.0±14.8, p=0.055) related to PR were statistically significant difference among PEP group, and SGRQ-symptom(41.2±17.3 v.s. 28.7±13.9, p=0.027), and total score(36.3±18.1 v.s. 30.3±18.5, p=0.036) related to PR were statistically significant difference among OPEP group(Figure 1). Differences in mean PR to OPEP treatment changes in SGRQ-symptom is statistically significant difference between usual sputum producer or not in OPEP group. **Conclusions:** We found no enough evidence to prove the efficacy of PEP and OPEP therapy in stable COPD related to pulmonary rehabilitation. Further studies will be applied to investigate PEP devices performance and may extrapolate to COPD patient with significant symptoms.
Sponsored Research - None

2754937

Standardization of Multidisciplinary MICU Rounds: An RT Perspective.

Carla Wollens[1], Prabalina Rajendram[2], Heather Torbic[3], Robert Chatburn[1]; [1]Respiratory Therapy, Cleveland Clinic, Cleveland, OH; [2]Respiratory Institute, Cleveland Clinic, Cleveland, OH; [3]Cleveland Clinic, Cleveland, OH

BACKGROUND: Daily rounding in the MICU is inefficient. There is inconsistent presence of multidisciplinary team members and poor use of caregiver time. A team consisting of MD's, RN's, PA's, PharmD and RT were involved in a quality improvement project with the aim of improving efficiency by increasing the team member presence for all patients in MICU AM rounds. Expected benefits were improved caregiver communication, better team member satisfaction, higher overall quality scores and more clarity of caregivers' roles in the daily rounding allowing each caregiver to practice to the full capacity of their licensure. **METHODS:** Volunteer RN, RT, PharmD, NP/PA, resident, fellow and staff were surveyed. Surveys were modified by discipline and targeted issues: perceived length of rounds, role clarity, satisfaction with rounds, perceived importance of participation in rounds, and attendance obstacles. An intervention was designed to make sure an RT was at bedside for any patient on a ventilator, high flow oxygen or non-invasive ventilation. A secret observer recorded daily the number of patients seen during rounds and the team members present (2 weeks pre-intervention and 2 weeks post-intervention). **RESULTS:** Survey results for RT were as follows: perceived length of rounds averaged about 3 hrs; agree role defined adequately = 73%; usually satisfied with rounds = 50%; agree RT presence at rounds is important = 77%. Reasons for not attending rounds included routine care of patients, a clinical change in another patient, rounds too long and need to transport a patient. Pre-intervention, RT's were present for 14% of the patients in rounds, and post-intervention they were present for 22.5% of the patients. **DISCUSSION:** This study indicates that calling attention to the rounds process improves engagement and attendance for RTs. Presence at rounds is now expected, and to sustain the gains, staffing now includes a clinical specialist to facilitate rounding and ensure that an RT is present during rounds.
Sponsored Research - None

2756269

Using the DMAIC Process to Improve Prone Ventilation Practices for the Treatment of Refractory Hypoxemia.

Doug Shook[1], Matthew Exline[2]; [1]Respiratory Therapy, The Ohio State University Wexner Medical Center, Columbus, OH; [2]Division of Pulmonary Diseases, The Ohio State University Wexner Medical Center, Columbus, OH

Background: Our institution uses a refractory hypoxemia (RH) guideline to steer decisions for intensive care unit (ICU) patients on mechanical ventilation. Guideline treatment options include repositioning the patient to a prone position and using an inhaled pulmonary vasodilator. Evidence-based guideline care states that when PF ratio < 200 mmHg for 12hours the patient should be placed in the prone position within 24 hours. This practice is estimated to lower mortality rate to 16%. The purpose of the study was to examine guideline adherence and explore methods to improve adherence with the positive benefit of decreasing mortality. **Method:** The scope of this project was concentrated in 3 medical intensive care units; with a total of 48 beds and over 400 team members participating. Baseline data from chart reviews of patient care from 8/1/15-10/30/15 reflected adherence to (RH) guidelines 8% of the time. Baseline analysis also revealed a 58% mortality rate for RH patients who received inhaled epoprostenol in the ICU. Following the DMAIC (Define, Measure, Analyze, Improve, Control) roadmap, descriptive statistics were used to analyze current data, identify improvements in our process, and a detailed root cause analysis was used to identify countermeasures. One root cause was determined to be a deficit in education of staff. A comprehensive staff survey was used to determine the educational needs of staff in order to target specific educational efforts. Re-evaluation of data occurred following the implementation of countermeasures from 4/1/16-9/30/16. **Results:** Following implementation of countermeasures, guideline compliance improved from 8% to 79%. A t-test revealed a statistically significant difference in pre and post-project compliance (p<0.0001). There was no statistically significant improvement in mortality rate during the data collection period. **Conclusions:** Using a formalized process like DMAIC for conducting process improvement is a useful tool to understand current conditions, identify root causes, and propose solutions. We were successfully able to make a significant improvement in our early recognition and treatment of (RH) patients utilizing prone ventilation, mortality rate was unchanged. Engaging staff with any process improvement initiative is the key to success and involving the right champion to oversee a large scale improvement project is essential. Organizational culture change is a considerable hurdle, but is possible.
Disclosures: None
Sponsored Research - None

2756660

How Exposed Are We? A Pilot Study to Determine Level of Radiation Exposure Among Neonatal Intensive Care Respiratory Therapists.

Helen A. Christou[2], Terri E. Gorman[2], Keith R. Hirst[1]; [1]Newborn Respiratory, Brigham and Women's Hospital, Boston, MA; [2]Newborn Pediatric Medicine, Brigham and Women's Hospital, Boston, MA

BACKGROUND: Radiation exposure is an occupational hazard for respiratory therapist. Current radiation exposure annual limits is 5,000 millirems (mrems) for whole body and 50,000 mrems for extremities. In the NICU, respiratory therapists are exposed to radiation while they hold patients steady for radiological images. We wanted to determine to what extent the respiratory therapist in the NICU was exposed to radiation and if the radiation exposure was something that we would need to monitor going forward. We hypothesized that the NICU respiratory therapists would not have any significant increase in exposure to radiation and would not need further monitoring for radiation exposure. **METHOD:** Enrollment consisted of 14/14 (100%) full time NICU respiratory therapists who voluntarily had their radiation exposure measured over 4 months. All therapists wore a whole body dosimeter badge. Six of the therapist wore an additional ring dosimeter badge (3 night shift and 3 day shift). All therapists were instructed on basic radiation safety and when and where to place their badges on them while working. Instruction was lead by the Radiation Safety Officer. Badges were collected each month by Radiation Safety and sent for independent analysis to Landauer, Inc (Glenwood, IL). Measurements included the following: 1) Deep Dose Equivalent (DDE) - applies to external whole body exposure at a tissue depth of 1 cm (1000 mg/cm^2). 2) Lens Dose Equivalent (LDE) applies to external exposure of the lens at a tissue depth of 0.3 cm (300 mg/cm^2). 3) Shallow Dose Equivalent (SDE) applies to the external exposure of the skin or extremity at a tissue depth of 0.007 cm (7 mg/cm^2) averaged over an area 1cm. Reports came back each month. Reports listed the average control dose for the month for both body (DDE, LDE and SDE) and extremity (SDE only) and if any therapist exceeded the average control dose level. Reported exposure had to be at least 10 mrems above the control dose level for the month for it to be considered high. **RESULTS:** See table below. **CONCLUSION:** During our 4 month trial, at least within our NICU environment, any exposure that was recorded was minimal and was determined that respiratory therapists were at minimal risk of exposure from radiation from imaging. It was felt that no additional monitoring was needed at this time.

Sponsored Research - None

2756699

Impact of an Accountability System on Turnaround Times for Pulmonary Function Tests.

Amanda Richter, Cathi Wilson, Nia George; Cardiopulmonary Services, Metroplex Health System, Kempner, TX

Background: Pulmonary function test (PFT) results are an important component of appropriate patient diagnosis and treatment. Timely results are key, not only for timely patient care, but also for timely billing and coding on patient accounts. Upon review by new leadership, it was determined that the PFT resulting turnaround time was unacceptable, averaging > 2 weeks. Further investigation led to the discovery that some medical records were missing the final interpretation reports altogether. The primary causes of delays centered on process variance, inconsistency in communication, and lack of accountability. **Method:** In conjunction with the HIM department, length of time measurements was conducted from the day the test was completed to the date the final report available in the patient chart. We then applied a tracking process for ensuring that all tests were interpreted with final report in chart. We implemented a standardized workflow process, along with an accountability process, to track individual trends. We retrospectively pulled data from July-October 2016 for pre-implementation comparison. **Results**: With the new tracking and accountability process in place, we observed a turnaround time, from date completed to date final report in medical record, drop from an average of 18.48 days to an average of 5.49 days, a 70% improvement (p=0.003). Streamlining the workflow process also decreased the amount of unnecessary wasted resources and time across multiple departments. **Conclusions**: Implementation of measurement, tracking, and accountability system improves turnaround time for final PFT results. **Disclosures**: None

Sponsored Research - None

2756733

An In-House System for the Generation, Storage, and Retrieval of Paperless Competency Assurance Checklists for Respiratory Care Departments.

Robert R. Demers; Professional Education, Kaiser Permanente of SoCal, Pasadena, CA

Objectives: An on-line paperless Competency Assurance system has been previously described (http://www.respiratorycareresearchclub.com/Vol_3,_Issue_1.html) It enables users to generate competency checklists and store those paperless records on an external server maintained by a vendor (Jotform®, San Francisco, CA). Some users might be disinclined to consign those files to the internet, from whence they could possibly be intercepted by a third party. Therefore, we were prompted to design a system that generates these checklists in real-time and stores them in a secure relational database, where they can be searched and retrieved only by authorized users. **Design & Methods:** A full complement of hard-copy Competency Assurance checklists was provided to us by the Respiratory Care (RC) Department of a prominent medical center (Ronald Reagan Hospital, UCLA Medical Center, Los Angeles, CA). These records were converted into electronic templates. After the proper electronic form is selected, preceptors: 1) complete the checklist, which is date- and time-stamped under computer control; 2) enter the signature of the preceptor and Respiratory Care Practitioner (RCP); and 3) store the results, all in real-time. The browser-accessible checkists are compatible with the Windows ("PC") and Macintosh ("Mac"). This system can be operated either in-house or cloud-based, at users' discretion. **Results:** In the sixteen months preceding the initiation of the on-line system formerly described, zero of twenty-nine (0%) of the full complement of forms required of newly-hired RCPs were retrievable within the ninety-day timeframe that was imposed by the hospital's Quality Assurance Department. In the seven months following the implementation of their paperless system, six of the full complement of forms of six newly-hired RCPs (100%) to whom the system was applied was retrievable from the database within ninety days of their respective hire dates. **Conclusions:** The availability of an in-house, secure database safeguards the privacy of RCPs, prevents the unauthorized interception of files, and avoids the costs ($100 per month) incurred when using the external vendor. Because the completed competency checklists of each of a department's RCPs can be summoned to the screen of a tablet computer on demand, the system can appreciably simplify verification of RCPs' compliance when an audit by The Joint Commission occurs. Financial support: none; Conflicts of interest: none.

Sponsored Research - None

2756969

Developing the Role of a COPD Navigator Presents Respiratory Care Practitioners Multiple Opportunities for Patient Care Interventions.

Denise McKinnon, Janice J. Thalman, Neil R. MacIntyre, Tony Diez; Respiratory Care Services, Duke Health, Durham, NC

Background: Developing a COPD navigator role presents Respiratory Care Practitioners multiple opportunities for patient care interventions. Method: Duke's Respiratory Department began a pilot program for COPD patients. A clinical therapist was pulled from existing staff to begin an education and follow-up program. Prior to the pilot our COPD navigator attended educational and certification courses: Courses through Duke education included: Diversity and Inclusion; Communicating with Challenging Patients; Health Literacy and Patient Safety; Patient Safety Goals for Home Care; Patient Education Documentation and Box for Sensitive Data Collection External conferences and certifications included: A COPD Symposium, A Research Conference, AARC Smoking Cessation, AARC COPD Educator, National Asthma Educator Certification and Certification as a Tobacco Treatment Specialist. 106 hours of shadowing experiences were included with: COPD navigators from hospitals with existing programs; pulmonary attending providers; pulmonary rehabilitation programs; home care and hospice; clinical case managers and sleep medicine. The respiratory department designed a daily report that was based on patient problem lists of COPD and SOB. This resulted on average of 70 patients per day. From that report the navigator reviewed charts and using a self-select process fine-tuned this list to one in which COPD was the principal problem. A combination of this list and consults from provider orders resulted in 4 to 5 patients per day identified for further evaluation and intervention. A tally sheet was developed and data collected demonstrated multiple interventions as potential patient safety and clinical quality improvements. Results: The COPD Navigator evaluated 136 patients. Of this total the navigator intervened on medications, current tobacco use, home oxygen, home non-invasive ventilation use, STOPBang questionnaire results, pulmonary rehabilitation programs, and follow-up appointments. Conclusions: 106 patients had medication related issues with 44% not understanding the medication or procedure of delivery. 56 of the patients were still smoking. 42 had oxygen in the hospital but did not have home oxygen prescribed. 25 of them did not attend a pulmonary rehab program due to transportation issues. 16 had home non-invasive ventilators in which non-compliance was identified. A dedicated COPD navigator has multiple opportunities to influence care and improve transfer to home for COPD patients.

Sponsored Research - None

2757497

Canister Usage and Financial Outcomes With a Conversion to Common Canister MDI Delivery.

Russell A. Acevedo[1], Wendy Fascia[1], Jennifer Pedley[1], Heather Eggleston[2]; [1]Respiratory Care, Crouse Hospital, Syracuse, NY; [2]Pharmacy, Crouse Hospital, Syracuse, NY

Background: As a Performance Improvement project, Respiratory Care and Pharmacy implemented a Common Canister protocol for MDI delivery. We hoped to demonstrate improved medication delivery while decreasing drug costs and minimizing canister wastage. **Methods:** Records of all MDIs delivered during the baseline period (11/1/14 - 10/31/15) and the common canister period (10/1/16 – 3/30/17) were downloaded into a database. With that data, we calculated how many actuations were delivered and then calculated how many canisters were needed. All patients receive treatments with a spacer. In the baseline period, each patient had their own canister. Actuations per day times treatment days determined the total amount of puffs needed. This was divided by the puffs per canister, rounded up to the next integer, to determine how many canisters were needed. We compared this to how many canisters were actually used. During the common canister period, for non-isolation patients the number of puffs was calculated in a similar fashion, but since patients were receiving fractions of canisters, there was no rounding up to determine the minimal number of canisters needed. Patients on isolation had their own canisters and the number of canisters needed was calculated in the same manner as baseline. The total number of canisters needed was the sum of both groups and was compared with what was actually used. The average canister cost during baseline and common canister periods were compared. Since we were comparing actual results to estimations, no statistics were performed. **Results:** During the baseline period, for each 1 canister needed we dispensed 1.43 canisters. We averaged 1,022 canisters/month baseline and 715 canisters/month during common canister. Average monthly medication savings was $18,776, annualized $225,314. We did a focus study of Mometasone/formoterol, our most prescribed MDI, for the common canister period. Without implementing common canisters, we estimated that canisters needed would be 649. With common canisters, the minimal number of canisters was estimated at 229 (0.35 canisters/canister needed). We dispensed 341canisters (0.53 canisters/canister needed). Average monthly cost at baseline was $20,625, for common canister was $7,100. There were no infection control issues. **Conclusion:** Common canister is a very safe and cost effective way to deliver MDIs. Cost and canister wastage was markedly reduced. **Disclosures:** Acevedo:Sunovion Advisory Board, Monaghan-consultant

Sponsored Research - None

2757544

7 x 13=28 (Abbot and Costello Math): A Comparison of Productivity Rates for Mott Respiratory Care to National Benchmarks.

Renee L. Uchtorff, Ronald E. Dechert, Ken P. Bandy; Respiratory Care, C.S. Mott Children's Hospital, Ann Arbor, MI

Background At C.S. Mott Children's Hospital, productivity is currently measured by administration utilizing the relative value units (RVUs). This measurement is not used throughout the Mott Respiratory Care (Mott RC) department at the respiratory therapist or supervisor level, creating confusion regarding work assignments and productivity assessments. Examination of what is included in Mott RC's RVUs compared to the AARC's Uniform Reporting Manual (URM) will determine if current standards at Mott RC are reasonable metrics in relation to national standards that can be used consistently by all levels of Mott Respiratory Care. This will create transparency in RVU assessment and productivity among all levels in the hospital setting. **Method** The four major activity drivers of mechanical ventilation, NMTs, MDIs, and O2 and aerosol therapy were examined to determine individual tasks associated with each activity. A comparative analysis was then performed to determine any variance in time standards between Mott RC and AARC; time standards were adjusted to compensate for any discrepancy in inclusive tasks. Statistical analysis was also completed to determine if any observed differences were significant. **Results** Figure 1 displays the comparisons of each procedural RVU for each activity driver. The Mott RC data is inclusive of all tasks associated with each driver and the AARC data has been adjusted to show an equalized comparison with bundled associated tasks. This allows for an accurate RVU comparison of all tasks and responsibilities within each clinical activity between the AARC and Mott RC. Mechanical ventilation, NMT therapy, and MDI therapy all showed moderately higher time allocations at Mott RC compared to the AARC national benchmark. O2 and aerosol had a moderately lower time allocation at Mott RC compared the AARC. Further examination with statistical analysis found that all Mott RC major activity drivers showed no statistical significance from the national standard AARC benchmark. **Conclusions** The URM was an effective tool that can be used to validate the time standards of major activity drivers. This validation is necessary when attempting to demonstrate effective staffing levels and productivity measurements. Further consideration is necessary to complete a full assessment of productivity as RVUs do not account for quality, patient outcome data, or non-billable activities that are routinely performed.

Sponsored Research - None

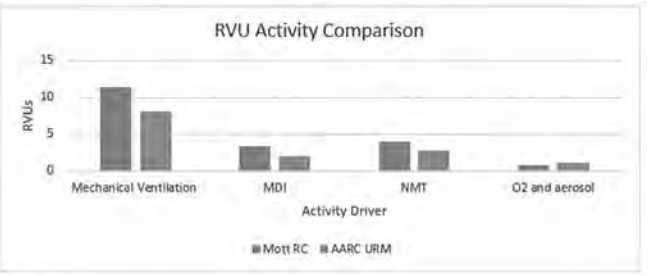


Figure 1

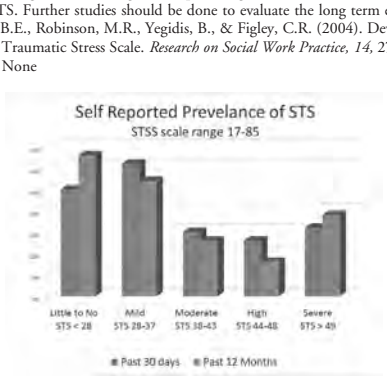
2757950

Respiratory Therapist Survey: Occupational-Induced Secondary Tramautic Stress.

Katlyn Burr[1], Paul O'Brien[1], Joel M. Brown II[1], James Hertzog[2,3]; [1]Respiratory Care, Nemours, Newark, DE; [2]Division of Pediatric Critical Care Medicine, Nemours, Wilmington, DE; [3]Thomas Jefferson University, Philadelphia, PA

Background: Secondary traumatic stress (STS) has been studied in various populations. Unlike other health professions, Respiratory Therapists (RTs) work a variety of patient care populations on a daily basis. Often these environments are conducive to stress. These situation include cardiopulmonary resuscitation, end of life care, trauma, surgery and code situations. The prevalence of stress within the field of Respiratory Care has been studied minimally even though RTs are exposed to traumatic events. The Secondary Traumatic Stress Scale (STSS) is a 17-item instrument designed to measure intrusion, avoidance, and arousal symptoms associated with indirect exposure to traumatic events via one's professional relationships with traumatized clients[1]. We evaluated the prevalence of self-reported secondary stress related to the workplace of licensed respiratory care practitioners based on survey responses to the STSS. **Method:** The STSS and a series of demographic questions were placed in an IRB approved survey tool. The survey was also approved by the AARC for list serve submission. The study was placed on the following AARC Connect Specialty sections for voluntary enrollment: Management, Long-term Care, Adult and Neonatal-Pediatric. The survey was open for 32 days. Any non-practicing or unlicensed RTs were excluded from the survey analysis. Individual results were analyzed based on a sliding scale score to indicate STS prevalence. **Results:** 201 licensed and practicing RTs ages 20-80 participated. 92% of participants worked more than 30 hours per week. 65% worked in critical care and 30% in acute care. 94% worked in hospitals and 47% of those were level 1-trauma centers. 75% worked in ICUs and 67% worked in adult care. In the past 30 days, 25% of RTs surveyed experienced little to no systems of STS, this increased to 33% for the time period of the past 12 months. 16% of RTs surveyed shows signed of STS in the severe category, this increased to 19% for the time period of the last 12 months. **Conclusion:** The risk for secondary stress among RTs is present. While the majority of RTs show no to mild signs of STS, a significant percentage of RT had results that would indicate high and severe levels of STS. Further studies should be done to evaluate the long term effect of STS for RTs. **References:** 1. Bride, B.E., Robinson, M.R., Yegidis, B., & Figley, C.R. (2004). Development and validation of the Secondary Traumatic Stress Scale. *Research on Social Work Practice, 14,* 27-35.

Sponsored Research - None



The graph above details the scored responses (n=201) using the STSS sliding scale scoring guidelines.

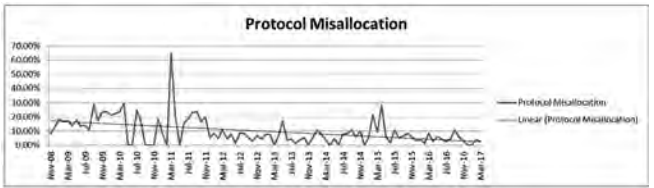
2757954

Effective Auditing System for Respiratory Therapist-Driven Protocols.

Cinthea Sparkman, Earl Fulcher, Paul Kappelman, Bret Lamb, Malinda Rush, Boaz Markewitz; Respiratory Therapy, University of Utah Health, Salt Lake City, UT

Background: The desire to ensure a safe and effective implementation of respiratory therapist (RT) driven protocols led to the development of a robust auditing system. In April 2008 the University of Utah Hospital Respiratory Therapy department developed a systematic approach to deliver RT driven protocols throughout the hospital. All orders were followed as requested for 24 hours and then specially trained RTs performed a patient assessment to develop individual care plans. Lung volume expansion and airway clearance protocols were initially offered followed a year later by bronchodilator and neuromuscular protocols. **Methods**: For the first 8 months of protocol use a chart review was performed on any patient in a protocol that was transferred to a higher level of care. This process did not identify any patient that deteriorated as a consequence of the RT protocol. The adult coordinator (AC) then developed an audit process and form and was the "gold standard" by which the RTs were measured. The AC did all the audits for over 2 years and then put together an audit team. The audits consist of reviewing the RTs' assessment of 9 clinical variables, determination of disease severity (which allocates treatment frequency), and choice of protocol. Protocol misallocation is defined as choice of incorrect protocol, treatment frequency, or therapy. Audits were then performed monthly to determine percent protocol misallocation with feedback provided to RTs. The audit process has now evolved into a system with groups of RTs assigned to one of 3 auditors. Audits are completed weekly with immediate feedback to the RTs. The RT feedback includes patients reviewed, acknowledgement of properly performed assessments, and areas for improvement. Each RT is audited at least 20 times annually. If individual audit results yield a misallocation rate > 5% then the RT will have additional assessments audited within the same time period while receiving ongoing feedback. Newly trained RTs have every assessment audited until their misallocation rate reaches <= to 5% with a minimum of 25 assessments reviewed. The departmental wide results are tabulated monthly and reported. **Results**: From November 2008 through March 2017, 4,387 audits have been performed on 61RTs. During this period the misallocation rate for protocol therapy has steadily declined to 4% (figure). **Conclusion**: A consistent and thorough auditing process along with continuing education can reduce protocol therapy misallocation.

Sponsored Research - None



2758083

Lean Approach to Affordable RT Department Staffing.

Jordan Kaminsky, Mark Martinez, Tamra Kelly; Sutter Roseville Medical Center, Roseville, CA

Background: Sutter Roseville Medical Center (SRMC) is experiencing challenges common to the current healthcare landscape causing decreased availability of resources and a need to improve affordability of care. The Respiratory Therapy department was noted to have high costs due to use of overtime. Staff were burned out due to frustration around uneven workloads and variation in support provided by Lead RCP's. The hospitals process improvement (PI) method is the Lean framework using A3 thinking to improve flow, standard work and efficiency. Methods: The department developed an A3 focused on overtime reduction and staffing efficiency by forming a team including supervisors and lead Respiratory Care Practitioners (RCP) to analyze the background, current condition and target condition. The department goal for overtime use was 5%, the actual overtime was 15.4% at the beginning of this project. The group was provided training on basic Lean PI principles and performed a gap analysis using the 5 Why method. The identified gaps were variation in lead RCP work flows, communication skills, and leadership tools. The group agreed to implement experiments to overcome these gaps. The experiments included a class on situational leadership, a Crucial Conversations class, development of leader standard work for workflow management, and increased frequency of Lead RCP meetings to progress of PDSA cycles. Specifically the standard work to assess and assign workload was modified to level the workload using the lean concept of heijunka. To ensure success the team incorporated input from the Respiratory Care Department supervisors and respiratory therapists to develop comprehensive and realistic metrics, staffing models, and benchmarks which are evidence-based and data-driven from the AARC whitepaper on staffing and productivity. Results: Thirty days after implementing the experiments our overtime rate dropped to 3.9% and this improvement was maintained for 18 of the next 19 pay periods. Conclusion: The Lean process improvement framework is an effective method for improving RT department management processes. Incorporating Lean methods with the AARC staffing and productivity guidelines can improve flow, standard work and efficiency in a Respiratory Therapy department. This investment in our staff creates a learning culture and helps establish a succession plan for developing future leaders.

Sponsored Research - None

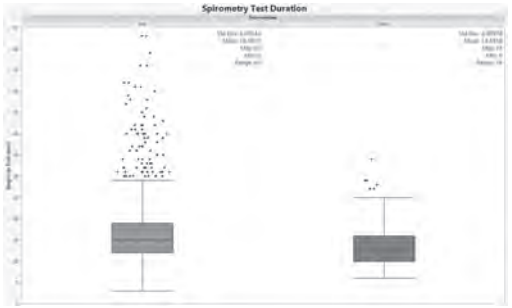
2758579

Value Engineering Improves Pulmonary Function Laboratory Utilization.

William McNett, Mike Mitchell, Phill Jensen, Earl Fulcher, Boaz Markewitz; University of Utah, Salt Lake City, UT

Background: The pulmonary function lab at the University of Utah Hospital was faced with increasing and volatile daily demand for testing resulting in an inability to fill appointments during preferred time slots. Based on feedback from patients and clinics, the lab launched a project to improve efficiency of its administrative and clinical processes to better meet demand. **Method**: A multidisciplinary team was established and applied the University's value improvement methodology, based on the DMAIC Lean Six Sigma improvement process. Specific goals were identified with defined targets: increasing overall lab utilization and increasing scheduling compliance. The scope of the analysis was focused on the Spirometry test as it represented 39% of total orders, although improvements were expected to be applicable to all test types. The team designed a "scorecard" which displayed metrics for proactive management and monitoring of progress. Information was communicated to all technicians to establish performance targets and to initiate dialog about objectives of the project. More rigorous data analysis uncovered potential root causes of unsatisfactory performance. Appointment percentage by day of the week was highly uneven, ranging from 34% of tests completed on Mondays to 9% on Fridays and morning tests represented 76% of studies. There was also significant variation in appointment durations, with a range of 60 minutes. Finally, the range between means of test times between technicians was 7 minutes. The team implemented a scheduling algorithm to level load appointments throughout the day as well as across the week. To decrease variation in appointment durations, "standard work" was implemented to document and standardize best practice test delivery. **Results**: Day of week appointment percentage for Mondays reduced to 27% of tests and the percentage of morning appointments were reduced to 67%. The range of appointment durations was reduced to 28 minutes. See figure for detail. The range between the means of the technicians was reduced to 4 minutes. **Conclusions**: Through the application of a standardized process improvement approach, the pulmonary lab was able to identify root causes of constrained capacity utilization and implement solutions which resulted in measurable impact. The team is continuing to identify and implement solutions to improve performance. **Disclosures**: None

Sponsored Research - None



Box plot of spirometry test duration before and after process interventions demonstrating reduced variability and mean. Also included are summary statistics: Stdev, Mean, Max, Min, and Range.

2758632

Identification of Trends in Alarm Management for Mechanical Ventilation.

Kevin J. Bullock[1], Peter Betit[1], Barry Grenier[1], Brian K. Walsh[2]; [1]Respiratory Care, Boston Children's Hospital, Boston, MA; [2]Anesthesia, Boston Children's Hospital, Boston, MA

Background: In 2014, the Joint Commission added *Use Alarms Safely* as a National Patient Safety Goal. Phase 1 required hospitals to identify the most important alarm signals to manage. In 2016, Phase 2 asked hospitals to establish policies and procedures for management of those alarms identified in Phase 1. Upon completion of Phase 2 within our own hospital, we sought to understand current practice in alarm management for mechanical ventilation across hospitals. Methods: We conducted an IRB approved survey regarding the quality and safety of mechanical ventilation involving three domains; composition and communication of prescriber orders, alarm management and quality metrics. The survey was distributed to the AARC and the Children's Hospital Association Respiratory Care Directors and Managers list serves. Results: There were 327 respondents to the survey, mainly from urban (55%), non-profit hospitals (59%) where adults were primarily cared for (59%). Of the 327 respondents, 250 (76%) completed the alarm management domain. The majority of respondents (94%) indicated that ventilator alarms are not ordered by providers. Disconnect (98%), high pressure (65%) and minute ventilation (34%) alarms were considered the highest priority alarms which were set during safety assessments, 85%, 93% and 88% of the time, respectively. 69% responded that tidal volume alarms are set with invasive ventilation, though our survey does not specify high or low tidal volume. Other results include, 57% of respondents leave the alarms volume at 100%, 53% are not utilizing remote alarms systems, 30% have no formal rules for who can silence alarms and 51% are not allowed to turn alarms off, even with a physician order. Conclusions: The results of this survey demonstrate great variability across institutions as it pertains to alarm management for mechanical ventilation. This variability may be due to the dynamic nature of mechanical ventilation or the fact that there is not a universal standard. Despite variance in which alarms are set during mechanical ventilation safety assessments, the survey results demonstrate that alarms associated with loss of ventilation and high pressure are the highest priority alarms, to be set with every safety assessment. Future research on alarm management may seek to formalize universal standards for alarm settings and identify methods to limit nuisance alarms.

Sponsored Research - None

2734876

A Multi-Faceted Approach to Reduce Pressure Injuries During Noninvasive Ventilation.

Kenneth Miller, Lucy Cascioli, Christine Hartner, Munawer Kermalli, Vanessa Ribaudo-Kaufman; LVHN, Allentown, PA

The increase in frequency and duration of non-invasive ventilation (NIV) in our network has resulted in an increase in pressure injury related to the use of the non-invasive mask. The reduction of hospital acquired pressure injuries is an overall goal for the network. In order to meet this goal a multidisciplinary team, including respiratory therapy, nursing and medicine was formed. The team focused on not only preventing pressure injury but also looked at the process around non-invasive ventilation including medical management. The multifaceted approach resulted in the introduction of a new NIV mask and an enhanced skin protective barrier that is worn under the mask. Additionally a NIV algorithm was developed to guide the practitioners when ordering non-invasive ventilation. The algorithm includes guidelines for initiation of therapy as well as defined end points for termination of therapy. Education for all disciplines was provided. In the six months since the implementation of the above measures only one patient (out of a total of 200) developed a pressure ulcer that was related to NIV therapy. (Table 1) Our results are a combination of factors including, enhanced education, well-defined NIV clinical management end-points, utilization of enhanced skin barrier, and NIV masks. Based on our results, the reduction of facial pressure injuries may be accomplished by employing a multi-facet approach. Continuous monitoring of this process will be maintained to ensure compliance and adherence to this new process.

Sponsored Research - None

Table 1 NIV Facial Ulcers

Site	FY '16 Total	FY '17 Goal	July	Aug.	Sept. Intervention	Oct.	Nov.	Dec.	Jan.	Feb.	March
LVH-CC	20	16	2	2	0	0	0	0	0	0	0
LVD-Muhl	2	2	0	0	0	0	1	0	0	0	0

2743456

Comparison of Two Endotracheal Tube Cleaning Processes in Reducing Airway Resistance for the Mechanically Ventilated Patient.

Linda C. Schofield[1], Denise Burkhart[2], Jori Poland[2]; [1]Nursing, McLaren Northern Michigan, Petoskey, MI; [2]Respiratory, McLaren Northern Michigan, Petoskey, MI

Introduction Endotracheal tube (ETT) intra-luminal volume loss due to mucus and biofilm is associated with longer times on mechanical ventilation, increased airway resistance and imposed work of breathing. Previous studies conducted at McLaren Northern Michigan hospital have demonstrated that daily cleaning of the ETT decreased the median airway resistance from 27 cmH2O/L/sec to 15 cmH2O/L/sec, ($p<0.01$). This result was associated with a decrease in average time on the ventilator by 1.1±4.7 days, and a decrease in the length of stay in the ICU and hospital by 1.5±5.5, and 1.7±7.4 days respectively. **Purpose** The primary objective of this study was to determine the outcome equivalence and cost of the new endOclear® Liberator™ (HCS) system in removal of adherent ETT secretions prior to weaning trials compared to the endOclear® Restore™ (ECD) device. HCS (Hybrid Closed Suction) is a sterile; 72-hour use catheter with a concentric inflatable cleaning wiper and the ECD is a sterile, single use, mechanically operated wiper. **Method** This study is an IRB approved, continuous outcome equivalence, prospective, randomized, controlled, single centered study to evaluate the efficacy and cost of the Liberator (test treatment) compared to Restore (control treatment). The primary endpoint of this study is the detection of difference in airway resistance reduction (ΔRaw) before and after the cleaning maneuver no greater than 3 cmH_2O/L/sec between the treatment groups. Based on our previous study, a ΔRaw of than 3 cmH_2O/L/sec between the two groups can be considered equivalent. A sample size of 114 subjects was calculated for power of 0.90 with a two-sided alpha of 0.05. Data is presented as mean ±SD. **Results** The ΔRaw with the ECD was 3.4±5.8cm H_2O/L/sec and the ΔRaw with the HCS was 2.8±5.3 cmH_2O/L/sec. Equivalence was established after enrollment of 114 subjects (N=183/172 HCS/ECD cleaning maneuvers) and the study was ended. The results of the difference between the Liberator and Restore device were significantly smaller than the established equivalence margin of 3 cmH2O/L/sec ($p<0.01$). **Conclusion** The HCS is as effective as the ECD at removing adherent secretions from the ETT prior to weaning trials, resulting in lower airway resistance. The HCS benefits over the ECD is it can be used several times per day up to 72 hours, it is a modular device that can be used with other attachments that can be changed without losing pressures or lung volumes, and it is less costly.

Sponsored Research - None

	Number of Subjects	Costs per Subject	Airway Resistance (mean cm H_2O/L/sec)			
			Before 6:00 am Cleaning	After 6:00 am Cleaning	ΔRaw	Number of Observations
Liberator™	**57**	**$120.23**	**18.53**	**15.88**	**2.8±5.3**	**183**
Restore ™	**57**	**$266.51**	**17.15**	**13.75**	**3.4±5.8**	**172**

2747632

Use of Anthropomorphic Measures to Predict Tracheal Length and Correct Tracheal Tube Placement.

Teresa A. Volsko[1], Neil L. McNinch[2], Donald S. Prough[3], Michael T. Bigham[4]; [1]Nursing Administration, Akron Children's Hospital, AKron, OH; [2]Rebecca D Considine Research Institute, Akron Children's Hospital, Akron, OH; [3]Department of Anesthesiology, University of Texas Medical Branch at Galveston, Galveston, TX; [4]Pediatric Critical Care Medicine, Akron Chilfren's Hospital, Akron, OH

Background: In intubated children the position of the tracheal tube (TT) tip should be mid-trachea. Pediatric Advanced Life Support (PALS) and Neonatal Resuscitation and Neonatal Resuscitation Program (NRP) guidelines use weight alone to guide TT positioning. We determined the prevalence of TT malposition using PALS and NRP guidelines and assessed the effectiveness of combining weight with additional demographic and anthropomorphic measures to estmate TT position. **Methods:** We selected a random sample of initial AP supine chest radiographs (CXR) from patients admitted to a tertiary care Pediatric Intensive Care Unit (PICU) from 01/01/09 to 05/05/12. Exclusion criteria included spinal/skeletal deformities and poor image quality. A properly positioned TT tip was below the clavicular heads and > 1 cm above the carina. TT internal diameter (ID) and demographic and anthropometric variables were obtained from the medical record. On CXR, we measured the TT tip-to-carinal distance and the distance from the superior borders of the clavicular heads to the carina (SC distance). For TTs of 2.5 - 4.0 mm, 4.5 - 6.0 mm and > 6.5 mm ID, respectively, adherence to PALS or NRP guidelines was defined as differences between predicted and actual TT markings at the lip of ± 0.25, ±0.5, or ± 1.0 cm. Descriptive statistics reported demographics. Correlation and regression analysis assessed relationships and predictive ability. **Results:** Of 2000 intubated PICU patients, 507 CXR's were reviewed. 390 had complete data (Table 1). 29.8% of TT's adhering to NRP and PALs guidelines were malpositioned. Significant associations with SC distance included age (A), height (H), and weight (W) (r =0.64, 0.65, 0.69, respectively, *p-values* < 0.01). Linear regression model included A, H and gender (G) plus their interactions: SC distance ~ 22.248 – 0.039*A + 0.135*H – 7.015 – 0.149*A + 0.159*H + 0.001*A*H + 0.001*A*H [If G =male]; SC distance ~ 22.248 – 0.039*A + 0.135*H + 0.001*A*H [If G=female]. (*p-value* < 0.01, r^2 = 0.60) **Conclusions:** Combining height, age, and gender using predictive modeling to estimate SC distance could improve TT positioning.

Sponsored Research - None

Table 1. Study population's demographic and anthropomorphic measures

Measure	N	Mean	SD	Median	IQR	Minimum	Maximum
Age (months)	508	46.78	63.28	16.39	64.97	0.01	345.58
BSA (M²)	411	0.56	0.42	0.40	0.41	0.05	2.09
Weight (kg)	508	16.57	17.03	10.35	14.20	1.89	120.70
Height (cm)	416	84.97	35.41	73.50	47	42	185
Intubated days)	507	3.34	4.14	1.91	4.27	0.17	41.68
PICU LOS (day)	507	8.73	14.49	4.52	7.8	0.05	190.82

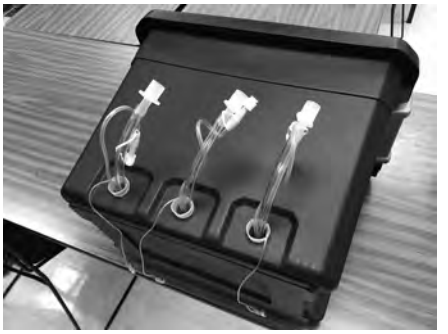
2757472

Can Palpating the Pilot Balloon of an ETT Accurately Assess Appropriate Cuff Pressure?

Caroline Sivcovich, Danny Bell, Jared Loewenberg, Madelyn Fuchs, Brandon Burk, Aaron Light; Respiratory Care Program, Ozarks Technical Community College, Springfield, MO

Background: Maintaining an appropriate cuff pressure is vital for patient safety. High cuff pressures may cause injury to tracheal tissue, while low cuff pressures may lead to increased ventilator associated events. The purpose of this study is to determine if a prudent respiratory therapist can accurately assess cuff pressure by palpating the pilot balloon. Our hypothesis is that there will be no difference in accuracy between palpating the balloon and measuring the cuff with a commercial device. **Method:** After IRB approval and informed consent was obtained, fifty subjects volunteered for participation. Each subject filled out a survey, then proceeded to the cuff assessment model. The model consisted of three 7.5 mm inner-diameter endotracheal tubes (Covidien Medtronic Solutions, Minneapolis, MN), inserted 21 cm into corrugated tubing (CareFusion, Yorba Linda, CA), secured in a box (Sterilite Corporation, Townsend, MA) with only corrugated tubing, ETT hub, and pilot balloon exposed. Pressures were randomly set for each ETT from left to right by Pretty Random, app, version 1.0 (FoxBytes, Coimbatore, Tamil Nadu, India), using numbers one through three (1=10 cmH2O, 2=25 cmH2O, 3=40 cmH2O). Each ETT cuff was inflated to the randomized pressure, generated by a Cufflator (Posey, Arcadia, CA). From left to right, participants attempted to identify whether the pilot balloon reflected a low, normal, or high cuff pressure by palpation. **Results:** The survey found that 38% of the subjects stated that they routinely use the palpation method of the pilot balloon for assessment of the cuff inflation pressure. 34.67% of the palpation assessments were found to accurately assess proper inflation. The inaccurate assessments were divided between 26.66% overestimating the pressure and 38.67% being underestimated. **Conclusion:** Based on our findings, the palpation of the cuff for assessment of cuff pressure is inaccurate 63.33% of the time and should not be used for proper inflation pressure. Oddly enough, subjects that stated that they regularly use the cuff palpation method were incorrect more frequently than subjects that do not regularly use this method. A commercial cuff pressure measuring device should be utilized to accurately assess a patient's ETT cuff pressure.

Sponsored Research - None



2758065

Frequency of Measurement of Endotracheal Tube Cuff Pressures and the Impact on Ventilator Associated Condition, Infection Related Ventilator Associated Condition and Possible Ventilator Associated Pneumonia.

Patty C. Silver, Peggy Reed-Watts; Respiratory Care Services, Barnes Jewish Hospital, St. Louis, MO

Background: This study evaluated if intermittent measurement of ETT cuff pressures improves Ventilator Associated Conditions (VAC), Infection Related Ventilator Conditions (IVAC) and/or Possible Ventilator Associated Pneumonia (PVAP) rates in intubated patients compared to measurement upon intubation and on an as needed basis. Maintenance of cuff pressure between 24 to 30 cmH2O is theorized to minimize rates of VACs including IVAC and PVAP. Our department's policy is to check cuff pressure upon intubation and on an as-needed basis following intubation. Method: Study was IRB approved as a Quality Improvement Study. In this single center study; 357 total patients were enrolled (159 in control group and 188 patients in study group) within 2 Adult Medical ICUs. Control group had cuff pressure measurements checked upon intubation and as needed once intubated. Study group patients had cuff pressures measured upon intubation and every shift (8 hr intervals) following intubation. 2 proportion test performed to determine statistical significance. Cuff pressures were maintained between 24 to 30 cmH2O via AG Cuffill device. All intubated patients were enrolled into study except those who required prone positioning. Frequency of cuff measurement was determined by room location: Even numbered rooms patients (study group) had cuff pressures monitored upon initiation of mechanical ventilation and every 8 hours thereafter. Patients in odd number rooms (control group) were assessed according to existing policywhich is on an as needed basis following intubation. Results: 349 intubations from Oct., 2016 through Feb. 2017. 159 patients were admitted to odd numbered rooms, while 188 patients to even numbered rooms. 2 patients were in both even and odd rooms due to room transfer. Initial room location determined the frequency of cuff pressure measurement. There were 14 total VACs, 0 IVAC, and 1 PVAP. 8 (5.0%) patients in the control group had a VAC while 6 (3.2%) of study patients developed a VAC. There was no statistical difference between groups; (p=0.39, 95% CI of -0.02 to 0.06). Conclusion: Monitoring cuff pressure on an as needed basis compared to intermittent, ongoing measurement every 8 hours did not prove significant in affecting occurrence of VACs in an adult population in two Medical ICUs. The practice of cuff pressure assessment upon intubation and followed by an as needed basis is equally as safe in prevention of VACs.
Disclosures: none to report
Sponsored Research - None

2758469

Evaluating Endotracheal Tube Depth in Infants Less than 1 kg.

Renee Bartle[1], Andrew G. Miller[2,1], Mihai P. Dumitrescu[3], Anthony J. Diez[1], P B. Smith[3], Michael A. Gentile[4]; [1]Respiratory Care Services, Duke University Medical Center, Durham, NC; [2]Respiratory Therapy, The Children's Hospital of Philadelphia, Philadelphia, PA; [3]Neonatology, Duke University Medical Center, Durham, NC; [4]Pediatric Critical Care Medicine, Duke University Medical Center, Durham, NC

Background: Endotracheal tube (ETT) depth in premature infants is of critical importance as potentially life threatening adverse events can occur if the tube is malpositioned. The National Resuscitation Program (NRP) uses a formula of 6 cm plus the weight in kg for infants weighing 1, 2 or 3 kg. However, the utility of this rule for premature infants <1 kilogram is unreported. We sought to validate a rule used in our intensive care nursery for infants < 1 kg. **Methods:** Following Institutional Review Board approval all infants < 1 kg born in our institution between July 2013 and November 2016 were identified from a search of electronic health records. Data were extracted on gestational age, birth weight, endotracheal tube depth (centimeters) as documented in the medical record. ETT position (defined as good, low, or high) on initial chest radiograph was noted. Good ETT position was defined as the tip of the ETT between the thoracic inlet and above the carina, at approximately thoracic vertebrae 2 or 3. ETT position was determined individually by both, RRT and physician. Two formulas for ETT depth were tested. The first was our institutional formula, 5.5 cm + 1 cm/kg of actual weight for infants between 500 and 1000 g. The rule was defined as being met if the ETT depth was within 0.2 cm of measured depth. This method was compared to the NRP formula. Data were analyzed using SPSS software (IBM) v24. Chi-squared and t-tests were performed for categorical and continuous data, respectively. Correlation between birth weight and ETTs depth was performed using Pearson's coefficient, using only ETT's determined to be in good position on CXR. The alpha was set a 0.05. **Results:** 131 subjects met our inclusion criteria. There were no differences for gestational age, gender, predicted ETT depth, or ETT position between subjects who met the Duke rule and those who did not. ETT depth was significantly deeper in subjects in whom the rule was not met (6.4 ± 0.5 cm vs. 6.2 ± 0.3, P=0.02). Results for our formula are summarized in Table 1. There was a weak correlation (R^2 0.20, p<0.001) between weight and ETT depth for ETTs well-positioned on CXR. **Conclusion:** ETT depth was only weakly correlated with patient weight, suggesting formulas based on weight may not be adequate. There is a continued need for determining initial placement of the ETT in premature infants less than 1kg.
Sponsored Research - None

Table 1

	Duke Rule Met	Not Met	P Value
Subjects	61	70	N/A
Gestational Age, weeks	25 ± 1.8	26 ± 1.7	0.34
Weight, g	725 ± 130	731 ± 147	0.79
ETT Depth	6.2 ± 0.3	6.4 ± 0.5	0.02
Formula Depth	6.2 ± 0.2	6.2 ± 0.2	0.82
ETT depth assessment			
Good position	42 (69%)	48 (69%)	
High	12 (20%)	12 (17%)	0.86
Low	7 (12%)	10 (14%)	

2758480

Effects of Oscillatory Positive Expiratory Pressure on Mucus Draining, Rheological Property and Lung Mechanics: Comparison of Acapella vs Vibralung.

Tetsuo Miyagawa[1], Tomomi Ichiba[2,1]; [1]Division of Respiratory Care, Showa University, Graduate School of Nursing and Rehabilitation Sciences, Yokohama, Japan; [2]Department of Physical Therapy, Kyorin University, Faculty of Health Sciences, Mitaka, Japan

Background : Oscillatory positive expiratory pressure (oPEP) devices are used to improve pulmonary function and airway clearance. oPEP generates orally intra-airway oscillations and positive expiratory pressure in order to mobilize mucus. The purpose of this study was to compare movement distance of the different viscoelastic mucus stimulants (MS) on different lung mechanics in two oPEP devices. Methods: oPEP equipment (Acapella® and Vibralung®) were compared the movement distance of MS in tube length 1m internal diameter 1cm with varying compliance and resistance using a TTL model lung. MS were prepared using thickener 1% (purulent sputum of chronic bronchitis) and 4% (plug mucus of asthma attack). We measured migration length of MS by applying Bellavista® mechanical ventilator drove 1 minute, PCV mode, inspiratory pressure 10cmH2O, PEEP 5cmH2O, respiratory rate 12/min in four ways of combining 30, 60 mL/cmH2O compliance, and 5, 20 cmH2O/L/sec resistance. Acapella® blue and Acapella® green were set highest and lowest resistance each. Vibralung® was set random noise, low, medium and high frequency each. Data analysis was performed by using software SPSS version17 and JMP version12, P values <0.05 were considered statistically significant. Results: The migration length of MS in Vibralung® were longer than Acapella® blue and Acapella® green highest resistance on different viscoelastic MS and lung mechanics (p<0.05). There is no difference of movement distance of MS in each setting of Vibralung®. The movement distance of MS1% was longer than MS4% in Acapella® and Vibralung®(p<0.05). However, the difference of migration length of different viscoelastic MS in Vibralung® was smaller compared with Acapella®. Conclusions: Acapella® needs a certain level of voluntary expiratory flow to oscillate. However, Vibralung® can oscillate without voluntary breath. Vibralung® is easy to use for patients with lower pulmonary function, worse lung mechanics and higher viscoelastic secretions.
Sponsored Research - None

Migration length of 1%MS (cm)

	C60R5	C60R20	C30R5	C30R20
Acapella® blue(+)	12.64±2.36	11.97±1.87	11.59±1.59	11.38±2.72
Acapella® blue(−)	15.68±3.42	14.49±1.69	14.76±3.76	13.75±4.45
Acapella® green(+)	12.72±4.42	13.06±2.96	11.70±0.70	11.13±2.77
Acapella® green(−)	16.45±2.55	15.75±1.65	14.95±2.45	16.53±3.07
Vibralung® RN	17.22±2.28	15.80±1.70	16.50±2.40	16.58±4.12
Vibralung® L	16.65±2.25	15.80±4.30	15.78±2.52	16.12±5.98
Vibralung® M	17.21±3.81	15.49±2.51	15.97±2.47	15.99±3.31
Vibralung® H	16.92±2.52	15.51±2.81	15.46±2.54	16.40±3.30

2758684

Factors Associated With Endotracheal Tube-Related Mucosal Injury.

Edita Meksraityte, Constance Mussa, Barbara Gulczynski, Jie Li, Jing Liu, Anna Kuruc, Anam Majeed; Cardiopulmonary Sciences, Rush University, Chicago, IL

Introduction Medical interventions often require the use of devices that are in contact with various parts of the body, and may exert pressure on specific areas of the body leading to mucosal injury and/or pressure ulcers. Medical device-related pressure ulcers and mucosal injury are iatrogenic complications that prolong hospitalization, increase the risk of morbidity and mortality for patients, especially those who are critically ill, and ultimately contribute to increased healthcare cost. **Purpose** The aim of this study was to assess the relationship between specific risk factors and development of endotracheal tube (ETT)-related pressure ulcer and mucosal injury. **Methods** This was a retrospective study involving manual abstraction of pre-specified data from the electronic medical record (EMR) of adult intubated patients in the medical intensive care unit (MICU) at Rush University Medical Center (RUMC). After obtaining Institutional Review Board approval, the medical records of 106 intubated patients who were in the MICU during the first quarter of 2015 were examined to determine the type and strength of the association between ETT-related pressure ulcer and mucosal injury, and specific clinical variables such as Braden score (a pressure ulcer risk assessment tool) and vasoactive drug therapy. **Results** The study revealed that Norepinephrine (p = .002) and Vasopressin (p = .008) were significantly associated with ETT-related mucosal injury, but Neosynephrine was not (p = .585). Additionally, mean Braden scores were lower for patients with ETT-related mucosal injury (10.16 ± 2.17) than for patients whose skin was intact (13.08 ± 3.12), a statistically significant difference of 2.92 (95% CI, 0.71 to 5.2), t(49) = 2. 651, p = .011, d = .98. Gender and BMI were not significantly associated with development of ETT-related mucosal injury. **Conclusion** Patients with low Braden scores and those being treated with specific inotropes may be at increased risk for developing ETT-related mucosal injury, indicating a need for increased vigilance in performing skin assessment in these patients.
Sponsored Research - None

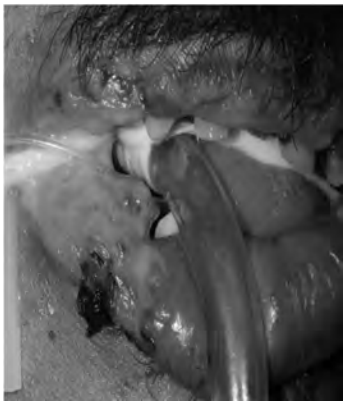


Figure 2. Pressure ulcer from ETT

2758691

Accuracy of the Cuff Sentry Cuff Inflation Device Over Six Hours.

Heather Cunningham, Amber Keller, Nick Kittleman, Brandon Burk, Aaron Light; Respiratory Care Program, Ozarks Technical Community College, Springfield, MO

Background: Ensuring an accurate and constant cuff pressure is important to reduce tracheal necrosis and the risk for ventilator associated pneumonia. Cuff Sentry (Outcome Solutions, Mocksville, North Carolina) claims that the device is capable of setting and maintaining a cuff pressure over an extended period of time, but how accurately can it set a cuff pressure, and can that accuracy be maintained? Our hypothesis is that there will be no significant difference between measured, and maintained pressures between the Cuff Sentry and a digital pressure transducer. **Method:** Four endotracheal tubes (ETT) (SunMed, Largo, Florida and Covidien, Dublin, Republic of Ireland) were inserted into large bore, corrugated tubing, four separate Cuff Sentry devices were placed on the ETT's, and cuffs were inflated per Cuff Sentry insert. The Cuff Sentry was attached to a 1 L/min air flowmeter and pressure set by occlusion and adjustment of Cuff Sentry device. Cuff pressures were set at 20, 25, and 30 cmH2O according to the dial on the Cuff Sentry. Over the course of six hours, each Cuff Sentry device was monitored for accuracy using the TSI Certifier FA Plus (TSI, Shoreview, Minnesota) by attaching the Cuff Sentry, ETT, and a gas sample line (Ikaria, Hampton, New Jersey) to a 3 way stop cock. Using this method, cuff pressures could be obtained every two hours without disconnecting the ETT pilot balloon and Cuff Sentry. Prior to each pressure check, the pressure transducer was zeroed. Data was analyzed using statistical software (SPSS v23, IBM, Chicago, IL). **Results:** It was found that the Cuff Sentry is capable of filling and maintaining a cuff pressure, however, the set pressure on the dial does not reflect the actual pressure in the cuff. When set at 20 cmH20, the mean pressure was 15.71 ± 1.12 cmH20, at 25 cmH20 the mean was 16.87 ± 3.11 cmH20, and at 30 cmH20 the mean was 20.72 ± 3.17 cmH2O. The pressure difference at all three set pressures was found to be statistically significant (P = .001). The Cuff Sentry was able to maintain the set pressure over the course of six hours (P = .712)**. Conclusions:** Without using a separate device to measure the cuff pressure achieved by the Cuff Sentry, it would be reasonable to question the validity of the pressure generated on the dial. Actual pressures were significantly lower than set pressures, indicating that the cuff may not maintain a seal to aid in prevention of VAP. **Disclosures:** None

Sponsored Research - None

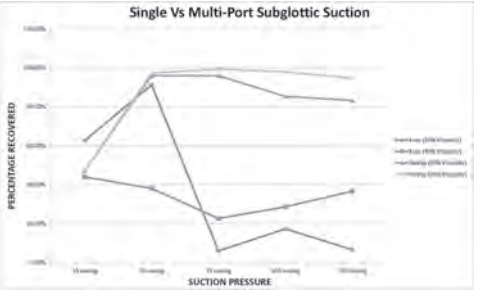
2758757

Performance Characteristics of Endotracheal Tubes During Single Port Subglottic Suctioning vs Multi Port Subglottic Suctioning in an Ex Vivo Porcine Trachea Model.

Brian M. Daniel[1,2], Leo Li[1], Elizabeth Choi[1], Patrick Mah[1], Richie Tan[1], Yohana Pena[1], Annie Cheng[1], Melisa Marin[1], Sally Liu[1], Danae Du Plessis[1]; [1]Respiratory Care Program, Skyline College, San Bruno, CA; [2]Respiratory Care/CVRI, University of California, San Francisco, San Francisco, CA

Background: Several commercially available endotracheal tubes are specifically designed and developed to offer continuous or intermittent evacuation of subglottic secretions in efforts of reducing the incidence of VAP. In general, endotracheal tubes that offer subglottic secretion clearance employ a single port where as a multi port clearance device might offer more efficient clearance. The aim of this experiment is to observe clearance efficiency of endotracheal tubes that employ single port and multi port subglottic suctioning. **Method:** A porcine trachea model was developed for this experiment. The model was setup to mimic an adult ICU patient in a 30-degree semi-recumbent position. Two subglottic suction endotracheal tube types were evaluated in this model. The Shiley™ Evac Endotracheal Tube with TaperGuard™ Cuff which has a single subglottic suction port and the NeVap™ Aspire Subglottic Suction endotracheal tube, which uses a multi port subglottic suction appendage. The endotracheal tubes were alternated and positioned to approximate tube position in a patient trachea. Two sucrose solutions were prepared for each endotracheal tube experiment to simulate subglottic airway secretion viscosity. Cuff pressures for each endotracheal tube were maintained constant. Each concentration of sucrose solution was dripped on top of each endotracheal tube cuff. Clearance for each endotracheal tube was evaluated at five different vacuum pressures (mmHg). **Results:** Leakage past the endotracheal tube cuffs as a percentage of each concentration of sucrose solution recovered, varied with viscosity of solution and vacuum pressure in both endotracheal tube types. At low suction pressures there was little difference in subglottic clearance. With the higher viscosity sucrose solution, there remained a significant reduction in subglottic recovery with the single port TaperGuard™ Evac endotracheal tube. The multi port structure on NeVap™ endotracheal tube performance was consistent with both viscosities and vacuum pressures beyond -25 mm Hg. **Conclusions:** This study evaluated the performance characteristics of a single port subglottic and multi port subglottic suction adjuncts in a porcine tracheal model. The results suggest factors that might challenge the performance of endotracheal tubes with single port subglottic suction structures, which might include viscosity of oral secretions and tracheal tissue blockage of the port at suction pressures greater -25 mm Hg.

Sponsored Research - None



2758017

Examining the Inspiratory and Expiratory Tidal Volumes of the Dräger Evita V500.
Amanda Shaffer, Gerald Hoskins, Amelia Kraus, Alexander Vargas, Courtney Woodworth, Lonny Ashworth; Respiratory Care, Boise State University, Boise, ID

Background: When examining the Dräger Evita V500 (V500) waveforms with Leakage Compensation off, the volume versus time waveform does not return to baseline during exhalation, indicating that a leak is present. However, when an inspiratory hold is performed, the pressure versus time waveform remains constant, indicating that there is no leak present. Additionally, it has been clinically observed that there is a difference in the displayed inspiratory tidal volume (VTi) and expiratory tidal volume (VTe), with a displayed percent leak of up to 16%. The purpose of this study was to evaluate the displayed VTi, VTe and the actual delivered and exhaled tidal volume measured by a calibrated device. **Method**: A TSI Certifier FA+ 4081 High Flow Module (TSI Certifier) was placed at the wye of a dual-limb, heated-wire circuit that was connected to one lung of a Michigan Instruments Dual Adult Test Lung (TTL). TTL settings: compliance 50 mL/cm H_2O; Rp 20 Pneuflo Resistor. V500 settings: VC-AC, VT 400 mL, RR 15 BPM, Flowrate 60 LPM, T_I 1.0 second, PEEP 5 cm H_2O, AutoFlow off. After performing a device check and breathing circuit test, the V500 was allowed to ventilate the TTL for 30 minutes. Data were downloaded from the V500 every five minutes, resulting in six data points. Inspiratory and expiratory tidal volumes were measured, under NTPD conditions, by the TSI Certifier as a 10-breath average and then recorded. The displayed ventilator VTi and VTe were also recorded and time stamped to correlate with the TSI measurements. The mean values of the six collected data points on the V500 and on the TSI Certifier were recorded. Next, tidal volume was increased to 600 mL and then to 800 mL, following the procedure described above. These methods were performed with Leakage Compensation off and then on. **Results**: As noted in the table, the difference between VTi and VTe on the TSI Certifier was negligible; however, the V500 VTi was consistently greater than the VTe and the difference increased with an increased tidal volume. This was seen with Leakage Compensation off and on. **Conclusions**: The Dräger V500 VTe was consistently less than the VTi at each tidal volume setting. The ventilator displays this as a leak, even though there is no leak in the system. Future research is necessary to investigate explanations for this observed hop and to evaluate patient impact. **Disclosures:** None. **Sponsored Research:** None.
Sponsored Research - None

		Dragar V500			TSI Certifier		
	Set VT (mL)	VTi (mL)	VTe (mL)	VTi - VTe (mL)	VTi (mL)	VTe (mL)	VTi - VTe (mL)
Leak Compensation OFF	400	399	380	19	342	342	0
	600	600	570	30	513	517	-4
	800	800	750	50	686	693	-7
Leak Compensation ON	400	411	384	27	348	351	-3
	600	619	583	36	525	531	-6
	800	831	779	52	710	719	-9

2758032

Nutritional Impact on Ventilator Weaning in a Long-Term Acute Care Setting.
Cindy Tew, Anne Woodbury; Ernest Health, Yorba Linda, CA

Introduction: At Ernest Health, we created a nutrition tracking form to specifically monitor tube feeding tolerance and nutrition administration with critical chronic ventilator patients in an attempt to measure nutritional impact with weaning a long term ventilator patient.. **Results:** We analyzed nutrition tracking forms from 204 patients with long-term chronic respiratory failure who were on ventilators during 2015-2017. **BG Control:** Many studies have suggested that improved BG control is associated with better ventilator weaning (3,4). Best-practice guidelines recommend keeping BG less than 180mg/dL for all ventilator patients during acute illness because this is associated with a decreased risk in mortality (2). We specifically analyzed whether LTACH patients who maintained a BG less than 180mg/dL during the ventilator weaning process had better ventilator weaning outcomes. Our data show that when a patient's BG is less than 180gm/dL, the patient is between 11.7% and 37.3% more likely to wean from the ventilator (p-value = 0.0002). **Protein Provision:** General protein recommendations from ASPEN critical care guidelines suggest providing 1.2-2.0gm/kg of protein/day (3). Though not statistically significant (p-value 0.08), there seems to be a positive trend between gm/kg of protein provided and ventilator weaning success.. It appears that providing between 1.6-2.0gm/kg may be better in the LTACH setting for chronic respiratory failure patients. **Diarrhea:** Our data showed that if a patient had acute diarrhea during the ventilator weaning process, the patient was less likely to wean from the ventilator (p-value 0.04). The patient could possibly engage in less therapy due to bowel incontinence, and therefore have less time in an upright position. Increased physical activity is associated with improved lung capacity and improved ventilator weaning. **Discussion** Nutrition does have an impact on the prolonged ventilator patient. The data collected reveals patients with protein levels around 1.6-2.0gm/kg, and blood glucose less than 180mg/dL tend to have a better chance to wean from the ventilator. Diarrhea shows a correlation to decrease the ability of the patient to ventilator wean. Dietitians are an integral part of the interdisciplinary team for ventilator management and should monitor actual protein provision, blood glucose control, and bowel movements during ventilator weaning.
Sponsored Research - None

2758078

Assuring Safe Management of Mechanical Ventilation during Setting Changes Made by Non-Respiratory Care Staff.
Patty C. Silver, Peggy Reed-Watts; Respiratory Care Services, Barnes Jewish Hospital, St. Louis, MO

Background: Respiratory Care Services staff are challenged to manage mechanical ventilators ensuring patient safety in busy critical care areas. At our institution; Attending and Fellow level physicians have been trained to perform these adjustments; (e.g. mode of ventilation, RR). Safe practice and internal policyrequire RCS be contacted immediately after the adjustment when unavailable to perform the change. This assures appropriateness of change, re-adjustment of alarms and documentation in EMR. Policy requires: 1. Changes are performed by trained MDs, 2. RCS is contacted ASAP following a mode change, 3. Orders are entered in a timely manner, and 4. Documentation is placed in the EMR. Method: The RCS manager met with Medical Directors of all ICUs to inform them of the new quality process which would assure compliance with hospital policy on mechanical ventilator management in order to assure safety of patients. Weekly audits were performed in all ICUs to evaluate the frequency of discordant mechanical ventilator orders as compared to ventilator settings. Data was monitored from September 2016 thru April 2017. The process entailed once weekly review of all mechanical ventilator settings as compared to active orders. Aggregate discordant findings (pass/fail) were presented to the medical directors of each ICU via written memo at period intervals to describe each unit's audit results compared to combined findings for all ICUs. 2 proportion test utilized to analyze for significant improvement. Results: Comparison of the first phase of the project (14 audits) compared to the second phase (14 audits) showed a statistically significant decrease in the overall rate of discordant orders. In Phase 1, 539 ventilators setting audits revealed 72 (13.4%) discordant settings. Phase 2 had 767 mechanical ventilator setting audits which yielded 59 (7.7%) defects. The decrease was statistically significant with a p-value of 0.001 (95% CI of 0.22 to 0.91) Conclusions: Significant improvement in overall discordance rate occurred due to 1. Initial engagement of medical directors to facilitate accountability of MDs who make ventilator adjustments and enter orders into the EMR; 2. Follow-up weekly monitoring with intermittent written feedback to medical directors. 3. Motivation of RCS staff to assure their area's compliance. The synergistic effects yield a safer environment for patients mechanically ventilated at our medical center. Disclosures: none to report
Sponsored Research - None

2758099

A Humidified Anesthesia Circuit: A Bench Analysis.
Kelly Massa[1], Katlyn Burr[1], Joel M. Brown II[1], James Hertzog[2,3]; [1]Respiratory Care, Nemours, Newark, DE; [2]Division of Pediatric Critical Care Medicine, Nemours, Wilmington, DE; [3]Thomas Jefferson University, Philadelphia, PA

Background: Inadequate humidification of inspired gas is one of the most important factors in impaired mucus formation and transport within the tracheobronchial tree.[1] Appropriate humidification has been proven to reduce inflammatory responses and damage to the cilia.[2] Humidification during anesthesia is important to prevent adverse changes in the upper airways and possible pulmonary compromise.[3] Status Asthmatics sometimes requires the use of Isoflurane delivery via anesthesia ventilator. Most anesthesia ventilators are not equipped with a heater. In addition, CO_2 absorbent remains virtually untested with humidified circuits. We assessed the performance of an anesthesia ventilator, with inhaled medication and active humidification in order to support the use of these therapies conjuntively. **Method:** GE© Aespire View and GE© Multiabsorber (M1173310) was set up with a Fisher & Paykel© Heater and heated wire circuit. A Drager© test lung with the addition of a proximal filter was used. A steady flow of 0.05 LPM CO_2 was bled in to simulate exhaled gas. An Aerogen© and Medfusion® syringe pump delivered Albuterol at a dose of 20mg/hr. Ventilator settings were as follows; PCV-VG, RR 20, I:E 1:4, VT 200mL, Pmax 40, Peep 0, Isoflurane 1%, Fresh 0_2 gas 4 LPM. Each hour, the test lung and expiratory filters were weighed and the multiabsorber was measured (cm). The total testing time was ten hours. **Results:** The average measured color change in absorber after ten hours was 3.8% (0.5 cm) of the total multiabsorber. Increases in PIP were observed and the expiratory filter was changed every 4 hours to reduce condensation. Additional measured parameters are listed in the data table below. **Conclusion:** All measured parameters from this bench analysis indicate that the use of active humidification and nebulized medications can coexist without the need for frequent equipment change out. Active humidification for patients using anesthesia ventilators should be considered, especially for patients at high risk for mucociliary compromise. Further studies must be performed to access outcomes in this population. **References:** 1. Stevens, H. (1970). Humidification during anesthesia. *International Anesthesiology Clinics, 8*(3), 727-743. 2. Jiang, M., et al. (2015). Airway Humidification reduces the inflammatory response during Mechanical Ventilation. *Respiratory Care, 60*(12), 1720-1728. 3. Carson, K. (1998). Humidification during Anesthesia. *Respiratory Care Clinics of North America, 2*, 281-299.
Sponsored Research - None

Data Comparison Table

	Hour 0 Average	Hour 3 Average	Hour 6 Average	Hour 10 Average
Temperature (Celsius)	24.9	25.2	25.9	25.2
Tidal Volume Expired (mL)	198.3	201.7	201.5	202.3
PIP (cm H2O)	14	14	15.3	17
MAP (cm H2O)	5	5	5	6
Multiabsorber Color Change (measured in cm)	0/13	0/13	0/13	0.5/13
ETCO2 Filter (Toft of H2O in cm)	0	0	0	0
Expiratory Filter Weight (grams)	40	40	40	40
Test Lung Weight (grams)	190	190.7	193	198
EtCO2 Reading (Philips Monitor)	60	69.3	69	70

This table displays data collected from the ventilator and applicable devices with an active humidification set up running for a total of ten hours.

2758240

Accuracy of Mechanical Ventilators in Clinical Setting in Eastern Saudi Arabia.

Hajed M. Al-Otaibi, Khalid A. Ansari; Respiratory care, Imam Abdulrahman bin Faisal University, Dammam, Saudi Arabia

Background: Mechanical ventilator is one of the most important devices in the critical care units. Improper ventilator settings may adversely affect patient care. The objective of this study is to evaluate the accuracy of volume, pressure and flow delivered by the ventilators in clinical settings. **Methods:** Thirty unselected mechanical ventilators from four main hospitals in the region were included. All types of modern ICU ventilators brands along with all versions were targeted. Pressure, volume and flow were evaluated at two levels (high and low); pressure at 30 and 15 cm H_2O, volume at 800 and 400 ml, and flow at 60 and 40 lpm; by using Fluke Biomedical VT PLUS HF Gas Flow Analyzer. Data was presented as a mean±$LA_{95\%}$. **Result:** Measurement of volume and flow showed significant differences between the set and measured values at both high and low settings (p<.001). The 95% limit of agreement ($LA_{95\%}$) between the set and measured volume is 121±89 ml at high volume and 56±47 ml at low volume. $LA_{95\%}$ between set and measured flow is 6.6±8.8 lpm at high flow and 4.2±7 lpm at low flow. No significant differences were observed between the set and measured values of high (p =.248) and low (p =.138) pressure. $LA_{95\%}$ between set and measured high pressure is 1.1±9.6 cm H_2O and low pressure is .4±2.5 cm H_2O. **Conclusion:** This data shows that mechanical ventilators in the clinical settings have some variations in their performance. The delivered flow and volume might be not accurate as it might be anticipated. These differences between the set and measured values may occur as a result of neglecting the periodic maintenance and regular calibration process before and after every patient. **Disclosure**: None
Sponsored Research - None

2758286

The Comparison of Spontaneous Ventilator Modes During Exercise.

Tetsuya Hasegawa[1,2], Kendra Clingerman[1], Samantha Davis[1], Gerald Hoskins[1], Trevor Lee[1], Camille Stover[1], Lonny Ashworth[1]; [1]Respiratory Care, Boise State University, Boise, ID; [2]Rehabilitation, Yokosuka General Hospital Uwamachi, Yokosuka, Japan

Background Literature promotes the benefits of early mobilization for mechanically ventilated patients. Prior research reveals that a spontaneous mode of ventilation is a more comfortable mode during exercise; however, there are many spontaneous modes. This study evaluated the subjective perception of work of breathing and instances of patient-ventilator asynchrony in various spontaneous modes of ventilation during exercise. **Method** After receiving IRB approval, informed consent was obtained from 20 subjects (10 female, 10 male). Subjects were screened for physical activity via the modified PAR-Q questionnaire. The modes evaluated on the Covidien Puritan Bennett 840 were: CPAP with PS 5 cmH_2O, Esens 50%; CPAP with TC 100%, Esens 50%; PAV+ with 30% support, Esens 10 L/min; PAV+ with 60% support, Esens 10 L/min. PEEP was set at 0 cm H_2O in all modes. The order of modes for each subject was randomized. Baseline heart rate and SpO_2 were recorded. While seated, subjects began breathing through a PFT mouthpiece attached to a 7.5mm ETT connected to the ventilator circuit in the mode of ventilation to be evaluated. After two minutes at rest, each subject walked for two minutes on a treadmill at 2.5 MPH with no incline. Subjects then sat in a chair to rank perceived work of breathing by using a Modified Borg Scale. After three minutes and after the heart rate and SpO_2 returned to baseline, the next mode of ventilation was evaluated. All ventilator graphics were recorded by video camera for detection of asynchrony during walking in post-analysis. The subjective ranking of each mode from easiest to most difficult (1-4) and Modified Borg Scale score were recorded for each mode, as well as total asynchronies. **Results** Data show that CPAP with PS had the lowest Modified Borg Scale score (2.4), lowest average ranking for perceived work of breathing (2.2), and fewest number of patient-ventilator asynchronies (79). CPAP with TC had the highest (2.58, 2.7, and 146, respectively). PAV+ 30% and 60% are ranked between CPAP with PS and CPAP with TC in each comparative category (PAV+ 30%: 2.43, 2.3, 125, respectively; PAV+ 60%: 2.48, 2.45, 117, respectively). **Conclusion** This study demonstrated that during exercise, CPAP with PS with Esens 50% had the least patient-ventilator asynchrony and was the most comfortable for subjects without known cardiopulmonary disorder. **Disclosures:** None **Sponsored Research:** None
Sponsored Research - None

Spontaneous Mode	Mode Rank Average 1-4 (Easy-Hard)	Borg Scale Average 0-10 (Easy-Hard)	Number of Asynchronies
CPAP with TC	2.7	2.58	146
CPAP with PS	2.2	2.4	79
PAV+, at 30%	2.3	2.43	125
PAV+, at 60%	2.45	2.48	117

2758346

Esophageal Manometry in Intubated Adult ICU Patients.

Keith D. Lamb[1], Trevor Oetting[1], Sejal Patel[2], Maria Griesel[2], Matthew Trump[3]; [1]UnityPoint Health, Iowa, Des Moines, IA; [2]Respiratory Care, Des Moines Area Community College, Des Moines, IA; [3]The Iowa Clinic, Des Moines, IA

Background: Esophageal manometry/ Esophageal Pressure (Pes) is increasingly being used in the Intensive Care Unit to help evaluate and sort out alveolar distending pressures or end inspiratory trans-pulmonary pressures). Additionally, Pes may be useful to set appropriate Positive End Expiratory Pressure (PEEP) or end-expiratory trans-pulmonary pressure. There is an increasing body of evidence that more attention paid to delta pressure may result in better outcomes and lower mortality. Currently delta pressure is calculated by subtracting PEEP from Plateau Pressure (Pplat). Our group wanted to see if there was a better correlation between outcomes and end inspiratory trans-pulmonary as this may be a truer reflection of alveolar distending pressure and delta pressure. **Methods:** After IRB approval, all patients that had Pes monitoring between 3/2014 and 3/2017 were retrospectively reviewed and physiologic and demographic data retrieved from the electronic medical record. These data were then compared and statistically analyzed. **Results:** There were 45 patients. Statistical significance was considered to be a p-Value of ≤ .05. Results are listed in the table below. All results are expressed in means. **Conclusions:** Inspiratory trans-pulmonary pressure, expiratory trans-pulmonary pressure, esophageal pressure, tidal volume before Pes measurement, mean airway pressure before Pes measurement and body mass index were all closely associated with death. Measuring esophageal pressure and monitoring inspiratory trans-pulmonary pressure may be a better way of approximating safe alveolar distending pressure than plateau pressures in sick patients, especially when they are morbidly obese. **Disclosures: Keith Lamb has consulted for Medtronic, Bayer Pharmaceuticals and Fisher Paykel**
Sponsored Research - None

Pes Data

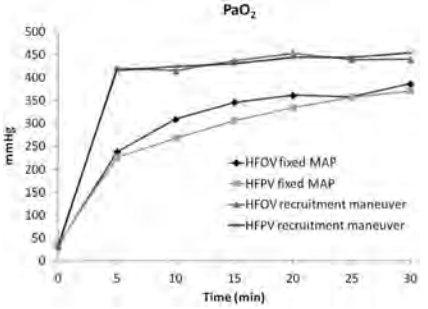
Parameter	Survivors (30)	Non-Survivors (15)	P-Value
Inspiratory Trans-Pulmonary Pressure (cm H2O)	9	11	.06
Expiratory Trans Pulmonary Pressure (cm H2O)	5	1	.03
Plateau Pressure (cm H2O)	31	31	.47
Esophageal Pressure (cm H2O)	22	19	.04
Total PEEP (cm H2O)	18	18	.32
Actual Weight (lbs)	307	365	.08
Age (years)	48	51	.23
PaO2 before Pes Measurement (mmhg)	98	97	.47
FiO2 before Pes Measurement	71	74	.36
P/F before Pes Measurement	154	141	.34
Tidal Volume before Pes measurement (ml)	537	474	.03
Mean Airway Pressure before Pes measurement (cm H2O)	22	20	.05
Oxygenation Index before Pes measurement	18	17	.45
PaO2 after Pes (mmhg)	102	89	.15
FiO2 after Pes	65	70	.18
P/F after Pes	170	145	.19
Tidal Volume after Pes (ml)	510	472	.21
Mean Airway Pressure after Pes (cm H2O)	23	21	.18
Oxygenation Index after Pes	16	17	.43
Height (inches)	70	68	.06
Predicted Body Weight (lbs)	164	152	.06
Body Mass Index	43	56	.01
Delta P (Pplat - PEEP)	13	13	.37

2758394

Comparison of the Rate of Improvement in Gas Exchange by High Frequency Oscillatory Versus Percussive Ventilation in a Newborn Piglet Saline Lavage Lung Injury Model.

Robert Gillette; Pediatrics, SAMMC, San Antonio, TX

Background: High frequency oscillatory ventilation (HFOV) and high frequency percussive ventilation (HFPV) are both used effectively in neonatal patients but investigation of the gas exchange they provide on comparable settings has been limited. Previous study in a piglet saline lavage injury model found no overall difference in oxygenation or ventilation. However, *post hoc* analysis suggested a hypothesis that HFPV improved oxygenation more quickly than HFOV. Objective: To test the hypothesis that oxygenation improves at a different rate on HFOV vs. HFPV in a prospective, randomized, crossover experimental animal model. Design/Methods: Sixteen 3-7 day old, 2-4 kg neonatal piglets were studied in a saline lavage lung injury model. After injury each animal was randomized to be ventilated on HFOV or HFPV for 30 minutes then, after re-injury, switched to the other HF ventilator for 30 minutes, in both cases on a matching fixed mean airway pressure (MAP) and matching frequency and tidal volume (Vt). The process was then repeated with each ventilator using a recruitment maneuver prior to the fixed MAP. Blood gasses were measured every 5 minutes. Data were analyzed using repeated measures ANOVA. Results: There were significant improvements (p<0.001) in oxygenation and ventilation over time during all four 30 minute experimental periods. No differences were found between ventilators in the rate of improvement in oxygenation (p=0.46 on fixed MAP, p=0.63 after recruitment maneuver), however the rate of improvement was greater after a recruitment maneuver than on fixed MAP for both HFOV (p<0.017) and HFPV (p<0.004) (Fig. 1). Also, no differences were found between devices in the rate of improvement in ventilation (p=0.65 on fixed MAP, p=0.18 after recruitment maneuver), nor any differences based on using a recruitment maneuver on either ventilator (p=0.13 on HFOV, p=0.71 on HFPV). The peak-to-trough pressure difference (ΔP) required for matched Vt was significantly higher on HFPV (p<0.001), while the ΔP readings on the HFPV's mechanical gauge were far below the electronically measured pressures on either device. Conclusions: No difference could be detected in the rate of improvement in gas exchange between HFPV and HFOV when initiated following an acute lung injury, with or without a recruitment maneuver. With both ventilators oxygenation but not ventilation improved more rapidly using a recruitment maneuver than on a fixed MAP.
Sponsored Research - None



2758422

Evaluation of the Accuracy of Delivered Tidal Volumes in Critical Ventilators at Various Settings.

Carly M. Petrie, Bridget A. Lawrence, Gerald Hoskins, Lonny Ashworth; Respiratory Care, Boise State University, Boise, ID

Background: Accurate volume delivery to mechanically ventilated patients is a critical part of quality care. However, there is a lack of research on the accuracy of delivered tidal volume (VT_i) as compared to set VT. This study evaluated the accuracy of delivered VT_i in seven critical care ventilators. **Methods:** Ventilators tested: Covidien Puritan Bennett 840 (PB 840), Covidien Puritan Bennett 980 (PB 980), Maquet Servo-i (Servo-i), Maquet Servo-U (Servo-U), Dräger Evita XL (XL), Dräger Evita V500 (V500), and CareFusion Avea (Avea). Ventilators were connected to a Michigan Instruments Adult/Infant Training Test Lung (TTL): compliance 0.05 L/cm H2O; Rp 20 Pneuflo Resistor. Two TSI Certifier FA+ 4081 High Flow Modules (TSI Certifier) were attached on the inspiratory limb of the circuit to collect a 10 breath average. Ventilator settings: Compressibility Factor Compensation on; with the XL and V500 Leakage Compensation was off. Tidal volumes of 300 mL, 500 mL, and 700 mL, were evaluated at peak flow rate of 50 LPM in a square flow waveform. Then, flowrate was increased to 70 LPM and data were gathered as before at each volume. The trials were then repeated in a decelerating flow waveform, excluding the ventilators that do not have a true decelerating flow waveform in Volume A/C (XL, V500, Servo-U). The mean VT_i was recorded and compared to the set VT at each setting. **Results:** The accuracy range between delivered VT_i and set VT was -11% to +13%. The Servo-i was the most accurate in decelerating flow waveform (±1% at each set VT and flow rate). The PB 840 was the most inaccurate with a difference of +13% in a square flow waveform, VT 300 mL. **Conclusion:** Of the seven ventilators tested, the PB 840, Servo-i, and Avea had the largest above-average differences across all settings (+8%, +7%, and +4%, respectively). The XL and V500 both had below average differences (-6% and -5%, respectively) resulting in delivered volumes lower than set. The PB 980 and Servo-U both had average differences of 0%. A flow of 70 LPM generally resulted in a less accurate VT_i than a flow of 50 LPM. Lower VT's were generally less accurate than larger VT's. Apart from the PB 980, the ventilators studied are generally more accurate in a decelerating flow waveform than a square flow waveform. Additional research is needed to determine the clinical implications of delivering tidal volume greater than or less than what is set. **Disclosures:** None **Sponsored Research:** None

Sponsored Research - None

	Square Flow Waveform (70 LPM)					
	Set Tidal Volume					
	300 mL		500 mL		700 mL	
	TSI Volume (mL)	% Difference	TSI Volume (mL)	% Difference	TSI Volume (mL)	% Difference
Servo-i	332	11%	528	6%	733	5%
Servo-u	309	3%	502	0%	685	-2%
PB840	339	13%	534	7%	727	4%
PB980	322	7%	488	-2%	666	-5%
Avea	322	7%	518	4%	709	1%
Drager V500	282	-6%	473	-5%	666	-5%
Drager XL	280	-7%	469	-6%	661	-6%

2758432

Evaluating Mechanical Ventilaor Time to Wean in a Long-Term Acute Care Hospital.

Edward Burns[1], Kathleen Haley[4,2], Elizabeth Kamau[3], Julie Silva[2]; [1]Respiratory Care Department, Massachusetts General Hospital, Boston, MA; [2]Respiratory Care Department, Cambridge Hospital, Cambridge, MA; [3]Respiratory Care Department, Spaulding Rehabilitation Hospital, Charlestown, MA; [4]Pulmonary, Brigham & Women's Hospital, Boston, MA

Background: Spaulding Hospital-Cambridge is a 180 bed long term acute care hospital, with a 30 bed ventilator unit for both medically complex on prolonged mechanical ventilation and chronic ventilator dependent patients-who were in need of transitional services to the home or a skilled nursing facility. We wanted to determine the median time-to-wean for those patients that were considered candidates for successful liberation from the ventilator. **Purpose:** To evaluate the time-to-liberation from prolonged mechanical ventilation for a group of patients admitted for failure to wean at an acute care facility and considered candidates for successful liberation. **Method:** As part of a Quality Improvement project, we retrospectively reviewed a total of 112 discharged mechanically ventilated patients. The discharges occurred during the calendar year of 2016. Each discharge was considered an individual patient admission. Our evaluation was conducted in a retrospective manner by chart review. The data elements for inclusion and exclusion were divided into 2 groups: 1-not liberated from the ventilator and 2-liberated from the ventilator. Discharge dispositions were classified as: acutely discharged, expired, home health services, long term care facility, inpatient rehabilitation facility, and skilled nursing facility. Each discharged patient diagnosis was classified as: 1-non-chronic or 2-admitted chronic ventilator dependent, (i.e. advanced ALS, muscular dystrophy) or 3-subsequently diagnosed as chronic ventilator dependent. **Results:** Of the total number of 112 discharged mechanically ventilated patients, 75 were not successfully liberated from the ventilator. Of the 75 that were not liberated from the ventilator, 32 were admitted with known or suspected chronic ventilator requirements. The remaining 43 patients were considered candidates for successful liberation from the ventilator. Of those 43 patients, 37 (86%) were successfully weaned. Of those discharged patients who remained ventilated, the median LOS was 35 days, IQR (13-86) days. Of those 37 patients successfully weaned, the median time to liberation from mechanical ventilation was 23 days, IQR (13-42) days. The median LOS was 54 days, IQR (32-114) days. **Conclusion:** The total number of discharged patients considered candidates for successful liberation from prolonged mechanical ventilation was 43. A total of 37 (86%) were successfully liberated from the ventilator and 6 (14%) were not. Sponsored Research-None

Sponsored Research - None

Discharge Disposition					
Liberated From Ventilator n=37			Not Liberated From Ventilator n=75		
Acute Discharge	0	(post wean)	Acute Discharge	43	(26-did not return and 17 readmitted)
Expired	2	(post wean)	Expired	16	(13 admit chronic + 3 DX chronic)
Home Health Services	12		Home Health Services	13	(with ventilatory support)
Long Term Acute Care	0		Long Term Acute Care	1	
Skilled Nursing Facility	9		Skilled Nursing Facility	2	
In-Pt Rehabilitation Facility	5		In-Pt Rehabilitation Facility	0	

Discharge Disposition

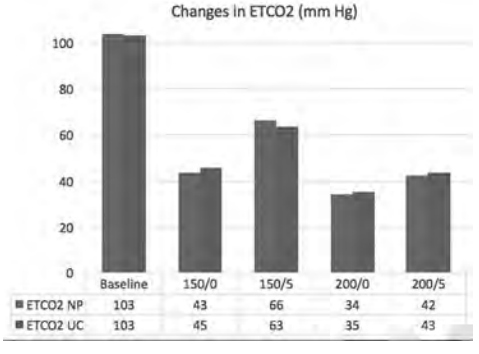
2758462

Carbon Dioxide Clearance and Tidal Volume Augmentation Using the Life2000h Ventilator in a Breathing Simulation Model.

Edna L. Warnecke[1], Michael S. Blaisdell[1], Mark S. Siobal[2]; [1]Respiratory Therapist Program, Ohlone College, Newark, CA; [2]Respiratory Care Program, Skyline College, San Bruno, CA

Background: The Life2000h™ (Breathe Technologies Inc, Irvine, CA) is an FDA cleared critical care ventilator that is intended to provide continuous or intermittent ventilator support. The Life2000h can be used non-invasively using Nasal Pillows (NP) or invasively using a Universal Connector (UC). We evaluated and compared CO_2 clearance and quantified tidal volume augmentation in a breathing simulation model using both interfaces. We hypothesized that end tidal CO_2 ($ETCO_2$) would decrease and tidal volume would increase as the set volume increased during breathing simulation of acute ventilatory failure. **Methods:** The ASL 5000 (Ingmar Medical, Pittsburgh, PA) breathing simulator was set to a frequency of 20/min, with Pmus adjusted to achieve a tidal volume of 300 mL, resistance set to 10 cm H_2O/L/sec, and compliance set to 50 mL/cm H_2O. An adaptor with a side port for CO_2 bleed-in was attached between the ASL 5000 and a 45 cm section of standard corrugated aerosol tubing. A mainstream CO_2 monitor (NICO, Philips Respironics, Murrysville, PA) was placed between the aerosol tubing and each of the two interfaces to monitor end tidal CO_2 ($ETCO_2$). Before the start of each test, gas from a CO_2 cylinder was bled into the side port adapter at the ASL 5000 until a baseline $ETCO_2$ of 103 ±1 mm Hg was reached during simulated breathing. The Life2000h was then set to deliver the following volume settings and PEEP combinations: 150/0, 150/5, 200/0, 200/5. End Tidal CO_2 changes from baseline, tidal volume augmentation, PIP, and PEEP measurements were then recorded after a period of stabilization. **Results:** While using the NP and UC interfaces at breathing simulator settings of 150/0, 150/5, 200/0, and 200/5, the $ETCO_2$ decreased by an average of 57%, 38%, 67%, and 59% respectively; the average tidal volume (mean ± SD) increased to 492 ± 45, 379 ± 21, 614 ± 79, and 513 ± 48 mL respectively; the average PIP (mean ± SD) was 6.5 ± 1.6, 7.9 ± 1.3, 11.4 ± 1.2, and 12.3 ± 2.3 cm H_2O respectively. The average PEEP (mean ± SD) when set at 5 was 4.3 ± 0.0 cm H_2O. **Conclusion:** In this simulated model of acute ventilatory failure, the Life2000h ventilator using both NP and UC interfaces provided CO_2 clearance and tidal volume augmentation at all levels of support tested.

Sponsored Research - Breathe Technologies, Inc supplied equipment



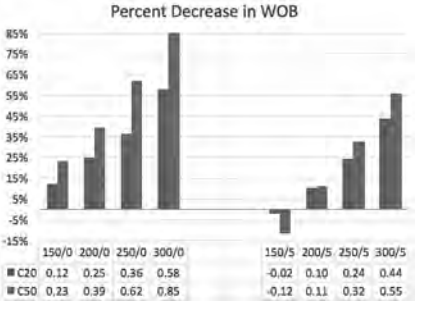
2758468

Work of Breathing Using the Life2000 Ventilator and a Nasal Pillow Interface With and Without PEEP.

Edna L. Warnecke[1], Michael S. Blaisdell[1], Mark S. Siobal[2]; [1]Respiratory Therapist Program, Ohlone College, Newark, CA; [2]Respiratory Care Program, Skyline College, San Bruno, CA

Background: The Life2000h™ (Breathe Technologies Inc, Irvine, CA) is an FDA cleared critical care ventilator that is intended to provide continuous or intermittent ventilatory support. The Life2000h can be used noninvasively using Nasal Pillows (NP) or invasively using a Universal Connector (UC). We tested the work of breathing (WOB) changes with and without PEEP at four volume settings and two different compliance levels during breathing simulation using the NP interface. We hypothesized that the WOB would be reduced as set volume on the Life2000h increased. **Methods:** The ASL 5000 (Ingmar Medical, Pittsburgh, PA) breathing simulator was attached to a nares model with the following settings: frequency of 20 b/min with a closed loop control of tidal volume at 500 mL, rise time 20%, inspiratory hold 0%, release time 20%, resistance set to 10 cm H_2O/L/sec, and compliance settings of 20 and 50 mL/cm H_2O (C20, C50). The Life2000h was set to the following: volumes of 150, 200, 250, and 300mL with and without a PEEP setting of 5 cm H_2O. Inspiratory time was set to 0.6 to 0.8 seconds with a trigger setting of 5. Baseline WOB measurements without the NP interface attached (B1) and with the NP attached (B2) were recorded. Measurements from the ASL 5000 were used to calculate total patient WOB in Joules/Liter (J/L). Additionally, PIP and PEEP measured by the ASL 5000 were recorded. A series of 3 runs were performed at each setting variable. The data for the volume setting of 300 mL and C50 was extrapolated from other results due to the limitations of the model. **Results:** WOB increased with the application of the NP interface (B2-B1) by an average of 0.1 J/L. The Life2000h decreased WOB as set volume increased. As volume settings increased from B1 (no volume) to 300 mL at the C20 and C50 settings without PEEP, the WOB decreased from 2.5 to 1.1 J/L (58% reduction at C20) and from 1.3 to 0.2 J/L (85% reduction at C50); with PEEP, the WOB decreased from 2.5 to 1.4 J/L (44% reduction at C20) and from 1.3 to 0.6 J/L (55% reduction at C50). At the volume settings of 150, 200, 250, and 300 mL, with C20 and C50, PIP ranged from 5.2 to 5.3, 7.3 to 8.6, 9.9 to 12.0, and 17.4 to 18.0 cm H_2O. When PEEP of 5 cm H_2O was set, the average measured PEEP was 4.0 ± 0.15 cm H_2O. **Conclusion:** In this simulated breathing model, increasing the set volume on the Life2000h resulted in a decreased WOB at every test condition studied with the exception of the 150/PEEP 5 settings.

Sponsored Research - Breathe Technologies, Inc. provided equipment



2758599

Impact of COPD to Mechanical Ventilator Days of Traumatically Injured Patients: A Retrospective Study.

samuel s. shan, Douglas S. Gardenhire, Robert B. Murray, Gordon L. Warren; Respiratory Therapy, Georgia State University, Atlanta, GA

Background: The elderly population is on the rise and more patients are admitted to trauma centers with chronic obstructive pulmonary disease (COPD). Literature suggests both longer and shorter durations for COPD patients on mechanical ventilation (MV). Studies show specialized care provided to COPD patients and the desire of clinicians to quickly wean COPD patients off MV, resulting in fewer MV days. Studies also show more days on MV for COPD patients due to their disease state which leads to asynchrony to MV and higher risks for ventilator associated events. Our objective was to examine the impact of COPD for patients who suffered a traumatic injury in regards to the need for MV and days on MV. **Methods:** Data was collected at a level-one trauma center located in Atlanta, GA, between January 2011 and September 2015. This retrospective study was approved by the university IRB and included patients that were admitted to the intensive care unit following a motor vehicle accident. Patients were categorized into two groups: patients who suffered chest trauma (CT) and patients who didn't suffer CT. Patients were subdivided into COPD and non-COPD groups. Descriptive statistics and an analysis of variance were used to compare if MV was needed and mean number of days on MV. **Results:** Of the 2542 patients included in the analyses: 76% suffered CT and 24% did not suffer CT. Of the 1921 patients who suffered CT, 5% were identified as COPD and 42% of those patients required MV, 95% were identified as non-COPD and 48% of those patients required MV. Of the 621 who did not suffer CT, 6% were identified as COPD and 20% required MV, 94% were identified as non-COPD and 25% required MV. The mean (SD) number of days each group was on MV were: CT with COPD=8 (15.2), CT without COPD=6.5 (12.2), without CT and with COPD=0.7 (1.8), without CT or COPD=1.7 (6.3). Results were adjusted based on injury severity score. There were no significant differences when we examined the need for MV or days on MV for patients who suffer COPD with or without CT compared to patients who were non-COPD with or without CT. **Conclusion:** When patients suffer trauma, COPD does not have a significant impact on MV days and need for MV, but COPD patients who suffer CT will stay on MV for more days and require MV more often than patients who have COPD without CT and non-COPD with or without CT. COPD patients without CT stay on MV fewer days than non-COPD patients. **Disclosures:** None; Sponsored Research-None.

Sponsored Research - None

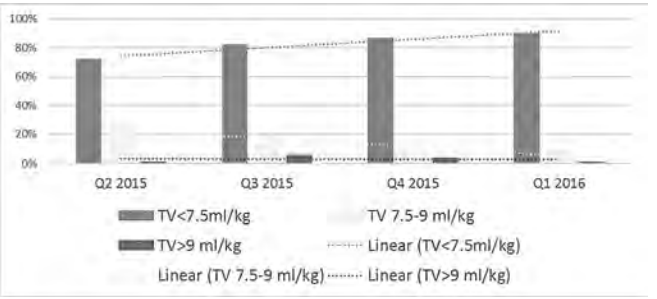
2758625

Utilizing Tele-ICU to Improve Adherence to Mechanical Ventilation Goals.

Amanda Richter; Cardiopulmonary Services, Metroplex Health System, Kempner, TX

Background: We utilize a telehealth ICU (tele-ICU) program to help improve quality of care and access to intensivists. Among the metrics that are tracked include adherence to Low Tidal Volume Ventilation (LTVV). Initially respiratory therapist involvement was virtually non-existent. With new department leadership on board, we partnered the RT department with our provider to expand these efforts. **Methods:** Single center, retrospective review of mechanically ventilated patients admitted to the ICU at a community based hospital. Data was collected and compiled by our telehealth service partner and includes arterial blood gas data to determine ratio values and EMR data for tidal volume information. Information is presented for 2016 Q2, Q3, Q4 and 2017 Q1. Patient data when either height or gender is not entered or unknown, ABG results that do not include all three ABG vent fields (pO2, FiO2, and V_T), and/or ABG results recorded when the value for V_T is less than 200, were excluded. V_T categories are defined as "Green" (V_T <7.5 ml/kg), "Yellow" (V_T 7.5-9.0 ml/kg), and "Red" (V_T > 9.0 ml/kg). With RT department involvement, we discovered our IBW/ V_T reference sheets were flawed, which were corrected nationally in all sites. We were also able to help justify the need for RT support from the telehealth provider. **Results:** In 2016 Q2 72.3% of these patients were in the green zone, 26.5% in the yellow zone, and 1.2% in the red zone. In 2016 Q3 81.8% of these patients were in the green zone, 12.7% in the yellow zone, and 5.5% in the red zone. In 2016 Q4 87.0% of these patients were in the green zone, 8.7% in the yellow zone, and 4.3% in the red zone. In 2017 Q1 90.5% of these patients were in the green zone, 8.3% in the yellow zone, and 1.2% in the red zone. There has been an evident increase in the percentage of patients with VT in the green zone, overall yellow zone percentages have decreased. **Conclusions:** The utilization of the teleICU program, along with tracking and reporting this data, and partnering with the RT department helps improve adherence with ARDSnet protocols, including low V_T standards.

Sponsored Research - None



2758703

Identification of Quality Metrics for Mechanical Ventilation.

Brian K. Walsh[1], Kevin Bullock[2], Barry Grenier[2], Peter Betit[2]; [1]Anesthesia / Critical Care, Boston Children's Hospital, Stoughton, MA; [2]Respiratory Care, Boston Children's Hospital, Boston, MA

Background: Because there is no standardized quality metrics for mechanical ventilation (MV) institutions are left creating their own metrics of success. This variability in metrics hinders the quality improvement process and makes benchmarking nearly impossible. **Methods:** We conducted an IRB approved survey regarding the quality and safety of MV involving three domains: communication, safety and quality. The survey was distributed to the AARC and Children's Hospital Association respiratory therapy listserves. **Results:** There were 327 respondents to the survey, mainly from urban (55%), non-profit hospitals (59%) where adults were primarily cared for (59%). Of the 327 respondents, 230 (70%) completed the quality metrics domain. The majority of respondents report conducting patient ventilator assessments every 4 hours (66%) and 86% report conducting a ventilator safety check with each patient assessment. Respondents that answered "always" for the types of quality metrics monitored are as follows; VAP (82%), VAE (79%), Unplanned extubations (75%), Duration MV (69%), ICU LOS (60%), Extubation failures (57%) and Hospital LOS (51%). Those who answered "Often" and "Always" that together became the majority of quality metrics are as follows; Airleak (67%), Order compliance (59%), MV protocol compliance (57%). Those metrics in which respondents answered "Never" or "Seldom" the majority of the time are as follows; Number of alarms per ventilator day (80%) and Ventilator free ICU days (56%). Additionally, there appears to be no standardize way of collecting quality metrics and the majority (86%) believe there should be the creation of a harm or risk index related to ventilator alarms or miscommunications. See table 1 for a summary of surveyed quality metrics. **Conclusion:** The results of this survey of quality metrics in mechanical ventilation demonstrate there is common agreement among the surveyed metrics. There is an apparent need for a risk/harm index. Yet, there is no common collection method which can make interpretation of the quality metrics results difficult. **Disclosures:** BKW discloses a research relationship with Maquet, GE Healthcare, Aerogen and Vapotherm.

Sponsored Research - None

Table 1

Metrics	Always	Often/Always	Never/Seldom
Vent Patient Assessments	66%-Q4		
VAP	82%		
VAE	79%		
Unplanned Extubations	75%		
Duration of MV	69%		
ICU LOS	60%		
Extubation Failures	57%		
Hospital LOS	51%		
Airleak		67%	
Order Compliance		59%	
Protocol Compliance		57%	
# of Alarms per Vent Day			80%
Ventilator Free Days			56%

2760338

Effect of Altitude on Performance of the VDR-4 and Clinician Monitoring.

Dario Rodriquez, Thomas C. Blakeman, Joel Elterman, Dina Gomaa, Richard D. Branson; University of Cincinnati, Cincinnati, OH

Background: The VDR-4 (Percussionaire, Sandpoint, ID) is a pneumatically powered and controlled high frequency percussive ventilator. The VDR-4 has been deployed for critical care aeromedical transport. **Methods**: Part I: The VDR-4 was tested in an altitude chamber at sea level, and 8,000 ft (P_B of 760 and 564 mmHg). Airway pressures, flow, and volume were continuously measured with a ventilation monitor (IMT PF-300, IMT, Switzerland) during ventilation of a test lung (TTL, Grand Rapids MI). The VDR-4 was set at a peak pressure of 30 cm H_2O, PEEP 10 cm H_2O, pulsatile frequency of 400 cycles/min, T_I of 3.0 s and T_E of 1.5 s. This provided a respiratory frequency of 13 breaths/min. TTL compliance was 20 mL/cm H_2O and resistance was 20 cm H_2O/L/s. Data were recorded on a breath-to-breath basis for analysis. Mean measured values at each altitude were compared to sea level data using analysis of variance (ANOVA). Part II: After ascent to altitude, RRTs and MDs with VDR-4 experience evaluated the device and made changes to return values to baseline. The study was approved by the Wright Patterson and University of Cincinnati IRBs and informed consent was obtained, 10 subjects were included. Clinicians were allowed to use the digital pressure gauge or other monitors (Monitron) to make decisions. Variables were measured after correction by clinicians and compared to baseline as a percentage. A P <.01 was considered significant. **Results:** At 8,000 ft the pulsatile frequency fell from 400±11 cycles/min to 345±13 cycles/min (P <.001) and respiratory frequency from 13±0.4 breaths/min to 11±0.6 breaths/min (P <.01). The delivered V_T increased 15% from 400±55 mL to 458±45 mL (P <.01). PEEP increased 40% from 10 cm H_2O to 14 cm H_2O, P <.001). Driving pressure remained constant but the peak pressure increased because of the increase in PEEP (30±1 cm H_2O to 34±1 cm H_2O). T_I also increased (3.0 s vs 3.53±0.1 s, P <.01). T_E changed from 1.5 s to 1.76 s (P <.01). In Part II, clinicians adjusted settings to mimic baseline values. Following adjustments the values at altitude varied from -56% to +24% for V_T, -11% to +5% for respiratory frequency, -9% to +0.3% for pulsatile frequency, -29% to + 11% for peak pressure and -29% to +16% for PEEP compared to baseline. **Conclusions**: The VDR-4 performance is altered by altitude and could lead to violation of lung protective standards. Experienced clinicians perceive this alteration and make changes which do not restore baseline values.

Sponsored Research - United States Air Force 711th Human Performance Wing

2758414

Correlation Between Calculated and Measured Mean Airway Pressure in Mechanically Ventilated Pediatric Patients.

Susan M. Smith, Ronald E. Dechert, Christine Ketz, Michelle Matthews, Kenneth P. Bandy; Pediatric Respiratory Care, C.S. Mott Children's Hospital, Michigan Medicine, Dundee, MI

Mean airway pressure (MAP) is a crucial component of respiratory assessment. This parameter has significant value in calculation of oxygen index (OI), management of mechanically ventilated ICU patients and assessment of patient risk for ventilator associated conditions (VAC). Given this importance, precision of MAP data is critical. The purpose of this study was to determine the utility of various common MAP formulas against measurements directly obtained from the mechanical ventilator. This retrospective analysis was conducted on 100 patients in our pediatric cardiac ICU. For each patient, we reviewed the electronic medical record documentation provided during routine patient-ventilator assessment. The review period was from February 6, 2017 through April 17, 2017. Three standard equations were applied to obtain calculated MAP values. Descriptive statistics and correlation analysis were employed to compare the strength of each formula against the reported values obtained from the mechanical ventilator. Additional data collected included the time, body weight, presence of open sternum, total respiratory rate, set mechanical ventilator rate, inspiratory time, MAP, PIP and PEEP. There was no direct intervention with human subjects to obtain this data and IRB approval was obtained before data extraction began. Research findings demonstrated consistency through all three MAP formulas. Thus, a single formula was chosen for data comparison. 64% of subjects had calculated MAP within 1 cmH2O of measured. Calculated MAP was consistently below measured values. It was observed that with higher spontaneous respiratory rates, the change in calculated MAP became more significant when compared against measured MAP (see Figure 1a). Calculation of MAP for retrospective analysis and predictive modeling is less precise than utilizing measured MAP values obtained directly from the mechanical ventilator. The three standard MAP formulas strongly correlated with each other. With increased respiratory rates, the gap between calculated and measured MAP values increased. Use of MAP measurements taken directly from the mechanical ventilator will provide more precise calculation of OI, management of mechanically ventilated ICU patients and assessment of risk for VAC.

Sponsored Research - None

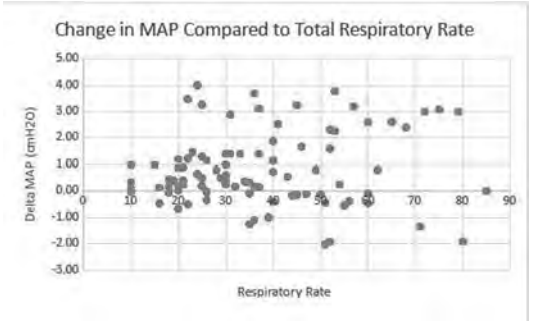


Figure 1a represents changes in calculated MAP when compared to increasing respiratory rate

2758419

Parental Perceptions of the Neonatal Respiratory Therapist: A Quality Improvement Teamwork Project.

Janet Lioy[1], John Chuo[1], Elizabeth J. Greubel[1,2]; [1]Neonatology, The University of Pennsylvania-The Children's Hospital of Philadelphia, Newtown, PA; [2]Student Research, Nazareth Academy High School, Philadelphia, PA

Background: Having a sick infant in a neonatal-infant intensive care unit, (N/IICU), is a stressful time. Because of the high intensity environment often parents are not give the opportunity to share their feelings, opinions and views about team interactions, comfort or trust issue. The neonatal respiratory therapist is an often underappreciated team member. Most families never rate their overall experience during their infant's hospital stay. **Purpose:** To understand the parental opinions, perceptions of all team members caring for their sick infant. **Methods/Design:** A 15-question survey was administered to a random selected group of 40 parents who infants were inpatients at a high level quaternary N/IICU with stays from < 2wks to over 6 months during 2014. Parents were scattered throughout the entire 98 bed N/IICU; were anonymously selected and did not represent any specific cohort of illness. The authors were not involved at all in the care of the infant. Survey questions centered on teamwork, trust, conflict awareness and caregiver preference. All responses were anonymous and data was entered into Survey Monkey and analyzed by descriptive statistics. This was a Quality Improvement project and did not need IRB approval. **Results:** Doctors, nurses and other parents were viewed as the most important and trusted team members. Interestingly, however, the neonatal respiratory therapists were ranked as one of the highest important trusted team members. Trainees, (residents and fellows), were seen as the least trusted caregivers. The majority families felt the team was skilled, responsive and communicated well. Perception of team conflict was minimal. **Conclusions:** Parental perceptions of team members impact their impression of who to trust and who is most important to care for their infant. Often, trust and confidence in caregivers become the key components influencing family satisfaction. Surprisingly, the neonatal respiratory therapy was seen as one of the most trusted and important caregiver on the team. Efforts must be made to incorporate the respiratory therapist into daily team rounds, family meetings and allow input into decision making involving all aspects of respiratory care of their patients.

Sponsored Research - None

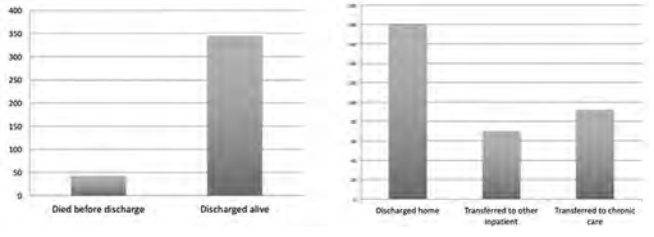
2758430

Survival and Decannulation After Infant Tracheostomy.

Janet Lioy[1,2], Kevin Moran[1,2], Edward Hopkins[1], Joanne Stow[2], Luv R. Javia[2,3], Sara DeMauro[1]; [1]Neonatology, The University of Pennsylvania-The Children's Hospital of Philadelphia, Newtown, PA; [2]Otolaryngology, The Children's Hospital of Philadelphia, Philadelphia, PA; [3]Otolaryngology, The University of Pennsylvania, Philadelphia, PA

Background: Mortality and airway morbidity immediately following tracheostomy, (trach),) are well documented in the literature. There are few reports about morbidity beyond the airway or longer-term course after tracheostomy. **Objective:** To compare timing of trach, decannulation rates, and time to decannulation based on the initial indication for trach. **Methods:** We performed a large retrospective study of children undergoing tracheostomy before 1 year of age at a single quaternary center over a 12-year period. Indication for trach was classified as: neurologic/neuromuscular/musculoskeletal (NEURO), bronchopulmonary dysplasia/respiratory failure (LUNG), congenital or acquired anomaly of the airway/neck/face (ANOM), congenital heart disease (CHD), or other. Continuous and categorical outcomes were compared between groups based on indication with ANOVA and chi-squared tests. **Results:** 387 children <1 year of age underwent trach; 60% were male. Gender distribution was similar across different indications for tracheostomy. There was a bimodal distribution of gestational age at birth; 58% were born preterm (<37 weeks). Mean postnatal age at trach was 140+/-88 days. The most common indication for trach was chronic lung disease (46%), while approximately 6% of all tracheostomies were in infants with CHD. There was a significant difference in age at trach based on indication (p<0.001). As of 12/2016, 42% were decannulated, 23% died, 22% transferred care outside of our institution, and 13% still had a tracheostomy (mean age 7.6+/3.1 years). Mortality and decannulation rates varied significantly by indication, as did initial age at trach, which also varied significantly by indication. There was a significant difference in age at trach based on indication (p<0.001). **(Table).** There was no difference in age at tracheostomy between those who were eventually decannulated and those who were not (133 vs. 148 days, p=0.11). **Conclusion:** This is the largest study of infants with tracheostomies to date, and includes infants of all gestational ages and all indications for tracheostomies. Indication for tracheostomy is strongly associated with both survival, likelihood of decannulation and time to decannulation. Such information will be of value during counseling of families about outcomes after tracheostomy placement.

Sponsored Research - None



Disposition and Survival

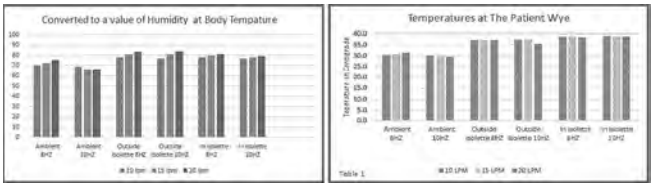
2758444

The Effects on Humidity When the Temperature Probe is Not Placed Proximal to the Patient Y.

Jeffrey W. Wright[1], Kevin L. Crezee[2]; [1]Respiratory Care, Primary Children's Medical Center, West Valley City, UT; [2]Medical Affairs, Mallinckrodt Pharmaceuticals, Hampton, NJ

Introduction: This study looks at the effects on humidity when F&P MR850 distal temperature (temp) probe is placed in various positions in a HFOV circuit and differing environments. The goal was evaluate for best practice. **Method:** Testing completed with a performance checked 3100A HFOV equipped with an F&P MR850 humidifier. Parameters were 8 Hz, 10 Hz, amplitudes of 15,20,25,30, and for each of the settings bias flows of 10,15, and 20 Lpm. A Fluke 971 Temperature Humidity meter was placed between the HFOV circuit wye and the test lung(imtMedical Smartlung Adult). The lung compliance was 8cm/H2O. The HFOV would be set to the desired settings. Humidity and temp readings were recorded once the Fluke 971 and MR850 readings were stable. Setting changes were made, and the process repeated. Testing was completed in 3 environments. Environment 1 (E-1), the ventilator circuit is in ambient room temp with the probe at the patient wye. Environment 2 (E-2), the HFOV circuit is placed in the isolette to just short of the limit balloon with the probe is just outside the isolette. Environment 3 (E-3), the temperature probe at the patient wye inside the isolette, and the HFOV circuit is in the same position as E-2. **Results:** It was found that the temp of the gasses at the measurement point varied. With E-1 the temps were 28.6°C to 31.8°C, averaging 30.3°C. E-2 the temps were 35.3°C to 38.2°C, averaging 37.0°C. E-3 the temps ranged from 37.9°C to 39.6°C, averaging 38.8°C(see Graph 1). The measured results were compared against a meter[3] of gas at a temp at 37°C with 100% saturation at sea level in (44mg of H2O). With E-1 the average amount of H2O measured was 70 %, E-2 averaged 81%, and E-3 averaged 79% (see Graph 2). **Conclusions:** The data showed the environment did have an effect on delivered amount of H2O particularly when the HFOV circuit was in an ambient environment. In E-2 and E-3 had little difference in the overall H20 delivery with a variance of 2%. Probe placement based on out result show that in a heated closed isolette enviroment the temperature loss may not be as great as previously thought. Also, probe placement may have an unknown effect on body temperature in the heated closed isolette environment. The authors wonder if the gas temp being greater than normal body temp (E-3) could have unknow physiological effects to the neonatal patient. Further investigation is needed to fully understand these effects.

Sponsored Research - None



2758451

Characteristics of Unplanned Extubations in Children's Hospitals: Data Analysis of a Large Multicenter Survey.

Justin Hotz[1,2], Russelle Cazares[2], Edward Guerrero[2], Narayan Iyer[3,4], Leo Langga[2]; [1]Anesthesia Critical Care Medicine, Children's Hospital Los Angeles, Los Angeles, CA; [2]Respiratory Care, Children's Hospital Los Angeles, Los Angeles, CA; [3]University of Southern California, Los Angeles, CA; [4]Neonatology, Children's Hospital Los Angeles, Los Angeles, CA

Background: Infant and pediatric patients experiencing unplanned extubations are associated with an increased risk for cardiopulmonary resuscitations, longer hospital stay and higher hospital costs. The reported rates of unplanned extubations vary widely amongst institutions. We sought to study and analyze unplanned extubation data from a multicenter Children's Hospital survey conducted through the Children's Hospital Association's (CHA) Respiratory Care Directors Forum. Our goal was to better understand the nature of unplanned extubation patterns and risks and its potential connection to varying clinical practices between different institutions. **Methods:** Data was collected using an on-line survey tool conducted by CHA specifically targeting Children's Hospitals. Surveys were performed in 2013, 2014 and 2015. The survey tool identified general clinical practices for securing endotracheal tubes, utilization of ventilator weaning and sedation protocols, inside and outside of NICU. Lastly, the participants reported their Unplanned Extubation rates for each specialty area, NICU, PICU, and CTICU. A Kruskal-Wallis test with posthoc Mann-Whitney U tests with adjustment for multiple comparisons were done to determine differences in unplanned extubations per 100 ventilator days for each survey question. **Results:** 32 Children's Hospitals participated in the survey. Median unplanned extubations per 100 Ventilator Days between year 2013, 2014, and 2015 were 0.48, 0.48, and 0.51 respectively (P = 0.48). Median unplanned extubations per 100 Ventilator days were highest in the NICU (0.83) followed by the PICU (0.45) and lowest in the CTICU (0.26) (P < 0.001). Median and Interquartile Range for unplanned extubations per 100 ventilator days, stratified by survey response and unit are shown in the Figure. For data outside of the NICU there was a significantly higher rate of unplanned extubations per 100 ventilator days for hospitals that used a ventilator weaning protocol (P < 0.05). **Conclusions:** Unplanned extubation rates are statistically higher in the NICU when compared to the PICU and CTICU across all institutions. Outside of the NICU, use of a ventilator weaning protocol was associated with a statistically higher rate of unplanned extubations. No significant difference was observed between different techniques of endotracheal tube securement technique, and use of a sedation protocol.

Sponsored Research - None

2758493

Functionality of Response Using Automatic Tube Compensation During CPAP in Neonatal Patients: A Bench Evaluation.

Tracey Roberts[1], Ryan M. Sharkey[2], Eric J. Kriner[3], Michael A. Gentile[1], Daniel D. Rowley[2], Janice J. Thalman[1], Thomas Mallinowski[2]; [1]Duke University Medical Center, Durham, NC; [2]University of Virginia Health System, Charlottesville, VA; [3]Medstar Washington Hospital Center, Washington, DC

Background: Automatic Tubing Compensation (ATC) is a feature designed to overcome endotracheal tube (ETT) resistance by modifying pressure to compensate for the pressure drop across the ETT. This is believed to alleviate imposed work of breathing for the patient and perform an "electronic extubation". Available data evaluating ATC in the neonatal population is sparse. We hypothesize neonates do not benefit from the application of ATC regardless of endotracheal tube size (ETT) or increased levels of active breathing. Methods: An ASL 5000 lung simulator (Ingmar Medical, Pittsburgh, PA) and VN500 ventilator (Draeger Inc., Telford, PA) were used to collect pre and post ATC data in a neonatal model of CPAP ventilation. Different ETT sizes (2.5mm and 3.5mm) were grouped and compared with differing levels of Pmus (Pmus10-30cmH2O). ASL settings included: Resistance 150 cmH2O/L/sec, Compliance 0.5 mL/cmH2O and rate 60bpm. The VN500 was set as follows: CPAP 5, Flow trigger 0.5L/min, Tmax 1sec, Paw high 15cmH2O, Slope 0, FiO2 0.40 and ATC compensation 100%. Data was collected over 60 breaths and repeated three times for each ETT size and with ATC on/off. Statistical analysis was performed using SPSS 23 (IBM, Armonk, NY). A Wilcoxon Ranked Sign test was applied to analyze the data. A two-tailed alpha is set at p < .05. Data are reported as median (IQR). Results: There was no statistically significant difference when comparing ATC off to ATC on in either ETT size group. Conclusions: Ventilation parameters were not statistically different between the ATC on and ATC off group no matter what size ETT was used or level of Pmus applied to the model.

Sponsored Research - None

Table 1

ETT size	Pmus	ATC On/Off	Exp Vt.(mL)	Peak Flow (mL/s)	Ppeak (cmH2O)	Time to trigger (ms)
2.5	10	Off	4.3 (4.3-4.4)	19 (18.9-19)	4.9 (4.9-4.9)	354
		On	4.4 (4.3-4.4)	19.8 (19.8-19.9)	5.0 (5.0-5.0)	346
	20	Off	8.4 (8.4-8.41)	33.4 (18.9-19)	4.8 (4.8-4.9)	358
		On	9 (8.9-9.0)	43.8 (43.0-43.8)	4.9 (4.8-5.0)	336
	30	Off	12. (12.0-12.1)	48.0 (48.0-48.4)	4.9 (4.8-4.9)	368
		On	13 (12.9-13.0)	56.3 (56.0-56.2)	4.8 (4.8-5.0)	352
3.5	10	Off	4.6 (4.5-4.6)	21.8 (21.8-21.9)	5.1 (5.1-5.1)	303
		On	4.6 (4.6-4.6)	22.3 (22.2-22.5)	5.1 (5.1-5.1)	288
	20	Off	9.1 (9.1-9.12)	46 (46.0-46.1)	5.0 (4.9-5.0)	320
		On	9.3 (9.2-9.3)	47.7 (47.2-47.8)	5.1 (5.0-5.1)	288
	30	Off	13.5 (13.5-13.5)	63.8 (63.8-63.8)	4.9 (4.9-4.9)	334
		On	13.8 (13.8-13.9)	65.6 (65.3-65.6)	5.2 (5.2-5.5)	293

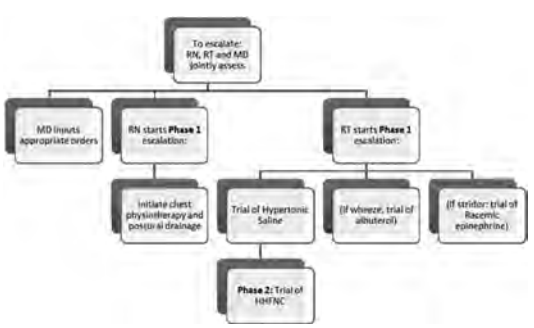
2758529

Escalation of Care Protocol for Bronchiolitis: Impact on Respiratory Care Workflow and Patient Outcomes.

George E. Mitri[1], Jeffrey Cain[1], Lindsey Borock[1], Heidi Flori[2], Kenneth Bandy[1], Ronald Dechert[1]; [1]Respiratory Care, C.S Mott Children's Hospital, Ann Arbor, MI; [2]Pediatric intensive care, Michigan medicine, Ann Arbor, MI

Introduction. Viral bronchiolitis is an acute illness initiated by upper airway virus infection affecting children generally under the age of 3. The American Academy of Pediatrics (AAP) has recently published management guidelines that do not provide a clinical practice pathway for patients who require escalation of therapy due to medical deterioration of the patient. During the 2015/2016 viral season (Dec-April), we experienced a substantial number of bronchiolitis patients requiring escalation of care and admission to the intensive care unit. In preparation for the past viral season, a multidiscipline group of clinicians was convened to develop an escalation pathway with the hope that avoidance or minimization of ICU admissions could be accomplished through more aggressive, escalated care in our general and moderate care areas. Respiratory Care interventions were at the forefront of this escalation pathway. The purpose of this study is to report on the utilization of Respiratory Care services related to escalation of care in our most recent bronchiolitis admissions and the impact of RT workflow resulting from these additional services. Methods. The bronchiolitis escalation pathway involves three stages as identified in Figure 1. Using the clinical pathway guideline for escalation of care (CPG), we monitored 146 hospital admissions who met the criteria for baseline support in this population. Patients were advanced through the stages (escalating care) if their medical status deteriorated throughout their stay. We initiated the escalation pathway on December 21, 2016 and followed all eligible patients throughout their stay ending with patients admitted on march 31, 2017. Results. Of the 146 admissions, 32 patients required direct admission to the ICU from the emergency department. Of the remaining 114 patients, 16 additional patients escalated care requiring ICU admission from the general or moderate care areas. Forty-two patients required escalation of care, including the use of hypertonic saline nebulization and/or heated high-flow nasal cannulas but did not progress to requiring ICU admission. Conclusion Our escalation pathway did result in increased Respiratory Care activities in this patient population. The increase in services did not overwhelm our workflow and the combined additional efforts of nursing and Respiratory Care appeared to decrease the need for ICU transfer from moderate and general care areas.

Sponsored Research - None



2758663

Comparison of Delivered Bubble CPAP Pressures at Varying Flows in a Simulated Infant.

Ryan M. Sharkey; Pulmonary Diagnostics and Resiratory Therapy, University of Virginia Medical Center, Charlottesville, VA

BACKGROUND: Bubble CPAP generates a continuous distending pressure when continuous flow is submerged in a water column. Multiple authors have described differences in the optimal flow used to deliver the set CPAP. The purpose of this bench study was to examine if set flow alters delivered CPAP with a bubble CPAP system. METHODS: A Bubble CPAP generator (Fischer Paykel, Auckland, NZ) with the bubble CPAP interface (Babi-plus ®, Carlsbad, CA) was set at 4,5,6,7, and 8 cmH_2O via water column submersion. Medical air gas flows of 4, 6, 8, and 10 L/min were set on the flowmeter. A simulated upper airway model was constructed to mimic the resistance and deadspace of a 27 week infant. Nasal prongs were fitted to minimize leaks. The model was connected to an ASL 5000 test lung (Ingmar Medical, Pittsburgh, PA) set with a respiratory rate of 60 breaths/minute, lung compliance: 3 ml/cm H_2O, resistance: 80 cm H_2O/L/sec, Pmus: 5 cmH_2O). Airway pressure was measured proximally at the "nares" of the model with a pressure manometer (Extech, HD750, Waltham, MA) and distally in the ASL test lung. Both were calibrated to manufacturers' instructions. Three sample runs were done at each CPAP level at the varying respective flows One minute of washout time occurred between measurements. A Paired Samples T-Test was used to compare distal pressure with set CPAP levels. Data are reported as mean ± SD. Wilcoxon Ranked Sign test was used to compare proximal pressure with set CPAP levels. Data are reported as median (IQR)[DR1]. A two-tailed Alpha level was set at P <.05. SPSS v 23 (IBM, Armonk, NY) was used to analyze the data. RESULTS: The set and distal measured CPAP was statistically significantly different at most levels of flow for distal pressure (no difference at 5 cm H_2O of CPAP set at 10 L/m; and 6 cm H_2O of CPAP set at 8 L/m). There was no statistically significant difference in the proximal pressure monitoring group when compared to set CPAP. DISCUSSION: We observed a statistical difference in the distal pressure CPAP level, but not proximal, when compared to the set CPAP. Altering set flow will change delivered CPAP in the lung, but this may not be recognized by clinicians at the bedside.

Sponsored Research - None

Distal

		CPAP				
		4	5	6	7	8
Flow	4	3.55 ± .02*	4.24 ± .02*	5.27 ± .02*	5.75 ± .02*	6.29 ± .50*
	6	3.13± .07*	4.69± .05*	5.68 ± .22*	5.85 ± .07*	7.04 ± .08*
	8	3.37± .06*	4.81 ± .07*	5.98 ± .06 (p=.051)	6.18 ± .10*	7.17 ± .03*
	10	3.78 ± .07*	5.00 ± .09 (p=.921)	6.10 ± .12*	6.59 ± .02*	7.20 ± .05*

*p<.001

Proximal

		CPAP				
		4	5	6	7	8
Flow	4	3.4(3.3-3.5)	4.4 (4.3-4.6)	5.4 (5.3-5.4)	6.4 (6.2-6.5)	7.4 (7.2- 7.5)
	6	3.6 (3.4-3.6)	4.5 (4.4-4.6)	5.5 (5.4-5.6)	6.5 (6.4-6.6)	7.6 (7.5-7.6)
	8	3.7 (3.5-3.8)	4.9 (4.9-5.0)	5.7 (5.6-6.8)	6.7 (6.6-6.7)	7.7 (7.6-7.8)
	10	4.0 (3.9-4.1)	4.8 (4.7-5.1)	5.9 (5.8-6.0)	6.9 (6.7-7.0)	7.9 (7.8-8.1)

2758682

Evaluation of Different Nasal Airway Interfaces on Carbon Dioxide and Pressure in a Preemie Lung Model Supported With Bubble and Ventilator CPAP.

Patrik Malone, Dave Crotwell, Bob DiGeronimo, Rob DiBlasi; Seattle Children's Hospital, Seattle, WA

BACKGROUND: Clinicians have many neonatal noninvasive interface options available for use in Bubble CPAP (BCPAP) and ventilator CPAP (VCPAP), including nasal masks, bi-nasal short prongs and RAM cannula (Neotech). Clinical concerns have been raised about whether these different nasal airway interfaces are equally effective in providing appropriate end-expiratory distending pressure and CO_2 clearance due to differences in resistance, leaks, and deadspace. We hypothesized that there were no differences in end-expiratory pressure and CO_2 elimination between nasal masks, bi-nasal short prongs, and RAM cannula during B-CPAP and VCPAP in a premature infant long model. **METHODS:** A 3D printed anatomic nasal airway of a 28 week GA infant was attached to a spontaneously breathing premature test lung (Ingmar ASL 5000). CO_2 was bled into the lung model to obtain $ETCO_2$ 60±1 torr. End expiratory pressure and CO_2 levels were measured at baseline (no CPAP) and 2 minutes following BCPAP and VCPAP (6 cmH_2O) affixed with FlexiTrunk (Fisher Paykel) bi-nasal short-prongs, nasal masks, and Neotech RAM cannula. Inhaled CO_2 and exhaled CO_2 were measured to represent simulated CO_2 rebreathed from anatomic deadspace and alveolar CO_2, respectively. All efforts were made to each interface and airway model to assure 100% nasal interface occlusion. ANOVA (Tukey Post-HOC) was used to compare differences in mean pressure and CO_2 data between the different interfaces, P<0.05 was significant. **RESULTS:** End expiratory pressure was greater with the bi-nasal prongs and mask than RAM cannula (*P*=0.05, Figure). Inspired CO_2 from deadspace was lowest with the bi-nasal short prongs with both forms of CPAP. The Neotech RAM cannula provided the lowest exhaled CO_2 from the lung model during BCPAP but the bi-nasal short prongs had the lowest exhaled CO_2 during VCPAP. **DISCUSSION/CONCLUSION:** The major finding from the current study is that pressure delivery was similar between all of the different nasal airway interfaces and CPAP systems (within 0.6 cmH_2O). Inspiratory CO_2 from different interfaces was ≤ baseline values, suggesting no risk for CO_2 rebreathing from mechanical deadspace. We believe the enhanced CO_2 elimination observed with Neotech RAM cannula with BCPAP may be related to flow resistive back-pressure which was shown to create lower frequency and higher amplitude pressure oscillations in the lung model when compared to the bi-nasal prongs and nasal mask.

Sponsored Research - None

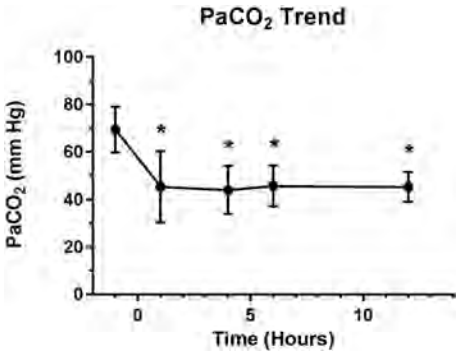
2758704

High-Frequency Jet Ventilation in Infants With Congenital Heart Disease and Hypercapneic Respiratory Failure: A Single Center Experience.

Gary G. Heyman[1], Craig R. Wheeler[1], Craig D. Smallwood[1,2]; [1]Respiratory Care, Boston Children's Hospital, Boston, MA; [2]Department of Critical Care Medicine, Department of Anesthesia, Preoperative and Pain Medicine, Boston Children's Hospital, Boston, MA

BACKGROUND: When children with congenital heart disease (CHD) exhibit hypercapneic respiratory failure, careful titration of the conventional ventilation (CMV) is required to reduce mean airway pressure while providing sufficient $PaCO_2$ elimination. The use of high-frequency jet ventilation (HFJV) has only sparsely been reported in infants with CHD and hypercapneic respiratory failure during the perioperative period. Therefore, we sought to analyze HFJV use, settings and outcomes when applied as a rescue modality in subjects with hypercapneic respiratory failure refractory to CMV. **METHODS:** Subjects were included in the study if they were admitted to the cardiac intensive care unit with CHD, weight ≤10kg and PaCO2≥55 mmHg; despite attempts to optimize CMV settings. Subjects managed on HFJV before admission were excluded from analysis. Demographics, ventilator parameters, and physiologic data were extracted from the medical record 1 hour preceding HFJV; and at 1, 4, 6 and 12 hours following conversion. We sought to report the number of subjects who failed HFJV in the first hour, defined a priori as no reduction in $PaCO_2$. Normally distributed data are expressed as mean ±SD; non-normally distributed data are reported as median (interquartile range). Continuous $PaCO_2$ data were analyzed using an unpaired t-test. **RESULTS:** Eighteen subjects were studied with a weight and age of 2.82 kg (2.25 - 3.68) and 4 weeks (3-8) respectively. $PaCO_2$ decreased from 69 ± 10 mm Hg to 45 ± 15 following transition to HFJV which was statistically significant (P = <0.0001) (Figure 1). 94% of the cohort demonstrated a reduction in $PaCO_2$ within the first hour of HFJV. Duration of HFJV was 66 hours (36 - 100), and subjects received CMV for a total of 390 hours (144 - 534) **CONCLUSION:** We demonstrate a significant reduction in $PaCO_2$ within the first hour of HFJV, which was sustained for 12 hours following initiation. These data suggest that HFJV may be an important tool for rescuing infants with CHD, and concomitant hypercapneic respiratory failure refractory to conventional ventilation.

Sponsored Research - None



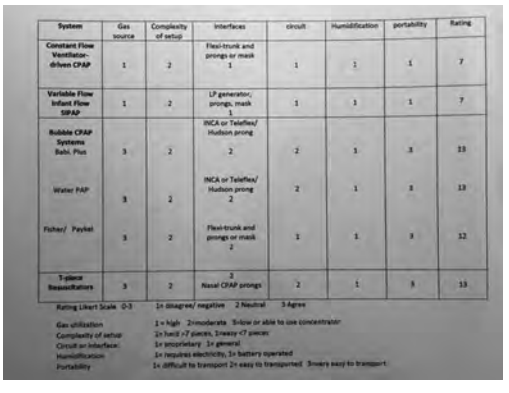
2758706

Evaluation of Noninvasive Respiratory Support Resources for Use in Disaster Planning in a NICU.

KAthleen Deakins; Pediatric Respiratory Care, UH Rainbow Babies & Children's, Chardon, OH

Background: Noninvasive positive pressure respiratory support (CPAP) is commonly used in a NICU to support infants with respiratory distress syndrome and other forms of respiratory insufficiency. In the face of a healthcare facility disaster, the resources needed for a NICU to support patients requiring continuous care are challenging and require planning and preparedness to prevent unanticipated barriers for caregivers on the front lines of care. The purpose of this evaluation is to review the types of CPAP devices available in most NICU's and determine potential alternatives or adaptations that can be used for response during a disaster. **Methods**: Four types of infant nasal CPAP systems available to most institutions were compared to assess the key elements to be used in the face of limited electrical, gas or equipment resources. Ventilator-delivered CPAP, infant flow SIPAP, and Bubble CPAP, and T-piece resuscitator systems with different interfaces, were reviewed to determine the types of gas sources needed, circuit and interface requirements humidification, and ease of transport. Gas supply choices considered included oxygen cylinders, or high flow oxygen concentrators: 0-10 Lpm (examples: Invacare Platinum 10, Invacare Elyria OH) and Respironics Millennium (Philips, Respironics, Koninklijke Philips, NV) were also reviewed. CPAP systems were rated based on manufacturer-available criteria using a three point Likert Scale: 0-3 in each category. System ratings were compared using a paired t-test with a statistical significance set at p=0.0001. **Results:** CPAP system scores for the rated categories are displayed in the table below. **Conclusion:** Bubble CPAP and T-piece resuscitator used for CPAP are preferable for use in a NICU during a hospital disaster. Providing gas sources are supplied by oxygen concentrators or low gas consumption blenders, these devices are easily maintained and transportable. Humidification for CPAP is dependent on an electrical source for any type of system. Further investigation on other portable systems is critically important to these areas of care

Sponsored Research - None



NASAL CPAP SYSTEMS

2758855

Impact of a Comprehensive Education Program for Parents of Children Requiring Long-Term Tracheostomy.

Joshua D. Curtis; Respiratory Care, University of Kentucky, Lexington, KY

BACKGROUND/METHODS: The Pediatric Intensive Care Unit (PICU) at Kentucky Children's Hospital (KCH) aimed to improve and standardize education to caregivers of patients with a fresh tracheostomy. The target population included all PICU patients with new tracheostomies. Incidence of readmission within one week or less after discharge, incidence of readmission within 8-30 days post discharge, the average number of admissions over the first three months after discharge, and length of stay (LOS) post tracheostomy placement were collected retrospectively (2014 –November 2015) and prospectively (December 2015 to March 2017). A multidisciplinary team of nurses (RNs), respiratory therapists (RTs), and a physician created a multi-stage process to improve and standardize tracheostomy education. The team met with the education coordinator of a local home care service to identify important competencies associated with tracheostomy care. A competency checklist was compiled and added to the electronic medical record in early 2015. An illustrated tracheostomy book with procedures and written references was also distributed. A companion video series was filmed and posted on YouTube. All PICU RNs and RTs underwent education competency training in trach care. An infant mannequin with a tracheostomy was purchased for staff training and for family education. Education methods included (but were not limited to) simulations, scenarios, check-off lists, teach-back, demonstration and discussion. All education materials were completed and distributed to families starting at the end of 2015. PICU RNs and PICU RTs were jointly charged with responsibility for initiating and completing tracheostomy education with at least two caregivers. RESULTS: After implementation, KCH experienced a 15% drop in the number of pediatric patients who had readmissions in a week or less, and a 22% drop in the number of pediatric patients who were readmitted between 8 days and 30 days as well as a drop in the number of average readmissions over 3 months from 0.8 admissions to 0.3 admissions. The mean hospital length-of-stay post tracheostomy placement was 21.2 days for non-vent dependent patients before and 20.8 days after the new education curriculum was implemented.

Sponsored Research - None

2758424

Readmissions and Resource Utilization Among Infants Who Underwent Tracheostomy Before 1 Year of Age.

Janet Lioy[1,2], Kevin Moran[1,2], Edward Hopkins[1], Joanne Stow[2], Luv R. Javia[2], Sara DeMauro[1]; [1]Neonatology, The University of Pennsylvania-The Children's Hospital of Philadelphia, Newtown, PA; [2]Otolaryngology, The Children's Hospital of Philadelphia-The University of Pennsylvania, Philadelphia, PA

Background: Infants under 1 year undergoing tracheostomy placement require complex multidisciplinary follow up and frequent re-hospitalizations. Few studies have analyzed the burden of ongoing care in this population. It is essential to understand the characteristics of post-tracheostomy resource utilization in order to design targeted strategies to improve care in this high-risk population. It is paramount to understand the burden of resources including readmissions and outpatient visits in this vulnerable population. **Objectives:** 1) To characterize the burden of outpatient subspecialty care among children who underwent tracheostomy before one year of age. 2) To evaluate the timing and number of hospital readmissions for infants who underwent tracheostomy before one year. **Methods:** We performed a large retrospective study of children who received a tracheostomy for any indication before 1 year at a single quaternary center over a 12-year period from 2001-2013. Because data were skewed, differences between groups were compared with Kruskal-Wallis tests. **Results:** 387 children <1 year of age underwent tracheostomy; 345 survived to discharge (89%). 180 (52%) were discharged home and 162 (47%) were discharged to another inpatient or chronic care facility. At discharge, 90% were receiving at least some feedings through a nasogastric or gastrostomy tube. 164 (48%) children were followed until decannulation, 47 (14%) died after discharge, 50 (14%) continue to have tracheostomies at a mean age of 7.7 +/- 3.1 years, and 84 (24%) were lost to follow-up. Among survivors not lost to follow-up, the median number of outpatient subspecialists involved in their care was 7 (IQR 5, 9); 15% had 10 or more different subspecialists. The median number of readmissions was 5 (IQR 2, 8); 20% had 10 or more readmissions. Median time to first readmission was 141 (IQR 30, 342) days. Median number of days to first readmission for children discharged home was 131 (IQR 28, 361); 178 (IQR 47, 319) for those transferred to other institutions, and 144 (IQR 25, 333) for those discharged to chronic care facilities (p=0.0001). **Conclusion:** Infants with tracheostomies require frequent hospital readmissions and care from multiple subspecialists during the first few years after discharge. These data highlight the need for coordinated multidisciplinary outpatient care and targeted interventions to reduce preventable readmissions in this high-risk population.

Sponsored Research - None

2757858

Respiratory Therapy Department Directors' Preferences Regarding the Educational Background of New Graduate Staff Respiratory Therapists.

Sarah M. Varekojis, Taylor J. Brownfield, Maddison A. Davis, Rachel M. Gates, Miranda J. Schulte; The Ohio State University, Columbus, OH

Background: The roles and responsibilities of respiratory therapists have evolved and expanded significantly since the start of the profession. With both associate's and bachelor's degrees in respiratory therapy prevalent nationwide, it is important to understand which educational background is desirable to provide safe, effective, and quality patient care. The purpose of this study was to describe respiratory therapy department directors' preferences regarding the educational preparation and background of staff respiratory therapists, as well as their current and anticipated hiring practices. Method: An electronic survey was developed to obtain data to address the research questions. Questions included information regarding the educational background of staff therapists, preferences of hiring managers, and reasons for these preferences. Members of the respiratory therapy network within Vizient were surveyed. A link to the survey was sent in an email to 288 respiratory therapy department directors, representing 139 hospital departments. The study was approved as exempt by the Institutional Review Board. Results: 70 participants completed the survey. Over 70% (n=68) of respondents preferred to hire new graduates with bachelor's degrees in respiratory therapy. 51% (n=70) of respondents believed graduates with their preferred educational background provide value to the department. In addition, 44%-48% indicated that these graduates communicate effectively and work effectively on the healthcare team, provide evidence-based, quality patient care, and are prepared for professional advancement. However, respondents indicated only 30% of current staff respiratory therapists hold a bachelor's degree. Approximately 80% (n=67) of respondents believed they will prefer to hire therapists with bachelor's degrees in the next 5 years. There were no significant differences in preferences based on hospital demographics. Conclusions: The majority of hiring directors prefer new graduates with a bachelor's degree in respiratory therapy, which they believe promote value and mission of the department and profession, and meet the needs of the department related to teamwork, communication, and quality patient care. It appears that there is a desire for more bachelor's degree prepared respiratory therapists entering the workforce to better match the expanding roles and responsibilities of respiratory therapists both now and in the future. Disclosures: None.

Sponsored Research - None

2757899

Healthcare Students' Perceptions of Simulation at an Urban University.

Fahad H. Al Enazi, Douglas S. Gardenhire, Ralph D. Zimmerman, Robert Murray; Respiratory Therapy, Georgia State University, Atlanta, GA

Background: Simulation can foster the learning process and assist in mimicking clinical scenarios. To enhance the healthcare learning environment, it is essential to examine students' perceptions toward the use of simulation in healthcare programs and to which degree simulation courses influence the learning process. The objective was to evaluate perceptions of students' use of simulation in nursing, respiratory therapy, physical therapy, nutrition, and occupational therapy programs. **Method:** The study was approved by the university IRB. Data were collected using a convenience sample. The survey presented a 4-point Likert-type scale and consisted of 10 questions. **Results**: Two hundred and fifty students (N=250) were surveyed from five different programs; physical therapy students accounted for 29.2%; followed by nursing students 28%; respiratory therapy students 27.6%; occupational therapy students 7.6%; and nutrition students 7.2%. The majority of participants were female (70.4%) while male students represented 29.6% of the population. Almost 58% of participants reported that they did not have any experience working in a healthcare setting. The majority of students (95.2%) reported that they engaged in a clinical simulation experience in their healthcare program. The study findings indicate students' overall perceptions have a high agreement with the statement that simulation experience was a valuable learning experience (M = 3.52; SD ± .577). Students demonstrate a high agreement that simulation should be an integral part of the clinical experience (M=3.48; SD ± .599). Moreover, students reported that simulation debriefing experience supports their understanding and reasoning (M=3.47, SD ± .598). The study findings revealed that clinical experiences have no significant effect on students' perception toward simulation. However, female students reported that they experienced more nervousness during simulation than male students (P = 0.005). Additionally, students who had previous simulation experience reported more agreement that simulation was realistic than students who did not have any simulation experience (P= 0.049). **Conclusion:** Healthcare professional students have a good perception toward simulation education and feel that simulation should be an integral part of education. Further studies with higher number of participants, disciplines and different institutions are recommended. **Disclosures:** None; Sponsored Research-None

Sponsored Research - None

2757907

The Use of Augmented Reality Glasses in Central Line Simulation.

Abdullah Alismail[1], Cynthia Huang[2], Avi Cohen[2], Michael Terry[2], Waleed Almutairi[1], Jonathan Thomas[3], Laren Tan[2,1]; [1]Cardiopulmonary Sciences, Loma Linda University, Redlands, CA; [2]Loma Linda University Medical Center, Loma Linda, CA; [3]School of Business, La Sierra University, Riverside, CA

Introduction: Central venous catheters (CVC) are frequently inserted for hemodynamic monitoring and infusion of medications, and are associated with a 4-7% complication rate. Simulations have become increasingly popular for demonstrating skills for CVC insertion. However, the complex multi-step procedure requires real-time instruction by an experienced provider. We investigated the use of augmented reality glasses (ARG) to provide real-time instructions in CVC simulations. With the AiRScouter, the learner controls the timing of each step and receives real-time directions from the AR glasses. **Methods**: The study was approved by the Institutional Review Board at Loma Linda University, CA, U.S.A. Subjects were randomly assigned into two groups: ARG group and non-ARG group. All subjects watched a tutorial on internal jugular (IJ) CVC insertion prior to simulation, and ARG subjects received additional teaching on the use of AiRScouter glasses. During simulation, a standard CVC placement manikin (Blue Phantom Central Line Model) was used. A grader recorded the time to placing AR glasses, time to venipuncture, number of sticks, and completion of the checklist. Before simulation, each subject completed a survey describing prior experience & perceptions of augmented reality. After the simulation, a survey was completed rating the experience & post-simulation perception of ARG in CVC simulation. **Results**: A total of 21 subjects participated in this ongoing study. Mean age of participants was 32±8.1 years; 7 Females and 14 Males; 10 Medical Doctors, 10 Respiratory Therapists, and 1 Sleep Technologists. Subject assignment was randomized with 10 in the traditional arm and 11 in the AR arm. When adjusted for the time to set the ARG, the AR group had a faster mean time to successful cannulation (420s vs. 493.08s). The AR group performed better in completing all tasks on the checklist (100% vs 83%). Seventy one percent of AR users believed that hand, head, and foot interaction for AR glasses was not difficult and does not require a lot of mental work. Sixty four percent of AR users felt that the AR glasses did not interfere with the procedure. **Conclusion:** Augmented reality glasses led to near perfect compliance with a pre-determined checklist in our ongoing study. Implementation is useful in simulation learning, and may be of benefit in real-life central line simulations across professions.

Sponsored Research - None

2757922

The Use of Augmented Reality in Intubation Simulation.

Abdullah Alismail[1], Michael Terry[1,2], Waleed Almutairi[1], Avi Cohen[2], Cynthia Huang[2], Jonathan Thomas[3], Laren Tan[2,1]; [1]Cardiopulmonary Sciences, Loma Linda University, Redlands, CA; [2]Loma Linda University Medical Center, Loma Linda, CA; [3]School of Business, La Sierra University, Riverside, CA

Introduction: The risk of failing or delaying tracheal intubation in critically ill patients has been associated with inadequate preparation. Clinicians and trainees in simulation courses for tracheal intubation are encouraged to recall a preparation checklist to mitigate risk of a failed intubation. The purpose of this study was to determine if using Augmented Reality Glasses (ARG) are useful as a training tool to perform intubation. **Methodology:** The study was approved by the Institutional Review Board at Loma Linda University, CA, U.S.A. Subjects were randomly assigned into two groups: ARG group and non-ARG group. Both groups reviewed a video on how to intubate following the New England Jounral of Medicine intubation guidelines. The ARG group underwent an additional training session on how to use augmented reality glasses. Both groups performed intubation procedure and group comparisons were analyzed later. A total of 21 subjects (physicians (n=10), respiratory therapists (n=10), and sleep technologist student (n=1)) participated to perform endo-tracheal intubation on a standard intubation manikin. ARG was used to present a preparation checklist to the user during the intubation process. The following variables were recorded: time to wearing the ARG, time to intubation, and number of completed tasks on a predefined intubation checklist. Both groups were given a pre-intubation questionnaire to determine their perceived proficiency in endotracheal intubation. A post-intubation questionnaire was given to the ARG group to record their experience using ARG as a tool for intubation procedure. **Results:** The mean age of the subject's was (32± 8) for the participants (14 males and 7 female). 65% of the subjects had previous exposure with intubating patients. All subjects had a mean of 15 intubations done previously on mannequins. In the AR group, the average time to place the AR glasses was 72 seconds(s). Post-intubation ventilation was 180s in the ARG group compared to 120s in the non-ARG group. 88% of the subjects believed that the information displayed on the AR screen was appropriate and 90% believed that the device does not require a lot of effort when intubating. **Conclusion:** This preliminary data of our ongoing study shows that Augmented Reality Glasses are useful in simulation training for complex medical procedures such as intubation. Further studies are recommended to better evaluate its usefulness as a training tool in educational programs.

Sponsored Research - None

2758438

Is Simulation an Effective Environment for Evaluating Effective Documentation?

Joe Camacci, Phillip Stark, Gina Civettini, Emily Scicchitano; Respiratory Care, Penn State Hershey Medical Center, Hershey, PA

Background Proper documentation is paramount in ensuring institutional integrity and avoiding needless legal repercussions. When our department was met with a challenge in addressing some serious deficits of proper documentation, we decided to investigate if incorporating documentation into a simulation was an effective way to evaluate and improve this skill. **Method** At our institution, complex medical management scenarios are frequently enacted to assess our therapist's knowledge and skill in clinical situations. These simulations require appropriate interventions to be performed and predetermined objectives to be met. But rather than end these scenarios with the typical overhead announcement of *"simulation has ended"*, we now require our participants to give a 'hand-off' communication of the scenario to another therapist entering the room. We also established a trainer charting area of our electronic medical record where the participants were given 10 minutes to document the scenario. We utilized SBAR (Situation-Background-Assessment-Recommendation), as our framework for assessing effective and thorough charting. We determined 17 separate aspects that needed to be documented in order to be considered thorough charting. We then calculated the overall success rates for charting all of these 17 items. In all, 47 participants were included for this study. **Results** Based upon the 17 individual aspects we deemed necessary for thorough charting, we calculated the successful percentage of their documentation by the entire study group.. **Conclusion** Simulation has become the premier method for enhancing critical thinking and developing kinesthetic skills. We have also found it to be effective in evaluating proper documentation of complex medical situations. Our study demonstrated serious deficiencies in what we considered thorough documentation. Ineffective charting leaves both the therapist and institution vulnerable. The realism of post scenario charting is an effective instructional method for assessing and addressing charting insufficiencies. For these reasons, we will continue to incorporate charting and its assessment into future simulation sessions.

Sponsored Research - None

Documentation Scoring Grid

Situation	Clearly identified the environmental and clinical situation	31%
Assessment	Ascertained pertinent background information	33%
Background	Performed and charted necessary clinical assessments	30%
Recomendation	Identified decision tree that lead to recommendation and ultimate action	65%

2758558

A Comparison of Exam Questions Categorized by Level of Critical Thinking in a Traditional and Flipped Respiratory Therapy Class.

Kathleen Hernlen, Vahe Heboyan, Andrew Mazzoli; Department of Clinical and Digital Health Science, Augusta University, Augusta, GA

Background: Passive learning has been the primary means of teaching respiratory therapy (RT) students. A flipped class is a technique requiring prior preparation by the student to enhance the interactive in-class experience. Past research has shown the flipped class is as effective as the lecture class. The flipped class may be a way to meet the increasing needs of critical thinking skills required by RT students. The purpose of this study was to compare the results of categorized critical thinking exam questions in a class taught in traditional and flipped class formats. Methods: The study compared exam questions on two tests from a first semester course. In year 1 (n= 23) the traditional class was taught with pre-class readings and in-class lecture presentations. In year 2 (n=24) the flipped class was taught using pre-class tutorials and readings, and in-class quizzes, activities and group discussions. The same teacher taught both classes. Each class received two exams with a total of 92 identical questions. The exam questions were categorized by type of question, (multiple choice (MC), short answer (SA), matching, labeling and math) and critical thinking level (knowledge, comprehension, analysis, application, synthesis and evaluation). Critical thinking categories were defined as: knowledge- recall material; comprehension- understanding facts; application- appliance of knowledge; analysis- break down of ideas; synthesis- compilation of ideas; and evaluation- judgements based on evidence. Questions were scored using a 1 point (0=incorrect, 1 = correct) or 2 point scale (0=incorrect, 1 partially correct, 2 correct). A Mann-Whitney T-test was performed on each question category and overall scores. Results: Exam 1 demonstrated significantly higher scores on MC Analysis and SA Knowledge in the traditional class. However, SA Application and SA Synthesis questions were significantly higher in the flipped class. Exam 3 showed significantly higher scores in the flipped class for MC Knowledge, SA Application, and SA Synthesis questions. The overall score for exam 3 was significantly higher for the flipped class. Conclusion: The flipped class demonstrated higher scores on questions with higher levels of critical thinking indicating flipped teaching methods may be of value for RT instruction. Limitations noted included possible instructor bias, the small number of participants, and the lack of comparison of the student GPAs and study habits.

Sponsored Research - None

A Comparison Critical Thinking Exam Questions in a Traditional Versus a Flipped Respiratory Therapy Course

	Mean Traditional	Mean Flipped	Std. Dev. Traditional	Std. Dev. Flipped	P Value CI 95%
Exam 1 MC Analysis [a]	0.96	0.74	0.20	0.45	.041
Exam 1 SA Knowledge [a]	0.65	0.46	0.23	0.33	.028
Exam 1 SA Application [b]	1.20	1.53	0.49	0.51	.031
Exam 1 SA Synthesis [b]	1.13	1.47	0.39	0.41	.010
Exam 3 SA Application [b]	1.42	1.82	0.60	0.39	.008
Exam 3 Synthesis [b]	1.10	1.51	0.32	0.30	.000
Exam 3 Overall Score	82.34	88.34	7.70	6.48	.006

a= scored out of 1 possible point, b= scored out of 2 possible points

2758685

Student Outcomes in a Collaborative Learning Environment: Team Based Learning Effectiveness in Teaching Electrocardiograms to Respiratory Care Students.

Alan A. Alipoon; Cardiopulmonary Sciences, Loma Linda University, Colton, CA

Background Studying alone can be challenging to some students trying to understand new topics in the medical field. Incorporating study teams as a strategy can be more effective in learning complex medical topics. The major purpose of this study was to assess the effectiveness of Team-Based Learning (TBL) by comparing individual Readiness Assessment Test (iRAT) scores with team Readiness Assessment Test (tRAT) scores in a bachelor degree in Respiratory Care program. Methods Subjects were students enrolled in Diagnostic Techniques course in 2016. Before taking the iRAT in class, students were instructed to study at home and review course materials provide for them by the instructor. After completing the iRAT in class, students were divided into small groups of five to six to take the tRAT. Each group took the same iRAT test but were instructed to discuss and give reasons why they chose to give a specific answer. Test results from their iRAT and tRAT scores were then compared using a paired t-test method for analysis. Results Paired t-test was used to compare means between individual readiness assurance test (iRAT) (15.42 ± 5.65) and team readiness assurance test (tRAT) (20.53 ± 1.98) scores for 19 participating students. A significant improvement in tRAT scores was noticed ($p<0.001$) compared to iRAT scores. A regression model was used to predict test scores in the final examination using TBL as a strategy of teaching ECGs. Having students participate in teams, conduct discussions and answer the question to validate their own answers is a significant predictor of having higher test scores ($p<0.001$). When comparing mean final test scores for 2016 using TBL method to 2015 non-TBL method, an improvement in mean scores was noticed in the TBL method (86 ± 9 vs 75 ± 29.6) Conclusion This finding suggests that TBL improved examination scores of all students who participated in the individual Readiness Assurance Test (iRAT) and team Readiness Assurance Test (tRAT) exercises; TBL also benefited lower-achieving students in particular. TBL also showed its effectiveness when compared to the previous non-TBL cohort, demonstrating the power of a learning team that is capable of solving very challenging and complex problems – problems that are beyond the capability of the best students in the class, working alone.

Sponsored Research - None

2758707

Improving Critical Thinking Skills of Undergraduate Respiratory Therapy Students Through the Use of a Student-Developed, Online, Respiratory Disease Management Database.

Rebecca Oppermann, Georgianna Sergakis, Crystal Dunlevy, Sarah M. Varekojis; The Ohio State University, Columbus, OH

Background: Development of critical thinking skills in higher education, especially in the allied health or medical fields, is well-documented as a crucial part of any undergraduate education. There is a need, in respiratory therapy education specifically, to create resources that develop critical thinking skills and application of knowledge skills in clinical settings. The purpose of this study was to determine if a student developed, online, respiratory disease management resource improves critical thinking skills in undergraduate respiratory therapy students. Methods: The study was approved by the Institutional Reveiw Board. Utilizing previously established assignments designed to assess critical thinking, 1st year respiratory therapy students developed their own online, respiratory disease management database in the form of a Wiki. The grades received by the 1st year respiratory therapy students were then compared to the grades received on the identical assignments by the 2nd year respiratory therapy students the previous year. 1st year student were then asked to complete a survey to gather their subjective feelings about the database creation and whether or not they perceived it as helpful in critical thinking skill development. Results: 39 students were enrolled in this study; 20 currently enrolled in their 2nd year and 19 currently enrolled in their 1st year. The study findings indicated, with a few exceptions, that 1st year students had higher scores on the specific assignments chosen to monitor critical thinking skill development. Four scores on early assignments were significantly higher for 2nd year students, but the final assignment showed a statistically significant improvement in scores by 1st year students. 73.7% of 1st year students completed the survey at the end of the study. Survey respondents used the database occasionally to often when completing assignments geared towards assessing critical thinking and a majority of respondents (92%) perceived the creation of this resource as useful in assignment completion and improvement of their critical thinking skills in the clinical environment. Conclusion: This study suggests that creation of an online disease management resource can improve the critical thinking skills of respiratory therapy students. Disclosures: None.

Sponsored Research - None

2758711

Interdisciplinary Study on Nursing, Respiratory Care, and Social Work Undergraduate Students' Practice of Attitudes Toward, and Knowledge/Skills with Evidence-Based Practice (EBP).

Lindsey A. Morris[1], Jennifer Gresham-Anderson[1], Kathleen Williamson[2], Satyanarayana Ayinagadda[3]; [1]Respiratory Care, Midwestern State University, Wichita Falls, TX; [2]Wilson School of Nursing, Midwestern State University, Wichita Falls, TX; [3]Social Work, Midwestern State University, Wichita Falls, TX

Background: Evidence-based practice (EBP) is the use of scientific evidence to provide better patient care and safety by using clinical decision making skills based on (a) relevant evidence, (b) one's own clinical experience, and (c) patient preferences (Laibhen-Parkes, 2014). The purpose of this study is to identify undergraduate nursing, respiratory care, and social work students' practice of, attitudes toward, and knowledge/skills with EBP. Results will allow faculty to integrate EBP into the classroom and clinical settings, which will help students develop superior skills before they enter the work force. **Method:** A survey was distributed to the students. Data from the surveys were entered into a software package for statistics (SPSS) and analyzed with statistical tests and descriptives. Two focus groups of approximately six to ten students from the three programs were conducted. Each focus group openly discussed questions in relation to EBP. Each focus group ran approximately 30 to 60 minutes. Themes were also drawn from the information collected from the focus groups. **Results:** The focus group had 15 participants, of that ten were female and five were male. The age range went from 21 to 28 years-old. All students responded "yes" to hearing about EBP. Four major themes were obtained (a) research, (b) safety, (c) patient care/quality care, and (d) evidence. The participants voiced that EBP "improves patient safety…[are] guidelines to promote safe practice… keeps up on cutting edge of healthcare…[but there is a] lack of knowledge how to access EBP." The survey had 366 participants, with 271 from the nursing program, 56 the from respiratory program, and 40 from the social work program. The results found that majority of the participants had heard about EBP, 333 said yes and 33 said no. The participants viewed EBP as being fundamental to professional practice, and that most participants would sometimes integrated evidence with their own expertise. **Conclusions:** The results showed that most the participants lacked great research skills, even though they felt that EBP was fundamental to professional practice. Further research on EBP should be done to see exactly how it should be integrated into the programs. **References:** Flynn Makic, M.B., Martin, S.A., Burns, S., Philbrick, D., & Rauen, C. (2013). Putting Evidence into nursing practice: four traditional practices not supported by the evidence. *Critical Care Nurse,* 33(2) 28-43.

Sponsored Research - Creative Endeavor Grant

2758726

Peer Teaching and Learning in Interprofessional Clinical Simulation: Exploration of Respiratory Therapy, Medical Dietetics and Pharmacy.

Kali Moore[2], Breanna Pope[1,2], Shelby Russell[1,2], Kaylee Siffert[1,2], Kelsey Tripp[1,2], Georgianna Sergakis[1]; [1]Respiratory Therapy, The Ohio State University, Columbus, OH; [2]The Ohio State University Wexner Medical Center, Columbus, OH

Introduction: Interprofessional (IP) clinical simulation has become a major component to education among the various healthcare professions. IP education is required of medical dietetic, pharmacy, and respiratory therapy programs as part of their accreditation standards. Although the specifics of fulfilling the IP requirement are not standardized, many programs use IP clinical simulations in order to prepare their students for patient care experiences as part of the healthcare team. Several studies have illustrated the beneficial impact of IP education, IP simulation, peer-precepting and preceptor training on student learning, self-efficacy, teamwork dynamics, and communication. Questions remain if this success will translate to peer-precepting within an IP simulation model. The study was approved by the IRB. *Objective:* This study explored the effects of peer-precepting during IP clinical simulation among respiratory therapy, medical dietetics, and pharmacy students to assess their perceptions and self-efficacy in the peer-precepting and learning roles before and after the standardized IP clinical simulation. *Methods:.* Eighty-two students participated: 42 Medical Dietetics, 11 Pharmacy, and 29 Respiratory Therapy. Changes in self-efficacy ratings were assessed via paired t-tests. Differences in attitudes and self-efficacy for peer-precepting and learning were also assessed. *Results:* Overall, ratings for the experiences were positive. No significant differences were found among 6 of the 8 peer-preceptors' self-efficacy ratings, but a statistically significant difference did exist among peer-learners' ratings. Qualitative data suggests that both groups gained confidence as well as received encouragement in their skills through this experience. These findings suggest that this model is beneficial and viewed as a positive experience by both the peer preceptor and the peer learner. Pharmacy, Medical Dietetics, and Respiratory Therapy students noted an increase in self-efficacy for their professional roles and leadership abilities that will be essential in future professional interactions. *Conclusion:* Participating in interprofessional clinical simulation for peer-preceptors and peer-learners is beneficial and leads to increased self-efficacy for their roles. The experiencesmay enhance communication, teamwork, confidence, and clinical skills, which may lead to future, positive interprofessional interactions and translate to better overall care of patients.

Sponsored Research - None

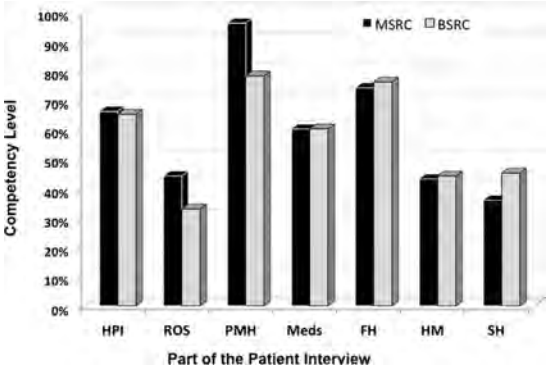
2758728

Do Students From an MSRC Program Apply the Skills to Become Advanced Practitioners Better Than Those Prepared in a BSRC Program? Results of a Preclinical Simulation Experience.

Pooja Bhasin, Kris Tran, Jaime Sanchez, Ruben D Restrepo; Respiratory Care, UTHSCSA, San Antonio, TX

Introduction: The advanced RT practitioner is expected to perform a thorough patient interview, complete a physical exam of the chest, and document the findings in the medical history. The interview covers chief complaint (CC), history of present illness (HPI), review of systems (ROS), past medical history (PMH), family history (FH), social history (SH), and health maintenance (HM). All respiratory care programs teach these components to RT students (RTS). Patient assessment skills to perform a real interview and physical exam of the chest are taught by a respiratory care department to undergraduate (BSRC) and graduate (MSRC) students using a similar teaching style. This study aimed to evaluate the level of competence of RTS from a BSRC and MSRC RT program in documenting the interview of a patient with respiratory symptoms. We have previously reported data on BSRC students overall competence in evaluating interviewing skills that are used in the standardized patients (SPs) interaction prior to their first clinical rotation. **Methods:** RTS and SPs were given "cough and shortness of breath" scenario that was "played during a preclinical encounter in a mock examination room. One RT faculty (RTF) revised the notes transferred to a computer after the patient encounter and evaluated competency against the original script on a total of 36 items. **Results:** Twenty-six MSRC and 21 BSRC students participated on this simulation experience the same day. The overall performance of the group in regards to recording on a chart the interview was 57% (92%-28%); (MSRC 56.9% ±16, range 28%-92%; BSRC 56.5% (SD ±14, range 36%-78%) (p=0.45). The areas of best documentation for the MSRC were HPI, ROS & PMH and for the BSRC were FH, MH & SH. **Conclusion:** This study demonstrated that the overall documentation competence of the patient interview was suboptimal in this group of students. The lack of a significant difference between the two cohorts may simply reflect that student performance was linked to student preparation, not to the degree program they enrolled into.

Sponsored Research - None



2758730

The Effect Factor of Evidence-Based Medicine Competition Jury Rating.

Chia-Chen Chu; Respiratory Therapy, China Medical University and Hospital, TaiChung, Taiwan

Background: February 2014 Respiratory Care magazine published for lack of evidence-based medicine concepts in Taiwan respiratory therapist, one of which is the lack of the major barriers were lack of time, insufficient materials, and lack of personnel tasked with implementation. Therefore, we expand nationwide education and training, evidence-based medicine and organized competition. The purpose of the competition in addition to enhance the concept of membership, but also want to train a group of experienced respiratory therapists become adjudicators of the competition. The purpose of this study was to investigate the effect factor of evidence-based medicine competition jury rating. **Method:** A total of 14 teams and 8 teams from across the country participated in the 2015 and 2016 competition separately, the jury was hired two groups, one of team were three formal experienced jury (Experienced group) and the other team were five senior respiratory therapists (Observe group) they repeat to join this two times competition. Both group juries are required to observe the quality and quantity of PICO, literature search and analysis methods and strict appraisal literature, clinical application of evidence, to make a live performance on five performance ratings. Scoring results collected, we come to ANOVA statistical analysis of the difference. This study was approved by the Institutional Review Board of the study organizations. **Results:** The scores of 14 and 8 competition teams respectively come from experienced group and observe group, to come statistical analysis by ANOVA. The score between experienced group and observe group have no significant difference (64.51±9.41 vs 75.51±9.9, P>0.05) in 2015, but have significant difference (81.34±4.46 vs 66.05±4.62, P>0.05) in 2016. Both group have no significant difference in the scoring results intra self-group (75.51± 9.90 vs 66.05±4.62, 64.51±9.41 vs 81.34±4.46, P>0.05). **Conclusions:** This studies have shown that the experience of jury and seniority of respiratory therapist are unable to ensure the consistency of scoring, because rating score mainly to see the jury's subjective consciousness, so the score that standard requires more time to reach consensus on consistency, each competition team's performance also affect the evaluation ratings. **Key words**: Evidence-Based Medicine (EBM), EBM Competition

Sponsored Research - None

2758735

Measuring Confidence of Respiratory Therapists in the Application of Mechanical Ventilation.

Terry M. Wilson, William C. Pruitt; Cardiorespiratory Care, University of South Alabama, Daphne, AL

BACKGROUND: Respiratory therapists (RTs) are valued members of the critical care team, especially pertaining to mechanical ventilation (MV). RTs must be competent in a variety of areas in order to manage critically ill patients receiving MV. The level of confidence critical care RTs have in competencies related to MV, as outlined by the "Conference of 2015 and Beyond," may vary depending on education and experience in the intensive care unit (ICU). **METHODS**: After obtaining IRB approval, a survey was conducted using a web based survey (SurveyMonkey) for hospitals who are clinical sites for our RT program. The survey consisted 10 questions to gather demographic information and used a Likert scale ranging from "very uncertain" to "very confident" to gather data on RTs self-assessment. These results were used to measure the confidence among RTs in the application of MV based on level of education and experience in the ICU. **RESULTS**: 12 bachelor degree (BSRT) graduates and 12 associates degree (ASRT) graduates responded. Answers showed a slightly increased confidence for BSRT responders. A comparison of proportions test was used to determine if there was a significant difference between the confidence of RTs based on education. BSRT had a CPP of 84.4% (81/96), with ASRT graduates had a CPP of 76.04% (73/96). The difference in confidence between BSRT versus ASRT was not significant (P>0.05, P=0.147). When evaluating the effects of job experience on CPP, those with 0-10 years had a CPP of 84.3% (54/64), 10-20 years CPP was 72.5% (29/40) and 20+ years CPP was 80.7% (71/88). BSRT graduates have an overall higher confidence level in the application of MV than ASRT graduates, though not by a significant margin. There were also some variance in confidence level depending on years of experience. The least experienced therapists (0-10 years) were most confident, and had the BSRT which could account for the higher confidence level. The most experienced therapists (20+ years) had the second highest confidence level, and were mostly ASRT. **CONCLUSION**: The application of MV is an important skill for respiratory therapists to possess. An AS degree may be sufficient when dealing with the application of MV in the ICU, however, therapists with BS degrees seem to be more confident. The study also showed that therapists with an AS degree have higher confidence levels as they gain more experience.

Sponsored Research - None

2758744

Use of Standarized Patients in Respiratoy Care: Preclincal Experience in a Master And Baccalaureate Degree Programs.

Pooja Bhasin, Kris Tran, Jaime Sanchez, Ruben D Restrepo; Respiratory Care, UTHSCSA, San Antonio, TX

Introduction: Standardized patients (SPs) are routinely used across the US to prepare students in a variety of clinical and academic programs. These SPs are given scripted scenarios that are "played" during the patient encounter in a mock examination room. Previously, we have reported results of the SP interaction on a small group of RT students (RTS) in a baccalaureate program. This study was designed to compare teh overall performance of RTS from a MSRC and BSRC after beign provided the same teaching on patient assessment skills. **Methods:** RT faculty (RTS) revised a previously validated 13 – item Likert type-scoring instrument used to gauge interviewing skills for medical students. After consensus from RT faculty (RTF), 8 items deemed most relevant to the role of a RT (proper instruction, appearance, organization, types of questions, listening, nonverbal facilitation, comfort during physical and closure of the interview) were selected for analysis. **Results:** A total of 47 RTS (26 MSRC; 21 BSRC) were evaluated by RTF prior to their clinical experience in the program. The overall score for the eight areas evaluated was 89.6% (±7.65%; range: 67% -- 100%). The highest scores were obtained in the areas of introduction, appearance & presentation, and organization during the student's self-evaluation, and during the faculty evaluation organization, comfort and introduction were the highest. The lowest scores were obtained in the areas of comfort, types of questions and closure of interview during the student's self-evaluation and during the faculty evaluation listening, closure of interview and types of questions were the lowest reported. The MSRC students scored significantly higher during the patient encounter than the BSRC students (93.1% +/-3.5% vs. 84.1% +/-1%; p = 0.034). **Conclusion:** The overall performance of all RTS who participated in this preclinical experience was very good. Although the significant difference displayed during the patient encounter between MSRC and BSRC candidates may be explained by their academic experience prior to entering their graduate program, it needs to be further investigated.

Sponsored Research - None

2722367

Association Between Asthma and Endometriosis: A Retrospective Population-Based Cohort Study.

Yi-Hao Peng[1,3], Ching-Hua Su[2]; [1]Department of Respiratory Therapy, Asia University Hospital, Asia University, Taichung, Taiwan; [2]Department of Respiratory Therapy, Taichung Hospital, Ministry of Health and Welfare, Taichung, Taiwan; [3]Department of Public Health, China Medical University, Taichung, Taiwan

Background: Asthma is a female-predominant disease in the adult population, and 6%–10% of women of reproductive age have been estimated to be affected by endometriosis. However, studies on the association between asthma and endometriosis are scant and their results appear to be inconsistent. We investigated the risk of endometriosis in women diagnosed with asthma compared with age-matched unaffected women. **Methods:** A retrospective, nationwide population-based cohort study was conducted using the data retrieved from the Taiwan National Health Insurance Research Database. A total of 7337 women aged between 12 and 50 years with new diagnoses of asthma and using asthma-related medications between 2000 and 2005 were included in the asthma group, and 29348 age-matched women without asthma were included in the nonasthma group. Both groups were followed until the end of 2013. A Cox proportional hazards regression model was used to compute the risks of endometriosis in women with asthma and without asthma for comparison. **Results:** The overall risk of endometriosis in the asthma group was 1.47-fold higher (95% confidence interval = 1.30–1.65) than that in the nonasthma group. A further stratified analysis revealed that the risk of endometriosis remained significantly higher in all the groups between 20 and 50 years. **Conclusion:** Compared with women without asthma, women with asthma of reproductive age are at higher risk of endometriosis.

Sponsored Research - None

2725334

Asthma Increases the Risk of Benign Prostatic Hyperplasia: A Retrospective Population-Based Cohort Study.

Ching-Hua Su[1], Yi-Hao Peng[2]; [1]Department of Respiratory Therapy, Taichung Hospital, Ministry of Health and Welfare, Taichung, Taiwan, Taichung, Taiwan; [2]Department of Respiratory Therapy, Asia University Hospital, Asia University, Taichung, Taiwan

Background: Asthma is a severe public health problem worldwide; benign prostatic hyperplasia (BPH) is common in aging male populations. However, the relationship between these diseases has rarely been explored. In this study, we investigated the risk of BPH in male patients diagnosed as having asthma compared with age-matched healthy individuals. **Methods:** Data in this retrospective nationwide population-based cohort study were retrieved from the National Health Insurance Research Database of Taiwan. Overall, 9415 male patients with newly diagnosed asthma were included in the asthma group, and 37660 age-matched enrollees without asthma were included in the nonasthma group. Cox proportional hazards regression model was used to determine the risk of BPH in the asthma group compared with the nonasthma group. The following factors were considered: comorbidities (diabetes, dyslipidemia, hypertension, and heart failure), use of tiotropium and ipratropium, and number of annual outpatient department visits. **Results:** The overall hazard ratio for BPH was 1.28 (95% confidence interval = 1.22–1.34) for the asthma group, compared with the nonasthma group, after adjustment for age, comorbidities, use of tiotropium and ipratropium, and number of annual outpatient department visits. Further stratified analysis revealed that the risk of BPH in asthma was significantly higher in all age group of men aged older than 40 years. **Conclusion:** Aging male patients with asthma were at a higher risk of BPH.

Sponsored Research - None

2752879

A Review of Compliance in Asthma Action Plan and Patient Education Documentation in a Pediatric Emergency Department.

Paul H. Easley[1], Marie E. McRae[1], Jennifer R. Cockerham[2], Randy Willis[1], Gary R. Lowe[1]; [1]Respiratory Care Services, Arkansas Children's Hospital, Little Rock, AR; [2]Strategic Planning, Arkansas Children's Hospital, Little Rock, AR

Introduction: In 2015, there were 3,066 visits to our Emergency Department (ED) with a primary, secondary, or tertiary diagnosis of asthma. Upon discharge from the ED, it was of extreme importance that asthmatics received an individualized Asthma Action Plan (AAP). The AAP is a tool that can be used to gauge the asthmatic's status at any given time, and provide information regarding specific signs and symptoms that allow for early intervention and treatment. Appropriate asthma education must also be provided with the AAP. The goal of this project was to determine proper documentation in the medical record of patient receipt of the AAP and accompanying education as ordered by the medical staff. **Methods:** This study was not deemed human subject testing by the local IRB. To limit the scope of this project, only asthmatics with the primary diagnosis of asthma were reviewed. Baseline data were collected retrospectively from 3/1/2016 to 8/31/2016. Three tests of change (TOC) were employed over a three month period (9/1/2016 to 11/30/2016). These included: 1) ensuring unit secretaries scanned records of the AAP and education documentation into the patient's medical record, 2) verbal education with Respiratory Care (RC) staff on completion of the documentation, and 3) PowerPoint presentation sent to all core and rotating RC staff outlining the proper steps for this process. Data were collected during and post-TOC (9/1/2016-2/28/2017) to determine the completeness of documentation with a goal of achieving 95% compliance. **Results:** Pre-TOC data showed a median compliance rate of 56% (range: 41%-75%) for AAP and education documentation in the medical record. During and post-TOC data showed an increase in the median compliance rate to 85% (range: 71%-95%). This resulted in a 52% increase in compliance with documentation and was statistically significant (p=0.004). **Conclusion:** Administering an appropriate AAP and patient education can prepare asthmatics to recognize early signs of an asthma exacerbation. Proper steps can then be initiated for early intervention and treatment. This can prevent further escalation of care. This project addressed the institution's operational goal of improving quality of care and resulted in increased documentation compliance. The 95% compliance goal has not yet been attained, but a significant improvement has been noted. Future steps include continued monitoring of compliance and reinforcement with staff to continue proper documentation.

Sponsored Research - None

2752929

Patient-Centered Medical Home Respiratory Therapist Impacts Asthma Care in a Pediatric Hospital.

Kelly C. Patrick[1], Gary R. Lowe[1], Joe Elser[2], Dennis Kuo[3]; [1]Respiratory Care Services, Arkansas Children's Hospital, Little Rock, AR; [2]Department of General Pediatrics, University of Arkansas for Medical Sciences, Little Rock, AR; [3]Division of General Pediatrics, Women & Children's Hospital of Buffalo, Buffalo, NY

Background: Arkansas Children's Hospital (ACH) Patient Centered Medical Home (PCMH) program integrated a part-time position for a Respiratory Therapist (RT) in October 2015 focusing on improving asthma care. PCMH is a population-based program that designates 10% of primary care patients as high priority beneficiaries, requiring care coordination, and population health management. Care teams, including licensed independent practitioners, one RT, RN care coordinators, and social workers began monthly care team meetings in March 2016. The RT created and maintained for each care team a registry of patients with asthma/wheezing. Variations in asthma management were identified among the care teams, including the number of Pulmonary Function Tests (PFTs) and Asthma Action Plans (AAPs) provided. The objective of this study was to examine the impact of RT leadership on population-level asthma care in a PCMH. **Methods:** This study was not deemed human subject testing by the local IRB. Clinic records were retrospectively reviewed (n = 2100) between Jan 2015-Feb 2017 on all asthma/wheezing patients seen in Continuity (CONT), Well/Service (W/S) clinics, and Adolescent (ADO). Specific data elements included total number of PFTs and AAPs completed in each clinic and broken down by month. Pre-intervention data (Jan 2015– Feb 2016), and post-intervention data (Mar 2016-Feb 2017) were examined. **Results:** Comparing pre- to post-intervention data, there was a 106% increase in the number of PFTs performed in ADO (median = 17.5 vs 36), a 46% increase in CONT (median = 23 vs 33.5), and a 136% increase in W/S (median = 7 vs 16.5). A similar trend was noted with AAPs with a 327% increase in ADO (median = 5.5 vs 23.5), a 62% increase in CONT (median = 19.5 vs 31.5), and a 110% increase in W/S (median = 10 vs 21). **Conclusion:** Preventive asthma care for a PCMH program improved with the addition of dedicated RT time to patient registry maintenance and care team leadership. The RT provided dedicated clinical leadership skills that may be valuable in population management programs in a preventive care setting. Future studies are planned to determine if patients that received AAPs had a decrease in urgent medical care utilization and exacerbations.

Sponsored Research - None

2756033

Effectiveness of an Interdisciplinary Asthma Education Program for a Pediatric Clinic.

Erin Sventy[1], Klodiana Myftari[2,3], Ellen Becker[1]; [1]Respiratory Care, Rush University, Brookfield, IL; [2]Population Health, Rush University, Chicago, IL; [3]Pharmacy, Midwestern University, Downers Grove, IL

Background: Asthma remains disproportionally burdensome among children in lower-income population and minorities living in inner cities. The staff providing care to these patients need strong asthma education skills. The goal of the Asthma Education Workshop was to enhance asthma knowledge, improve comfort using the asthma action plan (AAP) and increase confidence in providing the proper MDI + spacer instructions. **Methods**: A convenience sample of nurses, certified medical assistants, care coordinators, and social workers in an urban pediatric clinic completed the one-hour Asthma Education Workshop as part of an approved quality improvement project. The participants completed surveys pre-and post-workshop on Day 1 and at a 1-month or 2-month interval. Knowledge of the AAP was measured through responses to eight questions. Questions using a 5-point Likert-scale addressed the comfort explaining the AAP and confidence teaching inhaler technique. A MDI + spacer checklist was used to evaluate inhaler technique. The frequency of repetitions it took to perfect MDI + spacer technique was recorded. Wilcoxon Signed Rank tests were used to assess the knowledge, comfort, and confidence measures Day 1 of the workshop and at the 1 or 2-month interval and tested at alpha = .05. **Results**: The 22 participants showed significantly improved AAP knowledge scores on Day 1 pre-and post-test, (Z = -2.93, P = .003); and remained stable between the Day 1 post-test and the 1 or 2-month assessment score, (Z = -1.51, P = .131). The comfort with explaining AAP also significantly improved immediately after the workshop, (Z = -3.25, P =.001). Confidence with MDI + spacer instruction improved between Day 1 post-test and the 1 or 2-month assessment score (Z = -3.36, P = .001). Scores remained stable between Day 1 post-test and the 1 or 2-month assessment score (Z= -1.34, P = .180). However, no one could perform MDI + spacer technique perfectly on the second assessment one or two months later. **Conclusion**: Asthma education, knowledge, comfort, and confidence of clinic staff can be improved using a one-hour workshop. Additional sessions are required for correct MDI + spacer technique. All members of the clinic staff can deliver a more consistent asthma message after participating in the same asthma education workshop.

Sponsored Research - None

2756141

Improving Follow-Up Care for Patients Discharged From the Hospital After an Asthma Exacerbation.

Kimberly Cobb[1], Jennifer Cumming[1], Jennifer Cockerham[1,2], Gary R. Lowe[1], Kelly C. Patrick[1]; [1]Respiratory Care Services, Arkansas Children's Hospital, Little Rock, AR; [2]Strategic Planning, Arkansas Children's Hospital, Little Rock, AR

Background: The U.S. News and World Report (USNWR) survey ranks hospitals annually to provide parents with a tool to find facilities excelling in different specialties. One indicator for excellence identified by the USNWR is providing follow-up care with an asthma specialist within 30 days of hospital discharge after an acute asthma exacerbation. At our institution, there was not a consistent process for follow-up asthma care appointments. We initiated a quality improvement project to improve scheduling those appointments within the 30-day window. **Methods:** This study was not deemed human subject research by the local IRB. The project coordinator was a respiratory therapist (RT) who established a database and monitored daily discharges. Daily, the RT identified hospitalized asthmatics who met the inclusion criteria. Prior to discharge, the RT collaborated with a specialty nurse and patient's family to schedule a mutually acceptable time for a follow-up appointment with the specialty provider. The RT then gave the family an appointment card and contact information prior to discharge and followed with a reminder letter sent to the home. The RT provided a final appointment reminder via phone call within a 5-day window prior to the scheduled appointment. Inclusion criteria encompassed asthmatics admitted with a primary diagnosis of asthma and one specialty clinic visit within the year prior to admission; or an escalation of care during the current admission. **Results:** Pre-intervention data revealed that 18 of 66 patients were scheduled within 30 days, and post-intervention data showed 49 of 58 patients were scheduled within 30 days. This resulted in a 250% increase in the number of appointments scheduled for asthmatics that met criteria within the 30 day window (median = 25% vs 88%). The additional intervention of the reminder phone call did not impact show rates. Pre- and post-intervention show rates were 78%. **Conclusion:** A new process for scheduling appointments for asthmatics discharged from the hospital was introduced. This resulted in a sizeable increase in patients scheduled with an asthma specialist within 30 days of discharge. The phone call reminder did not improve show rates, but offered the opportunity for rescheduling. This process will continue to be part of routine care, and refined to address barriers to attendance by identifying and resolving issues including transportation and other limitations to attendance.

Sponsored Research - None

2756276

Pilot Testing the Asthma Action Plan Knowledge Questionnaire (AAP-KQ).

Yahya Alzahrani[2,1], Heidi S. Kautz[2], Ellen A. Becker[2]; [1]Respiratory Care, Imam Abdulrahman bin Faisal Unversity, Dammam, Saudi Arabia; [2]Respiratory Care, Rush University, Chicago, IL

Background: Proactive asthma self-management requires a firm understanding of the asthma action plan (AAP). Presently, no tool exists to assess patients' or caregivers' understanding of how to use their AAP. The purpose of this pilot study was to conduct an item analysis for the newly developed Asthma Action Plan Knowledge Questionnaire (AAP-KQ) and assess the inter-rater and intra-rater agreement of the AAP-KQ's scoring rubric. **Method:** The AAP-KQ items were derived from a review of the literature and asthma guidelines, and then items were reviewed by ten experts to establish content validity. After IRB approval, the questionnaire was pilot-tested with caregivers of children with asthma during routine clinic visits. The questionnaire's item analysis was evaluated through item difficulty (the percentage of participants who answered the item correctly) and item discrimination (the item-to-total score correlation). *A priori* criteria to delete or revise an item were an item answered correctly by < 20% or > 80% of the participants and an item-to-total correlation of < 0.20. Two graduate students independently assessed the participants' responses using the AAP-KQ's scoring rubric. Intra-rater and inter-rater agreements were evaluated using Cohen's kappa. **Results:** The participants were 40 caregivers (90% female), predominantly African American/Black (83%) and Hispanic or Latino (15%). Most participants (83%) reported receiving AAP education in the past. For item difficulty, one item was considered too difficult and answered correctly by only one participant. Item discrimination revealed that 50% of items had item-to-total correlations of < 0.20 (Table 1). According to *a priori* criteria, this resulted in one item needing revision. Inter-rater agreement had a kappa of 0.86 and the intra-rater agreements kappa values for rater 1 and rater 2 were 0.88 and 0.82, respectively. **Conclusion**: The AAP-KQ shows promise as an assessment tool based upon the pilot evaluation data. The item analysis indicates that one of the questionnaire's items either needs to be revised or the scoring rubric criteria relaxed. The reported kappa values confirm that the AAP-KQ scoring rubric has substantial agreements amongst and within raters.

Sponsored Research - None

Table 1. AAP-KQ Item Analysis*

AAP-KQ Item	Item Difficulty Participants who answered the item correctly n (%)	Item Discrimination Corrected item-to-total correlation
How can you tell if your child is having a problem with his/her asthma? What changes do you notice?	1 (3)	-0.025
What is the first think you do when your child has asthma symptoms?	19 (48)	0.453
If your child still has symptoms, what would you do next?	9 (23)	0.076
What do you do to prevent your child's asthma symptoms with physical activity (walking, climbing stairs, gym, PE, exercise)?	9** (39)	0.331
What do you do if physical activity makes your child asthma worse?	17** (74)	0.237
What are your child asthma triggers? What do you do to minimize his/her exposure to asthma triggers?	22 (55)	0.304
What do you do if your child does not have symptoms?	19 (48)	0.088
Concerning your child asthma, when should you call the doctor and take him/her to the emergency department?	21 (53)	-0.109

* The sample included 40 participants.

** The item was applicable to caregivers of children with exercise-induced asthma (n = 23).

2756342

Respiratory Warm-Up Effects on Running, Pulmonary Function, and Perceived Breathing.

Dennis J. Guillot[2,1], Arnold Nelson[2], Tim Mead[3], Dennis Landin[2]; [1]Teacher Education, Nicholls State, Thibodaux, LA; [2]Kinesiology, Louisiana State University, Baton Rouge, LA; [3]Health and Human Performance, University of St. Thomas, St. Paul, MN

PURPOSE: To evaluate the effect of a five-minute respiratory warm-up using an inspiratory/expiratory (IEC) device on pulmonary function (PFT) (FVC, FEV1, FEF 25-75%, PEF), rate of perceived exertional (RPE) breathing, and performance time [300-yard shuttle run (300y) and 1.5-mile run (1.5m)] in asthmatics and non-asthmatics. **METHODS:** Twenty non-asthmatic males (24.2±9.8 years) and five asthmatics (4 females, 1 male) (20.8±3.2 years) were recruited after IRB approval. Subjects performed initial resting PFT (asthmatics performed an additional five-minute post medication resting PFT), followed by either a five-minutes of a no-warm-up resting controlled condition (CC) or five-minutes of IEC (subjects were randomly assigned through all conditions and runs). After completion of the CC or the IEC, subjects rested for five-minutes and then ran either a 300y or a 1.5m for time. After the runs, subjects performed one-minute recovery intervals of PF and RPE up to 15-minutes as well as five-minute intervals of PFT up to 15-minutes. **RESULTS:** Paired sample t-tests were computed to compare CC to IEC across the two runs. The results indicated that non-asthmatic males benefited from the IEC and improved performance by 3.2% (average of 25 seconds) in the 1.5m over the CC [M=13.1075 v. 12.6830, SD=2.19429 v. 1.85474, p= 0.044*]. Asthmatics increased their FEV1 at five-minutes of recovery after the IEC versus the CC for the 1.5m [M=3.3120 v. 3.4280, SD=0.51339 v. 0.54929, p= 0.019*]. **CONCLUSION:** The results suggested that a respiratory warm-up could be beneficial by an improved running performance by increasing some pulmonary functions for asthmatics and non-asthmatics alike. **PRACTICAL APPLICATION:** Respiratory warm-up appeared to reduce perceived breathing during and following exercise; thereby, reducing the physiologic cost of breathing as seen in both subject populations. The suggested mechanism for the non-asthmatics was that breathing was perceived as easier during the early stages of the aerobic run, which ultimately produced exercise performance improvements. The asthmatic subjects appreciated a benefit during the recovery from the aerobic run, with reduced perceptions of breathing following the respiratory warm-up condition and an increased FEV1. Experiencing reduced work of breathing during and after exercise would seem to support performance improvements and/or subject's ability to recover more efficiently following run performance.

Sponsored Research - None

2756628

Acute Anaphylaxis And Asthma School Management Plans: Use of EpiPens and Rescue Inhalers Within the School Environment.

Brendan Hardie, Amanda Roby; Health Professions, Youngstown State University, Boardman, OH

INTRODUCTION: Current Ohio law, specifically Ohio House Bills 200 and 39, allows for the storage of rescue medication within the school environment. These rescue medications include epinephrine self-injectors and albuterol inhalers, respective to the aforementioned legislative acts. The purpose of this study was to investigate school districts' knowledge in regards to housing and administering these emergency medications within the school environment. **HYPOTHESIS:** If school districts become more aware of the hazards of anaphylaxis and acute asthmatic episodes in their population of children, as well as Ohio legislation regarding the accommodation of epinephrine self-injectors and rescue inhalers, then an increase in the amount of schools carrying these medications would be accomplished. **METHODS:** A 10-question anonymous survey was distributed to school districts with preferable attention to school nurses.. **RESULTS:** Of the 13 responsive school districts within the tri-county region, 92% were aware of Ohio House Bills 200 and 39, whereas 8% were uncertain. Survey response rate was 32.5% from the 40 school districts that were notified; no respondent withdrew. 85% of school districts had a protocol in place for storing rescue medications and 15% were, again, uncertain. With regards to the rescue medication storage, 84% of districts stored epinephrine self-injectors, only 8% accommodated the use of both epinephrine self-injectors and albuterol rescue inhalers, and 8% were uncertain. **DISCUSSION:** The hypothesis statement was unequivocally refuted, as >(0.5) of respondents indicated that they were aware of Ohio legislation and accommodated storage of epinephrine self-injectors. However, the research did annotate the concept that <(0.5) of districts housed albuterol rescue inhalers for acute asthma attacks and indicate issues with education of faculty in recognizing these acute conditions. Only 38.5% of districts indicated that staff has been adequately educated in recognizing these acute medical conditions, and only 23% districts have trained staff to administer both epinephrine self-injectors and albuterol rescue inhalers properly. Thus, this study conveys both the barriers regarding school securement of albuterol rescue inhalers and general faculty education that exists. Further effort is required by all parties involved in order to create a safer learning environment for our schoolchildren.

Sponsored Research - None

2756691

Occurrence of Asthma Symptoms Reported by E-Cigarette Users.

Rahaf Sultan, David Chang; University of South Alabama, Mobile, AL

BACKGROUND: The long-term effects of e-cigarettes on the respiratory health of users have not been studied extensively. This study sought to evaluate the use of e-cigarettes and the occurrence of asthma symptoms among users who had not been diagnosed with asthma. **METHOD:** Institutional IRB approval was obtained before the research study. A 5-level Likert Scale survey was developed by using the most common asthma symptoms described in available literatures. The 8 symptoms included in the survey were: coughing, wheezing, fatigue, difficulty sleeping, chest tightness, rapid breathing, congestion, and shortness of breath. Each question in the survey included 5 options: Never, Seldom, Often, Frequent, Always. The survey also included the backgraound characteristics of the e-cigarette users. The sample population for the study comprised of e-cigarette customers at a retail outlet of tobacco products in southern Alabama. E-cigarette users who had been diagnosed with asthma were excluded from the data analysis. Concurrent tobacco cigarette users were also excluded. **RESULTS:** Fifty individuals completed the survey and all surveys met the inclusion criteria. There were 24 females and 26 males ranging in age from 18 to 29 years old. For evaluation of the ordinal data, the 5-level Likert Scale was converted to 2 categories of responses (negative and positive). "Never and Seldom" were converted and served as a negative response. "Often, Frequent, and Always" were treated as a positive response. Figure 1 shows the distribution of these 2 categories of responses. Among the eight asthma symptoms, difficulty sleeping, shortness of breath, rapid breathing, and congestion had a positive response of 80%, 72%, 70%, and 66%, respectively. **CONCLUSIONS:** E-cigarette users in this study reported that difficulty sleeping, shortness of breath, rapid breathing, and congestion were the most frequent symptoms that they had been experiencing during e-cigarette use. The results show a positive correlation between e-cigarette use and presence of 4 common asthma symptoms. The main limitations of this study are (1) inability to independently verify if the survey respondents had experienced similar asthma symptoms before e-cigarette use, and (2) survey responses are personal opinions and they are subject to change over time.

Sponsored Research - None

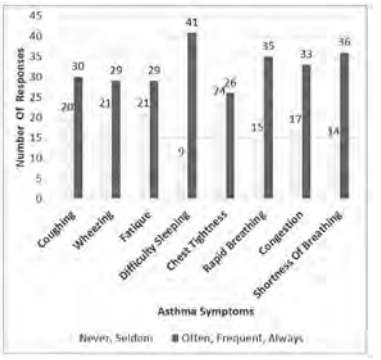


Figure 1 Asthma symptoms reported by e-cigarettes users who had not been diagnosed with asthma

2756736

The Effect of Climate and Altitude on Tuberculosis Transmission: A Systematic Review.

Yalemzewod A. Gelaw[1,2], Weiwei Yu[1], Yibeltal A. Alemu[1], Ricardo J. Magalhães[3,4], Gail Williams[1]; [1]School of Public Health, Faculty of Medicine, University of Queensland, Brisbane, QLD, Australia; [2]Department of Epidemiology and Biostatistics, Institute of Public Health, College of Medicine and Health Science, University of Gondar, Gondar, Ethiopia; [3]UQ Spatial Epidemiology Laboratory, School of Veterinary Science, Faculty of Science, The University of Queensland, Brisbane, QLD, Australia; [4]Children's Health and Environment Program, Child Health Research Centre, Faculty of Medicine, The University of Queensland, Brisbane, QLD, Australia

Background: In 2015, a total of 10.4 million tuberculosis (TB) cases and 1.4 million associated deaths have been estimated to have occurred. Studies have suggested that changing climatic factors and altitude determine the geographical limits of TB. We undertook a systematic review of evidence for an association between meteorological factors and the risk of morbidity, drug-resistant (DR-TB) and death due to TB. **Method**: A systematic review of the literature on the effect of climate and altitude on TB was performed using MOOSE guidelines. Electronic searches were undertaken from PubMed, EMBASE and Scopus. A quality score using the Newcastle-Ottawa scale for cross-sectional studies was attributed to assessing the strength of evidence on the association between climate and altitude and TB. A meta-analysis was performed on the association between altitude and TB morbidity. **Result**: We identified 17 studies, including two articles on DR-TB, one article on death due to TB and 14 articles on TB morbidity. These studies found changing climate and altitude were positively and/or negatively associated with the occurrence of TB morbidity, DR-TB and death. **Conclusion**: This review provides evidence for an association between TB morbidity and altitude and/or climate factors. TB control programs need to consider these factors in their strategies. However, there is limited evidence for the association between these factors and DR-TB and death from TB. More research is needed to estimate the contribution of these factors on TB infection, morbidity, drug-resistant and death and inform TB control strategies. **Keywords:** Tuberculosis, Climate, Altitude, Death, Drug-resistant, Morbidity

Sponsored Research - None

2757564

Factors Which Influence Adult African Americans Asthma Self-Management.

James D. Holland[1,2]; [1]Nursing, Valdosta State University, QUITMAN, GA; [2]Critical Care, Archbold Medical Center, Thomasville, GA

There are approximately 22.2 million Americans who are living with asthma and of those 18.4 million are adults and African Americans are more likely to be diagnosed with asthma in their lifetime when compared to Caucasians. The asthma attack prevalence rate is statistically significant for African Americans (40%) having more than Caucasians. The purposes of this study guided by the adapted Social Cognitive Theory were to determine the factors which influence asthma self-management in adult African Americans. A descriptive, correlational design was used. Data were collected from adult African Americans with asthma. Instruments measured asthma knowledge, health literacy, social support, asthma triggers, asthma self-efficacy, medication adherence, asthma self-management, sleep quality, asthma control, and asthma quality of life. Analyses included descriptive statistics, Pearson product correlation, and hierarchical regression. On average the asthmatics (n = 39) were middle aged (M = 55.9 ± 7.9 yrs), were female (65%), did not currently smoke, did not use a peak flow meter to self-manage their asthma. The asthmatics were over confident in self-managing their asthma (M = 75.46, SD = 12.34) out of 100, however had low medication adherence and fell below the cut-off score of 20 (M = 16.10, SD = 4.29) indicating uncontrolled asthma. On average, participants reported poor overall sleep quality (M = 8.53, SD = 4.95) indicated by the average total scale score greater than 5. Asthma control and BMI did account for significant variance (62.3%) in asthma QOL (F (2, 38) = 29.80, p = .001). Social support was an independent predictor of asthma self-efficacy (F (2, 38) = 5.65, p = .02). The participants in this study reported problems with being overweight, having poor sleep quality, having uncontrolled asthma. Education and assistance from the health care provider should address the ongoing challenges to asthma self-management that is specific to the African American population.

Sponsored Research - Georgia State University STEPS Grant

2758305

Changes in Exhaled Carbon Monoxide Level After 7-day Tobacco Abstinence and Ad Lib E-Cigarette Use.

Amanda Givens, David Chang; University of South Alabama, Mobile, AL

BACKGROUND: According to the CDC an estimated 42.1 million adults in the US smoke cigarettes. Tobacco cigarettes are highly addictive because they contain nicotine. Combustible tobacco also produces carbon monoxide in addition to 60+ carcinogens. These chemicals play an important role in the development of conditions such as cancer, coronary heart disease, and stroke. Electronic cigarettes (e-cigarettes) entered the US market in 2007 and have risen in popularity due to the ability to deliver the nicotine without CO and most chemicals in combustible tobacco. This study sought to measure the changes of CO among tobacco smokers after switching from tobacco cigarettes to e-cigarettes for 7 consecutive days. **METHOD:** IRB approval and individual consents were obtained before the study. The study included 6 volunteer smokers and they agreed to replace their tobacco cigarettes with e-cigarettes for 7 consecutive days. The participants were provided with e-cigarettes (0% nicotine) and they were able to use them ad lib in quantity and frequency. A Carefusion MicroCO monitor (Becton, Dickinson and Company, Franklin Lakes, NJ) was used to measure the initial exhaled CO levels (eCO) before the switch. Similar measurements were made at the end of the 7-day study period. A descriptive method and a data table were used to compare the changes in exhaled CO levels for each smoker. **RESULTS:** As summarized in Table 1, all 6 smokers showed a reduction in the post-switch eCO at the end of 7-day period. Three of the 6 smokers achieved a normal eCO (<7 ppm). The post-switch eCO measurements range from 0 ppm to 17 ppm and the percent reductions range from 11% to 100%. **CONCLUSIONS:** Combustible tobacco such as cigarettes produces CO. Since e-cigarettes use heat to vaporize the liquid containing nicotine, they do not produce CO. Based on the limited results of this study, ad lib use of e-cigarettes reduces the eCO and may be used as a patient education strategy to reduce the harmful effects of CO among smokers. Limitations of this study include a small sample size and inability to verify any concurrent use of tobacco cigarettes during the 7-day period.

Sponsored Research - None

Table 1 CO levels of smokers pre- and post-switch from tobacco cigarettes to e-cigarettes

Smoker	Smoking History (pack-years)	Pre-switch eCO (ppm)	Post-switch eCO (ppm)	Change (%)
1	15	7	3	↓4 (57%)
2	3	9	3	↓6 (67%)
3	42	35	0	↓35 (100%)
4	56	18	16	↓2 (11%)
5	66	55	17	↓38 (69%)
6	63	30	11	↓19 (63%)

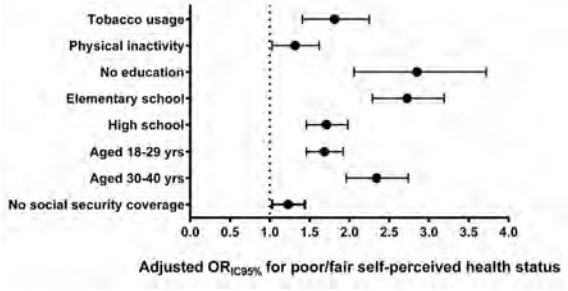
2758405

Impact of Tobacco Use, Leisure Time, and Physical Inactivity on Self-Perceived Health Status in Women in Colombia.

Amparo Cristancho Montenegro[1], Dario Mendoza Romero[1], Adriana Urbina[2]; [1]Programa de Terapia Respiratoria, Fundación Universitaria del Área Andina, Bogota, D.C., Colombia; [2]Departamento de Ciencias Biomédicas, Universidad del Rosario, Bogota, D.C., Colombia

BACKGROUND Smoking and physical inactivity are risk factors for chronic non-communicable diseases (CNCD), the leading cause of mortality worldwide. Women tend to be more physically inactive than men, and although they tend to smoke less, 5% of total mortality in women is attributed to tobacco. Along with tobacco and physical inactivity, a poor/fair self-perception of health status is associated with mortality in 4-9 years. The aim of this study was to determinate the association between tobacco use, leisure time physical inactivity, and poor/fair self-perceived health status in women in Colombia. **METHOD** Analytical prevalence study conducted with women data from the Colombia National Survey of Demographics and Health and its subsample, Nutritional Situation Survey 2010. The first includes tobacco usage information (n=12431) and the second, physical activity data (n=8224). Separate multivariate logistic regression for poor/fair self-perceived health status were performed adjusting for tobacco use and covariates, and adjusting for leisure time physical inactivity and covariates. **RESULTS** Prevalence of current tobacco use was 3%, and was associated with poor/fair self-perceived health status (OR=1.78; IC95%=1.41–2.25). Prevalence of leisure time physical inactivity was 94%, and was associated with poor/fair self-perceived health status (OR=1.30; IC95%=1.03–1.62). Other associated variables were poor education, increased age, no social security coverage (OR=1.22; IC95%=1.03–1.44), overweight and obesity, increased abdominal circumference, and low socio-economical level (OR=7.24; IC95%=3.81–13.76). Unfortunately, it was not possible to analyze the relationships between physical activity and smoking in the present study, so it is desirable that in the next health surveys in Colombia people interviewed for cardiovascular risk factors and healthy lifestyles were the same permitting to explore the relationships between these variables. **CONCLUSIONS** Both cigarette smoking and leisure time physical inactivity were associated with poor/fair self-rated health perceptions in women in Colombia. Other associated factors were increased age, low schooling, low socioeconomic status and no social security coverage. It is desirable to implement strategies for the promotion of physical activity, and prevention/cessation of tobacco use directed specifically to women as a tool for the control of CNCD.

Sponsored Research - None



2758692

Race/Ethnicity and Thirty-Day Readmission in COPD.

Daneen Nastars, Jose Rojas, James E. Graham; University of Texas Medical Branch, Galveston, TX

BACKGROUND: COPD is now included in Medicare's hospital readmission reduction program. Hospitals with excessive risk-adjusted 30-day readmission rates receive financial penalties. Race/ethnicity is not included in the risk-adjustment models. We examined whether race/ethnicity was independently associated with readmission after controlling for clinical factors and other demographic variables. **METHODS:** We used the 100% Medicare inpatient (Part A) files to identify patients hospitalized with COPD (MS-DRG codes 190, 191, 192) who were discharged between 01/01/13 – 09/30/14: N=416,744. The outcome measure was coded based on claims for unplanned readmissions within 30 days of discharge from the index stay. Race/ethnicity was limited to white, black and Hispanic. Demographic covariates included age, sex, and disability status (based on original reason for Medicare coverage). Clinical covariates included Elixhauser comorbidity index, length of stay, intensive care unit (ICU) use, and number of hospitalizations in prior year. We used ANOVA and chi-square tests to examine bivariate relationships between race/ethnicity and all covariates and generalized linear mixed models to test the independent effects of race/ethnicity on 30-day readmission. The University's institutional review board approved this study. **RESULTS:** Overall, 17.1% of COPD patients experienced an unplanned readmission with 30 days. Whites and blacks (17.2%) had significantly higher unadjusted rates than Hispanics (15.7%). Race/ethnicity also demonstrated significant associations with each of the covariates. The minority groups generally displayed higher-risk clinical profiles: blacks were most likely to have disability benefits and five or more comorbid conditions and they experienced more prior hospitalizations, whereas Hispanics were most likely to be admitted to the ICU and experienced the longest lengths of stay. After controlling for all these factors, the multivariable model suggested a benefit for both minority groups in terms of readmission risk. The adjusted readmission rates for whites, blacks, and Hispanics were 16.4%, 15.5%, and 14.4%, respectively. **CONCLUSIONS:** Racial/ethnic disparities in observed readmission rates may be largely explained by the more severe clinical profiles of minority populations. Controlling for known clinical risk factors effectively mediates the relationship between race/ethnicity and readmission. **Disclosures:** None.

Sponsored Research - None

2758755

Infection Control and Prevention Awareness Among Nurses and Respiratory Therapists in Cystic Fibrosis Care.

Layton L. Avery, William C. Pruitt; Cardiorespiratory Care, University of South Alabama, Daphne, AL

BACKGROUND: There are currently over 30,000 people in the US living with cystic fibrosis (CF). The purpose of this study was to determine the awareness of the 2013 Cystic Fibrosis Foundation (CFF) infection control and prevention (ICP) guidelines by health care workers responsible for the care of CF patients. These patients are affected by the possibility of acquiring various pathogens, and it has been shown that many of these patients are noncompliant in preventing their spread. It was hypothesized that some knowledge gaps will be evident. **METHODS:** With IRB approval, an on-line survey (SurveyMonkey.com) was used to ask 25 multiple choice questions assessing proper infection control and prevention practices and gather demographic information (job title, years of experience, credentials, etc). Nursing and respiratory therapy managers were asked to distribute the link to the survey to their staff. Nurses and respiratory therapists who are responsible for the care of CF patients in hospitals across the US were invited to participate via social media. **RESULTS:** There were a total of eighty-two responses, excluding students and those with no experience in caring for CF patients. Over half stated they had never heard of the ICP guidelines while 27% stated they would not know where to find the guidelines. Those with a RRT-NPS credentials answered 70% of questions correctly as opposed to those without it who scored an average of 53% correct. The RRT-NPS respnders were more likely to be aware of the guidelines and state that their facilities trained them on these guidelines. Additionally, their facilities offered training more frequently than those who scored poorly, ranging from training practitioners every three months to each year. **CONCLUSION:** There were many knowledge gaps. It is evident that more training is necessary to ensure that respiratory therapists and nurses alike are providing the best care possible for this patient population.

Sponsored Research - None

Posters Only

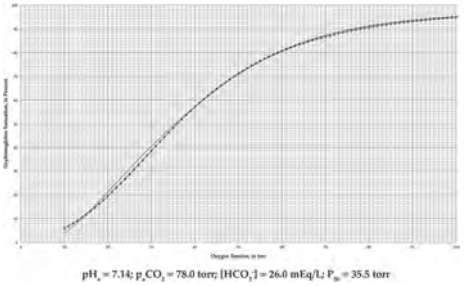
2719567

Dueling Algorithms: Relative Accuracy of the i-STAT and the RapidPoint 500 Point-of-Care Analyzers for Generating Oxygen Saturation Values During Profound Acidemia.

Barish A. Erenler[1], Robert R. Demers[2]; [1]Chest & Critical Care Consultants, Tustin, CA; [2]Regional Ambulatory Services, SoCal Permanente Medical Group, Pasadena, CA

Background: The i-STAT® (Abbott Laboratories, Princeton, NJ) and the RapidPoint 500® (Siemens, Norwood, MA) Point-of-Care analyzers each generate oxygen saturation values at the bedside by applying an on-board algorithm to the oxygen tension (p_aO_2) figure generated by their internal miniaturized Clark electrodes. We sought to compare the accuracy of the digital readouts supplied by each analyzer, both to each other, and also to a polynomial expression first described in 1966, when applied to a profoundly acidemic data set (pH_a = 7.14; p_aCO_2 = 68 torr; $[HCO_3^-]$ = 26.0 mEq/L), chosen to maximally "stress" (or challenge) the system. **Methods:** We implemented the i-STAT's and the RapidPoint's algorithms for this data set for integer values of p_aO_2 ranging between 10 and 100 torr. This succeeded in generating an oxyhemoglobin dissociation curve (OHDC) for each of the analyzers. We then generated an actual OHDC using a polynomial equation originally described by G. Richard Kelman (Kelman GR. Digital computer subroutine for the conversion of oxygen tension into saturation. **J Appl Physiol** 1966; 21: 1375-1376). The OHDCs for the Kelman Equation, the i-STAT's algorithm, and the RapidPoint's algorithm were plotted on the same grid, using Numbers® spreadsheet software (Apple, Inc., Cupertino, CA). This provided us with a visual comparison of the respective accuracy of the analyzers over a broad range, as compared to the Kelman Equation, which has long been considered to be "the Gold Standard". **Results:** The accuracy of each of the analyzers was impressive, with the RapidPoint being slightly more accurate than the i-STAT. **Conclusions:** In this mathematical modeling study, the accuracy of the oxygen saturation readouts from two Point-of-Care analyzers were found to be within two percent of the actual value in the presence of extreme acidemia. Furthermore, the OHDCs generated by the Point-of-Care analyzers were strikingly similar to the corresponding curve generated by a methodology that has long been considered "the Gold Standard", lying well within one percent saturation at p_aO_2 values between 36 and 100 torr. **Disclosures:** None

Sponsored Research - None



pH_a = 7.14; p_aCO_2 = 78.0 torr; $[HCO_3^-]$ = 26.0 mEq/L; P_{50} = 35.5 torr

The red curve represents the actual OHDC (Kelman), the black OHDC was generated by the i-STAT analyzer, and the blue OHDC was scribed by the RapidPoint analyzer.

2724973

Barriers to Asthma Education and Management Among Pediatric Respiratory Care Practitioners.

Melinda Marshall; Respiratory Therapy, Children's Healthcare of Atlanta, Atlanta, GA

Abstract: Respiratory therapists are providing care, case management, and educational services to an overwhelmingly diverse patient population. However, multiple barriers exist to the delivery of appropriate asthma education to hospital-based respiratory care practitioners, including parental literacy and socio-economic and psychological factors in parents' management of pediatric asthma. The perceptions of hospital-based respiratory therapists of these barriers experienced by caregivers when engaging in asthma education programs were examined through a quantitative ethnographic lens, guided by Bandura's social cognitive theory. In their investigation of behaviors, Prochaska, DiClemente, and Norcross (1992) justified the trans-theoretical model method for changing behavior responses (p. 1102). Fifty-six pediatric respiratory therapists participated in a modified questionnaire based on asthma barriers that consisted of 34 questions on a Likert-type scale. The asthma barrier questionnaire has been previously tested for its validity and reliability. Results suggested that respiratory care staff encounter daily barriers while performing their job duties. In light of these barriers, respiratory therapists often seek program changes within their organization. These program changes may include delivering asthma education to all patients admitted with respiratory distress syndrome, video on demand, and include more staff to teach the asthma education class. .

Sponsored Research - None

Single Table Analysis of Barriers Most Experienced During Educational CLass

Variables	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Beliefs	18.87	35.85	24.53	18.87	1.88
Job Burnout	13.46	23.08	32.69	25.00	5.77
Medication availability	10.00	28.56	15.00	30.00	13.44
Parental emotions	11.32	12.51	24.78	16.98	34.41
Total respondents to question	53.65	100	100.00	90.85	55.5

Notes: Chi-square for R by C table+ 20.67, degrees of freedom=9, p-value*=0.10. statistical correlations.

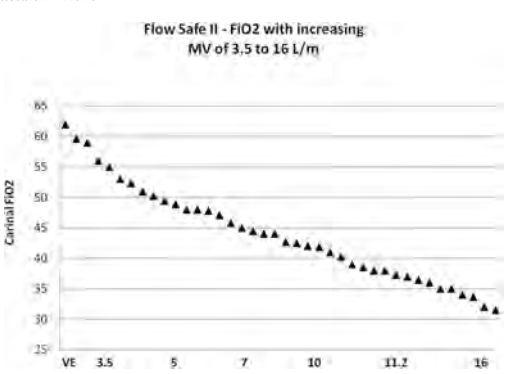
2729765

Does Pre-Hospital CPAP Delivery Also Deliver High Oxygen Concentration?

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

BACKGROUND: In physiologic terms heart failure (HF) is characterized by either or both pulmonary and systemic venous congestion and/or inadequate peripheral oxygen delivery. Patients with HF often enter the acute care setting after being managed with pre-hospital CPAP therapy. This treatment has not been well studied nor has there been significant improvement in overall ICU LOS when compared to conventional medical treatment. Pre-hospital CPAP administration is delivered by single-patient-use devices that are powered by an O_2 flowmeter. A venturi entrains room air which generates high flows to establish low level CPAP. These devices are considered reasonable for patients diagnosed with CHF and in episodes of acute respiratory failure. Our concern was the possible device limitation for oxygen delivery where patients have high F_{iO2} requirements. Considering that the CPAP device incorporates the blending of air with oxygen we wanted to know the carinal F_{iO2} as minute ventilation increased. **METHODS:** The Flow Safe II (FS-2), (Mercury Medical, Clearwater, FL), CPAP system was evaluated for carinal oxygen concentration delivery. Flowrate was adjusted to 6, 8, 10, 12 and 15 L/m. The FS-2 mask was attached to a LifeForm LF03699U adult airway management trainer, (Nasco, Fort Atkinson, Wisconsin), and connected to an ASL 5000 breathing simulator, (IngMar Medical Ltd, Pittsburgh, PA). Spontaneous breathing mode was programmed for 250 – 800 mL for a predicted VT to simulate 100 – 300 lb patients, RR = 14 and 20 BPM. Carinal F_{iO2} was measured using an Analytical Industries AII-2000M oxygen analyzer, (Analytical Industries, Pomona, CA). F_{iO2} was recorded after stabilization at each setting for a total of 40 measurements. The data were analyzed using ANOVA and paired t-tests with $p < 0.05$ considered significant. **RESULTS:** Baseline oxygen concentration of the unattached FS-2 mask was approximately 29%. Results illustrating carinal F_{iO2} with a leak-free mask during ASL-5000 programmed spontaneous breathing are illustrated in the graph below. The MD (±SD) between baseline and carinal F_{iO2} was 14.1%, ±7.9%, ($p < 0.05$). **DISCUSSION:** The results demonstrate a significant variation in inspired oxygen concentration of FS-2 mask compared to baseline. F_{iO2} decreased significantly as VE increased. These results suggest that caution be exercised when using a pre-hospital CPAP delivery device that does not allow for adjustment of a patient's F_{iO2} requirements.

Sponsored Research - None



2730326

Setting Optimal Postive End-Expiratory Pressure Utilizing Transpulmonary Monitoring and a Pressure/Volume Measurement.

Kenneth Miller, David Marth, Matt Reis; LVHN, Allentown, PA

Setting optimal positive end expiratory pressure (PEEP) is beneficial in improving gas exchange, promoting alveolar inflation, and minimizing ventilator induced trauma. The setting of PEEP has historically been done many different ways, FIO_2/PEEP algorithmic approach, compliance assessment, etc. Recently, we have employed the use of trans-pulmonary monitoring along with a pressure/volume measurement (P/V) to set the optimal PEEP. By utilizing both of these strategies the optimal PEEP can be set to maximize clinical objectives. We inserted an esophageal balloon (Cooper Surgical, USA) to monitoring TranspE and perform a pressure/volume (G-5 Hamilton Medical, Switzerland) to determine the lower inflection point on twelve patients diagnosed with severe to moderate ARDS. (Berlin definition) All patient were sedated and placed on a paralytic infusion. Esophageal balloon placement was verified via ventilator waveform and chest X-ray. Our goal was to set the PEEP to maintain a TranspE between -2 to +2cm/H_2O and 2 cmH_2O above the lower inflection point via the P/V measurement (G-5 P/V Tool). In nine of the patients the optimal PEEP was the same via the TranspE and P/V measurements. (Table 1) In three patients, all >125kg there was a greater than 4cm/H_2O difference between the TranspE and P/V measurement lower inflection (LIP) point regarding the optimal PEEP setting. On these three patients we set the PEEP between the two measurements and assessed clinical performance. Post PEEP setting in all twelve patients TranspI was maintained<25cm/H_2O and hemodynamic performance remained stable. Based on our experience, we believe utilizing both transpulmonary monitoring and pressure volume measurements can determine the optimal PEEP. Factors in chest wall impedance may cause a difference in these measurements and enhanced clinical assessment should be utilized to determine the optimal PEEP in that patient population.

Sponsored Research - None

Table 1

Wt/Kg	TranspE cmH_2O	LIP cmH_2O	Set PEEP
95	-1.5	14	16
150	+6	20	17
80	+1	12	14
55	-2	12	14
75	+2	10	12
110	-2	16	18
175	-6	16	18
130	-4	18	22
92	+1	12	14
89	-2	12	14
105	+1.5	14	16
72	-1	10	12

2737846

Five Year Study to Evaluate Cleaning Endotracheal Tube Prior to Weaning Trials.

Brian Wicker[2], Linda C. Schofield[1], Gary Salem[3]; [1]Nursing, McLaren Northern Michigan, Petoskey, MI; [2]Respiratory, McLaren Lapeer Region, Lapeer, MI; [3]Vice President of Medical Affairs, McLareen Lapeer Region, Lapeer, MI

Background: An endotracheal tube (ETT) is required for the management of critically ill, mechanically ventilated patients in the Intensive Care Unit. Patency of the ETT is commonly maintained by standard of care suctioning with the use of suction catheters. The effectiveness of ETT suctioning alone to maintain airway patency is questionable. ETT suctioning may be associated with short-term physiological complications, such as lung de-recruitment and resultant hypoxemia in patients with lung injury. Biofilm and mucus accumulate on the inner lumen of the ETT with increasing time of intubation and mechanical ventilation. Standard ETT suctioning and humidification do not prevent this build-up of mucus or biofilm. ETT intra-luminal volume loss due to mucus and biofilm is associated with longer period of time on mechanical ventilation and increased rate of ventilator-associated pneumonia. Purpose: The primary objective of this study was to compare objective outcome measures before and after implementing a daily ETT cleaning protocol with the endOclear® device. Methodology: This is an IRB approved, 5-year retrospective, observational, single centered study to evaluate the efficacy of cleaning the ETT daily prior to the spontaneous breathing trial. The primary endpoints are average duration of mechanical ventilation, average hospital length of stay, and average hospital direct cost per subject. Results: The results of cleaning the ETT before weaning trials are supported by this five year, retrospective, observational study of 1,320 subjects on mechanical ventilation greater than twenty-four hours. Data was collected on 426 subjects prior to using the daily ETT cleaning protocol and 894 subjects after implementing the protocol. This resulted in a decrease in average time on the ventilator from 4.2 to 3.5 days (0.7±0.8, p<0.01), a decrease in length of stay in the hospital from 9.9 to 8.3 days (1.6±1.9, p<0.01) and a decrease in direct cost per case from $13,101 to $12,024 ($1,077±2,784, p<0.15), a total of $926,838 net benefit. Data is presented as mean ±SD. Conclusions: This study demonstrates the importance of the removal of adherent ETT secretions after twenty-four hours of mechanical ventilation. Removal of adherent secretions should be completed every day prior to the time of the spontaneous breathing trial. Cleaning the ETT daily can return the ETT to nominal performance and maximum potential for decreased time on the ventilator and shorter length of hospital stay.

Sponsored Research - None

Duration of Mechanical Ventilation, Average LOS, & Average Hospital Direct Cost

McLaren Lapeer Region Five Year Retrospective Study (October 1, 2011 - September 30, 2016)				
	Number of Subjects	Average Duration of Mechanical Ventilation	Average Hospital LOS	Average Direct Cost Per Subject
Before ETT Cleaning Oct. 1, 2011 - Sept. 30, 2013	426	4.2 Days	9.9 Days	$13,101
After ETT Cleaning Oct. 1, 2013 - Sept. 30, 2016	894	3.5 Days	8.3 Days	$12,024

2740151

Aerosol Therapy During High-Flow Humidified Oxygen Therapy: A Bench Study.

Noah Jones[1,2]; [1]Kinesiology, University of North Carolina at Charlotte, Asheville, NC; [2]Respiratory Care, Mission Hospital, Asheville, NC

BACKGROUND: Dyspnea is a sensitive predictor of mortality in humans and occurs in up to 50% of patients in acute care hospitals. High-flow humidified oxygen therapy (HFHO) oxygen therapy has been shown to be superior in relieving dyspnea in human patients. Aerosol delivery to the airways may also be of benefit in alleviating a patient's dyspnea. It is unknown if intermittent aerosol therapy can be provided during HFHO. METHODS: An anatomic model and a high-fidelity lung simulator were used to simulate two patients, one normal and one diseased. HFHO was applied and aerosol therapy was provided for 10 minutes via mask or mouthpiece using an ultrasonic nebulizer. A filter was placed at the level of the trachea and aerosol delivery was assessed using the gravimetric analysis. Values were assessed for significance using ANOVA with Bonferroni correction. RESULTS: When compared to HFHO alone, HFHO with mask-aerosol caused significantly higher weight change ($p<0.005$). Filter weight was significantly higher after HFHO with mask-aerosol in the diseased patient compared to the normal patient ($p<0.005$). CONCLUSIONS: Aerosol therapy during HFHO appears to provide statistically significant amounts of aerosol to the lower airways in this model. Additional study is required to determine if this amount of aerosol would be clinically effective. DISCLOSURES: Author declares no conflict of interest.

Sponsored Research - None

2741025

Advanced Physiological Transmitting System Shortens the Time Required for Respiratory Therapists to Check Ventilator Parameters and Make Adjustments Accordingly in ICUs.

Chao Chun Lai, Hui-Min Yu; Department of Respiratory Therapy, CHANGHUA CHRISTIAN MEDICAL FOUNDATION YUANLIN CHRISTIAN HOSPITAL, Changhua County, Taiwan

Background: Respiratory therapists (RTs) in the intensive care units of most hospitals in Taiwan spend considerable amounts of time recording ventilator parameters by hand. Although monitoring each patient's responses by recording ventilator and physiological parameters, patients are sometimes left unattended because of RTs allotting excessive amounts of time to documentation. This study aimed to reduce the time RTs allot to documentation by implementing a system called Advanced Physiological Transmitting System_Ventilation (APTS_V). Methods: In an intensive care unit of a regional hospital with 50 beds, APTS_V was implemented through installation into the hospital integration system (HIS). The ventilator's current and historical trend parameters can be monitored on mobile devices carried by RTs. Before and after the implementation of APTS_V, the amount of time allotted to handwriting, scanning, uploading relevant information onto the HIS, and recording information for the next shift was noted by two independent inspectors over 1 month. Results: Before the implementation of APTS_V, the mean time period of an RT recording ventilator parameters and making necessary adjustments to ventilators for a single patient was 6.32 min (95% confidence interval (CI) = 4.21–8.01). After implementation of APTS_V, the time significantly decreased to 4.52 min (95% CI = 3.92–5.03). Further analysis revealed that the accuracy rate of patient records increased from 96.8% per patient per month before the implementation of APTS_V to 99.98% per patient per month after implantation. Conclusion: APTS_V appears to be an effective clinical tool enabling RTs to reduce the time allotted to manually recording ventilator and physiological parameters. Further research regarding the influence of this system on patient safety is advised.

Sponsored Research - None

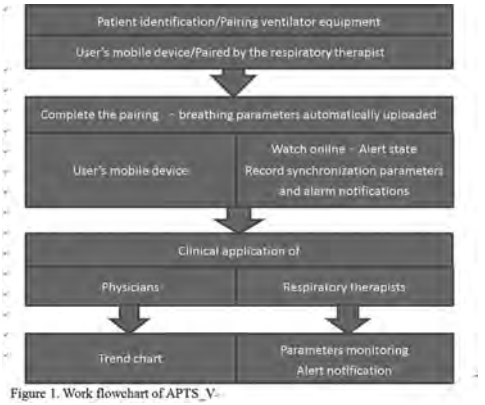


Figure 1. Work flowchart of APTS_V

2744640

Hospital Wide Survey on the Venner PneuX Endotracheal Tube: Validation of Feasibility Assessment.

Jing Zhao[1], Changsheng Zhang[1], Hui Zhang[1], Jacopo Fumagalli[1], Maddalena Teggia Droghi[1], Daniel Fisher[2], Robert Kacmarek[2], Lorenzo Berra[1]; [1]Department of Anesthesia, Critical Care and Pain Medicine, Massachusetts General Hospital, Boston, MA; [2]Department of Respiratory Care, Masschusettes General Hospital, Boston, MA

Introduction Emergent endotracheal intubation is a life saving intervention, which allows ventilation but does not prevent micro-aspiration through an inflated endotracheal tube (TT) cuff. Standard hi-volume low-pressure TT cuff fails sealing of the airways due to the cuff design and the material choice. Polyvinylchloride and polyurethane are commonly used materials however due to their inelastic properties, cuffs have been designed to be larger than the trachea size allowing folds formation, thus micro-aspiration. The Venner PneuX ETT cuff is made of a highly elastic thick rubber (silicon) that prevents folds formation thus avoids aspiration (Chenelle CT et al. Respir Care. 2017;62(1):102-112). In addition, the PneuX TT has a tracheal seal monitor and subglottic secretion drainage and irrigation system to avoid tracheal/oral trauma and improve oral care. Feasibility and usability of the PneuX TT has never been tested. We surveyed a group of anesthesiologists, respiratory therapists (RRTs) and ICU nurses (RNs) on the use of the PneuX TT. **Methods** The first part of the study was performed in the operating room (OR study). Patients were intubated with the PneuX TT and extubated in the OR by the anesthesiologist. The second part was performed in both OR and ICU (OR-ICU study). Major vascular surgery patients were intubated in the OR and transported to the ICU, while intubated. Anesthesiologists, RRTs and RNs received questionnaires regarding airway management, oral care and extubation. Questionnaires were scored as follows: -1 for "worse/difficult to use/safety concern/would not use again"; 0 for "same/no safety concerns/may use it again", 1 for "better/easier to use/would use it again". **Results** After IRB approval, sixteen patients in OR study and sixteen patients in OR-ICU study were safely intubated at the first pass with a PneuX TT. Thirty-tree questionnaires were obtained from anesthesiologists (20 in the OR-study and 13 in the OR-ICU study), 26 from RNs and 13 from RRTs. Scores of the overall use of the novel TT are shown in Figure 1. 72.7% of the anesthesiologists believed that PneuX TT was superior or same to standard TT at intubation and to ventilated the patient. Both the RNs and the RRTs believed that the PneuX TT improved oral care and prevented aspiration. **Conclusion** PneuX TT was safely used in both OR and ICU. RNs and RRTs graded the PneuX TT to be superior to standard TT in prevention of aspiration, oral care and patient's comfort.

Sponsored Research - Venner

2745249

Intrapulmonary Percussive Ventilation (IPV) Decreases Chronic Lung Disease of Prematurity (CLD) in the NICU.

Jonathan Callahan[1], Juan Corona[1], Stephen Elliott[2], Aaron Lambert[1], Curt Partain[1], Hank Perry[1]; [1]Respiratory, Community Regional Medical Center, Fresno, CA; [2]NICU, Community Regional Medical Center, Fresno, CA

Background: IPV is widely used for airway clearance in adult patients but been little studied in the NICU. We hypothesized that IPV would decrease the rate of CLD in premature infants. **Method:** In 2015, we began using IPV in NICU patients who were at least 6 days old and who had clinical evidence of airway secretions with or without atelectasis. IPV was given every 6 hours for 3 days, then weaned to every 12-24 hours. IPV treatments were discontinued once airway secretions were no longer being mobilized or when FiO2 was consistently 21%. IPV was given via the IPV-2C (Percussionaire, Inc). Each 15 min treatment used aerosolized saline, operational pressure 25 psig, frequency 300-350 bpm, peak pressure 5-10 cm to produce mild chest wiggle, and demand CPAP 2 cm. No other respiratory innovations were implemented in 2015. Demographic and respiratory data for all NICU premature patients were routinely submitted to the California Perinatal Quality Care Collaborative (CPQCC) using all 3 CPQCC definitions of CLD. We retrieved and compared our CPQCC data for CLD for 2014 (pre-IPV) versus 2015 (post-IPV). The rates of CLD were also compared with a statewide cohort of 81 similar NICUs in California. **Results:** Demographic data, surfactant use, and morbidity and mortality data were not different between 2014 and 2015. After implementation of IPV, the CLD rate decreased by 42%, 44% and 41% for the 3 respective definitions of CLD (Table 1). By contrast, the statewide cohort rates of CLD remained unchanged. **Conclusion:** IPV is a safe therapeutic modality for use in premature babies in the NICU and is associated with dramatic decreases in rates of CLD. We theorize that improved clearance of airway secretions decreases both atelectasis and air trapping, leading to decreased need for positive pressure ventilation.

Sponsored Research - None

CRMC and STATEWIDE COHORT CLD RATES 2014 (pre-IPV) vs 2015 (post-IPV)

	2014	2015
CRMC Patients (n)	200	217
CRMC CLD (Definition 1) %	29.5	17.2
COHORT CLD (Definition 1) %	23.4	24.1
CRMC CLD (Definition 2) %	23.2	13.0
COHORT CLD (Definition 2) %	17.9	18.4
CRMC CLD (Definition 3) %	23.8	14.0
COHORT CLD (Definition 3) %	19.5	20.0

2755946

Use of Mechanical Ventilation and Extracorporeal Membrane Oxygenation in Renal Transplant Patient With Bronchiolitis Obliterans Organizing Pneumonia.

Sajjad S. Raza[1], Jason A. Gluck[2], Patrick J. Troy[2]; [1]Hartford Hospital, Hartford, CT; [2]Hartford Hospital, Hartford, CT

Introduction: Bronchiolitis Obliterans Organizing Pneumonia (BOOP) occurs when granulation tissue replaces bronchiolar structures, causing obstruction and inflammation. Unresolved fibrotic remodeling, leading to ARDS, also increases pulmonary vascular resistance (PVR) affecting cardiac function. Specific etiology for BOOP can be difficult to confirm as it relies mainly on tissue biopsy. We report a case of a patient diagnosed with BOOP secondary to immunosuppresion due to failed renal transplant. Case Summary: A 40 year-old female presented with dyspnea, but had no history of pulmonary disease. CXR demonstrated diffuse perihilar airspace opacities, but BAL cultures were negative. As respiratory status deteriorated, a right-sided VATS procedure was performed within 48 hours of admission. Biopsy confirmed BOOP, revealing acute lung injury (ALI) with reactive pneumocytes, fibroblast proliferation, and bronchiolar plugging. Worsening hypoxia lead to reintubation 72 hours post-operatively, but with C_{dyn} 4.5 mL/cm H_2O, initial D_p 38 cm H_2O on PC-AC gave only V_T 250 mL with P_{Plat} 38 cm H_2O. Respiratory failure on mechanical ventilation and presence of a pneumothorax led to VV-ECMO initiation, with settings: F_iO_2 1, flow 4.35 L/min, and sweep speed 6 L/min. Prior echocardiography also demonstrated right ventricular dysfunction with interventricular septal flattening, consistent with volume overload. P_aO_2 improved post-cannulation, but C_{dyn} (5.4 mL/cm H_2O) did not, even on VC-AC, with settings: RR 6 breaths/min, PEEP 12 cm H_2O, and V_T 200 mL. Decreasing PEEP (8 cm H_2O) and V_T (125 mL) only improved P_{Plat} (26 cm H_2O). C_{dyn} (5.1 mL/cm H_2O) remained unchanged despite ongoing use of IV corticosteroids. Increasing cumulative pleural and thoracic pressures caused restriction of ECMO flow and the patient was paralyzed. The patient's health status continually declined after a week on VV-ECMO and care was withdrawn. Discussion: BOOP secondary to immunosuppression in renal transplantation is rare, but its aggressive nature is demonstrated throughout this case. Targeted treatment with corticosteroids, though brief, did not improve airway inflammation. Mechanical ventilation and VV-ECMO did not delay progression of ARDS nor decrease PVR. Additional research is required to establish effective treatment modalities and determine prognostic markers for advanced stages of BOOP coupled with ARDS. Varying application of mechanical ventilation and ECMO would be of particular interest.

Sponsored Research - None

2756174

Delivering a Standard of Care During Ambulation and Transport With Heated HFNC.

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

INTRODUCTION: Patients who require a heated HFNC to maintain adequate oxygenation can be extremely challenging to safely ambulate and/or transport for testing outside of their room. At times our patients also require continuous inhaled medications which can be a strategically larger barrier. The alternative practice of O_2 delivery with a NRB mask and/or another device to maintain S_{pO2} could compromise patient care. Patients also receiving continuous inhaled medications could be further restricted from ambulating or traveling. **PURPOSE:** A QI Initiative of providing the same in-room standard of care was designed using a portable HFNC system to enhance patient ambulation and transport capability. **METHODS:** The system included an H-cylinder of O_2, a 0-70 L/M flowmeter, (Precision Medical, Northampton, PA), a Medipure LC single cylinder delivery system, (Praxair, Inc. Danbury, CT), F&P 850 heated humidifier with RT-202 single limb heated wire circuit, (Fischer & Paykel, Auckland, NZ), RSD23004 HFNC, (ResMed, San Diego, CA), and an APC-1500 Smart uninterruptible power supply, (UPS), (APC, W. Kingston, RI). Adjuncts for inhaled medications included an Aerogen Solo nebulizer, (Aerogen, Galway, IE), and a Bodyguard 575 infusion pump, (CME America, Golden, CO). Prior to UPS disconnection from wall utility sources temperature was stabilized at 31ºC; flowrate = 60 L/m. Wall sources were then disconnected; heater operation timed, and gas consumption recorded. **RESULTS:** Patient #1 was ambulated using 31º C at 60 L/m with continuous i-epoprostenol. F_{iO2} at rest was 70% at 60 L/m with maximum i-epoprostenol dosing to maintain S_{p02} > 94%. The patient required a 6 minute walk study for a pre-lung transplant work up. (Prior attempts with conventional O_2 therapy were not tolerated). The patient had minimal SOB & was able to successfully complete 475 feet within 6 minutes while maintaining S_{pO2} > 90%. Patient #2 was on 25 L/m at 80% F_{i02} HFNC with maximum i-epoprostenol dependency through a HFNC. The patient required transport from the in-patient room to Radiology with anticipated duration of the transport of 45-minutes to 1-hour.VS remained stable: S_{p02} = 93-97%, HR = 74-83, RR = 18-20. Total transport and testing time was 47 minutes. There were no signs or symptoms of SOB. **CONCLUSION:** The evaluated system lowered prior barriers for severe oxygen dependent patients. Ambulation and transport delays may be avoided using a system providing a continuum of care.

Sponsored Research - None

2756335

Enhancing the Care of Children With Tracheostomy Tubes.

Bradley J. Boynton[1], Peter Smith[1], Christopher Bosley[1], Patricia Conlon[2], Karthik Balakrishnan[3], Jane Rosenman[4], Gina Rohlik[2], Shelagh Cofer[3], Tracy Barry[2], Dana Mullenbach[2], Scott Feigal[2]; [1]Respiratory Care, Mayo Clinic, Byron, MN; [2]Department of Nursing, Mayo Clinic, Rochester, MN; [3]Department of Otorhinolaryngology, Mayo Clinic, Rochester, MN; [4]Department of Pediatric & Adolescent Medicine, Mayo Clinic, Rochester, MN

Introduction: Children with tracheostomy tubes are medically fragile and are at an increased risk for serious adverse events. Challenges caring for these patients include: dislodgement, occlusion, inability to replace a tracheostomy tube, ensuring the correct emergency supplies and equipment are readily available, and having experienced and adequately trained staff. All of this coupled with an increased volume of these patients due to additional pediatric pulmonology and otorhinolaryngology staff, no long-term pediatric ward, and patients located in many different units in the hospital, lead one tertiary care facility to implement a process improvement project aimed at minimizing these challenges. **Case Summary:** A multidisciplinary group reviewed best practice literature relating to the care of pediatric tracheotomy inpatients. Many improvements and practice changes were made which included: a new standardized emergency bedside tracheostomy bag, a bedside tracheostomy card (printed in blue for easy identification), emergency respiratory bag for the pediatric general care area with advanced respiratory supplies for the difficult airway, patient/family educational material was updated and enhanced, implementation of weekly tracheostomy rounds (respiratory therapy, bedside nursing, ENT CNP, and CNS), creation of a comprehensive and standardized discharge order set, education was provided to all nursing and resident staff, and finally a redesign of family/caregiver education was developed (individual education sessions, written evaluations, and simulation). **Discussion:** Our facility has noticed an increasing number of pediatric patients requiring tracheostomies. The process improvements initiated have greatly improved the care of these patients since implementation. Nurses, respiratory therapists, and resident staff report increase comfort and knowledge caring for these complex patients. Tracheostomy related events have dramatically decreased since implementation. This process could be implemented in other institutions. **Disclosures:** All authors have nothing to disclose.

Sponsored Research - None

2756615

Extracorporeal Membrane Oxygenation and Independent Lung Ventilation in a Pediatric Patient With Necrotizing Pneumonia Complicated by Bronchopleural Fistula.

Greg Jones[1], Gary R. Lowe[1], Randy Willis[1], Katherine Irby[2]; [1]Respiratory Care Services, Arkansas Children's Hospital, Little Rock, AR; [2]Department of Pediatrics, Critical Care Medicine Section, University of Arkansas for Medical Sciences, Little Rock, AR

Introduction: Respiratory failure due to methicillin-resistant Staphylococcus aureus (MRSA) necrotizing pneumonia can lead to decompensation in a previously healthy child. This case reviews treatment interventions successfully utilized for a healthy, athletic 15 year old female who required veno-venous (VV) and veno-arterial (VA) extracorporeal membrane oxygenation (ECMO) and single lung ventilation due to MRSA necrotizing pneumonia complicated by the occurrence of a bronchopleural fistula (BPF). **Case Summary:** This young woman was admitted to an outside facility with respiratory failure and treated for a left-sided pneumonia and empyema. She required non-invasive ventilation and left sided chest tube placement for drainage of a pleural effusion and pneumothorax prior to transfer. On arrival to our pediatric ICU, she was intubated and x-ray demonstrated left lung consolidation with basilar lucencies. She was started on Vancomycin and Zosyn prior to cultures resulting positive for MRSA. Despite significant ventilator support, she developed worsening hypoxia and air leak. Attempts at right main stem intubation were unsuccessful due to ETT length and hemodynamic instability resulting in VV ECMO initiation. A persistent air leak prompted placement of a left-sided bronchial blocker (BB) with clinical improvement; however, she later became hypoxic and unstable due to migration of the BB into the right main stem bronchus. She was converted from VV to VA ECMO to support her hemodynamics, allowing time to safely exchange her ETT for a dual lumen ETT. She was unilaterally ventilated via the right lung with the left ETT lumen clamped. After weaning off inotropic support, she was converted to VV ECMO. On HD 17, she was successfully decannulated. On HD 24, application of positive pressure to the left side was initiated and slowly increased to a peak end expiratory pressure of 7 mmHg. On HD 27, a conventional ETT was placed. On HD 31 she was extubated and on HD 35 she was weaned to room air. She is undergoing rehabilitation for deconditioning, but has no permanent deficit. **Discussion:** Necrotizing pneumonia caused by MRSA can be lethal if not treated aggressively. This case illustrates three important points: (1) MRSA pneumonia can cause rapid deterioration requiring ECMO, (2) unilateral lung ventilation allows rest and recovery of a BPF, and (3) gradual advancement of ventilatory support to the affected lung can result in a successful extubation.

Sponsored Research - None

2756618

No More Snore.

Bob Diamond, Amanda Roby; Health Professions, Youngstown State University, Youngstown, OH

Although it may not sound serious, snoring can be a problem for many people in this country. Many individuals are affected and claim they cannot get the proper sleep because the snoring of their significant other is too loud and it can very easily disturb both the parties. There are many products that claim to cure the simple snore. The purpose of this study is to utilize the Slumber Bump™ belt and see if it improves snoring. HYPOTHESIS: The Slumber Bump™ belt will decrease the amount of snoring compared to each patient's baseline snoring. METHODS: A survey was utilized to investigate the amount of snoring participants usually have as perceived by the subject and the subjects significant others or roommates. Participants underwent an Out of Center Sleep Test (OCST) to determine the amount of snoring. With these results if the subjects had a high snore index, they then underwent another night with the OCST device while wearing the Slumber Bump™ belt as well. RESULTS: Only 6 participants were testing due to academic time constraints. The survey revealed that on average bed partners listed the snoring with an intensity of 6 out of 10. When the Slumber Bump™ belt was worn by the 6 participants, the amount of snoring and respiratory events were both reduced by approximately 41% as compared to their baseline study. DISCUSSION: With the aid of the Slumber Bump™, snoring and respiratory events were greatly reduced. More research needs to be completed with these alternative therapies to determine if they could improve the outcome of patient care in the world of sleep disorders.

Sponsored Research - None

2756643

Availability and Education of Using Spacers or Holding Chambers With MDIs.

Tiffany McCormick, Amanda Roby; Health Professions, Youngstown State University, Youngstown, OH

INTRODUCTION: The physicians throughout all practices of medicine play a vital role in the education of patients using spacers or holding chambers through MDI administration. The purpose of this study is to investigate the education and availability of holding chambers or spacers used for MDI administration in various area physician practices. **HYPOTHESIS:** Physicians that prescribe MDI's do not provide patients with adequate education of the benefits and availability that a spacer/holding chamber provides. **METHODS:** An 8 question survey was distributed to physicians throughout area hospital and private practices. Informed consent was obtained. Once the surveys were obtained they were analyzed. **RESULTS:** A total of 16 participants completed the survey. The results showed that of those surveyed, overall, 25% of physicians always order a spacer/holding chamber in conjunction with meter dose inhaler (MDI) medications. 43.8% of the total participants also said they are familiar with the benefits of ordering a spacer/holding chamber in conjunction with Meter Dose Inhaler (MDI) medications. 50% of the physicians had no idea as to whether they stocked or ordered spacers or holding chambers, and 31% did not feel that their patients were familiar or educated on the benefits of using them. **DISCUSSION:** Using a spacer or holding chamber in conjunction with an MDI has come a long way since its first appearance. The benefits and advantages of using a spacer or holding chamber is not widely known or recognized. Physicians, Respiratory Therapists, Nurses and all clinicians need to have a global understanding of all the benefits that using a holding chamber and spacer in conjunction with an MDI can provide.

Sponsored Research - None

2756853

Comparison of Exhaled Carbon Monoxide Level Between High School Students With or Without Exposure to Second-Hand Smoke.

Payton Terral, David Chang; University of South Alabama, Mobile, AL

BACKGROUND: Exposure to second-hand tobacco smoke may occur among infants and children living with adult smokers. Carbon monoxide (CO) is a byproduct of tobacco smoke and it can be monitored non-invasively by measuring the exhaled CO level. The exhaled CO level may be reported as ppm or %COHb. **METHOD:** Approvals were obtained from the IRBs of the institution and the County School System. Signed parental consents were also obtained prior to the study. The device used to measure the exhaled CO level was a CareFusion MicroCO Monitor (Becton, Dickinson and Company, Franklin Lakes, NJ). Standard procedure for exhaled CO measurement was done to high school students in a Health Class. Three questions were asked at the end of the test: (1) Are you exposed to second-hand smoke? (2) Do you smoke e-cigarettes? (3) Do you smoke tobacco cigarettes? The unpaired t-test was used to compare the CO levels between students with or without exposure to second-hand tobacco smoke. **RESULTS:** Thirty-five high school students participated in the study with 14 females and 21 males ranging from 15 to 18 years of age. One student was excluded from data analysis because this student did not have a consent to answer any questions besides performing the test. Thirty-four students reported that they did not use smoking tobacco or e-cigarette. Among these 34 students, 12 reported regular exposure to second-hand smoke and 22 reported no exposure to second-hand smoke. Figure 1 shows that the %COHb for all 34 students were within normal limits (<1% COHb), ranging from 0% to 0.8%. Twenty-five students had 0%COHb. In comparing the measured %COHb between students with or without exposure to second-hand smoke, the calculated t was 0.5902 ($p = 0.05$, table $t = 2.037$). There was no significant difference in the measured %COHb between students who were or were not exposed to second-hand smoke. **CONCLUSIONS:** In this high school population, the exhaled %COHb for all students were normal (<1%), ranging from 0% to 0.8%. There was no significant differnece in the %COHB between students who reported with or without exposure to second-hand smoke. Limitations of the study included the sensitivity of the questions asked, the testing technique performed by students, and the timing / proximity of exposure to second-hand smoke prior to the study.

Sponsored Research - None

2756899

Changes of Exhaled Carbon Monoxide Level During Short-Term Tobacco Smoking Abstinence.

Jessica DeJesus, David Chang; University of South Alabama, Mobile, AL

BACKGROUND: Tobacco cigarette smoke contains over 4,000 harmful chemicals. One of the substances that cigarettes produce is carbon monoxide (CO). CO has a half-life of 4 to 6 hours in human subjects while breathing room air. The aim of this study is to measure the changes of exhaled CO level from short-term smoking abstinence. The exhaled CO level may be expressed as parts per million or %COHb. **METHOD:** Institutional IRB approval and patient consent were obtained before the study. The CareFusion MicroCO Monitor (Becton, Dickinson and Company, Franklin Lakes, NJ) was used to measure the %COHb. Six smokers were recruited for this study and one non-smoker served as control. For each smoker, the initial %COHb was measured immediately after smoking one cigarette of his or her choice. The smokers were asked to stop smoking for a period of 360 minutes. The %COHb of each smoker were measured every 20 minutes until the end of study at 360 minutes. Similar measurements were made to the non-smoker. Due to the small sample size, the data were analyzed using a descriptive method and a serial line graph (%COHb vs. time). **RESULTS:** The initial and end-of-study %COHb of six smokers (#1 to #6) were: (#1) 6.56% and 1.12%, (#2) 5.40% and 1.76%, (#3) 7.60% and 3.20%, (#4) 7.20% and 3.76%, (#5) 10.47% and 5.75%, (#6) 6.08% and 1.28%. The initial and end-of-study %COHb of the non-smoker were 0.64% and 0.64%. Figure 1 shows the steady decline of %COHb from 6 smokers during 360 minutes of smoking abstinence. **CONCLUSIONS:** After 360 minutes of smoking abstinence, none of the smokers achieved the predicted normal %COHb (<1%), Four smokers showed a decline of at least 50% from the initial measurements. This decline of >50% is consistent with the published half-life of CO in human subjects. The non-smoker showed no change in the %COHb and they remained stable at 0.64% throughout the study. The steady decline of %COHb over time from smoking abstinence may be a useful visual tool for patient education among smokers. Further studies may include more smokers and a longer period of smoking abstinence.

Sponsored Research - None

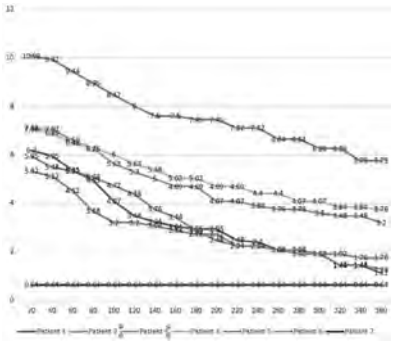


Figure 1 (%COHb vs time). The serial %COHb of 6 smokers and 1 non-smoker during 360 minutes of smoking abstinence. The constant 0.64% represents the non-smoker.

2757092

Using the Epic EMR to Automate Respiratory Therapy Acuity Numbers Leads to Streamlined Staffing and Workload Reporting.

Lindsay Hattan[2], Anne Cole[2], Kahli South[1], Rachel Shirk[1], Michael Haskins[1], Brooke Schuster[2]; [1]Respiratory Therapy, Children's Hospital & Medical Center, Omaha, NE; [2]Information Technology, Children's Hospital & Medical Center, Omaha, NE

Introduction: Gathering & calculating workload numbers can be a time consuming part of a Respiratory Therapists day. Moreover, it is difficult to accurately capture this information in real-time and there are many tasks that Respiratory Therapists complete that are not included in these manual calculations. Using the Epic EMR, we were able to design a report that automatically gathers acuity information on each patient & calculates totals for the entire floor. Case Summary: We designed an automated report in Epic that looks at a combination of active orders and documentation to calculate real-time acuity numbers. This report looks at orders for ventilators, treatments, medications, off-unit travel, patient education, isolation status, procedures & more. It also captures important documentation from the previous 12 hours on specific patients who are being seen frequently by the Respiratory Therapist and applies points for every documented assessment. These numbers are available in real time within each patient's chart in Epic. This same information is also filed to a flowsheet every 4 hours & can be pulled for reporting purposes. In addition, Epic generates a report that the Respiratory Therapy Managers & Charge RTs use for shift-to-shift staffing. This report shows total RT Acuity numbers for each floor & highlights where the high acuity patients are located in the hospital. Discussion: The development of this report has allowed our department to be more efficient by eliminating the need for manual calculations of these numbers. It has also given us real-time access to Acuity calculations & the ability to track & capture information that we were unable to in the past. In addition, our Managers & Charge RTs can know where the high acuity patients are and they are able to make staffing adjustments based on immediately up-to-date information. We are hopeful as we move forward that we will be able to use the reporting features to advocate for more positions and for our department as a whole.

Sponsored Research - None

2758103

Utilizing High-Flow Nasal Cannula to Resolve Tension Pneumocephalus Should Be Explored as a Viable Treatment Option.

Karen W. Hampton[1], Jason L. Siegel[2]; [1]Respiratory Services, Mayo Clinic Florida, Kingsland, GA; [2]Department of Neurology, Mayo Clinic, Jacksonville, FL

Introduction: High-flow nasal cannula (HFNC) is used in a variety of situations including hypoxemic respiratory failure, pre-intubation oxygenation, post-extubation failure, and others. In our institution, we have identified a novel use of HFNC in the treatment of pneumocephalus (PNC). Case Summary: We identified three cases of postoperative PNC which resolved quickly after administering 100% oxygen via HFNC. In the following case, the patient was aphasic with right hemiplegia and sensory loss post-operatively. A CT of the head showed a PNC causing an 8mm shift. She was placed on a FLO2MAX® reservoir mask under our protocol. Her SpO2 was 97% and the PaO2 on her ABG was 163 mmHg. After several hours of no improvement in her neurological status, oxygen therapy was change to a HFNC at 30 L/min and 100% oxygen. This resulted in her PaO2 increasing to 411 mmHg. Over the next several hours, her alertness increased and a repeat CT of the head showed a decrease in the PNC. We identified two additional cases of tension PNC which decreased within 12 to 24 hours after treating with 100% oxygen via HFNC at 20 to 30 L/min. Each of these patients showed improvement in neurological status as the PNC resolved. Discussion: A PNC is a situation in which air enters the cranial cavity and is a common complication in head trauma and cranial surgery. In some cases the intracranial pressure increases causing a decline in neurological function. This is defined as a tension PNC. In reviewing many case studies, treatment for tension PNC varies. The treatment protocol at our institution includes the delivery of oxygen via a FLO2MAX® reservoir mask for 24 hours or to alternate hourly between the mask and a FiO2 to maintain SpO2 above 92% for 24 hours. The alternating protocol requires a blended oxygen source to quickly change the FiO2. Utilizing a HFNC system allows for delivery of 100% FiO2 for the continuous protocol and ability to change the FiO2 in the alternating protocol. In the cases discussed, HFNC proved superior to mask delivery of oxygen by decreasing the PNC quickly and restoring neurologic function. This has prompted us to suggest a change in our protocol. We feel the use of HFNC in the treatment of PNC certainly deserves further investigation.

Sponsored Research - None

2758600

Sleep Hygiene and College Students.

Kristen Chance-Habuda, Kelly Colwell, Amanda L. Roby; Health Professions, Youngstown State University, Boardman, OH

Introduction: It has been well established that exercise and diet are major factors responsible for obesity. Recently, other heath behaviors such as sleep duration and hygiene have been recognized as another key player in this societal epidemic. Thus, short sleep duration has been shown to be a risk factor for obesity. The purpose of this research was to investigate the likelihood that sleep deprivation has an effect on Body Mass Index in today's college student. The prevalence of poor sleep patterns, school schedules and Epworth Sleepiness Scale scores were all explored. **Hypothesis:** College students with poor sleep hygiene are at a greater risk for high BMI's. **Methods:** A mass survey was administered to Youngstown State University students of all age, race and gender via a blast email. The survey was anonymous and consisted of 16 questions and the 8 question Epworth Scale. Duration of sleep per night was asked and self reported height and weight was utilized to calculate BMI. **Results:** 637 surveys were completed, 7 surveys were excluded because they did not meet the age criteria of 18 years old. Out of 630, 296 students were classified as overweight or obese. Out of the 296 students, 57.8% were considered sleep deprived and 42.2% had the adequate amount of sleep. Other factors investigated included the students majors and the relationship to sleep deprivation and BMI's. **Discussion:** There is a huge emphasis on the need for sleep education in today's society. Dearth amount of data is available linking sleep hygiene and high BMI indexes among college students; however we now have a bridge connecting this specific lifestyle.

Sponsored Research - None

2758652

Multi-facility Oxygen Shut Down at a Tertiary Care Medical Center.

Earl Fulcher[1], Michael Sanders[1], Cinthea Sparkman[1], Lynnae Napoli[2], Boaz Markewitz[2,1], Robert Brownell[3], James Maxfield[3], Danny Moore[3], Dwayne Van[3], Philip Chaffee[4], Jerry North[3], Scott Cummins[3], James A. Sarten[3]; [1]Respiratory Services, University of Utah Health, Salt Lake City, UT; [2]Pulmonary Division, University of Utah Health, Salt Lake City, UT; [3]Facilities & Engineering, University of Utah Health, Salt Lake City, UT; [4]Emergency Management, University of Utah Health, Salt Lake City, UT

Introduction: In February 2015 damage occurred to the main oxygen supply pipe feeding the University of Utah Health complex. The pipe was physically examined, electronically scanned and determined not to be at immediate risk for failure. Months later the pipe was again examined then secured per current construction standards. Leaders from Facilities & Engineering (F&E), Respiratory Therapy (RT), and Emergency Management (EM) then began a 16 month process to review back-up oxygen systems and plan for the repair. **Case Summary:** The primary oxygen source for the medical complex is an 11,000 gallon liquid vessel with a 1,500 gallon secondary vessel providing a reserve supply via the same pipe. A 900 gallon back-up liquid vessel which supplies oxygen on the opposite side of the facility was assessed and found to be inadequate due to the recent addition of patient care buildings and an undersized evaporator. Plans were then made to add a back-up H/T cylinder manifold system to supply the main hospital which includes 4 connected buildings. A primary, alternate, contingent, and emergent (PACE) plan for each oxygen shut down was developed with the guidance of EM leaders. After design and construction of the 36 cylinder manifold, 2 of the 4 buildings had to be shut down and tied into this system. For this phase of the project, individual H cylinders were deployed to supply each patient care zone. One building was tied in at a time with respiratory therapists and F&E personnel stationed on each patient unit. During this and subsequent shut downs, leaders from RT, F&E, EM, and nursing were stationed in the hospital command center. In August 2016, the oxygen supply for the entire medical complex was shut down and the damaged pipe repaired. There was no loss of oxygen to any patient during this project. **Discussion:** Most hospitals only have a back-up oxygen supply that is connected to the same inlet pipeline as the primary source. If damage occurs to the main pipeline, cylinders must be deployed which creates several supply, manpower, and safety concerns. A redundant system and coordination between key departments can ensure the continuation of oxygen therapy to patients. **Conclusion:** A multi-facility oxygen shut down and back-up can be performed safely with uninterrupted oxygen flow to all areas. When such a project is necessary, proper planning, communication, and a coordinated effort between all involved departments is the key to a successful outcome.

Sponsored Research - None

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Comparison of the Metaneb and IPV High Frequency Therapy Device Capabilities.

Ricki Hackworth, Alexandra Ghan, Tai Lundquist, Jessica Thomason, Brandon Burk, Aaron E. Light; Respiratory Therapy, Ozarks Technical Community College, Springfield, MO

Background: The two devices, MetaNeb 4.0 (Hill-Rom, St. Paul, Minnesota) and IPV 1C (Percussionaire, Sagle, Idaho) provide similar high frequency percussive therapy for patients that have secretion mobilization and/or atelectasis problems. Given the similarity in devices, we set out to directly compare the two machines in three areas- delivered pressure amplitude, flow amplitude, and frequency. Our hypothesis is that the two devices will provide similar frequencies and pressure amplitudes during treatments. **Methods:** An ASL 5000 Breathing Simulator (Ingmar, Pittsburgh, PA) with a set lung compliance of 40 mL/cmH2O and an airway resistance of 12 cmH2O/L/sec was used as a passive lung for the study. These values were used to reproduce the types of patient lungs these devices are normally used on. After the pre-use check, the Metaneb mouthpiece set on the lowest resistance (one dot), the lowest frequency setting and then connected directly to the ASL 5000. Acclimation for one minute was allowed and then data was recorded. These steps were repeated for a total of three trials before changing to medium resistance (two dots) and high resistance (three dots) on the Metaneb. The Metaneb was then placed in the high frequency setting and the testing procedure was repeated for the same three resistance settings. The IPV 1C was connected to the ASL with the working pressure set to between 30-40 cmH2O and the frequency knob turned to the lowest setting on the IPV. One minute was allowed for acclimation and then data was recorded, this was repeated three times before increasing the frequency to the highest setting on the IPV where three more trials were recorded. **Results:** The IPV was found to have a statistically higher flow amplitude and pressure amplitude at all frequency and resistance settings on the Metaneb. Additionally, the IPV was found to have a wider range of frequency capabilities than the Metaneb. **Conclusion:** The greater flow amplitude and pressure amplitude achieved could result in greater secretion mobilization than the metaneb, further research is needed. An incidental finding in this study was that the higher the resistance on the MetaNeb, the greater the volume amplitude was, presumably this is due to the exhalation port allowing for more air to escape with the lower resistances (larger exhalation port).

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	Frequency	Flow Amp L/min	Press Amp cmH2O	Vol Amp ml's
Metaneb Low Frequency	168.78 ± 10.78	58.63 ± 9.37	11.83 ± 1.98	62.43 ± 17.63
Metaneb High Frequency	232.33 ± 5.32	77.26 ± 11.68	17.61 ± 3.10	62.46 ± 16.04
IPV Low Frequency	123.33 ± 1.53	199.733 ± 1.16	45.78 ±0.25	258.27 ± 0.76
IPV High Frequency	382.33 ± 2.89	143.37 ± 3.33	54.30 ± 0.35	53.53 ± 1.31

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Effects of Sitting Position on Thoracic Configuration and Changes in Volumes of Hemithoraces.

Akira Shobo, Fujiyasu Kakizaki; Department of Physical Therapy, Bunkyo Gakuin University, Fujimino, Japan

[Background] Poor posture is detrimental to breathing. During the assessment of patients with dyspnoea, it was frequently observed that right-left asymmetry of respiratory muscle activity occurred. This asymmetrical movement included abnormal alignment of the thorax on a sagittal plane, changes in thoracic configuration in relation to the pelvis on a frontal plane and right-left discrepancy in chest expansion. Therefore, the purpose of this study was to investigate effects of Two Sitting Positions between the asymmetric chest configuration and change in the chest volume. [Methods]The participants were 11 sedentary healthy men with a mean age of 21.6 years, mean body mass of 59.8kg, mean height of 169.7 cm and a body mass index of 20.7kg/m2. In stooped and upright sitting 84 reflective markers were placed anteriorly and posteriorly on the trunk. Using three-dimensional motion analysis, the difference in volume within the upper and lower hemithoraces was measured during quiet and volitional deep breathing. For calculation of the thoracic volume six imaginary hexahedra were visualized for the upper and lower thorax using four reflective markers for each on the anterior and posterior aspects of the thorax. Each hexahedron was then divided into three imaginary triangular pyramids to calculate positional vectors. Finally, the volume for both the hexahedra and triangular pyramids was calculated. Upper thoracic volume encompassed a space from the sternal notch to a midpoint on the ventral aspect of the third rib and the lower thoracic volume from the xiphoid process to midpoint on tenth rib's dorsal aspect. For statistical analysis, the Wilcoxon rank-sum test was employed for comparison of the changes in volume of the bilateral hemithoraces. This study was approved by the Bunkyo Gakuin University Medical Ethics Review Board (Approval No. 2016-0034). [Results] In stooped sitting the left lower hemithorax showed a significantly greater change in thoracic volume during quiet breathing and a significantly greater change in thoracic configuration during inspiration and expiration for both breathing patterns.[Conclusion] The left lower hemithorax may require special attention for patients with stooped posture.[Disclosures]The authors have no conflicts of interest directly relevant to the content of this article.

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Change in thoracic volume due to thoracic configuration in upright and hunched-back sitting positions

			Change in the thoracic volume (ml)			
			Quiet breathing		Volitional deep breathing	
			Upright sitting	Hunched-back sitting	Upright sitting	Hunched-back sitting
Upper thorax	Inspiration	Right	768.0±162.4	960.7±337.6	791.6±100.5	898.2±156.4
		Left	1039.0±175.0	1046.4±168.5	1118.4±145.5	1093.2±175.5
	Expiration	Right	750.5±155.7	940.0±328.1	733.9±97.0	842.7±139.7
		Left	1022.8±164.9	1015.3±168.5	1020.9±139.1	1029.9±161.1
Lower thorax	Inspiration	Right	1420.1±365.2	1360.8±428.9	1439.6±366.3	1419.8±469.1
		Left	1200.0±287.0	1494.0±439.6 *	1227.0±318.4	1553.7±476.8 *
	Expiration	Right	1364.5±358.3	1300.6±408.8	1292.9±336.3	1311.1±442.3
		Left	1153.2±280.3	1422.8±423.2 *	1122.2±269.9	1436.6±456.8 *

Mean (SD)
*p<0.05 (right hemithorax vs. left hemithorax)

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Appreciation of Reviewers

The Editors of RESPIRATORY CARE are deeply grateful to the following persons who contributed their expertise and time reviewing the 2017 OPEN FORUM abstracts.

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