**USE OF THE ONE WAY VALVE WHEN ADMINISTERING HFOV AND INHALED NITRIC OXIDE**

**Kenny Winn**

Respiratory Care, Carolinas Medical Center, Charlotte, NC

**Background:** Traditionally a one-way-valve is necessary for delivery of inhaled Nitric Oxide (INO) in conjunction with High Frequency Oscillatory Ventilation (HFOV). Conversely, we believe the one-way-valve does not create unidirectional flow during HFOV. We believe the flow is laminar and in the one-way-valve may not be necessary when delivering INO in conjunction with HFOV. This study measures flow and pressure through the one-way-valve during HFOV. **Method:** 1. Set-up 3100A and 3100B HFOV circuits and place the one-way-valve pre-heater and pre-use procedure for both 3100A and 3100B. 2. 3100A: Set Bias Flow 10 L/min, Hz 15, ΔP 18 cmH2O. 3100B: Set Bias Flow 20 L/min, Hz 6, ΔP 70 cmH2O. 3. Measured change in pressure (ΔP) in ccmH2O pre and post one-way-valve pre-heater for 3100A and 3100B. 4. Measured bias flow (l/min) pre and post one-way-valve for 3100A and 3100B. 5. Removed the one-way-valve and re-performed pre-use procedure for 3100A and 3100B. 6. Repeated measurements from steps 3 and 4. Results: 3100A: Measured ΔP pre and post one-way-valve: 4 cmH2O. Measured ΔP without one-way-valve: 6 cmH2O. Bias Flow measured 20 L/min pre and post one-way-valve and 10 L/min without one-way-valve. 3100B: The measured ΔP pre and post one-way-valve: 6 cmH2O. Measured ΔP without one-way-valve: 4 cmH2O. 7. Conclusion: These findings propose that the one-way-valve allows for bidirectional flow during HFOV. Hence, the one-way-valve may not be necessary when delivering INO during HFOV. Additionally, measured bias flow was consistent with and without the one-way-valve in both the 3100A and 3100B circuitry. Accordingly, INO injected into the HFOV circuit may be the same with or without the one-way-valve. Discussion: Both HFOV and INO are therapies with well-documented adverse events. However, INO administration to the critically ill patient. Therefore, when combining these two modalities together it is valuable to eliminate unnecessary technical equipment to facilitate efficient patient care, decrease practitioner anxiety, and decrease unnecessary medical interventions which may cause serious harm to the patient. Additional studies to determine necessity of the one-way-valve during HFOV and INO are necessary.

Sponsored Research - None

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**THE THERAPIST DRIVEN POLICY AND PROTOCOL: POSITIVE CHANGE FOR PATIENT CARE.**

**Joel M. Brown, Justin Stevenson, John S. Emberger, Lori Killian, Francis A. Gott, Melani Murphy, Virginia Markowski, Christiana Care Health System, Newark, DE**

**Background:** When patients experience recoverable acute respiratory distress, non-invasive positive pressure ventilation (NIPPV) is often considered. One of the biggest challenges when providing this life saving therapy is acquiring immediate patient care within the time window when needed. In order to overcome this challenge we developed a Respiratory Therapist Driven Protocol (RTDP) for the management of NIPPV. In this project we retrospectively reviewed the outcomes of our COID patients that required NIPPV at the time of the RTDP implementation. The RTDP for NIPPV was implemented on January 30th 2009. The RTDP included parameters that allowed the RCP to adjust IPAP, recommend level of care, trial patients off NIPPV, and discontinue if appropriate. During electronic respiratory documentation we retrospectively analyzed all adult COID patients who were admitted to the hospital and were ordered continuous NIPPV. The data was collected from July 2008 to April 2010. The data was divided into two different categories: Pre RTDP Group (July 2008 to January 2009) and Post RTDP Group (February 2009 to April 2010). All patients who were ordered invasive ventilation during their stay were excluded. For each group we collected the following data: IPAP settings, length of stay on NIPPV (LOSnin) hospital length of stay (LOS), and the number of patients transferred to the ICU’s or stepdown units. We also identified patients who were still on NIPPV within 48, 24 and 12 hours of discharge. Results: We identified a total of 765 COID patients in the Pre RTDP group and 132 (17.3%) of them received continuous NIPPV. We identified 853 COID patients in the Post RTDP group and 160 (18.8%) received continuous NIPPV. See table for additional data. Conclusion: There was no difference in IPAP level or the number of patients requiring NIPPV within 48 hours of discharge Pre or Post RTDP. Fewer patients required NIPPV within 24 and 12 hours of discharge in the Post RTDP Group. The RTDP resulted in a statistically significant decrease in LOSnin and LOSh. More patients were transferred to the stepdown units and fewer patients were transferred to the ICU for care in the Post RTDP group. Among the RCP’s they used the same gas mixture, they were able to discontinue NIPPV quickly which may have contributed to a reduced hospital stay. The use of a NIPPV RTDP is an effective way to manage COID patients requiring continuous NIPPV.

Sponsored Research - None

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**CASE SERIES: REPORT OF PATIENTS AT OUR INSTITUTION VENTILATED IN NEURALLY ADJUSTED VENTILATORY ASSIST (NAVA) WITH SEVERE OBSTRUCTIVE PHYSIOLOGY.**

**Brandy Seger, Carrie Morgan, Cynthia White, Alice West, PICU, Cincinnati Children’s Hospital Medical Center, Cincinnati, OH**

**Introduction:** An advantage of NAVA is the introduction of an electrical trigger offering physiological breath cycle synchrony in comparison to pressure or flow triggering. Several small studies have reported the use of NAVA in the pediatric population, but none of these mention NAVA in conditions with severe obstructive physiology. Aim: The purpose of this study is to describe respiratory outcomes in NAVA infants and children with severe obstructive physiology that were ventilated in NAVA with obstructive physiology resulting in prolonged exhalation. **Case Report:** Patient 1 is a 3 yr old female admitted with status asthmaticus and pneumonia with a history of reactive airway disease (RAE). On PD1 3100A and 3100B: The measured ΔP without one-way-valve: 4 cmH2O. Bias Flow measured 20 L/min pre and post one-way-valve and 10 L/min without one-way-valve. 3100B: Set Bias Flow 20 L/min, Hz 6, ΔP 70 cmH2O. 3. Measured change in pressure (ΔP) in ccmH2O pre and post one-way-valve pre-heater for 3100A and 3100B. 4. Measured bias flow (l/min) pre and post one-way-valve for 3100A and 3100B. 5. Removed the one-way-valve and re-performed pre-use procedure for 3100A and 3100B. 6. Repeated measurements from steps 3 and 4. Results: 3100A: Measured ΔP pre and post one-way-valve: 4 cmH2O. Measured ΔP without one-way-valve: 6 cmH2O. Bias Flow measured 20 L/min pre and post one-way-valve and 10 L/min without one-way-valve. 3100B: The measured ΔP pre and post one-way-valve: 6 cmH2O. Measured ΔP without one-way-valve: 4 cmH2O. Bias Flow measured 20 L/min pre and post one-way-valve and 10 L/min without one-way-valve. Conclusion: These findings propose that the one-way-valve allows for bidirectional flow during HFOV. Hence, the one-way-valve may not be necessary when delivering INO during HFOV. Additionally, measured bias flow was consistent with and without the one-way-valve in both the 3100A and 3100B circuitry. Accordingly, INO injected into the HFOV circuit may be the same with or without the one-way-valve. Discussion: Both HFOV and INO are therapies with well-documented adverse events. However, INO administration to the critically ill patient. Therefore, when combining these two modalities together it is valuable to eliminate unnecessary technical equipment to facilitate efficient patient care, decrease practitioner anxiety, and decrease unnecessary medical interventions which may cause serious harm to the patient. Additional studies to determine necessity of the one-way-valve during HFOV and INO are necessary.

Sponsored Research - None

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**NIVA Data**

- **Total # of patients:** 8
- **Vent day transitioned to NAVA:**
  - Days on NIVA 3
  - Ph Post NIVA 7
  - Ph Post NIVA 2
  - Ph Post NIVA 1
  - Ph Post NIVA 1

- **Follow up:**
  - Case 1: 20
  - Case 2: 16
  - Case 3: 16

- **Summary:**
  - Case 1:
    - Initial NIV treatment for 7 days
    - Transitioned to Niva
    - No adverse events
  - Case 2:
    - Initial NIV treatment for 7 days
    - Transitioned to Niva
    - No adverse events
  - Case 3:
    - Initial NIV treatment for 7 days
    - Transitioned to Niva
    - No adverse events

- **Follow up:**
  - Case 1:
    - Initial NIV treatment for 7 days
    - Transitioned to Niva
    - No adverse events
  - Case 2:
    - Initial NIV treatment for 7 days
    - Transitioned to Niva
    - No adverse events
  - Case 3:
    - Initial NIV treatment for 7 days
    - Transitioned to Niva
    - No adverse events

- **Additional information:**
  - Case 1:
    - Initial NIV treatment for 7 days
    - Transitioned to Niva
    - No adverse events
  - Case 2:
    - Initial NIV treatment for 7 days
    - Transitioned to Niva
    - No adverse events
  - Case 3:
    - Initial NIV treatment for 7 days
    - Transitioned to Niva
    - No adverse events

- **Conclusions:**
  - NIVA is a safe and effective alternative to NIV for certain patients

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Monday, December 6; 12:30 pm to 2:25 pm (Room N239/N241)
DECREASING UNPLANNED EXTUBATIONS IN A LEVEL IV NEONATAL INTENSIVE CARE UNIT.
Annette E. Norman, Christopher Lynn; Pediatric Respiratory Care, Monroe Carell Jr. Children’s Hospital at Vanderbilt, Nashville, TN

BACKGROUND: Through data collection from electronic documentation and paper records, it was identified that a number of patients were experiencing unplanned extubations. Data was collected and analyzed to identify the circumstances surrounding any unplanned extubations. RCPs worked with multiple disciplines to develop a plan to address the issues.

OBJECTIVE: To decrease the number of unplanned extubations in a level IV NICU. METHOD: All nursing and respiratory personnel were re-educated on a standardized procedure for securing endotracheal tubes with tape. In addition, a protocol was developed to provide specific steps that must be followed prior to any unscheduled patient extubations. A policy was implemented placing the RCP at the bedside prior to any intubation, extubation, or re-taping of an endotracheal tube. DATA: Data was collected on all unplanned extubations before, during and after protocol changes. Data collected included: date, time of day, patient weight, cause, and need for re-intubation. The number of unplanned extubations was also plotted against the number of ventilator days. RESULTS: The number of unplanned extubations decreased from 45 in the 3rd quarter of 2009 to 12 in the 4th quarter of 2009. Total ventilator days were 1062 and 1443 for quarters 3 and 4, respectively. Potential advantages of decreasing unplanned extubations include: decreased risk of airway trauma, decreased use of sedation to decrease patient anxiety, and decreased VAP risk. CONCLUSIONS: Unplanned extubations could be largely avoided through education and the utilization of a pre-extubation checklist. FUTURE DIRECTION: Data revealed that 33% of patients in 2009, who self-extubated, did not require re-intubation. The development of a NICU ventilator weaning protocol should help liberate patients from the ventilator sooner, thus decreasing ventilator days and associated ventilator risks. Continuing education will be on-going regarding the proper procedure to follow prior to extubations and re-taping of the ETT. Monthly reports will be conveyed to staff showing progress on an on-going basis.

Sponsored Research - None

EVALUATION OF PATIENT-VENTILATOR SYNCHRONY IN THE RESPIRONICS ST/D, VISION AND V60 WHEN VENTILATING A MANNEQUIN INTERFACED WITH AN ELECTRONIC BREATHING SIMULATOR.

Henry L. Griffith, Dana Svancara, Lorren Ashworth; Respiratory Care, Boise State University, Boise, ID

Background: Respironics recently released the latest model in their line of BiPAP ventilators, the V60. To date, there has been little research conducted on its performance. Commonly, patients who are experiencing an exacerbation of COPD are placed on BiPAP to reduce their work of breathing (WOB); however, there are other factors, such as patient-ventilator dys-synchrony, that may actually increase WOB in these patients. The dys-synchrony can be exhibited as lengthened inspiratory time and/or trigger delay. The purpose of this project is to determine if the V60 enhances patient-ventilator synchrony when compared to the Respironics Vision and the ST/D when ventilating a mannequin interfaced with an electronic breathing simulator. Methods: The Laerdal SimMan mannequin was modified by connecting the left and right mainstems to the Hans Rudolph HR 1101 Electronic Lung simulator via corrugated tubing and 15 mm adaptors to simulate a spontaneously breathing patient. A Respiratory Comfort Gel face mask was placed on the mannequin (with a measured leak of 45 L/min) to complete the circuit. The V60, Vision, and ST/D were connected to the mask via standard BiPAP tubing. Ventilator settings were: Mode: Spontaneous Time, Rate 4 breaths/minute, EPAP 5 cmH2O, IPAP 15 cmH2O, rise minimum allowed by the ventilator. HR 1101 settings: Resistance 25 cmH2O/sec, Compliance 60 ml/cmH2O, Rate 15 breaths/minute, Amplitude 8, Effort slope 15%, % inhale 20, Target Volume 3000 mL, Load Effort Normal. Each ventilator ran for five minutes; the middle two minutes were used for analysis. Results: Data was measured by the HR 1101 at intervals of 0.05 seconds. Inspiratory time was measured as the amount of time from the beginning of inspiratory flow to the beginning of expiratory flow. The average inspiratory time was 0.93 seconds for the V60, compared to 1.0 second for the Vision and 1.75 seconds for the ST/D. Trigger delay was measured as the time from when patient effort began (measured by amplitude) to when inspiratory flow began. The average trigger delay was 0.10 seconds for the V60, compared to 0.25 seconds for the Vision and 1.75 seconds for the ST/D. Conclusion: The findings in this study have determined that the V60 is potentially more effective at reducing patient-ventilator dys-synchrony than the ST/D and the Vision, as measured by trigger delay and inspiratory time. This study could impact the clinician’s choice in ventilators for COPD.

Sponsored Research - None

SYMPOSIUM 1: VENTILATION/VENTILATORS

SYMPOSIUM 1: VENTILATION/VENTILATORS—Part 1

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A COMPARISON OF DELIVERED FIO2 WITH A 10 LPM 80/20 HELIOX BLEED-IN ON A RESPIRONICS VISION AT DIFFERENT SET FIO2'S AND TIDAL VOLUMES.

Michael G. Cloutier, Stanley Baldwin, Michele Grueniger, Michael H. Terry, Respiratory Care, Loma Linda University Medical Center, Loma Linda, CA

BACKGROUND: We measured the effect of a 10 LPM 80/20 Heliox bleed-in on the delivered FIO2 for a Respironics Vision delivery system. We were also concerned that combining a fixed bleed-in with different tidal volumes might lead to significant variation in delivered FIO2. So, we compared three delivered tidal volumes and measured FIO2. METHODS: We connected the Resprionics Vision to a wall O2 source and bled-in 80/20 heliox into the circuit. (Universal, Non-invasive Ventilator Circuit, Hudson RCI), at the outlet of the ventilator at 10 LPM. Ventilator settings were: rate=24, ITime=0.8, IPAP/EPAP=16/5. The leak test was performed and the system was connected to a Michigan Test Lung (MTL). Set FIO2 was varied in four steps, 1.0, 0.7, 0.5 & 0.3. The delivered VT was measured on the MTL (volumetric measurement) and was varied by changing the compliance and resistance to achieve three VT's 800, 500 & 200 mL. The delivered FIO2 was measured distal to the proximal pressure port, at the patient connection with a MiniOx III O2 analyzer. The ventilator was operated for 5 minutes between changes of Set FIO2 or VT. FIO2 stability was reached within 2 minutes of each change. RESULTS: A Set FIO2 of 1.0 resulted in a delivered FIO2 of 0.4. Decreasing the Set FIO2 decreased delivered FIO2, (see figure 1). We did not observe significant variation in delivered FIO2 with changes in delivered VT. CONCLUSION: The bleed-in method to a Resprionics Vision at 10 LPM 80/20 heliox resulted in a stable delivered FIO2 at the settings tested.

Sponsored Research - None

TIDAL VOLUMES: Measured FIO2 with a 10 LPM Heliox Bleed-in at Three Tidal Volumes

DIAGNOSING DIAPHRAGMATIC DYSFUNCTION WITH CONTINUOUS DIAPHRAGMATIC MUSCLE ACTIVITY MONITORING.

Daniel D. Broyles1, Frank J. Cartus2, Stuart Lowson3, Jürgen Wirtz1,2,3; Pulmonary Diagnostics & Respiratory Therapy Services, University of Virginia Medical Center, Charlottesville, VA; 1Anesthesiology & Intensive Care Medicine, University of Virginia Health System, Charlottesville, VA; 2Anesthesiology & Intensive Care Medicine, University of Münster, Münster, Germany

BACKGROUND: Pulmonary complications after liver transplantation (LTX) are common and lead to increased morbidity and mortality. Although right phrenic nerve injury is regarded as common after LTX, it is difficult to diagnose objectively at the bedside. Neurologically adjusted ventilator assistance (NAVA) is a new mode of mechanical ventilation (MV) that uses a special esophageal tube with embedded electrodes to detect diaphragm myoelectric activity (Edi) during expiration. As part of an ongoing assessment of Edi monitoring and NAVA mode, we identified and diagnosed three cases of diaphragmatic paralysis post-OLTX. METHOD: Adult patients were identified who were spontaneously breathing but not ready for extubation because of a failed spontaneous breathing trial (SBT). Flow trigger sensitivity of 2 is standard. Communication between the Edi catheter and ventilator was established with a cable-module connection. The Edi catheter was inserted via the nasal route. Correct placement was verified with a disposable CO2 detector and by visualizing the EOG waveform color changes on the ventilator's monitor when Edi signals occurred. Airway and Ei scalar waveforms was then recorded. Transthoracic ultrasound was performed to assess diaphragmatic muscular activity when an Edi signal of less than 2 μV was displayed on the ventilator’s monitor. RESULTS: Three patients were identified who failed to remain extubated after passing a 30-minute CPAP SBT. Evidence of accessory muscle flexion during inspiratory efforts was present in each patient, and no Edi-signals were detected during patient inhaled breaths. Bedside transthoracic ultrasonography revealed ascites and diaphragmatic paralysis; unilateral in one case and bilateral in two. CONCLUSION: Our findings reveal that patients may potentially trigger assisted breaths during MV despite having markedly suppressed, or absent, diaphragm myoelectric activity. Flexion of accessory muscles may explain why the breath trigger occurring when Edi signals are suppressed or absent. This could further explain the failed extubation attempts in this patient population. Our observations demonstrate that diaphragmatic dysfunction during MV may be grossly under appreciated by using standard assessment techniques. Aside from NAVA mode, the Edi catheter may be used as a clinical adjunct to evaluate diaphragm function objectively at the bedside.

Sponsored Research - None

Symposium 1: Ventilator/Ventilators – Part 1

COMPARISON OF APRV AND BIPAP IN A MECHANICAL MODEL OF ARDS.

Ehab Daoud, Robert L. Chatburn; Cleveland Clinic, Cleveland, OH

BACKGROUND: Airway Pressure Release Ventilation (APRV) and BiPhasic Positive Airway Pressure (BIPAP) are alternative modes to treat the difficult to oxygenate patients. While both modes are forms of pressure controlled intermittent mandatory ventilation with unrestricted spontaneous breathing, APRV is usually set with higher I/E ratios than BIPAP. No objective data are available directly comparing the two modes. The purpose of this study was to compare major parameters of ventilation, between the two modes when settings are based on time constants to manage expected tidal expiratory pressure and volume. METHODS: A spontaneously breathing ARDS patient was modeled with a lung simulator (IngMar ASL 5000): compliance = 30 mL/cm H2O, resistance = 10 cm H2O/L/s, respiratory rate = 10/minute, and muscle activity (Edi) was used. BIPAP: Press High = 25 cm H2O and number of releases (10/min) were the same in both modes. T Low was set to one time constant (1T) = 0.3 seconds in APRV (LE = 1.9) to generate predicted auto-PEEP of = 9 cm H2O. In BIPAP = 1.5 seconds (LE = 3.1) to minimize auto-PEEP. P Low was = 0 cm H2O in APRV and 9 cm H2O in BIPAP (theoretically equal to the auto-PEEP generated with the APRV T Low). Mandatory and spontaneous minute ventilation (MV), mean airway pressure (mPaw) and total PEEP were compared with t-tests; P value of <.05 was considered significant. RESULTS: The results are summarized in the table. All the spontaneous breaths fell on the P High in both modes. CONCLUSION: There is no irrefutable evidence of superiority of one mode over the other. Extreme prolongation of the T High generates higher mPaw but at the expense of MV and vice versa. The lower tidal volume with APRV was due to the lower pressure gradient (P High minus total PEEP). Total PEEP was higher than expected in APRV because: a) volume decay lagged flow decay, b) flow takes a few milliseconds to achieve peak expiratory value and c) flow decay from peak is not consistent between different time constants. Our data show that a real ventilator does not behave like a mathematical model. Setting T Low for either mode according to the respiratory system time constant results in unpredictable total PEEP. Further research is needed to identify an optimum strategy for setting T Low. The clinical significance of our study needs to be validated in an human trial to compare the effects on oxygenation, ventilation and hemodynamics between both modes.

Sponsored Research - None

AUTO-PEEP DURING APRV VARIES WITH THE VENTILATOR MODEL.

Ehab Daoud, Robert L. Chatburn; Critical Care, Cleveland Clinic, Cleveland, OH

BACKGROUND: Airway pressure release ventilation (APRV) is a form of the “open lung approach” ventilation strategy used for acute respiratory distress syndrome (ARDS) and it is incorporated on almost all modern ventilators through different names. This mode is used usually with very short inspiratory time constants to minimize auto-PEEP. CONCLUSIONS: All tested ventilators did not follow the mathematical model as expected and resulted in significantly different auto-PEEP, flow decay, and PEEP settings of the T Low settings. An unexpected finding was that peak flow was delayed from the start of expiration flow by 0.11 to 0.17 ms, which affected the flow decay data. System TC was larger than model TC because it included both model and ventilator circuit resistance and compliance and was affected by the delay. Setting T Low according to predicted time constants may not be reliable and results in either expected auto-PEEP.

Sponsored Research - None

Variable | APRV | BIPAP | P value
---|---|---|---
Spontaneous minute volume (mL) | 176.8 | 176.8 | <.001
Mandatory breath volume (mL) | 379.7 | 510.1 | <.001
Minute ventilation (L/min) | 5.56 | 6.87 | <.001
Mean airway pressure (cm H2O) | 25.2 | 22.6 | <.001
Total PEEP (cm H2O) | 14.34 | 10 | <.001
EVALUATION OF ELECTRICAL IMPEDANCE TOMOGRAPHY IN VARIOUS MODES AND SETTINGS OF MECHANICAL VENTILATION.

Mark Stronati 1, Rena Laliberte 1, Shirley Smith 1, Henry Ford Health System, Detroit, MI; 2 Department of Acute Care Medicine, Henry Ford Health System, Detroit, MI.

BACKGROUND: Electrical Impedance Tomography (EIT) is a non-invasive radiologic-free monitoring tool. EIT generates cross-sectional images of the chest from measurements of transthoracic electrical conductivity. The device monitors impedance changes in regional lung ventilation with the use of an electrode belt applied around the chest wall. We hypothesized that increases in impedance should correlate to increases in measured tidal volumes on the Evita XL ventilator ( Draeger Medical ) with various changes in Continuous Positive Airway Pressure ( CPAP ) and Pressure Support Ventilation ( PSV ) during mask ventilation. METHODS: After obtaining IRB approval, 10 volunteers ( n = 10 ) were mask fit and placed on the following settings for one minute: CPAP 0/PSV 0; CPAP 5/PSV 0; CPAP 5/PSV 5; and PSV 5/CPAP 0 while tidal volume ( V ) were collected using the Draeger Medical EIT Evaluation Kit 2. We also recorded an average tidal volume ( V ) obtained by the minute for the corresponding ventilator settings. For data analysis a Pearson correlation coefficient was calculated for each individual and is summarized in Table 1. RESULTS: For the study we anticipated a positive correlation of measured Vt and global tidal variations (impedance changes). The pooled correlation was 0.168 with a positive slope of 0.0125, meaning that correlation was small and there was no apparent linear relationship between the two variables ( global tidal variations and measured Vt ) was not well correlated. Our data shows that increases in global tidal variations, obtained from the EIT device, do not consistently reflect a simultaneous increase in tidal volume as measured on the ventilator. CONCLUSION: Draeger Medical makes no claim to a numeric correlation between global tidal variations (unitless number) to volume measurements. The use of EIT bedside for quantifying any changes would require additional clinical studies. Future clinical studies are needed to assist in finding those methods which would be most beneficial to the bedside clinician.

Sponsored Research – None

Table 1: (N=10) Summary of Results of Correlation and Slope

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EFFECT OF VOLUME OR PRESSURE CONTROL VENTILATION ON SIMULATED CHEST TUBE LEAKS.

Olga Nazarenko, Robert L. Chatburn, Madhu Sasidhar; Respiratory Institute, Cleveland Clinic, Cleveland, OH.

BACKGROUND: Leaks occur during ventilation and may cause a reduction in minute ventilation. Leaks may arise through a chest tube (CT) to treat a bronchopleural fistula. There are few data available to determine what affect mode of ventilation has on leaked volume. At least one study, of infant ventilations, suggests that pressure control ventilation (PC) is more efficient in maintaining minute ventilation than volume control ventilation (VC). The purpose of this study was to compare PC and VC using an adult model of H1N1 in the presence of simulated leaks. We hypothesized that during volume ventilation (VC), the tidal volume and endotracheal tube leak would be increased, whereas with pressure ventilation (PC), tidal volume and endotracheal tube leak were decreased. METHODS: We used an Ingmar ASL 5000 lung simulator (with Leak Module) set with a compliance = 35 mL/cm H 2 O, resistance = 3 cm H 2 O/L/s. A linear resistor (6 cm H 2 O/L/s) was attached to represent airway resistance above the leak. A 7.0 mm id PE 1000 mL (with no leak) and fixed tidal volume (12 mL/kg Ideal Body Weight, IBW) respiratory rate (70 BPM). The control group had no leaks, while the experimental group had leaks at 0.1 cm H 2 O (labeled as Group 1), 0.2 cm H 2 O (Group 2), and 0.3 cm H 2 O (Group 3). RESULTS: As frequency increased, leak reductions were less for volume control ventilation (VC) compared to pressure control ventilation (PC). CONCLUSION: This study demonstrates that pressure ventilation is more effective in maintaining minute ventilation than volume ventilation in a simulated H1N1 patient with a chest tube leak.

Sponsored Research – None

EFFECTIVENESS OF THERAPIST DRIVEN MECHANICAL VENTILATION WEANING PROTOCOL IN A LONG TERM ACUTE CARE HOSPITAL.

Patricia C. Silver, Robert Farmer; Quality Improvement, Methodist Extended Care Hospital, Memphis, TN.

BACKGROUND: Extensive evidence demonstrates the effectiveness of use of therapist driven weaning protocols at acute care hospitals for decreasing patient’s LOS on mechanical ventilation. Our long term acute care institution implemented the use of a therapist driven mechanical ventilation weaning protocol in Aug. 2008 with the hypothesis that it would be effective decreasing the LOS on mechanical ventilation for patients in our long term acute care hospital. Patients coming to our facility had failed to wean in an acute care setting. Methods: A weaning protocol was developed and used on all patients who were deemed able to wean (non-hospitalized, excluded DNR, etc.). Results are as follows: Total Mean vent days for period 1 was 31.8 (n=119); period 2 was 16.56 (n=83); period 3 was 7.33 days (n=12) p<0.002. Period 1 was the time prior to use of the protocol; Period 2 was the implementation and adjustment phase of the protocol and Period 3 was the steady state phase of the project. Conclusion: Implementation of a weaning protocol is effective in a long term acute care setting evidenced by the statistically significant decrease in LOS for patients at our long term acute care facility.

Sponsored Research - None

HFOV FOR ARDS AND H1N1 INFLUENZA: A RETROSPECTIVE REVIEW.

Crystal Robertson, Kimberly Bauer, Carl Haas; University of Michigan Hospital, Monroe, MI.

BACKGROUND: We use HFOV for refractory hypoxemia and applied it to patients with H1N1 Influenza ARDS. STUDY OBJECTIVE: To compare treatment and outcome of the H1N1 patients with non-H1N1 H1N1 patients. STUDY DESIGN: Retrospective review of the following from a HFOV database: gender, ARDS triggers, BMI, mortality, use of iNO and ECMO, incidence of air-leaks, and duration of ventilation. UL and PaCO2 were recorded as baseline, and at hour 1, 12, 24, 48 of HFOV. RESULTS: 28 H1N1 (H) patients were compared with 28 non-H1N1 (NH) patients during a similar period. There were 68% vs 64% males, with a mean age of 40 ± 12 vs 40 ± 12 years and a BMI of 30 ± 4 vs 30 ± 4 for H and NH respectively. ARDS triggers for NH included pneumonia (43%) and sepsis (39%), while all H was pneumonia. Air leaks were present at baseline in 7% (H) and 25% (NH) of patients and a new leak developed in 18% (H) and 7% (NH). iNO was used with 60% (H) vs. 50% (NH) of patients. ECMO was used pre-HFOV in 7% (H) vs 4% (NH) of the patients and during HFOV 25% (H) vs 18% (NH). Days of ventilation pre-HFOV were 3.3 ± 4 H vs 3.6 ± 3.4 (NH). Mean duration of HFOV was 3.9 ± 3 H vs 2.6 ± 2 (NH); median was 4 vs 2. H Hospital mortality was 30% for H and 30% for NH. Pre-HFOV and HR 1, 12, 24, and 48 values (mean ±SD) for PC, PaCO2 and HFOV frequency (Hz) were (please see attached table). CONCLUSIONS: H1N1 patients tended to be younger and heavier, and their degree of hypoxia more refractory to treatment (slower to respond, increased use of iNO and ECMO, longer HFOV, DOV) and their mortality higher than non-H1N1 H1F0 patients.

Sponsored Research - None
NON INVASIVE ASSISTED RAPID SHALLOW BREATHING INDEX FOR PREDICTION OF FAILURE IN NON INVASIVE VENTILATION.

Jerry R. Lang, Michael Cocchi, Justin Salciccioli, Michael W. Donnino; Beth Israel Deaconess Hospital, Boston, MA

Background: Non-invasive ventilation (NIV) can reduce the need for intubation and the mortality associated with acute respiratory failure (ARF). However, there is currently no standard physiologic parameter to predict respiratory failure during NIV. We conducted a prospective observational study to evaluate the effectiveness of an (assisted) rapid shallow breathing index (RSBI) to predict the failure of NIV early in the course of ARF.

Methods: We evaluated patients with ARF requiring NIV in either the emergency department or intensive care unit at a large, tertiary care center with approximately 50,000 emergency visits each year and 50 intensive care beds. A non-fatiguing form of ventilatory support was targeted using the Draeger Evita XL in the mask ventilation mode, and the RSBI was calculated after patient was placed on support. The primary endpoint of the study was failure of NIV defined specifically as the need for intubation. The secondary endpoint was in-hospital mortality. After fifteen minutes of NIV, the RSBI was calculated and recorded using the exhaled tidal volume and the RR. The RSBI threshold of 105 was used as a cutoff value for stratification of high risk or low risk for death or intubation. The following parameters were recorded: ventilator mode, respiratory rate (RR), exhaled tidal volume (ExVt-exh), inhaled tidal volume (Vt-inh), and minute ventilation (MV) every fifteen minutes for the first hour.

Results: We evaluated 77 patients with ARF of which 47% were female with mean age of 69 +/- 16. Of the patients with RSBI > 105, 8/17 (47%) were intubated and 6/17 (35%) died. Of the patients with RSBI < 105, 19/60 (32%) were intubated and 7/60 (12%) died. The p values for intubation and mortality were 0.44 and 0.08 respectively. Conclusion: A RSBI > 105 was associated with a higher mortality and need for intubation in patients with ARF though this did not reach statistical significance likely due to sample size.

Sponsored Research - None
RAPID EXPANSION OF AN ECMO PROGRAM: A NOVEL, SIMPLIFIED VENOVENOUS SYSTEM FOR ADULT PATIENTS.

Anthony J. Diehl1, W. Lee Williford1, Michelle Peters2, Rich Walczak3, Ian Shaver1, John Thalman1, Iris Ocheltree1, David Turner1; 1Department of Respiratory Care, Duke University Medical Center, Durham, NC; 2Duke University Medical Center, Durham, NC

Background: The H1N1 pandemic caused significant life-threatening, refractory hypoxemia in the adult population. As a result, our hospital administration charged the ECMO Leadership Committee with rapidly expanding our ECMO program to include adults within a 8 week period. One of the major obstacles was to develop a simplified venovenous (VV) system that could be quickly and easily integrated into the current program infrastructure. Methods: A multidisciplinary team developed a simplified VV ECMO system for patients > 40 kg. This new system included a Maquet Centrifugal pump, a Quadrox D oxygenator, and a greatly simplified circuit with minimal monitoring and only one access port. Results: In comparison to traditional ECMO, new challenges and advantages became apparent with the new VV ECMO system. The largest change in practice resulted from the simplicity of the new circuit, which does not allow for administration of blood products, volume, or medications (including heparin) directly to the pump. The circuit includes only one access port, which is used solely for ACT sampling. This change requires the administration of all medications directly to the patient. Additionally, the newly simplified system displays only revolutions per minute (rpm) and liters per minute (lpm) and requires significantly less monitoring equipment as compared to traditional systems. A major advantage of the decreased requirements for both monitoring and interventions was the creation of a staffing model with one ECMO specialist managing two ECMO pumps rather than our traditional one specialist per pump. This model was a critical element in the expansion of our ECMO program, as it allowed for a doubling of the capacity of our ECMO program with only a 25% increase in ECMO staff and no increase in nursing staff. Conclusions: Expansion of an existing ECMO program to include adult patients is an extremely complex process with numerous hurdles. With an interdisciplinary approach and adequate administrative support, a simplified VV ECMO system can be quickly, efficiently, and safely implemented to expand an established ECMO program in response to an emerging health-care crisis.

Sponsored Research - None

198739

A NEW DELIVERY CIRCUIT IN EVALUATING VASODILATOR RESPONSE OF INHALED NITRIC OXIDE IN PATIENTS WITH IDIOPATHIC PULMONARY ARTERIAL HYPERTENSION.

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Background: Idiopathic pulmonary arterial hypertension (IPAH) is a rare and devastating disease. Acute vasodilator test is important in selecting effective drugs of treatment in IPAH. A number of studies indicated that inhaled nitric oxide (INO) can be used as a tool for assessing the response to vasodilation and adequacy of oxygenation for the patients. However, there was no standard circuit for applying INO. Here we propose a new INO delivery circuit to evaluate the response of vasodilator in patients with IPAH during spontaneous breathing. METHODS: Idiopathic PAH patients were enrolled for the vasodilator test. Hemodynamic measurements were recorded by cardiac catheterization at baseline breathing room air and after breathing NO. An INOvent delivered NO from source tanks to achieve proper dosing. With the patients breathing spontaneously, a NO and oxygen mixture was injected into the inspiratory limb of the circuit and delivered to the patient via a non-rebreathing mask. Flow rates were maintained at a rate greater than the patient's minute ventilation through a one-way valve into a non-rebreathing facemask. All patients received INO at doses of 10, 20, 40 and 80 ppm, or stopped at the dose with positive response. Five minutes was allowed at each INO dose before hemodynamic assessment was undertaken. A positive response to vasodilator testing was defined as a mean pulmonary artery pressure (mPAP) ≥ 20 mmHg at a mean pulmonary artery pressure (mPAP) ≥ 20 mmHg at a 20 mmHg at a mean absolute value of mPAP ≥ 40 mmHg with an increased or unchanged cardiac output. RESULTS: We studied 7 patients, including 4 females and 3 males, the average age was 53 ± 13 years. Two of 7 patients (28.6%) were positive response to INO, and 3 patients were non-response (71.4%). Two patients were positive responder at 40 ppm, 40 ppm, and 5 patients were non-responder even at 80ppm NO inhalation (Table). All of the patients were tolerated the INO test without adverse effects. CONCLUSION: This study revealed that this new delivery circuit can be effective and safe in evaluating vasodilator response of INO in patients with IPAH.

Sponsored Research - None

Sponsored Research - None

Acute vasodilator test with NO inhalation in patients with idiopathic pulmonary arterial hypertension.

mPAP, mean pulmonary artery pressure; CI, cardiac index; CO, cardiac output; PVR, pulmonary vascular resistance; SVR, systemic vascular resistance.

Sponsored Research - None

INTEGRATED PULMONARY INDEX AS A POSSIBLE SCREENING TOOL FOR PULMONARY DISEASE.

John Hill, M. Murphy, A. Martin, Caroline Panichello; Deborah Heart and Lung Center, Browns-Mills, NJ

Introduction: The Integrated Pulmonary Index is a new score which integrates measured end tidal CO2 (etCO2), heart rate (HR), pulse oxygen saturation (SpO2%), and respiratory rate (RR) into one integer value (FDA cleared algorithm developed by Oridion Capnography, Inc) in a scale of 1 through 10 with normal being a high value (8-10). Spirometry is a screening tool for respiratory health where expired volume and flow are measures and an abnormal result is any measurement outside of a normal range. The Integrated Pulmonary Index is a cardiopulmonary status indicator. We hypothesized that the at rest IPi could be a predictor of lung function for those patients referred for a routine spirometry pulmonary function test. Methods: Pulmonary function tests with documented values for at rest IPi, FEV1/FVC, FEV1% predicted (FEV1%), and gender were included in the data analysis. Results: Fifty-one patients (54 males and 31 females) met the criteria for data analysis. The IPi Normal Group (IPi 8-10, n=57) had a mean FEV1/FVC of .70, mean FEV1% of 72, and a mean IPi of 10. The low IPi Group (IPi < 8, n=8) had a mean FEV1/FVC of .48, mean FEV1% of 45, and a mean IPi of 6.

Discussion: The IPi scale suggests interventions by health professionals may be considered beyond current treatment at an IPi of 6 or less. In this retrospective study, some patients had prior diagnosis and were already receiving treatment, as indicated by a higher IPi score. For example, one patient with poor spirometry was noted to be on O2 therapy while the IPi was recorded and had a normalized IPi – an indication that oxygenation was effective. Conclusion: In this study the IPi identified patients with poor lung function, possibly in need of intervention. The study also revealed that patients on bronchodilator and oxygen therapy were responding positively to the therapy. A prospective controlled study is needed to evaluate more precisely IPi as a potential screening tool and method to monitor response to therapy for pulmonary patients. The IPi may have a role to screen for unrecognized pulmonary disorders and also as a tool to monitor outcomes of pulmonary care.

Sponsored Research - None

198952

EVALUATION OF FREE FLOW OXYGEN DEVICES FOR USE IN NON RESUSCITATION SITUATIONS.

Kathleen Deckens, Nancy Johnson, Timothy Myers; University Hospitals Rainbow Babies & Children's, Cleveland, OH

Background Free flow oxygen (FFO2) is often provided during resuscitation in the delivery room. The Neonatal Resuscitation Program (American Academy of Pediatrics Neonatal Resuscitation 5th Edition 2006-2-16-18) suggests that FFO2 be provided by oxygen mask, flow inflating bag or oxygen tubing from large bore tubing. FFO2 provided through a self inflating bag should be avoided. FFO2 is sometimes required in non-resuscitation situations. The purpose of this bench study was to identify the most effective methodology of delivering FFO2 within a target FFO2 range of 80-100% for non-resuscitation situations compared to our current methodology. Methods: FFO2 was measured proximal to the mouth of a resuscitation mannequin by attaching a calibrated Mastec oxygen sensor (Care Fusion: McGaw Park IL) near the mannequin's mouth at 15 LPM using six free-flow oxygen methods and our standard methodology (control); (1) large bore tubing, universal adapters and oxygen tubing, (2) infant oxygen mask (Safier Medical, Arvin CA #1114), (3) infant nasal cannula (Safier #1113), (4) resuscitation mask with oxygen tubing, (5) pressure line adapter with oxygen tubing capped on one end, and (6) Oxykid mask (Alberta, CAN) versus a self inflating CPR bag (Mauric Medical, Clearwater FLA). Free flow measurements (per position and device) were recorded as the mannequin was positioned on a flat plane with the head at a 45degree angle (facial midline) and turned linear toward the free flow device positioned horizontally at 2 and 5 cm distances. FFO2 is displayed as mean values and standard deviations for both positions and distances and are displayed in the chart below. Results: The graph below displays the mean percentages of FFO2 at a 45 degree angle (purple line) and turned linear toward the free flow device (green line). Combining both positions and distances, the mean FFO2 of a self inflating bag measured 24 ± 2% (Control), while the device that generated the highest mean FFO2 (large bore tubing with adapter and oxygen tubing) of devices assessed measured 90 ± 14%. The data was used to create a mean free flow oxygen table. In non-resuscitation situations, free flow oxygen can be provided by a simple large bore tubing setup to achieve a temporary and higher concentration FFO2 if a flow inflating resuscitation bag is not available.

Sponsored Research - None

919076

920371
ETCO2 MONITORING IN THE POST-OPERATIVE SURGICAL PATIENT
Corin Daniels; Lakeland Regional Medical Center, Lakeland, FL
Lakeland Regional Medical Center Cory Daniels BS, RRT-NPS Advanced Practice Specialist Background: Does capnography monitoring via ETCO2 nasal cannula on post-operative (total knee and total hip) surgical patients improve patient safety with patients receiving patient-controlled analgesia/opioids? This study aims to increase patient safety by decreasing the number of incidents of patients developing respiratory depression post-operatively using capnography monitoring via ETCO2 nasal cannula. Method: A quasi-experimental design was used to study 32 patients who were screened pre-operatively and did/did not score out as high-risk patients (Score ≥ 5) for developing respiratory depression post-operatively on the capnography monitor. All patients were automatically placed on capnography monitoring regardless of pre-screening tool score. JMP software was utilized to analyze the data. We measured patient safety in the following ways: Use of opioid reversal agent Narcan (opioid antagonist). If the Critical Care Assessment Team (CCAT) was called to evaluate the patient. Track number of “high ETCO2 alarms ≥ 60mmHg” (alarms with alerts of possibility of respiratory depression) on the capnography monitor. These measures have the ability to store and download all alarms within a 24 hour period. Results: The following data was collected during the study: Total males = 8 Total females = 24 Participants who met criteria = 9% of total who met criteria = 28% of total, age = 65.50 Mean score tool screen = 5.22 Total number of hips = 8 Total number of knees = 24 Total number of high (≥ 60mmHg) ETCO2 events that occur within 24 hours post-operatively = 71 independent episodes, which meet criteria for developing respiratory depression post-operatively. Pre-screening tool predicted with 94% accuracy patients who would develop elevated ETCO2 ≥ 45mmHg. An astonishing number (71 events) of high (≥ 60mmHg) ETCO2 occurred within 24 hours post-operatively. ETCO2 as high as 60mmHg was measured 14 hours post-operatively on one patient was noted.

ETCO2 Monitoring in the Post-Operative Surgical Patient. Corin Daniels; Lakeland Regional Medical Center, Lakeland, FL. Laser Light. Respiratory Institute, Cleveland Clinic, Cleveland, OH. (919812)

MEASUREMENT OF PEEP ON MANUAL VENTILATION SYSTEMS.
Rodrigo S. Adams; Respiratory Care, Catholic university Hospital, Santiago, Chile
Introduction:Manual ventilatory support (MVS) is done by all members of the health care team in Critical Care Units. The ability of these devices to generate and maintain PEEP is still an open question. Methods: We measured 3 devices: Adult self inflate bag (ASIB) (Hudson RCI. Durham, NC); Adult self inflating bag and PEEP valve, (ASBP) (Hudson RCI. Durham,NC). and Flow inflator bag, (FIB) (Vidal Sigura,Toledo,Spain). All measured 15 cmH2O with a manometer (HIDH-Wampolven,NY) to give feedback to the operator. MIP, PEEP and RR were recorded and analyzed with a proximal pressure/flow sensor Varithex Biorc CP 100 blinded. Shape of the curve was measured with a pressure monitor GE AVANCE 3000, blinded. 3 independent, well-trained R’s were asked to generate MVS with MPI 30 cmH2O and keep PEEP of 6,5,10,15,20 cmH2O stepwise with an initial RR of 15 bpm, then 30 bpm for 1 minute for each PEEP. Adult test lung was ventilated by 3 different ventilators: Siemens-Elema AB, Solna,Sweden, compliance 20 ml/cmH2O, resistance 12 cmH2O. We recorded PEEP, shape of curve, MIP & RR. Shape was classified: Dpacelent, if PEEP were maintained; OK, if PEEP maintained and keep plateau; and Keeping, PEEP remained without plateau. Results: ASIB with 15 bpm generated a MIP of 30,97±2,09 cmH2O and 25,6±2,77 bpm. With both 30 bpm, MIP 30,53±3,04 cmH2O and 31,9±5,89 bpm. PEEP generated were 1,88±0,47 (was OK); 3,68±0,02 (was OK); 5,08±0,4; 7,82±0,14) and 9,73±0,71 cmH2O, deacelerant. With ASBP, 15 bpm was 13,67±1,87 bpm, MIP 31,07±6,67 cmH2O. RR 30 bpm, 24,13±2,91) bpm and MIP 31,67±1,61 cmH2O. PEEP obtained were 1,65±0,46, OK; 4,03±0,66, deacelerant; 9,65±1,49, OK; 13,9±0,94 and 18,17±1,04, deacelerant. With FIB, 15 bpm, RR was 59,27±8,38 bpm, MIP 29,27±2,02 cmH2O, RR of 30 bpm, RR 29,5±4,27 bpm, MIP 30,2±3,48) cmH2O. PEEP was 1,55±0,21; 4,03±0,19; 9,80±0,33; 14,82±0,499 and 19,65±0,21 cmH2O, all OK. Conclusions: RR with MVS tends to be higher(reported). Training and manometer are essential. PEEP with ASIB is poorly maintained and no plateau, however, it can generate PEEP. ASBP keeps stable PEEP values and a steady shape, but it shows typical mistake of over estimation.FIB maintains PEEP values with stable plateau, but at low RR the risk of reverting RR and the handling requires a longer training. Use of ASIB or FIB are reliable to maintain PEEP. Clinical studies are needed.

Measurement of PEEP on Manual Ventilation Systems. Rodrigo S. Adams; Respiratory Care, Catholic university Hospital, Santiago, Chile. (920998)

REFERENCE DATA FOR DETERMINING VENTILATOR ALARM LIMITS.
Bara Mullins, Robert L. Chatburn; Respiratory Institute, Cleveland Clinic, Cleveland, OH
BACKGROUND: Few studies are available regarding ventilator alarm setting algorithms and no rational approach to developing intelligent alarms has been described. A review of the literature revealed one study that uses a 23% of ICU alarms as effective (Anesth Analg 2009;108:1546 –52). The purpose of our study was to determine the inherent variability of three alarm parameters as a potential rationale for setting limits based on expected percentage of alarm events. The three alarm parameters considered were minute ventilation, peak inspiratory pressure (PIP) and tidal volume (TV). METHODS: We conducted a chart review of patients in surgical, medical, neurological, and cardio-thoracic intensive care units. Modes of ventilation included were pressure control (PC) and volume control. Percentage of alarm events were screened pre-operatively and did/did not score out as high-risk patients (Score ≥ 5 or higher) for developing respiratory depression post-operatively. All patients were automatically placed on capnography monitoring regardless of pre-screening tool score. JMP software was utilized to analyze the data. We measured patient safety in the following ways: Use of opioid reversal agent Narcan (opioid antagonist). If the Critical Care Assessment Team (CCAT) was called to evaluate the patient. Track number of “high EtCO2 alarms” ≥ 60mmHg (alarms with alerts of possibility of respiratory depression) on the capnography monitor. These measures have the ability to store and download all alarms within a 24 hour period. Results: The following data was collected during the study: Total males = 8 Total females = 24 Participants who met criteria = 9% of total who met criteria = 28% of total, age = 65.50 Mean score tool screen = 5.22 Total number of hips = 8 Total number of knees = 24 Total number of high (≥ 60mmHg) ETCO2 events that occur within 24 hours post-operatively = 71 independent episodes, which meet criteria for developing respiratory depression post-operatively. Pre-screening tool predicted with 94% accuracy patients who would develop elevated ETCO2 ≥ 45mmHg. An astonishing number (71 events) of high (≥ 60mmHg) ETCO2 occurred within 24 hours post-operatively. ETCO2 as high as 60mmHg was measured 14 hours post-operatively on one patient was noted.

REFERENCE DATA FOR DETERMINING VENTILATOR ALARM LIMITS. Bara Mullins, Robert L. Chatburn; Respiratory Institute, Cleveland Clinic, Cleveland, OH. (920998)

VARIABILITY AMONG T-PIECE RESUSCITATION CIRCUITS: ARE ALL CIRCUITS CREATED EQUAL?
Yadid Aharoni; Sharon Estok, Timothy Myers; University Hospitals Rainbow Babies & Children’s, Cleveland, OH
Background T-piece resuscitation has gained popularity in the delivery room and in Neonatal Intensive Care Units in the last decade. Currently there are 3 commercially-available t-piece resuscitators and circuits used to achieve consistent inspiratory (PIP) and expiratory pressures (PEEP). Circuits are typically interchanged with one another or tested on other resuscitator types. Frequently the devices are set-up prior to patient use by ancillary support staff. The purpose of this study was to determine if variability in PIP and PEEP existed when interchanging proprietary circuits with one manufacturer’s methods. Methods: Four samples of each brand of 3-piece circuits were purchased from 3 brands purchased by an Infant Star test lung (compliance 2mL/cmH20), the GE Panda Infant Resuscitator (GE Healthcare, Helsinki, Finland), Neopuff (Faisher and Paykel Auckaland NZ) and NeoPuff (Neoforge Group Ireland, PA) and tested at suggested inspiratory flows of 8LPM, 10LPM and 1SPM using the maximum pressure relief valve test. Resistor valves were not altered prior to testing and breath rate was manually cycled on at each flow rate. PIP and PEEP values were measured by the NICO monitor (Phillips, Andover, MA) tested at suggested inspiratory flows of 8LPM, 10LPM and 15LPM using the maximum pressure relief valve test. Results values were not altered prior to testing and breath rate was manually cycled on at each flow rate. PIP and PEEP values were measured by the NICO monitor (Phillips, Andover, MA) using an infant flow sensor. Pressures from each series of circuits tested with the 3 inspiratory flows for each device were recorded. Results: Data are reported as mean values and standard deviations in the table below. Conclusion Dynamics of t-piece resuscitators with different resuscitation circuits are highly variable and can have drastic effects on inspiratory and expiratory delivered pressures within the manufacturer’s recommended flow ranges. Circuits should be tested and preset by skilled care-givers prior to clinical use.

Variability Among T-Piece Resuscitation Circuits: Are All Circuits Created Equal? Yadid Aharoni; Sharon Estok, Timothy Myers; University Hospitals Rainbow Babies & Children’s, Cleveland, OH. (908748)
PULSE OXIMETRY EVALUATION IN HYPOPERFUSED ICU PATIENTS.

Lara Brewer, Joseph Otr, Bioengineering, University of Utah, Salt Lake City, UT

Background: The ARDSnet ventilation protocol recommends a tidal volume (Vt) setting of 6-8 mL/kg predicted body weight. Respiratory rate (RR) is adjusted to achieve a target pH of 7.35-7.45. The current protocol does not consider the effects of PaCO2 on PaO2. Methods: A sample set of seven patients (n=7) included on a RED/S target protocol. Vt was calculated by the protocol and RR was adjusted accordingly. PaCO2 and PaO2 were measured with a standard (Masimo Radical 7) and a new (Nellcor OHMmax N-600) pulse oximeter. Results: PaO2 was not significantly different between the devices. However, PaCO2 was always lower on the Nellcor device (p<0.001). Conclusions: The RED/S target protocol may not be effective in patients with low perfusion. The new device may have potential to improve patient outcomes.

PATIENT-SPECIFIC CALCULATION OF INITIAL RESPIRATORY RATE SETTING.

Lara Brewer, Joseph Otr, Bioengineering, University of Utah, Salt Lake City, UT

Introduction: Pts with low perfusion present a challenge to pulse oximetry monitoring. It is often unsuccessful or inaccurate as compared to arterial blood gases. Newer technology with improved algorithms and ability for signal acquisition at other non-conventional sites (forehead) is now available. Randomized trials comparing oximetry devices (Masimo Radical 7 and Nellcor OxiMax N-600) were evaluated in our ICU’s to determine their response in hypoperfused patients. Methods: Pts with a systolic blood pressure < 60 mmHg and/or inability to capture a signal or unreliable signal from our standard pulse oximetry technology (Philips, Inc.) were monitored. All patients were evaluated with capnometry and pulse oximetry. Results: Respiratory rate (RR) was related to pulse oximetry technology (p<0.001). Conclusions: Newer generation oximeters can provide accurate RR measurements in hypoperfused patients.

SYMPOSIUM 2: Monitoring/Equipment—Part 1

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Symposium 2: Monitoring/Equipment—Part 1

INTEGRATED PULMONARY INDEX STABILITY IN HEALTHY ADULTS UNDER CHANGING CONDITIONS.
Jonathan B. Waugh¹, David L. Vines², Donna D. Gardner³, Richard B. Wettstein³; ¹Clinical and Diagnostic Sciences, University of Alabama at Birmingham, Birmingham, AL; ²Department of Respiratory Care, Rush University, Chicago, IL; ³Department of Respiratory Care, The University of Texas Health science Center at San Antonio, San Antonio, TX

Background: Pulse oximetry and capnography are established, non-invasive methods of monitoring oxygenation and ventilation status respectively. A fuzzy-logic algorithm that combines the 4 variables measured by these methods, oxygen saturation (SpO2), heart rate (HR), end-tidal CO2 (EtCO2), and respiratory rate (RR), into a single variable is found in the Integrated Pulmonary Index (IPI) by Oridion Capnography, Inc. (Needham, MA). Our goals were to determine which of the measured variables had the greatest influence on the calculated IPI and if the integrated measure remained stable with changing conditions (gas composition, delivered flow rates, and mouth position). Methods: 20 adult volunteers (75% female, ages 20-36 yrs.) with normal spirometry were measured. EtCO2 and RR were measured by capnography as subjects breathed heliox (20% oxygen/80% helium) via a non-rebreather mask compared to breathing room air at rest. Participants were coached to keep their frequency between 10-20 bpm as needed while watching a video to help maintain a regular breathing pattern. Each level of testing lasted six minutes and a six minute washout period occurred between each testing period. Results: Analyses used a linear mixed model to account for covariance among the repeated measures on the same subjects. The IPI scale ranges from 1-10 with normal being a high value (8-10). Bivariate analyses (tests of slope between the variables of interest and IPI) revealed that under these conditions increases in IPI were associated with increases in EtCO2 and RR (if within normal ranges for the contributing variables—changes below/above normal ranges produce a decrease in IPI). A multivariable analysis showed increases in EtCO2, RR, and SpO2 were associated with increases in IPI. A standard deviation (SD) increase in EtCO2 was associated with a 28% increase in a SD of IPI. A SD increase in RR was associated with a 20% increase in a SD of IPI. A SD increase in SpO2 was associated with a 10% increase in a SD of IPI. There was no effect from gas mixture, delivered flow rate, or mouth position (see table). Conclusions: The IPI variable was unaffected by the gas compositions, delivered flow rates, and mouth positions used with this adult sample during resting breathing. The most influential measured variables on IPI under these conditions were EtCO2, RR, and SpO2. A single, reliable variable for respiratory status has potential clinical implications for faster assessment and response.

Sponsored Research - Funded by Oridion Capnography, Inc.

IPI Statistics for Effects

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BEST LEADERSHIP PRACTICES IN INTERDISCIPLINARY COMMUNICATION BETWEEN REGISTERED NURSES AND RESPIRATORY THERAPISTS.

Paula M. Aherns, Diane E. Adler; Organizational Leadership, St. Catherine University, St. Paul, MN

Background: Though research was available on interdisciplinary communication in health care settings, specific research on interdisciplinary communication between Registered Nurses (RNs) and Respiratory Therapists (RTs) was lacking despite their frequent interactions and need to collaborate in the delivery of patient care. Research was conducted to answer the question, “What are the best leadership practices in interdisciplinary communication between RNs and RTs?” Method: A mixed methodology was used by the researchers, combining quantitative and qualitative approach, through a literature review plus a survey and interviews with RN and RT leaders. Seventy members of the American Association of Respiratory Care, Management Section and 32 members of the Minnesota Organization of Leaders in Nursing participated in the survey; four phone interviews with members of the two organizations were conducted. Results: Frequency of response to the survey and interview quoted their first year data on the success of the facility's Rapid Response Team (RRT) at the AARC International Congress in Orlando. The Rapid Response idea was still fairly new, and there was sparse long term data available. 2008 saw a focus on the RRT, with the Joint Commission establishing formation of RRT's as a National Patient Safety Goal. The Institute for Healthcare Improvement (IHI) included the “5 Million Lives” campaign. Numerous individual RRT success stories are in print and in the media(2). Data collection on Rapid Response has been ongoing, and additional data are now available. Methods: Retrospective Review of the Rapid Response database, specifically tracking total calls, transfers, and floor Codes. Results: 2005 data for floor codes (n=90) was used the reference. RRT calls have risen progressively from the team’s inception in 2006, and the statistically significant reduction in floor Code rate has been maintained. The transfer rate has remained almost unchanged (see Table 1). Conclusions: Rapid Response Team makeovers by facility. Guidelines are available that suggest team composition, but each facility determines Team composition and function locally. Our facility is a tertiary care referral center with a Level I trauma center and Medical School affiliation. Our facility’s Rapid Response Team experience has remained positive, and has served to dramatically reduce the floor Code rate at our institution. Further study into the efficacy of RRT impact on hospital mortality is indicated. Comparative review of Team composition, policies, and training is also indicated. 1 Arch Int Med 2010 Jan 11;170(1):18-26 2 www.ihi.org

RAPID RESPONSE REVISITED – A CONTINUED SUCCESS STORY
Russell E. Graham, Bob Herrington, Adam Mulally, Stanley Rhone; Respiratory Care, Memorial Hermann - Texas Medical Center, Houston, TX

Background: While the Rapid Response Team (RRT) concept has been implemented across the nation as well as the world, widespread acceptance and questions about effectiveness are still the subject of intense debate. One recent study found no decrease in hospital mortality with the implementation of the RRT, thereby raising questions about efficacy(1). In 2007, our facility (Memorial Hermann – Texas Medical Center) published their first year data on the success of the facility’s Rapid Response Team (RRT) at the AARC International Congress in Orlando. The Rapid Response idea was still fairly new, and there was sparse long term data available. 2008 saw a focus on the RRT, with the Joint Commission establishing formation of RRT’s as a National Patient Safety Goal. The Institute for Healthcare Improvement (IHI) included the “5 Million Lives” campaign. Numerous individual RRT success stories are in print and in the media(2). Data collection on Rapid Response has been ongoing, and additional data are now available. Methods: Retrospective Review of the Rapid Response database, specifically tracking total calls, transfers, and floor Codes. Results: 2005 data for floor codes (n=90) was used the reference. RRT calls have risen progressively from the team’s inception in 2006, and the statistically significant reduction in floor Code rate has been maintained. The transfer rate has remained almost unchanged (see Table 1). Conclusions: Rapid Response Team makeovers by facility. Guidelines are available that suggest team composition, but each facility determines Team composition and function locally. Our facility is a tertiary care referral center with a Level I trauma center and Medical School affiliation. Our facility’s Rapid Response Team experience has remained positive, and has served to dramatically reduce the floor Code rate at our institution. Further study into the efficacy of RRT impact on hospital mortality is indicated. Comparative review of Team composition, policies, and training is also indicated. 1 Arch Int Med 2010 Jan 11;170(1):18-26 2 www.ihi.org

THE RELATIONSHIP OF EMPLOYEE PRODUCTIVITY TO BILLING UNITS IN A RESPIRATORY CARE DEPARTMENT OF AN ONCOLOGICAL ACADEMIC CENTER
Clarence Finch, Hollie Lampont, Christine Carbaugh, Kristen J. Price; Respiratory Care, MD Anderson Cancer Center, Houston, TX

Introduction: Measuring employee productivity is one method of justifying staffing levels in respiratory care departments. But how do these levels of productivity relate to the revenue generated by each respiratory therapist? This study explores that question. We hypothesize that a correlation exists between an employee’s monthly productivity and the billing units he/she generates. Methods: For this study, we collected data on a population of 38 respiratory therapists in an 8 month period. A simple regression analysis was performed to determine if employee average monthly productivity, as measured by the ratio of total treatment time to total time worked (minutes), could be used to predict average monthly billing units (dollars). The employees were then divided into three groups based on primary work location: Floor (inpatient units), ICU (intensive care unit), or Both (a combination of both areas). A simple regression analysis was performed for each group using the same variables as the previous model. The division and analysis process was repeated with the groups Day Shift (employees working 7:00am to 7:00pm) and Night Shift (employees working 7:00pm to 7:00am). Finally, a multiple regression test was performed on the 15 ICU respiratory therapists. The independent variables were productivity and average monthly ventilator hours; the dependent variable remained billing units. Results: The overall regression test of the correlation between productivity and billing units showed no statistical significance (p = 0.101). When the employees were divided by work area, the group working on the floor exhibited statistical correlation with billing units (p < 0.001), while the groups working in the ICU (p > 0.500) and both areas (p > 0.500) did not. Day shift employee productivity showed statistical correlation with billing units (p < 0.001), but night shift productivity showed no correlation (p > 0.500). Further analysis of the ICU respiratory therapists showed no correlation (p > 0.500) between ventilator hours, and billing units. Conclusion: In this analysis, we found that employee productivity can be used to predict potential billing units generated by respiratory therapists who treat patients on inpatient floors or who work on the day shift, but not for respiratory therapists working in the ICU or on the night shift. Further research is warranted to find prediction factors for the ICU and night shift employees. Sponsored Research - None

DEVELOPMENT AND IMPLEMENTATION OF AN ELECTRONIC MEDICAL RECORD CHART AUDIT PROCESS
Russell E. Graham, Michael Bernstein, Roberta Melton, Adrienne Gentry, Stanley Rhone; Respiratory Care, Memorial Hermann - Texas Medical Center, Houston, TX

Background: There are multiple Joint Commission standards in place that necessitate an ongoing chart audit process. These standards include: PC.01.01.01, PC.01.02.10, PC.01.03.01, and PC.02.03.04. Traditional audits usually involve the use of a handwritten format, requiring multiple entries of the same data to reach a statistically analyzable end-point. The implementation of the Electronic Medical Record in addition to (or in lieu of) a written record can further complicate the objective collection of data by requiring the auditor to search between charts. The Respiratory Care Department at Memorial Hermann – Texas Medical Center sought to develop and implement a chart audit process that allowed for data entry directly to a database. No formal process was in place for audits. Capability would allow the department to utilize the Chart Audit as part of the Department’s PI efforts, and would allow trending data over time. Method: A Department-initiated PI project. A database was built that randomizes all charts associated with care provided by the department, and then queries an auditor to enter responses to presence/absence of documentation that supports the delivered care. These responses include Appropriateness of MD Orders, Interdisciplinary Plans of Care, Patient Education, Assessment of Response to Therapy, VAP Bundle requirements, and documentation of high risk/Sentinel Event indicators. Audits and Data Entry is performed by a trained group of Department Leadership. Data is automatically tabulated and scored, and is identified by Area and Shift. Results: The first month of data collected was considered as the benchmark of current performance (n=137 charts). The overall baseline score was 70.3% compliance of the 10 evaluated areas, with 5 of 10 (50%) of the evaluated areas, with 5% of 10 (50%) of the scored areas above this threshold. Department scores were posted for staff review and discussion. Audit for the following 90 days resulted in an overall score of 73.8% (a 5% improvement), with threshold met or exceeded in 71/10 (70%) of the scored areas. Data collection is ongoing at this time. Conclusions: Design and implementation of this chart audit process has helped Department Leadership identify areas for improvement. Objective collection of data reduces/removes bias, and data entry error has been eliminated. This process has been incorporated into the Department’s Quality Improvement plan. Sponsored Research - None

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THE IMPACT OF THERAPIST-DRIVEN PROTOCOLS ON RESPIRATORY THERAPIST’S JOB SATISFACTION.

Kristin N. Burg, Teresa A. Volko; 1Emergency Department, Cleveland Clinic Foundation, Cleveland, OH; 2Department of Health Professions, Youngstown State University, Youngstown, OH

Background: Respiratory therapist-driven protocols are a growing trend among hospitals around the country. The literature supports the use of respiratory therapist-driven protocols and reports positive outcomes such as more accurate respiratory therapy treatments, lower cost to patients, and to decrease patient’s length of stay. The purpose of this research endeavor was to describe respiratory therapists’ perception of job satisfaction when therapist-driven protocols are in place. Methods: A survey was used to collect demographic information and ascertain respiratory therapist’s views regarding job satisfaction and autonomy. This tool was comprised of twenty-nine questions. Informed consent was implied and included in the introduction to the survey. The survey was electronically distributed to respiratory therapists from four separate respiratory care departments within a large (>1000 bed) teaching hospital in Northeastern Ohio using KwikSurveys. Data was entered into Microsoft Excel (Microsoft Inc., Redmond, CA) for analysis. Descriptive statistics were used to communicate results. Results: Thirty seven percent of the individuals eligible for the survey completed the process. Approximately two-thirds of the participants (67%) were female. The vast majority of participants (92%) achieved the advanced level credential, RRT. At least 95% percent of all participants that reported the use of respiratory care protocols felt that they are adequately using their respiratory education. At least 70% of the therapists with protocols believe that they are a respected member of the medical team and their opinions regarding patient care were valued. The individuals that responded that respiratory care protocols are in use in their respective departments, also reported that having therapist driven protocols in place increases their job satisfaction. Seventy four of ninety five (78%) reported the use of respiratory care protocols and were very satisfied to somewhat satisfied with their job. Conclusion: The survey demonstrated that respiratory therapists that have therapist-driven protocols have more satisfaction with their jobs. Respiratory therapists that work under the auspices of respiratory care protocols feel protocols do indeed improve a therapist’s job satisfaction.

Sponsored Research - None

NATIONWIDE SURVEY OF LICENSURE REQUIREMENTS FOR MANAGEMENT STANDARDS IN RESPIRATORY CARE PRACTICE ACTS.

Daniel J. Grady, Terrence F. Smith, John Riggs, Devin Smith; Respiratory Care, Mission Health System, Asheville, NC

Background: There are multiple instances across the state of North Carolina where Respiratory Care Directors/Managers have been replaced by non-Respiratory Therapists. In North Carolina, Pharmacy and Nursing Practice Acts both contain language that requires managers in their respective professions to be licensed practitioners. In the NC Respiratory Care Practice Act, no language addressed the qualifications for management of Respiratory Care Departments and Educational Programs. Methods: This study inspected Respiratory Care Practice Acts of all 48 states in the United States. Each individual state Respiratory Care Practice Act was reviewed; noting the licensing requirements for the management of Respiratory Care departments. Results: There was one state out of 48 (1/48 = 2.0 %) that required that a department Director/Manager must be a licensed Respiratory Care Practitioner. Conclusions: Because of restructuring and cost containment initiatives which have replaced Respiratory Care Directors with non-Respiratory Care personnel, a deficiency has been identified in many state Respiratory Care practice Acts. The deficiency may result in misguided cost containment initiatives which replace licensed Respiratory Care managers with unlicensed, and unqualified personnel. To correct this deficiency in RC Practice Acts, it is recommended that state licensure laws are reviewed and amended to include licensure standards for management/administration of Respiratory Care services. This correction is recommended in order to ensure patient safety and protect patients from unqualified personnel in management positions. To date, the North Carolina Respiratory Care Licensing Board has adopted a rule change and drafted a position statement for Management standards of Respiratory Care services.

Sponsored Research - None

THE PERCEIVED CULTURAL SELF-EFFICACY OF RESPIRATORY THERAPIST AND NURSES: A COMPARATIVE STUDY.

Linda Birnbaum, Valerie Olson, Andrew McDonough, Raja Patashri; Seton Hall University, South Orange, NJ

Background: Given the changing minority demographics of the US population and their consequent diverse healthcare needs, it is imperative that healthcare workers become culturally competent (Benkert et al., 2005). Respiratory Therapists (RTs), a large part of the healthcare team are increasingly interacting with this diverse population. This study investigated the current levels of cultural self-efficacy in practicing RTs and how they compare to nurses. Methods: The Cultural Self-Efficacy Scale (CSES) survey tool and a demographic questionnaire were sent to 1000 respiratory therapists and 1000 nurses. The CSES measures the confidence in knowledge and skills of health care workers in providing transcultural care using a 5 point Likert scale (Bernal & Froman, 1987). The CSES is divided into three subscales: cultural concepts, cultural skills, and cultural patterns. Descriptive statistics were used to analyze the data and where needed, differences were evaluated using an independent t-test, p<0.05. Results: Four hundred and eighty three surveys were returned for a response rate of 22.4%. The returned surveys were broken down by profession as follows: 182 respiratory therapists, 258 nurses, and 10 were both professions. Reliability of the CSES using Cronbach’s alpha coefficient was 0.97. Participants were primarily Caucasian with an average age of 47-49 years, who had earned at least an associate’s or bachelor’s degree. Combined, the two samples had an average of 19-22 years of work experience. The mean total CSES scores for the RTs were 3.40 and 3.41 for the nurses, indicating confident to moderately confident cultural self-efficacy. There was no significant difference between RTs and nurses in the overall CSES levels; however they differed in cultural skills with nurses scoring higher than RTs. Conclusion: Overall the results suggest that RTs have average levels of confidence in providing care to a culturally diverse population. Interestingly, their levels of confidence matched other healthcare providers (nurses), despite having had no formal education in cultural diversity. It is possible that their years on the job may have contributed to the acquisition of this skill (19-22 yr). This study provides preliminary data on this very important subject. These findings should be used with caution.

Sponsored Research - None

IMPLEMENTATION OF COMMUNITY BASED OUTREACH.

Sandy Rhodes, Richard M. Ford, Isaac Zamora; Respiratory Care, University of California San Diego Medical Center, San Diego, CA

BACKGROUND: We recognized the mutual benefits of partnering with schools and community agencies to promote the profession and lung health. In 2009 we formally established a department objective to expand our outreach programs, specifically in the areas supporting regional youth and in community initiatives involving lung disease. We report how we have structured our program and the successes of the past year. METHODS: We formulated an objective to engage ourselves in the community that was approved by both administration and medical staff. We started accepting request made through the AARC office for activities in the San Diego region that involved the support of RCPs. We solicited the interest of staff willing to visit schools and events. We identified situations that RCPs could participate in approved events as paid hospital time. In addition we provided a high level of recognition of these events and RCP participation. RESULTS: The following activities took place: RCP’s interested in community outreach participated in local high school career fairs, Poster board presentations were made to give visual aide to the students. At another school there was an impressive interest in partnering with the hospital to support the UCSD smoke free campaign. This support lead to students creating a mural for the hospital supporting the smoke free campaign. This mural was presented to the Chief Executive Officer of UCSD on the day of the smoke free kick off. We were able to work in partnership with the local chapter of the American Lung Association and partner in lung health, specifically asthma education. We now have an RCP Community Liaison and five therapists interested in doing similar outreach. CONCLUSION: By implementing community outreach projects UCSD has established partnerships with local schools and the American Lung Association to better educate our communities about lung health and the role of the respiratory therapist. This has and will continue to expand with volunteered support. Our hope is to continue to grow community outreach as well as support our patients beyond the confines of the medical center.

Sponsored Research - None
USING HME'S TO REDUCE THE COST OF MECHANICALLY VENTILATED PATIENTS
Frank D. Sandusky; Douglas Lahe; Respiratory Care, Fairview Hospital, Cleveland, OH

Background: In 2009, a Financial Performance Improvement was initiated to maintain quality, while at the same time to reduce operational cost. After reviewing all Respiratory processes, we determined that the most effective way to achieve this goal was to have patients on mechanical ventilation started on Heat and Moisture Exchanger (HME) rather than active humidification. Method: Review of the literature indicated that Heat and Moisture Exchanger (HME) could be effective longer than 24 hours of use. Several manufactures also indicated that their device could be utilized up to 48 hours. Our institution had used humidifiers with HMEs on open heart patients in the past. While the average ventilator length of stay (VLOS) for these patients was less than 4 hours, 72% of all medical/surgical ventilator patient’s VLOS was 72 hours or less. We hypothesized that if we could utilize HMEs on patients for the initial 48 to 72 hours, there would be a significant cost savings. Criteria, based on current acceptable standards of practice, were established for use of the HMEs. Active humidification would be utilized on patients that did not meet the criteria. Also, criteria were developed to replace the standard HME with a HME with a bypass for ventilator patients receiving Meter Dose Inhaler or Aerosol therapy. Results: The original projections were base projected data for 2008. The projected volume for 2009 was 870 patients accounting for 3,160 days of mechanical ventilation. The program was started on January 1, 2009, with a cost saving goal of $14,000. The actual cost saving for the total year was evaluated through analysis of budge cost for 2009, our cost saving goal of $14,000. The actual cost saving for the total year was evaluated in January 2010. While mechanically ventilated volume was a significant increase from 2008, our cost saving fell below plan. It is suspected that this difference came as a result of increased use of the HME with bypass and more frequent HME change-outs then forecasted. Even with the initial problems encountered we realized a $12,187 cost savings for 2009.

Conclusion: Therefore, starting the patient with a HMEs or HMEs with a bypass more frequent HME change-outs then forecasted. Even with the initial problems encountered we realized a $12,187 cost savings for 2009. Active humidification would be utilized on patients that did not meet the criteria. Also, criteria were developed to replace the standard HME with a HME with a bypass for ventilator patients receiving Meter Dose Inhaler or Aerosol therapy.3 Results: The original projections were base projected data for 2008. The projected volume for 2009 was 870 patients accounting for 3,160 days of mechanical ventilation. The program was started on January 1, 2009, with a cost saving goal of $14,000. The actual cost saving for the total year was evaluated through analysis of budge cost for 2009, our cost saving goal of $14,000. The actual cost saving for the total year was evaluated in January 2010. While mechanically ventilated volume was a significant increase from 2008, our cost saving fell below plan. It is suspected that this difference came as a result of increased use of the HME with bypass and more frequent HME change-outs then forecasted. Even with the initial problems encountered we realized a $12,187 cost savings for 2009.

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COMPARISON OF METHODS FOR MEDICATION STORAGE AND TRANSPORT BY RESPIRATORY THERAPISTS IN AN 800 BED MEDICAL CENTER.
Douglas Orens, Robert L. Charbun; Respiratory Institute, Cleveland Clinic, Cleveland, OH
BACKGROUND: The American Association for Respiratory Care (AARC) has established a productivity benchmarking service (https://www.respiratorybenchmarking.org/login.aspx). Unlike other similar services, this one bases metrics on abbreviated data from only 3 billable procedures: mechanical ventilator-days, airway clearance treatments, and aerosol treatments. The system was designed this way on the assumption that these 3 procedures comprise the majority of the workload for all departments and hence would provide an adequate surrogate for recording all workload. The purpose of this study was to test that hypothesis. METHODS: Monthly procedure work units for 2009 were recorded using our billing volumes and the AARC benchmark reporting format (3 billable procedures) and standard procedure times (see website). For the same period, work units (all billable procedures) were recorded from data generated by our hospital’s management engineering department as part of our regular management reporting system. The two data sets were compared using linear regression.
RESULTS: The figures show that the abbreviated data set of the AARC benchmarking system was highly correlated with the total workload data set (R = 0.8, P = 0.004). AARC Benchmark workloads were consistently higher than hospital reported workloads despite the abbreviated data set because the former weights a ventilator-day 3 hours of standard time whereas the latter weights it at 0.25 hours.
CONCLUSION: The purpose of using an abbreviated data set is to allow benchmarking across departments whose total set of procedures varies greatly. The results of this study indicate that for benchmarking purposes, an abbreviated set that is based on billing data for only the number of ventilator-days, airway clearance treatments, and aerosol treatments is an acceptable surrogate for total workload data based on all billable procedures. This information supports the AARC benchmarking metric calculation.
Sponsored Research - None

Table 1: Comparison of Medication Temperatures between Therapist and Pyxis Machine

<table>
<thead>
<tr>
<th>Storage Method</th>
<th>Mean Temp (F)</th>
<th>Standard Deviation</th>
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<tr>
<td>Pyxis Machine</td>
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<td>3.00</td>
</tr>
<tr>
<td>Therapist</td>
<td>77.2</td>
<td>3.64</td>
</tr>
</tbody>
</table>

EVOLUTION OF AARC BENCHMARKING METRIC VALIDITY.
Douglas Orens, Robert L. Charbun; Respiratory Institute, Cleveland Clinic, Cleveland, OH
BACKGROUND: The American Association for Respiratory Care (AARC) has established a productivity benchmarking service (https://www.respiratorybenchmarking.org/login.aspx). Unlike other similar services, this one bases metrics on abbreviated data from only 3 billable procedures: mechanical ventilator-days, airway clearance treatments, and aerosol treatments. The system was designed this way on the assumption that these 3 procedures comprise the majority of the workload for all departments and hence would provide an adequate surrogate for recording all workload. The purpose of this study was to test that hypothesis. METHODS: Monthly procedure work units for 2009 were recorded using our billing volumes and the AARC benchmark reporting format (3 billable procedures) and standard procedure times (see website). For the same period, work units (all billable procedures) were recorded from data generated by our hospital’s management engineering department as part of our regular management reporting system. The two data sets were compared using linear regression.
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Sponsored Research - None

IMPLEMENTATION OF A PATIENT DRIVEN PROTOCOL IN THE ERA OF COMPUTERIZED PHYSICIAN ORDER ENTRY (CPOE).
Dana Stauffer, James Radudcig; Respiratory Care, Penn State Hershey Medical Center, Hershey, PA
BACKGROUND: The misallocation of respiratory care services has been a growing concern with the introduction of a Computerized Physician Order Entry (CPOE) system at the Penn State Hershey Medical Center, a 500 bed academic medical center. In 2007, we introduced a respiratory therapy (RT) Assess and Treat protocol on the general ward at the Penn State Hershey Medical Center. In November of 2007, a change in medical leadership allowed an introduction of the Assess and Treat protocol in the Heart and Vascular Intensive Care Unit (HVICU). The overall objective was to individualize patient care and improve the utilization of organizational resources in the face of automated order sets with prescribed respiratory therapy treatments.
METHOD: We conducted a retrospective analysis of 43 patients prior to implementing the Assess and Treat protocol in the HVICU, compared to 43 patients over the course of seven months following implementation. The data collected included the number of patients started on bronchodilator and recruitment therapy, total hospital length of stay (LOS), respiratory charges, and labor expense. Results: The Assess and Treat protocol implemented in the HVICU resulted in an 11% decrease in total bronchodilators ordered during FY 2009 (delivered by Respiratory Therapists and Registered Nurses) adjusted for patient volume. Total patient charges decreased by $23,890, with a savings of 101 hours of RT labor realized. Length of stay (LOS) for patients of comparable diagnosis related groups (DRG’s) decreased by 0.4 days; however, the results were inclusive (mean LOS 7.16, SD 3.24 pre Assess and Treat, post mean LOS 6.72, SD 2.85 t(84)=6.72, p<0.0001). Conclusion: In the era of CPOE systems, a patient driven protocol is a viable option to improve the allocation of scarce organizational resources.
Sponsored Research - None

IMPROVING RESPONSE TIME FOR RESPIRATORY CARE DISASTER PREPAREDNESS PLAN.
Jennifer J. Graves, Jan Phillips-Clar, Richard Ford, Fernando Gonzalez; UCSD Medical Center, San Diego, CA
OVERVIEW: Hospitals are mandated to have emergency disaster preparedness plans in place. Keeping over 90 UCSD Respiratory Care staff informed of the status of the Medical Center and request to report to work proved to be labor intensive and inefficient. To improve communication with off-site Respiratory Therapists during disasters we evaluated and implemented systems to facilitate group messaging. Method: We determined that over 70% of our staff had text enabled cell phones. Existing on-line programs to facilitate group messaging were evaluated. We selected two readily available web based group messaging programs and configured both Google and Microsoft Outlook to auto route messages to RCPS. The major US cellular carriers use the 10_digit_number@cell.carrier_domain.com format for SMS to text capable cell phones, with a limit of 160 characters in the subject and message body (total). User lists were developed to identify specific shifts; sites; and an all user list for all staff covering both sites. By doing so, we are able to contact staff depending upon what emergency event has taken place. This process is as simple as placing an email which notifies all users on the distribution lists which have been created. Results: All staff provided consent to notify them through this process during an emergency situation. In a situation in which a major catastrophic event occurred, 78 employees would receive notification and direction that takes less than 2 minutes to transcribe and send out to these individuals. In drill situations, this program has resulted in decreasing the time spent on phone calls. Employees have become receptive to this form of communication. Conclusion: Developing a mass distribution texting lists and incorporating this process as part of your department disaster preparedness plans improves efficiency during urgent situations and events. It also provides a mechanism to update staff instantly on the disaster. This process was so efficient and effective that we carried it over to our every day staffing module to recruit additional staff or offer employment the day off. The few remaining staff not on cell phone text programs require traditional calling.
Sponsored Research - None

RESPIRATORY CARE • NOVEMBER 2010 VOL 55 NO 11
Monday, December 6; 3:00 pm to 4:55 pm (Room N239/N241)
THE VALUE OF A CAPITATED PULSE OXIMETRY PROGRAM.
John S. Emberger, Lori Killian: Respiratory Care, Christiana Care Health System, Newark, DE

BACKGROUND: Disposable patient use items can cause a financial burden on healthcare systems, especially if costs increase due to increased volume of patients or increased disposal of an item multiple times for the same patient. We sought a cost containment program for pulse oximetry in our hospitals. We wanted to examine the value of incorporating a capitated pulse oximetry program for cost containment. METHODS: In 2003 through 2004 a multidisciplinary team was formed to choose a new pulse oximetry platform for our 2 hospitals: 913 bed, level 1 trauma center, level III NICU teaching hospital and 241 bed community hospital. After clinical and financial evaluations, the multidisciplinary group chose a capitated, reusable pulse oximetry program (Dinamap Novametrix, Wallingford CT). A large education effort took place with Nursing and Respiratory Care to be sure everyone knew that the pulse oximetry sensors were not disposable. After the initial 5 year agreement, we entered a second five year agreement. Capitated pulse oximetry program included: monitoring for 214 ICU Beds, 122 stand-alone devices, large pool of reusable sensors, unconditional warranty and unlimited attachment supplies. Pulse oximetry costs from before capitation through the 2 capitated agreements were analyzed. RESULTS: Previously our system was using $530,670.93 per year in cost of disposable sensor supplies. Pulse oximetry costs from before capitation through the 2 capitated agreements were evaluated. The cost was reduced by 67% of original costs in the second agreement. Over the first five year agreement, cost saving was $1,148,350. In the second five year cost saving will be an additional $1,774,830. See chart for annual costs. CONCLUSION: We demonstrate that a large hospital system can provide pulse oximetry with a capitated program alone, not including repairs and purchase of the pulse oximetry devices. Capitated program reduced pulse oximetry costs by 43% in the first agreement. The cost was reduced by 67% of original costs in the second agreement. Over the first 5 year agreement, cost saving was $1,148,350. In the second five year agreement, cost saving will be an additional $1,774,830. See chart for annual costs.

Sponsored Research - None

Annual Pulse Oximetry Cost: Pre-Capitated Program and During Two Capitated Agreements

920094

DECREASING RCP EXPOSURE TO POTENTIALLY HARMFUL AEROSOL PARTICLES.
Susan Rinaldo-Gallo, Rickie Bowen: Respiratory Care Services, Duke University Health System, Durham, NC

BACKGROUND: The emergence and spread of 2009 pandemic influenza A (H1N1) virus resulted in substantial influenza activity in the United States throughout the summer and fall months of 2009, with activity peaking in late October. Providing respiratory care is associated increased risk to RCPS. In particular administering aerosol treatments exposes therapists to exhaled airborne particles that can carry H1N1 virus. We put practices in place that would reduce environmental exposure to aerosol particles from both symptomatic and non-symptomatic patients. METHODS: We made two program changes: 1. Reinforced our delivery device selection protocol for Albuterol and Ipratropium. Orders. Patients who could perform MDI maneuver were automatically switched to MDI with a spacer holding chamber. MDI treatments emit fewer particles than Small Volume Nebulizer treatments. 2. In addition to MDIs, we selected other equipment that would decrease the quantity of exhaled aerosol particles. Patients unable to perform MDI were placed on Breath Activated Nebulizers (BAN). If patients were unable to perform the BAN maneuvers, they were given treatments with a SVN and a mouthpiece using a filter on the exhalation port. If patients were unable to perform treatments with a mouth piece, the treatment was administered with a SVN nebulizer using a mask that had filters over the exhalation ports. RESULTS: Six months prior to implementation of this program the average Albuterol and Ipratropium treatments administered via MDI was 41.8%. After implementation the per cent increased to 55.1%. We could not quantify if these precautions actually decreased the transmission of H1N1 to our employees. Conclusion: Transmission of respiratory infections such as H1N1 is possible through aerosol particles. Infection control precautions should be taken with symptomatic and non-symptomatic patients during a pandemic. The above describes the extra precautions taken at Duke Hospital by the Respiratory Care department.

Sponsored Research - None

903282

RESSTRUCTURE OF HIRING PROCESS TO INCREASE RETENTION RATES.
Carol Mihalik, Jan E. Phillips-clar, Elsie Collado-Koman: Respiratory Care, UCSD Medical Center, San Diego, CA

OBJECTIVE: The cost incurred in the hiring and orientation process per new hire is approximately $22,000. We hire 8 to 10 new staff each year and identified retention as an opportunity for improvement. Our goal was to increase the retention rate by improving the processes of recruitment, screening and hiring new staff. METHODS: A workgroup was formed consisting of RC leadership and staff to identify improvements in screening, interviewing and selection of applicants. The newly created program included: 1) Collaboration with Human Resources ensuring initial screening for a California licensed RCP and Registered Respiratory Therapist. Applicants meeting these criteria were sent to RC Manager that confirmed the RCP was in good standing with the Respiratory Care Board. 2) All referred applicants were contacted directly by the RC Manager acknowledging receipt of application and resume. 3) The creation of a respiratory specific questionnaire for referred applicants to complete and return to further get “know” the applicant. 4) The creation of a new database containing applicant’s resume and completed questionnaire for the hiring team to review. 5) A 4-hour RC Shadow was required for all applicants selected to be interviewed for assessment of skills and character. 6) Revision of interview questions in collaboration with Human Resources. 7) The creation of a score matrix aided in information gathering and in the objective selection of candidates. Retention rates were obtained and compared before and after implementing of the program. RESULTS: Collaboration between Human Resources and the RC manager refined the selection of applicants. Candidate shadowing was beneficial for staff and prospective employees to share knowledge, ask and answer questions. This was a first look at a prospective team mate and employer. The year prior to implementing the program retention rate was 65%. The one year retention rate improved to 90% with the revised implementation. CONCLUSION: The structure and implementation of the hiring process was beneficial in several ways: 1) collaboration with Human Resources guided the team in creation of carefully constructed interview questions to gather information pertinent to the job position. 2) The screening, questionnaire and shadowing process produced a desired pool of highly qualified candidates. We estimated a savings of $88,000 in salary expenses.

Sponsored Research - None

919863
OVERINFLATION CUFF OF TRACHEOSTOMY TUBE-ACQUIRED POST INTUBATION TRACHEO-ESOPHAGEAL FISTULA.
Shao Yu Li, Jen-Yu Hung, Jong Rung Tsa; Kaohsiung Medical University, Kaohsiung, Taiwan

Introduction: An acquired tracheo-esophageal (T-E) fistula is an abnormal communication between the trachea and esophagus. It is an infrequent complication with a variety of conditions, occurring most commonly in relation to tumors, prolonged mechanical ventilation, mediastinal inflammation and trauma. Case summary: A 90-year-old female patient was a victim of chronic respiratory failure with mechanical ventilator support. The patient had fever and shortness of breath, and her condition deteriorated in the period of one week. Additionally, she had frequent cough attacks - especially after nasogastric tube feeding. As her oxygenation and shortness of breath deteriorated, she was transferred to our hospital. At our emergency room, a chest X-ray revealed overinflation tracheostomy tube cuff and a prominence of gastric gas except bilateral lower lobe pneumonia and reticulonodular pattern. High cuff pressure was noted by sphygmomanometer. As we tried to reduce cuff pressure, significant air drainage from the nasogastric tube was found. Low inflation tidal volume was also noted. Tracheo-esophageal fistula was then highly suspected. Immediate bronchoscope examination revealed a large tracheo-esophageal fistula at the cuff area after deflation the cuff. We replaced the tracheostomy tube with a longer vertical tracheostomy tube. With a consistent antibiotic and nutrition supply, her clinical condition became stable. However, the patient’s family refused subsequent surgical intervention and the patient was transferred back to the respiratory care ward later. Discussion: Cuffed endotracheal and tracheostomy tube can seal the tracheal lumen by inflating the cuff to maintain airway pressure and prevent aspiration of regurgitation. The cuff pressure exerted against the mucosa by inflated cuff can impair mucosal blood flow and induce several tracheal complications, including loss of mucosal cilia, ulceration, hemorrhage, tracheal stenosis and T-E fistula. Now, it is recommended cuff pressure should be frequent monitor and be maintained at 20–25 mmHg (25–35 cmH2O) to minimize the risks for both tracheal-wall injury and aspiration.

Sponsored Research - None

919632

TRACHEAL AGENESIS.
Hsiung-T. Chang, Zen-Kong Dai, Hsiung-I Tseng, Shah-Hwa Chou; Kaohsiung Medical University, Kaohsiung, Taiwan

Introduction: Tracheal agenesis is a rare congenital malformation of the respiratory tract where patients lack the fistule between the airway and esophagus. This condition is incompatible with life. There are classification by Floydy’s. Our patient belongs to type II. The prognosis is not much different, it depends on airway achievement to maintain. Case Summarized: A 32 days-old newborn male was transferred to the NICU for further evaluation and management. In the NICU, we did a more detailed physical examination, and found that the infant had subcostal retraction. More importantly, the breathing sound of the infant had bilateral crinkles. As for blood examination, we could see that the WBC had increased slightly, and that PCO2, CPK, CK-MB had raised substantially. Treatments included not only general survey, but also antibiotics such as Amphotericin B and ventilator support. In the end, he refused subsequent surgical intervention and the infant was transferred back to the NICU. We confirmed the tracheal atresia with HRCT because the fibrotic bronchoscope showed a normal, larynx but the subglottic area was difficult to assess. Conclusion: Although emergency management (by either bag and mask ventilation or esophageal intubation) can at times be successful after definitive diagnosis of tracheal agenesis, long-term therapy of this condition remains a problem. We feel that at present, with no long-term solutions for tracheal agenesis at hand, it would be appropriate to consider minimizing clinical interventions once the diagnosis has been made.

Sponsored Research - None

920834

ECMO: A NOVEL TREATMENT FOR TRACHEAL DEHISCENCE AFTER SLIDE TRACHEOPLASTY.
Jenni Raake1, Brandt Segar2, BethAnn Johnson, Penso Eighsteadt, Peter Manning, Mike Kitter1, Paul Bousc4, Amanda Woolad4, Ranjit Chima4; Cardiovascular ICU, Cincinnati Children’s Hospital, Cincinnati, OH; 2Respiratory Care, Cincinnati Children’s Hospital, Cincinnati, OH; 3Pediatric ICU, Cincinnati Children’s Hospital, Cincinnati, OH

Introduction: Long segment congenital tracheal stenosis is characterized by complete tracheal rings. Surgical intervention is required during infancy to optimize outcomes. Complications from surgery can include mucus plugging, airway trauma, dehiscence at the surgical site, and death. Case Summary: A 5 week old with long segment congenital tracheal stenosis (LSCS) underwent a slide tracheoplasty. She failed extubation on post op day (POD) 2. She was reintubated. Bronchoscopy revealed thick secretions and tracheal edema. She required daily periods of manual ventilation and on POD 5 she had an acute respiratory event requiring CPR. Bronchoscopy revealed surgical site dehiscence. She was placed on ECMO, and electively extubated to avoid further airway trauma. On ECMO day 5, a flexible bronchoscopy revealed airway sealing. She was extubated and placed on low ventilator settings. On POD 14, she was transitioned to HFOV, de-cannulated on POD 19, and transitioned to conventional ventilation on POD 24. She was successfully extubated on POD 39, transferred out of the ICU on POD 43, and discharged to the referring facility on POD 55. Discussion: LSCS patients during asthma exacerbation (by either bag and mask ventilation or tracheal intubation) can be successful after definitive diagnosis of tracheal agenesis, long-term therapy of this condition remains a problem. We feel that at present, with no long-term solutions for tracheal agenesis at hand, it would be appropriate to consider minimizing clinical interventions once the diagnosis has been made.

Sponsored Research - None

920208

A CASE STUDY: USE OF HIGH FLOW NASAL AND VIBRATING MESH NEBULIZER DURING ASTHMA EXACERBATION ON A PREGNANT WOMAN.
Pamela J. McDermott, Patricia Dailey, Srikanth Penunetsa; Respiratory Care, Baystate Medical Center, Springfield, MA

Introduction: High flow nasal cannula has successfully been used with patients during asthma exacerbation1,2. In addition, adequate aerosol delivery through high flow cannula (HFNC) with vibrating mesh nebulizer (VM) has been demonstrated3,4. Our goal was to utilize whatever tools necessary to provide adequate oxygenation for the unborn fetus, provide optimal delivery of aerosolized albuterol at minimal doses, decrease the patient’s work of breathing and avert another intubation for the patient. Case Summary: A 43 year old woman in her last trimester of pregnancy admitted for treatment of acute asthma exacerbation. Her history included 4 intubations for asthma exacerbations. She was placed on heliox (80/20) via non-rebreather mask due to increased work of breathing (WOB) and in-line continuous albuterol via jet nebulizer (Misty Finity™). She continued to deteriorate throughout the night with O2 saturations <90%, respiratory rate (RR) 24, breath sounds decreased aeration with espiratory wheeze and marked use of accessory muscles. She was placed on 50 lpm HFNC (Fisher & Paykel Optiflow ) at 40% and the nebulizer was changed to a VM (Aeronbe Solo) placed on the dry side of the humidifier. Post HFNC her O2 saturations were ≥ 93%, RR 20 and decreased use of accessory muscles with some increase in aeration. 2.5 mg of albuterol was administered with VM nebulizer. Post treatment she had further increase in aeration with increased aeration. Patient visibly appeared less distress and continued to improve. She gave birth to a health infant and intubation was not required for this admission. Discussion: We were able to accomplish our stated goals for this patient using HFNC and VM technology with this patient. This experience in addition to other similar case scenarios has prompted us to pursue IRB approval for a controlled study looking at the use of HFNC and VM for the treatment of asthma exacerbations.

Sponsored Research - None

884941
LUDWIG’S ANGINA AND NEGATIVE PRESSURE PULMONARY EDEMA: A CASE REPORT.

Damien P. Bellman1, David L. Acuna2, Roy E. Cole3; 1Respiratory Care, Wesley Medical Center, Wichita, KS; 2Oral and Maxillofacial Associates, Wichita, KS; 3Trauma Services, Wesley Medical Center, Wichita, KS

Introduction: First described in 1836, Ludwig’s Angina is a life threatening cellulitis of the sublingual and submaxillary spaces that can rapidly deteriorate to airway compromise. Negative Pressure Pulmonary Edema (NPPE) was demonstrated in 1927 in spontaneously breathing dogs exposed to high inspiratory resistance. The relationship between negative pressure and the development of pulmonary edema was described in 1942. We present a unique case of non-cardiogenic pulmonary edema with resulting acute lung injury in response to an acute upper airway obstruction that was successfully treated with mechanical ventilation and liberal PEEP. Suggested Research - None

CASE REPORT: 72 YEAR OLD MALE PRESENTING WITH PULMONARY ALVEOLAR PROTEINOSIS.

Michael Beeg, Ken Hargett, Kim Bloom, Jose Rodriguez, Romar Reyes; Respiratory Care Services, The Methodist Hospital, Houston, TX

Introduction: The prevalence of acquired Pulmonary Alveolar Proteinosis (PAP) has been estimated to be 0.37 per 100,000 persons. Excessive thick granular phospholipidoproteicaceous material protein builds up in the alveoli of the lungs. In some cases, the cause of the Pulmonary Alveolar Proteinosis is unknown; in others, it is associated with infection or immune deficiency. Patients present with abnormal chest x-rays, decreased oxygenation and Pulmonary Function Tests show restrictive lung disease with abnormal diffusion. This rare disorder generally affects people 30-50 years old and is seen in men more than women. Treatment consists of periodically washing out the protein substance from the lung with complete lung lavage. Lung transplant may be recommended for patients with the disease. Case Summary: The patient is a 72 year-old male presenting with severe hypoxemia (PaO2 of 49 mmHg). Bronchoscopy was performed, and tranbronchial biopsies obtained. The result was nondiagnostic. Subsequently an open-lung biopsy was completed which demonstrated an accumulation of granular material. These findings confirmed the diagnosis of PAP. Complete lung lavage was scheduled in 2 separate sessions. The patient was intubated with a double lumen tube. The right lung was deagedosed by clamping the right-sided port for 5 minutes and ventilating only the left lung. Right lung lavage was accomplished by repeatedly instilling 750 to 1000cc of warmed normal saline solution and allowing each instillation to drain by gravity. The lavage fluid initially was opaque and fairly thick. With repeated instillations, the fluid cleared and was translucent and minimally cloudy. A vibratory percussor vest was utilized to improve distribution of the fluid. The pulmonologist utilized 24 liters (L) of normal saline with a return of 25.9L. The left lung lavage was completed the following week. 28L were instilled with a return of 20.4L. The increased returned volume was secondary to what was washed out of the lung. Significant improvement in oxygenation occurred after each procedure and PaO2 increased to normal levels. The patient’s dyspnea was also resolved. Seven months have passed and the patient has not needed a repeat of the lung lavages. Discussion: Though a rare disease, Respiratory Therapist should be familiar with the diagnosis and treatment of PAP. Suggested Research - None

WEGENER’S GRANULOMATOSIS SEEN IN AN ADOLESCENT FEMALE WITH BRONCHO-PLEURAL FISTULA.

Gary B. Long1, Mark Heulin2, Ariel Belinski3; Respiratory Care/Nursing Research, Arkansas Children’s Hospital, Little Rock, AR; 1Department of Pediatrics, Critical Care Medicine, University of Arkansas for Medical Sciences, Little Rock, AR, 2Department of Pediatrics, Pulmonary Medicine, University of Arkansas for Medical Sciences, Little Rock, AR

Introduction: Diagnosis of Wegener’s Granulomatosis (WG) in an adolescent is challenging, and mortality is high in cases involving the pulmonary system. This case illustrates the presentation and course of a previously healthy 14 year old female ultimately diagnosed with WG, who developed long-term sequelae including broncho-pleural fistula (BPF). Case Summary. While being treated for a presumed pulmonary infection, this adolescent developed dyspnea and hemoptysis and presented for medical care at our institution. Her SpO2 was in the 60’s and CXR showed severe bilateral pulmonary edema. She received oxygen via 50 Ventimask with improved oxygenation. She rapidly deteriorated, progressing from supplemental O2 to BiPap, ventilatory support, INO, and ECMO over the next 73 hours. Her admitting diagnosis was respiratory failure and pneumonia. She required V-A ECMO following cardiac arrest. She remained on ECMO for 13 days, and weaned to conventional ventilation with INO. In addition, she received PRBCs for anemia and substantial intravenous support. She developed persistent bilateral pneumothoraces and was diagnosed with BPF. She remained on ventilatory support for 25 days, and was successfully extubated. Autopsy was suspected and later confirmed with positive C-ANCA. Treatment for WG was initiated with steroids and cyclophosphamide. When the BPF did not resolve over time, she was discharged home with chest tube connected to a Heimlich valve. Discussion: WG is a rare autoimmune disease, characterized by the presence of necrotizing granulomas of the respiratory tract and/or kidneys. The overall prevalence is 1:20,000 to 1:30,000 for all ages and the peak incidence is ages 40-60. It is difficult to diagnose, requiring positive lab tests, CXR, and biopsy. This patient continues with BPF on the right side, requiring a chest tube with Heimlich valve. This case illustrates the rapid deterioration that could accompany WG and the importance of early recognition and intervention to treat the inflammatory process. It also illustrates that aggressive support, including ECMO, can lead to survival in patients with significant pulmonary involvement. Suggested Research - None

SKIN PREPARATION PROCESS FOR THE PREVENTION OF SKIN BREAKDOWN IN PATIENTS WHO ARE INTUBATED AND TREATED WITH ROTOPRONING.

Marc Ellen Jackson1, Joell X. Verano1, Anthony P. Rodrigues2, Jill E. Fry3; 1Respiratory Care, University Medical Center at Brackenridge, Austin, TX; 2WOCN, University Medical Center at Brackenridge, Austin, TX

Background: While performing QI of Respiratory Care device related issues in UMC-B ICU, we encountered problems such as, redness, breakdown, and pressure ulcers due to airway devices. Interventional task force was established with RT Skin Champions and WOCN to develop best practice for skin preparation processes addressing the issues of skin breakdown, redness, and pressure ulcers relating to all RT devices. Further work was done regarding rotoproning patients following a severe deep tissue injury to the face of a patient caused by a RT device. A new preventative care plan specific to rotoproning patients was initiated. The purpose of the new process was to find a method of securing the endotracheal tube in the rotoproning patient while minimizing or preventing the incidence of pressure ulcer and breakdown of the face and lips. Also an interventional care plan was initiated if any redness or breakdown occurred. Case Summary: The initial case study patient was a 26 year old female admitted with respiratory distress, cough, fever, body aches and nausea for 5 days. Her diagnosis was Community Acquired Pneumonia and Acute Respiratory Distress Syndrome. On 9-9-2009, at UMB ICU the initial case study patient was placed on the rotoprone bed and the endotracheal tube was secured with an oral endotracheal tube fastener. On day 97, 9-14-09, a deep tissue skin injury had occurred to the patient’s bilateral cheeks due to pressure exerted by the oral endotracheal tube fastener. Discussion: Following the use of the preventative and interventional steps outlined, there has been a good outcome for the skin on the cheeks and lips of six rotoproning patients following the initial case study patient. Analysis results showed with Network S.K.I.N. Team comprised of WOCN, Respiratory Care, Registered Nurses and Seton Network Patient Safety Project Management Consultant, Clinical Quality and Patient Safety Skin Team. Trial Process was accepted at the Seton Network S.K.I.N. Team and Respiratory Care Clinical Practice Group. Changes were implemented and the spread of Best Practice across the Network to all nine Austin Area Seton Family Medicine Services, The Methodist Hospital, Houston, TX

Deep tissue injury after five days of rotoproning caused by RT device

Sponsored Research - None

Sponsored Research - None

CASE REPORT: 877860

WEGENER'S GRANULOMATOSIS SEEN IN AN ADOLESCENT FEMALE WITH BRONCHO-PLEURAL FISTULA

Sponsored Research - None

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Deep tissue injury after five days of rotoproning caused by RT device.
IMPLEMENTATION OF THE 2005 AHA CPR GUIDELINES INCLUDING THE USE OF AN IMPEDANCE THRESHOLD DEVICE IMPROVES IN-HOSPITAL CARDIAC ARREST SURVIVAL RATES - A 5-YEAR CASE HISTORY.

Ken Thiengo, Laura Simmons, Zinth James, Chad Neely; Pulmonary Services, Sr. Dominican Hospital, Jackson, MS

BACKGROUND: the 2005 aha guidelines recommended many new interventions/approaches during cardiopulmonary resuscitation (CPR), including a level ii-a recommendation to use the impedance threshold device (ITD). In-hospital cardiac arrests (IHCA) result in the premature death of >300k patients annually in the U.S. IHCA survival rates average 17% and provide an indicator of in-hospital quality of care. We have tracked outcomes after IHCA since 2006. We implemented the 2005 guidelines with the addition of hyperemia. We focused on high performance CPR (HP-CPR) with use of the ITD. The ITD acts as a mechanical drug by increasing circulation by regulating intra-thoracic pressure. In an effort to improve outcomes from IHCA, we compared our experience over the past 5 years before and after HP-CPR.

METHOD: the study was performed at Sr. Dominican hospital in Jackson, Mississippi. Hospital discharge (HD) rates were compared before and after HP-CPR on a total of 681 patients over 5 years, using fischer’s exact test, odds ratio (or) and 95% confidence intervals (CI). Only the first IHCA occurring on the patients were included. The ratios of survivors to HD to total patients (SHD-TP) based upon patients with a known initial rhythm of ventricular fibrillation/tachycardia (VF/VT), asystole, (AS), or pulseless electrical activity (PEA) were also compared before and after HP-CPR. RESULTS: there were 157 IHCA in the historical control period. From 2006 to 2010, there were 524 patients treated with HP-CPR. The age, gender, and distribution of presenting rhythms for IHCA remained relatively constant between the 2 groups. HD rates were 28% (145/524) WITH HP-CPR vs 17% (27/157) historically (p<0.009, or 1.8, CI [1.2, 2.9]). The % of patients with normal or near-normal cerebral performance category scores (1 or 2) were similar between the two groups. 108/145 (74%) with HP-CPR vs 119/27 (44%) historically, during the control period. The SHD-TP (expressed as %) for patients with VF/VT, as, and was 68.2, 7.1, with HP-CPR respectively vs 51, 5.1, 5.7 historically (p<0.035 for pea). CONCLUSIONS: HP-CPR increased IHCA survival rates by 63% with the largest gain in patients presenting with PEA initially. Significant benefit was associated with good neurological outcome and was sustained over four years, which is supportive of widespread adoption of this approach as the standard of care for IHCA.

Sponsored Research - None

921028
USE OF ELECTRICAL ACTIVITY OF THE DIAPHRAGM TO HELP TRANSITION A PATIENT TO A HOME MECHANICAL VENTILATOR: A CASE REPORT.

Matt McNally1, Robert Darnall1, 1Respiratory Care, Dartmouth Hitchcock Medical Center, Lebanon, NH; 2Neonatology, Children’s Hospital at Dartmouth, Lebanon, NH

Background: False triggering of the mechanical ventilator can often be problematic when a variable airway leak is present. When determining the appropriate triggering sensitivity it is often difficult to determine the difference between a false breath and a true patient triggered breath. Electrical activity of the diaphragm (Edi) could be used to help determine the sensitivity and level of support that the patient actually needs by giving the care provider to see the patient’s true neural respiratory rate and work of breathing. Case: The patient is a 33 week GA male baby with trisomy 21 and extreme laryngeal / tracheal malacia requiring a tracheostomy tube and ventilator dependency. It was determined after a lengthy ICU stay that the patient was going to require long term mechanical ventilation after discharge. The patient was weaned to minimal settings on the Servo I (Solna, Sweden), Pressure Support ventilation with a Pressure Support 14 cmH2O, PEEP 5 and FiO2 .25. a flow trigger was set at 5. The patient was then transitioned to the Pulmonetics LTV 1150. The same settings were used as were used on the Servo I with the exception of the triggering sensitivity, which was placed at 1L. Twenty four hour trials often resulted in the patient becoming irritable, restless and desaturating during the night. It was decided to place a catheter to measure the patient’s electrical activity of the diaphragm (Edi). An 8fr naso gastric Edi catheter was placed. It was noted that the patient’s Edi was 6 to 10 mv. When the patient was asleep, the ventilator was delivering 60 breaths/min but the patient’s neural respiratory rate was only 42. The trigger was adjusted so that the the neural and ventilator RRs matched and the patient’s Edi remained stable at 6 to 12. Once the patient was placed on the LTV with a set respiratory rate of 15 breaths/min he was able to tolerate the LTV 1150 through the night. Discussion: There is limited data to support the use of Edi on the LTV with a set respiratory rate of 15 breaths/min. he was able to tolerate the LTV 1150 through the night. Discussion: There is limited data to support the use of Edi to titrate mechanical ventilation in infants. In this case we were able to successfully obtain an Edi measurement in an infant having difficulty transitioning to the home mechanical ventilator. Using the Edi monitoring capabilities of the Servo I we were able to titrate the triggering sensitivity on the Servo I and also determine settings needed for the patient to tolerate the LTV 1200.

906231

USE OF HELIOX AND NON-INVASIVE VENTILATION IN COMBINATION TO TREAT ACUTE CYSTIC FIBROSIS EXACERBATION: A CASE REPORT.

Matt McNally1, Robert Fitzgerald1, H. Worth Parker2, 1Respiratory Care, Dartmouth Hitchcock Medical Center, Lebanon, NH; 2Pulmonary Medicine, Dartmouth Hitchcock Medical Center, Lebanon, NH

Background: Cystic Fibrosis (CF) is the most common lethal genetic disorder of Caucasians. During a pulmonary exacerbation, airways resistance may increase due to excessive thick secretions and airway inflammation. Non-invasive ventilation (NIV) may be used to reduce increased work of breathing while Heliox may be used to overcome increased resistance of the airways. Case: A 38 year old male with advanced CF (genotype: G551D homozygote) and FEV1 of less than 20% of predicted presented with increased WOB, wheezing and changes in mental status despite high flow nasal cannula ( FiO2 0.6). A CXR revealed a new right lower lobe infiltrate. An ABG revealed a pH 7.41/73/72/48. The patient was weaned off the NIV and Heliox. Six days later worsened hypercapnia and symptoms returned and we were able to reproduce the same results using Heliox and NIV therapy. Discussion: Literature does exist to support the practice of using NIV in conjunction with Heliox therapy but none specifically in the case of an acute CF exacerbation. Henchey reports using Heliox alone to treat CF exacerbations and Stucki et al reports use of Heliox with non-invasive high frequency positive pressure ventilation. This case was able to show that these therapies can be used safely and effectively together to treat hypercapnia in an ill CF patient. It was also noted that the patient had a base line extremely productive cough that was suppressed during this exacerbation. Secretion clearance with the assistance of IPV, after Heliox and NIV, was back to baseline. In this particular case employing a combination of Heliox with NIV avoided intubation and enabled the patient to verbalize input into critical decisions at the end of life. Further studies in CF patients are indicated to validate these findings and clarify mechanisms of the observed improvement in gas exchange.

918901
THE VALUE OF THE SHIFT/TEAM LEADER IN FACILITATING HOME CARE DISCHARGES.
Ernest Jones1, Jan Phillips-Clar2, Jennifer Graves3, Michelle Diep4, Jenifer Graves2, Roberts Home Medical, Inc., Germantown, MD; 1Respiratory Care, UCSD Medical Center, San Diego, CA; 2Respiratory Care, UCSD Medical Center, San Diego, CA; 3Respiratory Care, UCSD Medical Center, San Diego, CA; 4Respiratory Care, UCSD Medical Center, San Diego, CA

BACKGROUND: The University of California, San Diego Medical Center serves as the County Hospital with the greater majority of our patients covered through Medicare or Medi Cal. Considering the limitations in payment for home DME, it is a challenge to make the transition from hospital to home. Case Management is responsible for assessing patient needs pertaining to discharge planning, however for patients with respiratory issues, the Respiratory Care department can play an essential role. To improve accountability and coordination of discharge planning activities these duties can be coordinated through specialized Respiratory Care Shift Leaders and tools created to insure needed processes are followed. METHOD: We identified the many rules and regulations related to the use and coverage of DME. Based on those rules and regulations, we developed a set of on-line reference documents to guide and track the process. Resources include instructional power point presentations, specific evaluation forms, tools to coordinate activities with discharge planners, DME referral guidelines and contacts, and mechanisms to track patients through the process. Shift leaders were assigned this responsibility and familiarized with these resources. RESULTS: The process has been in place for one year in which approximately 300 respiratory home care discharges occurred. It appears the timeline from the initial order for home care related to respiratory issues to discharge from the medical facility has been improved as there are little or no complaints regarding delays. There is better cooperation between the respiratory department, nursing and case management and also improved follow-up after discharge. CONCLUSIONS: The creation of this program improved coordination, continuity, and insured the needed equipment is available to the patient. The Shift/Team Leader is best at facilitating this because of their understanding of respiratory issues. The process of assessing the patient, determining the qualifications for the various DME’s and contacting the various home care companies is much more streamlined and less complicated through this program. Respiratory Care can play a major role in improving the transition from discharge to home. 
Sponsored Research - None 919684

ASSESSMENT OF PATIENT INSTRUCTION OF CONTINUOUS POSITIVE AIRWAY PRESSURE THERAPY IN THE PATIENT’S HOME VS. IN THE MEDICAL EQUIPMENT SUPPLIER’S OFFICE.
Louis M. Kaufman, Classydis Miner; Roberts Home Medical, Inc., Germantown, MD

Background: Patient instruction of continuous positive airway pressure (CPAP) therapy is offered in the patient’s home or workplace (office) or in the medical equipment supplier's office (office). Potential advantages of office instruction include a larger selection of interfaces, an environment free of distractions, and more time for face-to-face interaction. We compared the functional outcome of CPAP therapy instruction in these environments. Method: A retrospective review of records of consecutive CPAP therapy instruction patients was conducted ninety (90) days after initial setup. Results: Fifty-four (54) home and forty-seven (47) office instruction patients were evaluated. The groups had a similar apnea-hypopnea index (AHI) (average 26.1 and 25.3); age (average 58.9 & 59.4) and prescribed therapeutic pressure (average 10.9 & 10.8). 11% of the home group required re-instruction compared to 4% of the office group. 17% of the home group required re-fitting of the interface compared to 13% of the office group. Daily use averaged 5.7 hours in the home group and 6.2 hours in the office group. Conclusions: The higher rate of re-instruction required for home setup patients may be due to fewer distractions during the office setup. Patients setup in the office are exposed to a wider selection of interfaces; therefore their requests for re-fitting may be higher due to their familiarity with alternatives. Although the AHI, age and therapeutic pressure average between the two groups is similar, the fact office patients elected to travel for their instruction may indicate a higher level of motivation to succeed with CPAP therapy. The higher daily use in the office group may be attributed to higher motivation or better understanding due to the teaching environment. In this patient population providing CPAP therapy instruction at home or office provides similar and acceptable results. 
Sponsored Research - None 901744

DISCHARGE AND TRANSFER OF A VENTILATOR DEPENDENT PATIENT FROM OUT-OF-STATE TO HOME: A CASE REPORT.
Clint Swanson, Louis M. Kaufman; Roberts Home Medical, Inc., Germantown, MD; Pediatric Lung Center, Fairfax, VA

Introduction: Transferring ventilator dependent patients from an acute care facility to home requires an orchestrated effort on the part of the family, caregivers, institution, community, and respiratory home care company. This process is near impossible when geographic separation prohibits local personnel from conducting the patient evaluation and caregiver education prior to discharge. We report on collaboration by two non-related independent respiratory homecare companies to safely and successfully discharge a ventilator dependent patient to home. Case Summary: A 60 y/o male suffered a complete C-1/C-2 spinal cord injury on 09/06/08. His water accident resulted in near drowning and cardiac arrest. He was resuscitated at the scene and was transferred to a tertiary care facility. Intensive treatment including mechanical ventilation via tracheostomy continued until 02/02/09 when the patient was transferred to an acute rehabilitation hospital in New Jersey. Discharge planners were subsequently unable to locate a respiratory homecare company to accept the patient for transfer to home care in Virginia. The patient, who had medical insurance, had accepted included transfer to a local in-patient facility for evaluation and training. In this case, the discharging institution refused to transfer to a local facility. AfHome Medical, a partner member of the MED Group’s National Respiratory Network, contacted us on 04/15/09 and we agreed respiratory therapists from AfHome Medical and Roberts Home Medical would work together to facilitate a safe and quality transition for this patient to his home. As a result, Respiratory Care therapists conducted caregiver training and patient acclimation to the home ventilator prior in New Jersey. Roberts Home Medical respiratory therapists performed the home evaluation, equipment setup, and caregiver training in Virginia, and information was communicated frequently by email. On 07/07/09 the patient was transferred to his home in New Jersey by ambulance. Since his return home, he has been hospitalized once for a bowel resection, and has not required hospitalization for any respiratory related condition. Discussion: Long-distance facility to home transfers of ventilator dependent patients can be accomplished through a collaborative effort of accredited respiratory home care companies. Effective communication, patient evaluation and caregiver education are required to effect a safe transfer.
Sponsored Research - None 899134

USE OF HEATED HUMIDIFIED HIGH FLOW NASAL CANNULA FOR AN INFANT AT HOME: A CASE STUDY.
Clint Swanson1, Louis M. Kaufman1, Robert Hol2, Robert Rice3, Michael J. Fields4; Roberts Home Medical, Inc., Germantown, MD; Pediatric Lung Center, Fairfax, VA

Background: Patient instruction of continuous positive airway pressure (CPAP) therapy has become common practice in hospitals but has not been available in the homecare setting due to the complexity of available equipment and the lack of adequate reimbursement. We report on the successful use of HHHFNC in the home. Case Summary: A 760 gram 24 week gestation female born 06/26/08 with severe chronic lung disease, pulmonary hypertension, and hypoxemia experienced a complicated hospital course until initial discharge home on 02/02/09 at 5.8 Kg. The patient’s medical team ordered continuous oxygen 0.5 L/min via nasal cannula, apnea monitor, pulse oximeter, systemic steroids and feeds via gastrostomy tube. She was re-admitted to the newborn ICU on 04/15/09 for respiratory distress, and required oxygen via HHHFNC to maintain airway patency and prevent hypoxemia. By the middle of May it was apparent she would need this support for a prolonged period. We were contacted by the family and the healthcare team and accepted the challenge to provide this therapy to a low birth weight infant in the home. Respiratory therapists from our company, the manufacturer, and the hospital collaborated to configure an appropriate system. System design challenges including pressure variability between the air compressor and oxygen concentrator, air compressor flow oscillation and accurate flow measurement were met by adding a copper coil water trap, multiple flowmeters and varying lengths of exhalation tubing proximal to the humidifier. A Fisher & Pockel MBR800 CPAP and heated humidifier, RT329 heated wire circuit with pressure relief and a pediatric BC3780 nasal cannula completed the circuit. Because there was no established reimbursement code for this system in the home, a single case agreement was negotiated with the insurance company. The system was set up in the hospital for patient acclimation prior to her discharge on 05/29/09 on 4.5 L/min FIO2 0.30 HHHFNC @ 32C. The patient has received regular monthly respiratory therapist visits with no hospital admissions. She has been weaned to nocturnal HHHFNC and sole use of standard nasal cannula while awake, is now on oral feeds and exhibiting appropriate developmental gains. Her care plan currently includes complete weaning of HHHFNC by August 2010. Discussion: With appropriate planning and clinical intervention, HHHFNC can be used safely and effectively in the home environment with pediatric patients.
Sponsored Research - None 879636
ASSESSMENT OF RESPIRATORY THERAPISTS’ KNOWLEDGE OF CUR- RENT LONG-TERM OXYGEN EQUIPMENT.

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

Background: The concept of the healthcare continuum from acute care hospital to home care has been discussed for some time, and the American Association for Respiratory Care (AARC) Homecare Section Chair has recently proposed the “Respiratory Care Anywhere” philosophy to help identify ways we can make respiratory care “streamlined.” This study was designed to quantify respiratory therapists’ (RT) knowledge level of the technology used to provide long-term oxygen therapy (LTOT) targeting 201 NBRC certified respiratory therapists (total 1017). Correct responses were received from 816 National Board for Respiratory Care (NBRC) registered respiratory therapists and 201 NBRC certified respiratory therapists (total 1017). Correct response percentages were: Q1: 18%; Q2: 63%; Q3: 60%; Q6: 7%; Q5: 56%. Conclusions: NBRC certified RTs do not have the knowledge required to safely and adequately manage patients utilizing respiratory equipment.

EVALUATION OF THE INVACARE IOC100P OXYGEN CONSERVING DEVICE.

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

Background: The IOC100P (Invacare, Elyria, Ohio) is a commercially available, cylinder mounted pneumatic oxygen conserving device (OCD). Published specifications for this third-party bench evaluated device indicated it delivers a fixed flow rate of 2 L/min. This study re-evaluated the flow rate within +/- 10% range. This was a limited study, and further research needs to be done on other sized tanks and composition to ensure the accuracy of the flow rates.

COPD: TRANSITION OF CARE AND REHOSPITALIZATION RATES.

Brian W. Carlin1, Kim Wiles2, Dan Easley3; Allegheny General Hospital, Pittsburgh, PA; 1Klingensmith Healthcare, Ford City, PA

Background: COPD rehospitalizations within thirty days post discharge in Western Pennsylvania account for up to thirty percent of hospital admissions with cost ranging up to fifty million dollars annually. The overall 30 day readmission rate in this area for these patients approaches 25%. Third party payers are beginning to deny payments for those patients who are rehospitalized within thirty days of discharge. In addition, healthcare reform initiatives are placing an increased emphasis on improving quality, developing and reporting key metrics, and bundling all payments into a single episode of care cost. Achieving a reduction in the readmission rates required new and innovative relationships between acute care and home care providers. Objective: To develop a home care based, respiratory therapist centered COPD transition of care program to reduce the thirty day rehospitalization rate for patients with COPD exacerbations who use supplemental oxygen therapy. Method: The Discharge, Assessment and Summary @ Home (D.A.S.H., Klingensmith HealthCare, Ford City, PA) program was implemented for home oxygen dependent patients. The program consists of incorporating predischarge patient data with a home care program using face to face respiratory therapist visits at 2, 7, and 30 days following discharge supplemented by 12 care coordinator phone interviews during that same period. The program uses educational, behavior modification, skills training, oxygen titration during ADL activities, clinical assessment, and adherence data collection. Program results were converted into performance metrics for review. Results: 72 patients with COPD were enrolled in the program over a 17 week period. During that time, four rehospitalizations (5.5%) occurred. This represents a 75% reduction in the probability of readmission rate of 22.2% for these patients. Conclusions: The program metrics for goal attainment were established and documented. Conclusions: The use of a respiratory therapist based patient management focused DASH program resulted in a successful decrease in the readmission rate for patients with COPD exacerbations who are using oxygen therapy. Collection of performance data provides valuable insight into patient risk factors for future resource utilization.

VALIDATION OF LITER FLOW RATES ON AN OXYGEN CYLINDER SYS- TEM WITH BUILT IN REGULATOR.

Ryan Steckels1, Shirley J. Holm1, Tom Linsingten1, Randy Will1, Gay R. Low2, Mark J. Heit1; 1Respiratory Care/Nursing Research, Arkansas Children’s Hospital, Little Rock, AR; 2Department of Pediatrics, Critical Care Medicine Section, College of Medicine, University of Arkansas for Medical Sciences, Little Rock, AR; 3Respiratory Care, Arkansas Children’s Hospital, Little Rock, AR; 4Arkansas Children’s Hospital Research Institute, Little Rock, AR

Background: Respiratory Therapists are utilizing the long-term oxygen therapy (LTOT) users. Method: Fifty (50) OCDs were obtained for a prescribed patient evaluation and titration by a respiratory therapist (RT). Patients were randomly selected from a group of stable LTOT users. Clinical assessment included oxygen saturation measured by pulse oximeter (SPO2) at the prescribed C02 setting at rest and exercise, defined in this study as performing activities of daily living (ADL) to limitation or a 6 minute walk, whichever came first. The assessment was repeated using the OCD with the device set to maintain equilibrium SPO2 at rest and at the same level of exertion. Results: Thirty-two (32) of 68 patients evaluated were effectively titrated for use of the OCD. Failure to consistently trigger was the primary reason patients were unable to tolerate the device. Of the 32 OCD users titrated with exertion, 12 required an OCD setting higher than C02 with exertion, 3 at rest & exertion and 1 required a lower setting with exertion. Seven (14%) of the devices did not work properly at the onset of the study and were returned to the manufacturer for analysis. Testing concluded while every OCD passes a comprehensive end of line test, including bolus size and sensitivity, returned units from this study had some drift in the sensitivity setting that allowed them to be at the high end or outside of the device specification range.

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Conclusions: Prior published research and this empirical data suggest that many stable LTOT users clinically tolerate OCDs. We hypothesize the variability in the sensitivity range of this particular device may have been the reason less patients were effectively titrated. One weakness of the study is the lack of randomization of the evaluation order (C02 first) may have fatigued some patients and altered their tolerance of the OCD. This study re-emphasizes the prior published research and suggests recommendations for assessment and titration of the specific OCD for each patient at rest and with exertion.

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Sponsored Research - None

Sponsored Research - None
EVALUATION OF BRONCHIAL PRESSURES DURING ADULT HIGH FLOW NASAL CANNULA.
Keith R. Hiest, David L. Vines; Respiratory Care, Rush University, College of Health Sciences, Chicago, IL.

Background: Since the use of High Flow Nasal Cannulas (HFNC) has increased, speculation has been made as to whether or not any kind of CPAP is created in adults. Our hypothesis is that HFNC does create a level of CPAP at flows of 40 LPM or greater. Method: We attached a driver (7200; Covidien, Boulder CO) to simulate spontaneous breathing to one test lung of a dual test lung system (Dual Adult TTL, Michigan Instruments, Grand Rapids Michigan). The other test lung was attached via tubing to an intubation manikin (Lauderdale Falls, New York). The left mainstem of the manikin was capped. Monitoring devices were placed In-line at the right main stem. These included a pressure manometer and a flow sensor which was connected to a NICO cardipulmonary monitor (Philips Electronics, Andover, MA). The intubation manikin was first opened to room air, then HFNC therapy (Teleflex Medical, Research Triangle Park, NC) was administered at 40, 50, 60, 70 LPM respectively. The driver was set on CMV, rate-15, sine flow waveform at VT of 400, 600, 800, 1000 mL and peak flows of 30, 40, 60 and 80 LPM. Measurements were taken with the mouth open and closed. Results: See Chart/graph Conclusion: We conclude that bronchial pressures may be increased during HFNC at flows of 40 LPM or higher when the mouth is open. The elevated airway pressures are relative low and may have the potential to vary depending on flow rate used and resistance of the upper airway.

Sponsored Research - None

EFFECT OF SIGNAL LOSS ON RESPIRATORY RATE RECORDING WITH A CLINICAL OXYGEN DOSE RECORDER.
Lauren R. Furnkase1, Dana E. Strollo2, Teresa A. Volsko3, Kathryn A. Tessmer3, Youngstown State University, Youngstown, OH; 3Human Ecology, Youngstown State University, Youngstown, OH; 4Summa Health System, Akron, OH

BACKGROUND: The Clinical Oxygen Dose Recorder (CODR) is a non-invasive monitor which continuously measures respiratory rate (RR), heart rate and oxyhemoglobin saturation. This study sought to determine if signal loss affected respiratory rate averages calculated from recorded data. We hypothesized that signal loss would affect respiratory rate calculations.

METHODS: Adult patients who had been passed their competencies to date and are ready to step up in times of disaster, the Pulmonary Rehabilitation (PR) staff were trained to work in acute floor care and process equipment in the Respiratory Care department was carried out. A Surge Equipment Manual was developed that included training for Pulmonary Rehabilitation staff in how to clean, stock and process equipment in the Respiratory Care Department in the event of a disaster. The ability for a department to be flexible in such an unexpected and catastrophic event is its key to excellent patient service.

RESULTS: Pulmonary Rehabilitation team member’s individual strengths and weaknesses of their critical care response capabilities must be determined to best assist in the development of novel rehabilitation interventions. Pulmonary Rehabilitation designs a plan to step up in times of disaster, the Pulmonary Rehabilitation, Respiratory Care Surge 2010 Disaster Plan.

PULMONARY REHABILITATION DESIGNS A PLAN TO STEP UP IN TIMES OF DISASTER, THE PULMONARY REHABILITATION, RESPIRATORY CARE SURGE 2010 DISASTER PLAN.
Jill L. Baker, Sidnie Hess, Marcel Pieretti, Susan Farrell, James Lamberti, Shane Blake, Gerilyn A. Connors; Pulmonary Rehabilitation, Inova Fairfax Hospital, Falls Church, VA

BACKGROUND: Pulmonary Rehabilitation team member’s individual strengths and weaknesses of their critical care response capabilities must be determined to best assist in the development of novel rehabilitation interventions. Pulmonary Rehabilitation designs a plan to step up in times of disaster, the Pulmonary Rehabilitation, Respiratory Care Surge 2010 Disaster Plan.

RESULTS: Pulmonary Rehabilitation team member’s individual strengths and weaknesses of their critical care response capabilities must be determined to best assist in the development of novel rehabilitation interventions. Pulmonary Rehabilitation designs a plan to step up in times of disaster, the Pulmonary Rehabilitation, Respiratory Care Surge 2010 Disaster Plan.

CONCLUSIONS: Surge training will be part of the annual Pulmonary Rehabilitation skills fair. All team members have passed their competencies to date and are ready to step up in times of disaster.

Sponsored Research - None

PULMONARY REHABILITATION DESIGNS A PLAN TO STEP UP IN TIMES OF DISASTER, THE PULMONARY REHABILITATION, RESPIRATORY CARE SURGE 2010 DISASTER PLAN.
PATIENT REFERRAL TRACKING OUTCOMES IN A PULMONARY REHABILITATION PROGRAM.

Susan G. Farrell, Sidnie Hess, Shane Blake, James P. Lamberti, Gerilynn Connors; Respiratory Care Services, Pulmonary Rehabilitation, Inova Fairfax Hospital, Falls Church, VA

BACKGROUND: Physician referrals are required to be admitted into a pulmonary rehabilitation (PR) program. This referral process should be routinely analyzed for quality assurance to understand the referral volume by diagnosis, physician, geographic area, and reasons why patients do not attend. Other vital information from the referrals includes: prior program attendance, wait time, program placement and program completion. METHODS: Retrospective analysis of the physician referral data was collected and entered into an excel patient database and analyzed. Data entry is performed on a monthly basis by the PR RCP III and the Pulmonary Rehabilitation Patient Administrative Representative. RESULTS: 244 patient referrals received were in 2009, 55% female and 45% male. Of these, 216, 88% were admitted to the comprehensive program. 40% of these patients did not attend the program. Reasons for non-attendance included transportation 12.5%, not interested 12.5%, feeling better 10%, no PFT’s 10%, etc. The average wait time was less than one month for 41%. Of those who attended, 64% completed the program. 76% of those referred to the program had never attended a PR program. The disease process categories included: Obstructive, 63%, Restrictive, 33.5%, 10% had a secondary diagnosis of PH and 4% had a combination of Obstructive and Restrictive process. CONCLUSIONS: It is important to track and analyze referral data in order to facilitate the referral process, strategically market the program to the appropriate physicians, address volume of referrals and target and resolve issues of non-attendance. It is important that the PR program is designed to meet the needs of the pulmonary patient and physician community.

Sponsored Research - None

SUCCESSFUL APPLICATION OF ADAPTIVE SERVOVENTILATION IN A PATIENT WITH SLEEP DISORDERED BREATHING SECONDARY TO CHRONIC OPIOID USAGE.

Vichaya Arunthari; Joseph Kaplan; Pulmonary Medicine, Mayo Clinic Florida, Jacksonville, FL

Introduction: Adaptive servoventilation (ASV) has been effective in Cheyne-Stokes respiration and complex sleep apnea. However, data regarding ASV and sleep disordered breathing (SDB) related to chronic opioid usage is limited. In the last decade, SDB related to chronic opioid usage when ASV showed to normalize the underlying breathing pattern. Case Summary: A 66 year old lady was seen in our sleep center due to insomnia and excessive daytime sleepiness for years despite sleeping 12-14 hours a day. Occasional apneas and snoring has been observed without paroxysmias or abnormal body movements. Past medical history includes diabetes mellitus, hypothyroidism, hypertension, dyslipidemia, depression, and chronic back pain on four different narcotics. Physical examination was unremarkable except for elevated blood pressure, body mass index of 28, and a Mallampati IV classification. A polysomnogram was performed and revealed a moderate degree of SDB with an overall apnea hypopnea index of 21.6. However, the underlying breathing pattern was consistent with atactic breathing or Biot’s breathing secondary to opioid usage. An oxygen trial and continuous positive airway pressure (CPAP) plus oxygen supplementation failed to improve the underlying breathing disorder. Eventually the patient had a separate titration trial with ASV which improved the underlying breathing pattern. Discussion: Axatic breathing or Biot’s breathing is an irregular ventilatory pattern of rate and tidal volume. Previously was described in neurological diseases such as meningitis is currently more recognized with chronic opioid usage. Opioid therapy alone is usually ineffective and CPAP therapy has shown variable results. There are conflicting data with the usage of ASV in sleep disordered breathing related to chronic opioid therapy [1, 2]. We demonstrate a case where ASV successfully improved the underlying SDB and well tolerated by the patient. Further studies with larger number of patients are needed to provide insight on the best modality for SBD secondary to chronic opioid therapy.

Sponsored Research - None

ART AS A THERAPEUTIC OUTLET IN THE PULMONARY REHABILITATION SETTING.

Chika Hirota1,2, Tetsuo Miyagawa1, Kaoru Konishi1, Kaori Tsuruta1,4; 1Department of Rehabilitation, Nippon Konkan Hospital, Kawasaki, Japan; 2Department of Respiratory Care, Graduate School of Nursing and Rehabilitation Sciences, Showa University, Yokohama, Japan; 3Department of Community Health & Home Care Management, Graduate School of Nursing and Rehabilitation Sciences, Showa University, Yokohama, Japan; 4Rehabilitation, Kanagawa Cardiovascular and Respiratory Center, Yokohama, Japan

BACKGROUND: Art diversion in the Pulmonary Rehabilitation setting was started twelve years ago to offer a creative means of coping with end-stage lung disease. METHODS: ODS: A Respiratory Care Practitioner enlisted patients individually and through support groups. Patients and hospital personnel then started to request the opportunity to participate. Art diversion included instructions in drawing and painting. Department sponsored materials included colored pencils, watercolor, acrylic, templates, and canvases. Our current project is the coloring of mandalas. Mandala is Sanskrit for “circle” or “center,” in ancient Indian language. RESULTS: Several projects were offered to approximately forty patients per month. The patients produced two art exhibits. We published a book (Transplant Teddies) of their rendition of teddy bears. The Cystic Fibrosis patients produced a display of roses entitled “We Are the Roses of Cystic Fibrosis.” The public expressed delight in being able to enjoy the art exhibiting many positive comments. A local television station did a show on the why and how of the art work. CONCLUSION: Art diversion appears to be an option for patients in coping with end-stage lung disease. Further study is required to determine impact within this patient population.

Sponsored Research - None

DETERMINANT FACTOR OF OXYGEN DESATURATION RECOVERY TIME AFTER A SIX MINUTES WALK TEST IN PATIENTS WITH COPD.

Chika Hirota1,2; Tetsuo Miyagawa1; Kaoru Konishi1; Kaori Tsuruta1,4; 1Department of Rehabilitation, Nippon Konkan Hospital, Kawasaki, Japan; 2Department of Respiratory Care, Graduate School of Nursing and Rehabilitation Sciences, Showa University, Yokohama, Japan; 3Department of Community Health & Home Care Management, Graduate School of Nursing and Rehabilitation Sciences, Showa University, Yokohama, Japan; 4Rehabilitation, Kanagawa Cardiovascular and Respiratory Center, Yokohama, Japan

Background: Because patients with COPD leads to exercise induced hypoxemia, it is necessary to monitor the oxygen saturation by using a pulse oximetry in pulmonary rehabilitation. There are many studies related to the exercise capacity or change of SpO2 in a six minute walk distance testing (6MWDT). It has been reported that the SpO2 decreases immediately after the patients start walking. However there is no study related to SpO2 recovery after 6MWDT and the mechanism of the SpO2 recovery has not been clarified. The aim of this study is to examine the factors related to SpO2 recovery time after 6MWDT in patients with COPD. Methods: Sizable COPD outpatients enrolled in this study. We compiled the data of pulmonary function, dyspnea scale, GOLD classification, BODE index, and ADL. The SpO2 was recorded 5 minutes before walking at the rest sitting, also until completely recovery after walking. Bivariate analysis is performed by Mann-Whitney U test and correlation coefficient is estimated by Spearman rank method. Each of these possible explanatory variables was independently evaluated to determine their association with SpO2 recovery in a multiple regression analysis. We also analyzed cutoff value of SpO2 during the walk by using ROC curve. Result: There were 40 cases of patients with a fall in SpO2 after 6MWDT. The SpO2 recovery time correlated significantly with %SpO2, %DLco, 6MWMDL, %DLcoVA, and MRC dyspnea scale. In a multiple regression analysis, a subgroup of two variables had the association %SpO2 and BODE index (p<0.04). Moreover, the cutoff value of SpO2 which a ROC curve shows was 88%. When the lowest values of SpO2 were classified by 88%, %DLco was significantly lower than 88% group in %DLco (p=0.03). Conclusion: In this comprehensive evaluation using the BODE index, it was effective in finding the seventy for patients. Moreover it was necessary to evaluate not only the SpO2 measurement value but also %SpO2 during the pulmonary rehabilitation. %SpO2 88% is the cutoff value for SpO2 during walking and is a reference value in the home exercise. Art and sleep disordered breathing related to chronic opioid usage were also identified as discontinuance criteria of exercise in pulmonary rehabilitation. FEVER 0.0% was not correlated with the SpO2 recovery time and SpO2 lowest value. However %DLco was a high correlation with the SpO2 recovery time, %SpO2 and SpO2 lowest value.

Sponsored Research - None

Mandala Template

911772

919556

905306

903988
A BENCH STUDY TO COMPARE HUMIDITY OUTPUT OF VARIOUS CPAP MACHINES EQUIPPED WITH INTEGRATED HUMIDIFIERS.

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

Background: Humidification can be an important factor in a patient’s CPAP compliance. Delivery of cool, dry air can cause significant oro-nasal discomfort. There are numerous models of CPAP devices equipped with integrated heated humidifiers and all have the aim of supplying warm, humidified air to the patient. As with general CPAP performance characteristics, each of these CPAP/humidifier models has unique and sometimes proprietary methods of delivering humidified air. The purpose of this test was to record humidity output, airflow temperature, water loss, and accumulated rainout of three newer models of CPAP machines equipped with integrated heated humidifiers in static use conditions. Method: Three models of CPAP devices equipped with integrated heated humidifiers (Fisher & Paykel Healthcare ICON Auto, ResMed AutoSet S9, Respironics System One REMstar Auto) were tested for various performance characteristics over two separate six hour test periods, one at 74°F (23°C) ambient temp and the second at 68°F (20°C). Ambient humidity was not controlled, but averaged 58% RH. Devices were filled with distilled water to the maximum fill line and set to the maximum temperature and humidity settings. Devices were set to deliver static CPAP pressure at 10 cmH2O. Exhaust fittings were created to allow exhaust flow at 40 LPM @ 10 cmH2O and was funnelled out of the test lab. Tube weight, chamber weight and chamber water volume were measured before and after the test. Ambient temperature & humidity and tube-end temperature & humidity readings were taken every five minutes for the first half hour, every half hour up to two hours, and every hour up to six hours. Rainout volume was measured at the end of the test. Results: At both 68°F (20°C) and 74°F (23°C) none of the tested devices delivered any rainout. Delivered air temperatures were consistently lower on the SystemOne unit, which did not have a heated tube. The ICON delivered the highest humidity output compared to System One and S9 (Figure 1). The time taken for the ICON to reach its highest output was within 20 minutes while the System One and S9 took 1 hour and 2 hours respectively. Conclusion: No device delivered air temperatures and relative humidity consistent with another device. It is important that clinicians and sleep labs understand the capabilities and limitations of each device before providing this equipment. Sponsored Research - Fisher & Paykel Healthcare paid for this study.

THE ROLE OF CARE-GIVERS IN ASSISTING COPD PATIENTS WITH THE USE OF NEBULIZERS AT HOME.

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Background: The contribution of informal care-givers in the delivery of care is increasingly recognised by governments throughout the world as vital. Many patients with long-term illness depend on care-givers for assistance in the use of medicines. Medicines-related activities are known to be an integral part of care-giving and to contribute to carer-burden. The aim of this study was to identify the types of assistance that care-givers provide for COPD patients using nebulizers, to identify the problems they experience which may impact on the safety and effectiveness of therapy and contribute to carer-burden. Method: Face-to-face semi-structured home interviews were conducted with 15 care-givers who assisted a family member or friend with COPD in the use of a nebulizer. Detailed data were gathered on the extent and type of assistance provided in the use of nebulizers for COPD care, and any problems experienced. Structured instruments were included to obtain data on personal characteristics and carer-burden. Qualitative analytical procedures, using a Framework approach enabled an analysis of care-giving activities and problems in the context of which they occurred. Results: The majority of care-givers were females (n=10), and the mean age of care-givers was 61.2 years (range 26–79). Care-givers assisted with the use of nebulizers on an average of 4.5 years, provided a considerable amount of assistance (3.5 hours per week), and had a mean burden score of 21.5. Assistance provided ranged from taking full responsibility for use of the nebuliser to providing assistance with particular aspects only when required. Care-givers activities included assembling and setting up equipment, mixing of medicines, and operation, dismantling and cleaning of equipment. A wide range of difficulties were described with all aspects of care. Care-givers also reported concerns about side-effects from medication and the lack of information about the equipment. Conclusion: Optimal health outcomes for patients with COPD often depend on the effective use of nebulizers; and many patients may depend on a care-giver for vital assistance. The responsibilities that may be assumed by care-givers and the problems and concerns they experience are hugely varied. Support must be directed to care-givers if therapy is to be effective, and their needs and perspectives are to be addressed. Sponsored Research - None
HANDS ON SIMULATION EXPERIENCE VS. OBSERVATION: A KNOWLEDGE OUTCOMES ANALYSIS.


Background: Isoflurane administration for asthma is an infrequent clinical intervention for most respiratory therapists. The use of high-fidelity simulation has been shown to be effective for other respiratory care activities. This study sought to determine the impact of high-fidelity simulation on respiratory therapists’ knowledge after their experience in a simulation as either a hands on participant or as an observer. Methods: A five-question knowledge-based pretest on the use of the Drager Apollo anesthesia machine was given prior to an asthma simulation requiring Isoflurane administration. Subjects were assigned to be either hands on participants or observers of the simulation based on their likelihood to be exposed to the anesthesia machine with observers having a lower likelihood. Immediately after the simulation, the knowledge test was administered again. Approximately 2 months after the simulation, all subjects were retested.

Results: 103 respiratory therapists took the pretest. 75 subjects had hands on experience in the simulation, while 28 observed. The pretest showed no difference between the two groups (p = .480). On immediate post test the hands on group scored significantly higher than the observation group (mean 89.3 versus 78.6, p < .0001). At approximately 2 months (mean 64.3 days) after the simulation the hands on group had a mean of 84.8, and the observation group had a mean of 60.0 (p < .0001). The rate of knowledge degradation over the two month interval for the hands on group was significantly less than the observer group (mean 4.5 versus 18.6, p = 0.003). The statistical method used was mean +/- standard of error and t-test. Conclusions: Hands on simulation experience produces better knowledge outcomes than observation immediately post simulation and after two months. Knowledge degradation for those with hands on simulation experience is significantly less than for those who observe.

Sponsored Research - None

SURVEY OF STUDENTS UTILIZATION OF VIDEO TAPED CLASSROOM LECTURES.

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Background: The Respiratory Therapy Program at the University of Texas Medical Branch, Galveston, TX has been providing its students with video recordings of lectures accessed through Black Board for the past two years. The purpose of the survey was to assess student’s utilization and motivation for using the taped classroom lectures. We also sought input from students regarding perceived improvements in their learning outcomes. Method: We conducted the survey following the spring 2010 semester. Lectures were recorded in the classroom setting using a video camera with a lapel blue tooth audio transceiver and posted to blackboard with 25 hours 45 minutes in duration. We surveyed five lecture based classes taken by the first year students enrolled in the Respiratory Care program. Students also had access to videos for the previous year. Students were asked to complete the questionnaire anonymously and the surveys had no other student identifiers. The questionnaire was divided into four parts: (1) usage, (2) intent/purpose of using the video, (3) outcome, and (4) technology. Results: A total of seventy-five surveys were collected. The seventy-five surveys were categorized into two groups: lecture video viewers versus lecture video non-viewers. (1) Usage: Out of 75 student surveys 50 of them or 67% viewed videos on black board. (2) Intent/purpose of using the video: 78% (n=39) watched lecture video(s) to improve their understanding of the subject; 46% (n=23) to complete their notes; 54% (n=27) to review prior to an exam; and 20% (n=15) to review videos because they were absent from class. (3) Perceived Outcome: Students believe that their test scores were higher as a result of watching the video 72% (n=36) and 82% (n=41) think that the video is an effective instructional tool. 82% (n=41) of the students would recommend viewing lecture videos to future students. (4) Technology: 86% of the students did not encounter any problem in accessing the lectures from black board. 86% (n=43) agreed that the quality of the video was adequate, versus 10% (n=5) disagree and 8 % (n=4) were neutral. Conclusion: Videotaped classroom lectures are a valuable educational tool in supporting student learning beyond the classroom. Our study indicates that students believe the videos are an effective teaching tool and that use of the videos improved their test scores.

Sponsored Research - None

NBRC SECURE SELF ASSESSMENT TESTS IN SAUDI ARABIA EXPERIENCE.

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(1) Background: Respiratory Therapist (Specialist) programs in Saudi Arabia have no standardized external board requirement. The 1st generation of Saudi respiratory therapists was eligible for the National Board for Respiratory Care (NBRC) through the pioneering program of Loma Linda University (LLU). About 1/4th of Saudi respiratory therapists are credentialed by the NBRC and the rest not eligible. The current generation of Saudi respiratory therapists practice with a fee-based registration (no exam) through the Saudi Commission for Health Specialties (SCHS). LLU permits a Baccalaureate Certificate in Respiratory Care option for Saudi university respiratory care graduates integrated within LLU’s entry level BS degree. wRRT SAE data was extracted to see if Saudi respiratory care graduate applicants were already meeting the cut scores of the Commission on Accreditation for Respiratory Care (CoARC) and the NBRC. (2) Material and methods: 2008-2009 accepted applicants were included in the study and were given the wRRT SAE. Data from traditional 4 year BS students was excluded. Successful certificate graduates took a different and subsequent year’s wRRT SAE. Format: proctored, secure, online. (3) wRRT SAE Results: Scores from 2008 wRRT SAE Entry: 43% (n=12) > NBRC cut with 79% (n=23) and 57% (n=16) > CoARC cut. Senior students on entry 2009 wRRT SAE: 75% (n = 15) > NBRC cut with 100% (n= 20) > CoARC cut. Certificate seniors scoring < NBRC cut score were not allowed a Certificate of Completion but results were included in this study. (4) Conclusion: This initial experience supports graduate success if an NBRC equivalent international board could be offered by the SCHS for outcomes assessment, produces better knowledge outcomes on experience in the simulation, while 28 observed. The pretest showed no difference between the two groups (p = .480). On immediate post test the hands on group scored significantly higher than the observation group (mean 89.3 versus 78.6, p < .0001). At approximately 2 months (mean 64.3 days) after the simulation the hands on group had a mean of 84.8, and the observation group had a mean of 60.0 (p < .0001). The rate of knowledge degradation over the two month interval for the hands on group was significantly less than the observer group (mean 4.5 versus 18.6, p = 0.003). The statistical method used was mean +/- standard of error and t-test. Conclusions: Hands on simulation experience produces better knowledge outcomes than observation immediately post simulation and after two months. Knowledge degradation for those with hands on simulation experience is significantly less than for those who observe.

Sponsored Research - None

ENHANCED KNOWLEDGE OF EVIDENCE BASED PROCESS(EBP) THOUGH PROFESSIONAL INQUIRY (PI) COUNCIL PROJECT FOR RESPIRATORY THERAPIST.

Cynthia C. White, Abby Motz, Tonie Perez, Carmen Williams, Tracey Neff, Susan Allgeier; Cincinnati Childrens Hospital Medical Center, Cincinnati, OH

The majority of RT’s have been exposed to little formal education focused on research and the evidence based process(EBP). A process has been established by the SCHR for outcomes assessment, producing a systematic process of synthesizing the literature, synthesizing the evidence, and implementing and evaluating a practice recommendation based on those findings. In 2009, the RT Professional Inquiry (PI) council went through evidence training with one of the Center for Professional Excellence(CPE), EBP mentors to complete their first EBP project. The group formed a clinical question, and systematically searched the literature. The council completed a literature review, and the critical appraisal process. Articles deemed applicable were placed into a summary table. Council members learned how to grade the evidence, write a summary of their findings, and establish a best practice recommendation based on the evidence found. Method: A 5 question survey was developed to evaluate new knowledge gained by each council member. The survey evaluated new skills and confidence gained from the EBM process. Results: 100% survey return rate was achieved with survey completion. 100% of members felt the EBM systematic process was helpful in the enhancing their individual knowledge of evidence based practice. 100%of members now feel they able to independently conduct a literature search within the CCHMC system. 83% reported being able to teach others in their unit how to search the literature. The remaining 16% felt they could do this to a degree and know where to find the resource. 100% of respondents are able to identify good quality research after learning the institutional critical appraisal process. 100% correctly identified a randomized Controlled Trial(RCT) as the highest quality evidence for a single study design. Discussion: The RT PI council at CCHMC achieved a good understanding of the EBP process through their work on a EBM project in 2009. Advancement of this knowledge enables RRT’s to be able to converse and interact with physicians and other health professionals regarding topics relating to evidence based medicine and practice. Respiratory Therapy will now have an established area for publishing best practice statements on the CPE evidence based website.

Sponsored Research - None

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882526
A CAMPUS COMMUNITY’S ATTITUDES AND BEHAVIORS REGARDING TOBACCO Usage.

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Background: Many college campuses are considering adopting a tobacco-free policy. During the spring semester of 2007, a group of campus community members including administrators, faculty, staff, and students convened to begin dialogue about this issue. As a first step, the committee gathered data via a survey to determine campus community members’ tobacco use behaviors and attitudes.

Method: All campus community members (a total of approximately 2,900 individuals including administrators, faculty, staff, and students) were invited to participate by electronic mail. A link to the electronic survey (adapted from the Indiana University Southeast Smoking Survey) was included in the invitation. The instrument included 25 items including demographic questions as well as questions about tobacco and smokeless tobacco usage. In addition, participants were asked about their attitudes regarding a specific tobacco use policy (for example, specific policy language, who should be responsible for enforcing the policy, as well as the preferred sanctions if the policy is violated). Results/Conclusions: The response rate for the participants was approximately 20%. The majority of respondents were female undergraduate students. Only 3.7% of survey participants smoke more than 10 cigarettes daily. While most respondents did not use tobacco, over half reported that they were impacted at least weekly by someone else’s smoking on campus. Members of the campus community were also aware of the health implications of tobacco usage. In general, most participants were satisfied with the current tobacco use policy on campus; however, over half agreed that a more strict policy would either significantly or slightly improve the overall campus environment. In addition, community members desired more tobacco cessation programming offered on campus.

Sponsored Research - None

RESPIRATORY PRACTICE TEAM BOOSTS EMPLOYEE MORALE WHILE IMPROVING PATIENT CARE/OUTCOMES AND DECREASING COSTS.

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Background: A Respiratory Practice Team was initiated that utilizes the Plan Do Study Act (PDSA) Model to improve Respiratory Care at Mayo Clinic Phoenix. The team’s goals are to improve employee morale, improve patient care, and decrease costs. Method: An educational meeting was held, open to all therapists, to understand how the PDSA Model works. Therapists identify issues/deficits and the group prioritizes them based on the needs and feasibility of the project. After selecting an idea the project is submitted to management to ensure proper support and approval. The PDSA Model is a step by step process that allows for planning, implementing, testing, and analyzing the results. Outcomes are compared to the original project goals and changes are made based on what is learned. The circular method allows for changes and improvements to be made before the project is finalized. Results: For the first project, the team implemented a patient safety initiative that utilized standardized trach supply kits to be kept at the bedside. The project resulted in potentially improved patient safety by increasing compliance of having all necessary trach supplies at the bedside. Initial patient audits indicated that supplies were routinely missing (less than 60% compliance). Post implementation audits showed 100% of required supplies were at the bedside. Therapist time taken to gather supplies has been reduced as well as an estimated annual cost savings of $6,720. Even more substantial than the savings recorded was the unexpected consequence of improved teamwork and morale that this project provided. The team has been educated on a step by step process of improvement that can be utilized in future projects. Volunteer therapists were utilized for the team, resulting in a greater buy-in, improved staff satisfaction, and a feeling of empowerment. A diverse team with different experience levels and backgrounds enables projects to be viewed from different angles resulting in more creative ideas and better prediction of obstacles. Conclusion: In addition to improving patient safety and decreasing costs, creating a Respiratory Practice Team resulted in improved employee morale by empowering therapists to become change agents while utilizing the PDSA Model for Improvement. A team of therapists have spread the word to the department generating a sense of excitement that change can be made.

Sponsored Research - None

EVIDENCE-BASED PRACTICE READINESS SURVEY: AN ANALYSIS OF CURRENT KNOWLEDGE OF A PEDIATRIC RESPIRATORY CARE SERVICES DEPARTMENT.

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Introduction: The Institute of Medicine identified evidence-based practice (EBP) as key to improving health care quality. Little is known about respiratory therapists’ (RTs) perceptions of EBP. A survey specifically for RTs was adapted from a nursing tool and administered to determine current knowledge and practices of Respiratory Care Services staff at Arkansas Children’s Hospital (ACH). Method: The Research Factor Questionnaire-Evidence-Based Practice©, a previously validated and reliable (0.89) nursing survey, was adapted with the author’s permission. The survey contains 43 questions and was adapted for RTs by the collaborating authors. After obtaining IRB approval, RTs at ACH were invited to participate in an online survey to determine baseline knowledge and practices regarding EBP. Data were analyzed using descriptive statistics. Results: Of the 229 staff invited to participate, 125 participated in the survey (response rate =54.6%). The majority of respondents were female (71.2%), Caucasian (81.6%), full-time (80.6%), an average age of 37 years (SD=10.0). Respondents were predominately RTs (90.7%) with a BS Degree (62.6%). Most RTs had heard of EBP (95.8%), were interested in learning more (90.0%), had taken research, EBP, or statistics courses (55.8%), and reported attending local professional meetings (70.8%). PICO questions were identified that department policies/procedures were based upon evidence. Finally, respondents identified that ACH actively supported research and EBP by providing material (69%), human (72%), and financial (65%) resources. Conclusion: Since adding a research RT position in 2009, a research committee has convened to facilitate research and EBP in the department. This survey determined baseline knowledge and practices will be used to assist with strategic planning for education and support for the staff. A follow-up survey is planned in 12 to 15 months to evaluate our progress.

Sponsored Research - None

BRIDGING THE KNOWLEDGE GAP BETWEEN THE BEDSIDE RESPIRATORY THERAPIST AND THE EVIDENCE: EDUCATING RESPIRATORY THERAPISTS ON THE USE OF EVIDENCE-BASED PRACTICE SKILLS.

Abby Mong, Cynthia White; Division of Respiratory Care, Cincinnati Children’s Hospital and Medical Center, Cincinnati, OH

Background: Practicing evidence-based medicine (EBM) is becoming a standard within our healthcare system. Today’s registered respiratory therapists (RTs) need to be prepared to engage and participate in EBM. Learning the necessary skills to contribute in evidence-based practice (EBP) is not a part of standard curriculum taught in respiratory therapy programs. The Professional Outcomes of-Care (POC) scholar program was designed to prepare the healthcare team at our institution on the importance of understanding and participating in EBM. Method: The program was designed to teach the following: developing a PICO question, searching and critically appraising the literature, evidence summary, and developing a care recommendation and/or change in current practice. This program took place over one year, on a designated weekly eight hour day. The RTs’ salaries were paid for by the institution’s Center of Professional Excellence. The RTs developed separate PICO questions, literature searches and appraisals, evidence summaries, and practice changes. Two RTs, upon application review, were selected to partake in the POC program. Scheduled program updates were given by the RTs to the hospital’s intra-disciplinary and respiratory care professional inquiry councils. Method: A survey was developed and distributed to 8 key stakeholders to evaluate the involvement of the RTs in the POC program. Results: There was 100% compliance from the stakeholders in completing the survey (See Table 1). Survey results indicated that 100% of the respondents felt: the POC program was a worthwhile investment for the institution, the POC RTs shared valuable knowledge gained and could be EBP mentors, and practicing EBP skills were important for RTs to learn. Conclusion: As a direct result of this program, both POC RTs developed research projects and one RT will develop a new hospital policy. The respiratory care division has added the POC program and EBP mentors into long term planning goals. The POC RTs will continue to educate and mentor fellow RTs on the EBP process.

Sponsored Research - None

Evaluation of RTs in the POC program
FOSTERING EDUCATIONAL GROWTH TO PROMOTE FUTURE LEADERS IN RESPIRATORY CARE.

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Background: As the respiratory care workforce ages, it is inevitable that the leaders of our profession will be stepping aside to allow new registered respiratory therapists (RRTs) to play a role in this decision in addition to organizational support. At our institution, RRTs are positioned themselves to be future leaders in the respiratory care profession. Sponsored Research - None

904356

WRITING ANALYSIS OF STUDENT VOLUNTEER EXPERIENCE VERBATIMS SHOWS LITTLE LINGUISTIC DIVERSITY.

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Background: The level of diversity among students studying respiratory care has increased; this change likely parallels the general US population. For many of these students, English is not their first language. Although there is literature that examines this diverse composition of students, there are none that have studied the effect of language background and ethnicity on the ability to write personal reflections in English. The purpose of this project was to determine whether language background and/or ethnicity on writing style that might affect a student’s ability to express oneself in reflective writing. Methods: Sixteen senior respiratory care students at our program individually chronicled their shared experiences of serving an evening meal at a local homeless shelter. LIWC was used to assess six variables: self reference, social words, cognitive, big words, and positive and negative emotion. An analysis of the scores of each variable was performed between those students with English first language backgrounds (EFLB) and non-English first language backgrounds (NEFLB). Student T-test was used for statistical analysis. Results (refer to table 1) Conclusion: This study suggests that regardless of origin and differences in linguistic background, students display similar fundamental characteristics and ability when writing in a reflective manner on personal experience. References: US Census Bureau. U.S. Interim Projections by Age, Sex, Race, and Hispanic Origin: 2000-2050 http://www.census.gov/population/www/wwwprojections/interimproj/; Pennabaker JW, Francis ME, Booth MJ. Linguistic Inquiry and Word Count. Mahwah, NJ: Erlbaum Pub, 2001. Carroll DW. Patterns of student writing in a critical thinking course: A quantitative analysis. Assessing Writing 2007;12:213-227. Lee HC, Kim K, Seo SY, Chung K C. The Relations between personality and language use. J Gen Psychol 2007;134(2):205-413. Sponsored Research - None

920280

SURVEY OF EXISTING CONDITIONS OF THE RESPIRATORY CARE TEAM IN JAPAN: AN ANALYSIS OF IMPACT FACTORS.

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BACKGROUND: Respiratory Care is not recognized as a profession in Japan. Therefore, this role is performed by a team of respiratory therapists (RThTs) that includes nurses, physical therapists, clinical engineers and physicians. The purpose of this study is to survey the current status of respiratory care teams in Japan, and also to analyze the impact factors of the team. Methods: The subjects of this survey were 960 respiratory therapists (RThTs) who participated in the Respiratory therapy education in Japan. We randomly selected subjects for this survey in Japanese respiratory care related journals. We surveyed 370 individuals from 92 hospitals who were members of the respiratory care team, and 427 individuals from 39 hospitals who were not members of the respiratory care team. The method of this study was a mail-in questionnaire survey from October 1 to November 20, 2008. RESULTS: We received 249 questionnaires (31% return rate), and 196 valid responses (24.6% response rate). The respiratory care team group was significantly higher than the none-team group regarding years of clinical experience (P < .01). The leader of the team was a physician (50% of the team groups) or a nurse (38.9% of the team groups). The average number of people on the team was 14. The team activities included rounding on patients who received mechanical ventilation (70.5%), providing workshops for team members (67.9%) and providing workshops for the medical staff (85.6%). Five factors were evaluated: “work environment,” “ability of the individual,” “specialties and education,” “system of organization;” “motivation”. The respiratory care team group had a significantly higher score than the none-team group regarding work environment (P < .01) and “motivation” (P < .05). The respiratory care team group differed significantly from the none-team group for each of the items within the “work environment” (P < .05). However, there was no significant difference between groups in the items related to technique and assessment skills evaluated as “ability of the individual”. CONCLUSIONS: Currently, the respiratory care team members don’t have a high level of clinical skills, but the team can improve the work environment related to respiratory care and enhance the clinical skills. In the future, it is important that the respiratory care system receives the necessary specialty education and cooperation of the professional organizations. Sponsored Research - None

919928

RESPIRATORY THERAPIST USE OF A PEDIATRIC TRACHEOSTOMY TRAINING MANUAL FOR HOME CAREGIVERS.

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Introduction: At The Children’s Hospital of Philadelphia, 50 patients with a new tracheostomy tube are discharged to home annually. Respiratory Therapy (RT) involvement in training home caregivers of mechanically ventilated patients with tracheostomy tubes to assure a safe transition to home, is a comprehensive education that is provided by the multidisciplinary Airway Advisory Committee. The RT was interested in determining the impact of the training manual on RT’s education. Method: RT performed 31 home visits to 31 patients with a new tracheostomy tube. During a comprehensive revitalization of teaching methods and content by the multidisciplinary Airway Advisory Committee, it was discovered that staff did not use standard prompts or teaching methods. The survey consisted of 9 questions to assess knowledge of the old tracheostomy teaching manual. The Airway Advisory Committee reviewed existing patient family education materials, established best practices for home support by family caregivers, and actual content delivered by staff educators. Existing education materials were revised, and new materials developed to create Breathe Easy: Caring for Your Child with a Tracheostomy at Home. During a skills fair, RTs received education on the contents of Breathe Easy and their responsibilities, 5 months after Breathe Easy implementation, the survey was re-administered to assess understanding. Results: 53 RTs responded to the pre-survey and 44 to the post-survey. Awareness of a tracheostomy training manual for caregivers increased by 45%. The Likert scale survey was used to rate Breathe Easy when teaching increased to Most of the Time/Always by 33%. Review of the manual before a teaching session with a caregiver increased to Most of the Time/Always by 40%. Use of Breathe Easy as a self learning tool increased to Most of the Time/Always by 33%. Rating for user friendliness increased to Most of the Time/Always by 50%. Conclusion: RT knowledge and use of a uniform training manual increased after an education program, RT involvement in the teaching process has significantly increased. Standard materials reduced content disparities by discipline providing education. Sponsored Research - None

920300
INTERDISCIPLINARY HIGH-FIDELITY CLINICAL SIMULATION: EFFECTS ON TEAMWORK, COMMUNICATION AND DECISION MAKING.

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Background: Healthcare professionals are required to work together as a team to care for patients. However, traditional pre-professional training methods for nursing and respiratory therapy do not usually involve opportunities for interprofessional education. The research literature supports that learning via high fidelity clinical simulation translates to the clinical environment. The purpose of this study was to implement interprofessional education in a simulated, multifaceted patient scenario and describe the interactions between the pre-professional students, as well as to examine their attitudes, beliefs, and understanding of the other professional students’ roles. Method: As part of pre-professional baccalaureate coursework, a group of 20 senior respiratory therapy students and 86 senior nursing students were assigned to small interdisciplinary teams. Teams collaborated in the high fidelity management of a patient in respiratory distress, requiring intubation and mechanical ventilation. A pre- and post-simulation survey using a 5-point Likert scale was utilized to assess participant’s confidence, attitudes toward teamwork, understanding of roles, and beliefs regarding interprofessional communication and teamwork. Interactions were videotaped and qualitative data collected as participants were debriefed about their experiences and reflected on the performance of the team. Video observation, qualitative analysis, descriptive statistics and paired t-tests were utilized to analyze video and survey data. Results: Differences in confidence, attitudes toward teamwork, understanding of roles, and beliefs regarding interprofessional communication and teamwork for each discipline were assessed using paired t-tests with p ≤ 0.05. Results: 62 completed surveys were returned. Based on results of paired t-tests, there was a statistically significant change from pre to post simulation for items within each of the constructs examined: interdisciplinary education, understanding of roles, and teamwork/communication. Video observation yielded fairly similar communication patterns for the simulation. Qualitative data supported the need for improved communication and teamwork and reinforced the collaboration as a positive learning experience. Conclusion: Interprofessional patient care in the safe, yet realistic environment of a high-fidelity clinical simulation is a positive way to introduce teamwork and interprofessional patient care. Video observation, qualitative data collected as participants were debriefed about their experiences and reflected on the performance of the team. Interactions were videotaped and qualitative data collected as participants were debriefed about their experiences and reflected on the performance of the team.

Sponsored Research - None

921180

DELIVERY OF ASTHMA EDUCATION IN THE U.S.

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Background: Asthma education has become an important part of the patient’s self-management. The certified asthma educator credential (AE-C) has helped formally prepare healthcare providers to deliver quality education. This study sought to determine the prevalence of asthma education delivered by those holding the AE-C credential compared to the practice patterns across the nation. Methodology: The Association of Asthma Educators (AAE) partnered with an internet-based survey provider to distribute a 24 question survey to all the contacts in the Association of Asthma Educators (AAE) data base (n=7,730). The data was analyzed to explore the prevalence of the AE-C credential and the practice patterns across the nation. Results: 1,730 email addresses were contacted; there were 222 responses (response rate of 12.8%). The top four disciplines responding (followed by the number holding the AE-C credential) were respiratory therapists - 73 (56), nurses - 69 (48), nurse practitioners/clinical nurse specialists - 34 (24), and community health workers - 12 (6). All 5 major national regions responded. Asthma education was given (or supervised) by a person with the AE-C credential in the majority of the responses (Yes -133, No – 70, question skipped -19). 42.6% of the respondents worked in an office/clinic environment (42.6%) followed by hospitals (32.7%), universities (8.4%) and community health (6.9%). In describing how asthma education was given, seventy-four of the respondents (33%) provided it in a 1-on-1 setting and 74% had the AE-C credential. Twenty-one (9%) of the surveys provided the education on the same day as the visit but in a separate service and 86% of these had the AE-C. Fifty-one (23% of the surveys) provided education by the healthcare practitioner as part of the overall visit (not a separate service) and twenty-five of the 51 (94%) had the AE-C. In total, 57 of the respondents (7%) stated that the development of asthma education programs is considered and 124 individuals (70%) had the AE-C. Conclusions: This study presents baseline data describing who is delivering asthma education (by profession) and the practice settings and practice patterns being used.

Sponsored Research - None

921288

EVALUATION OF THE OHIO STATE UNIVERSITY HEALTH COACH TRAINING PROGRAM.

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BACKGROUND: Competent health coaches have the ability to positively affect client health outcomes, yet the current literature lacks standards for didactic instruction and practice using motivational interviewing (MI) techniques. METHOD: Seven trainees completed content examinations on health risk assessment areas and Likert-type surveys that assessed confidence with MI techniques and self-efficacy with all components of health coaching, both before and after training, and 90 days post-training. Scores were compared using paired t-tests, with p < 0.05 considered to be statistically significant. RESULTS: Post-training assessment revealed a significant increase in confidence using MI techniques (p = 0.04) and improvement in all other areas of health coaching. Regarding MI, participants maintained their level of confidence 90 months post-training compared with pre-training (p = 0.04). Confidence levels with MI techniques did not differ from pre-training (p = 0.62). Improvements in other aspects of health coaching were also maintained at 90 days, but they did not reach a level of statistical significance. CONCLUSIONS: Findings support the use of a training program that devotes the same amount of time to hands-on practice using MI techniques as it does to didactic information about components of a typical health coaching session on the various risk assessment topics.

Sponsored Research - None

903080

THERAPISTS’ EXPERIENCES AS CLINICAL PRECEPTORS.

Jennifer L. Keely, Cardiopulmonary and Diagnostic Sciences, University of Missouri, Columbia, MO

Abstract Title: Therapists’ Experiences as Clinical Preceptors Background: The education of respiratory therapy students encompasses classroom, laboratory, and clinical periods. Frequently, respiratory therapy students are assigned to staff therapists not designated as clinical preceptors and who lack additional training for working with students. As a result, students’ clinical experiences may vary considerably. The degree to which students’ education may be adversely affected is significant but difficult to measure. Also significant is the possible greater job dissatisfaction of therapists who precept students. This study sought to understand the experience of Missouri respiratory therapists who precept students in the hospital setting. The researcher’s hypothesis was that clinical precepting is a significant stressor which may adversely affect job satisfaction for therapists assigned the task. Methods: Data collection occurred via a researcher-developed electronic survey e-mailed to respiratory therapy department managers at 25 Missouri hospitals. Managers were asked to forward the survey to therapists in their departments. The participant sample included therapists who precept students in acute care settings. The survey used a mix of multiple-choice type items as well as open-ended questions, allowing the participants to respond freely. Results were analyzed using an open-coding method. Results: Results were collected over eight weeks with 89 respondents. Sixty-five percent of the respondents were staff therapists with the remaining respondents being department educators and supervisors. Ninety-two percent of the respondents rated their precepting experience as positive but many said heavy workloads encroached on the time necessary for effective teaching. Conclusions: Most therapists serving as clinical preceptors find clinical precepting a positive work experience. However, departmental and institutional responsibilities and the development of asthma education programs is considered and 124 individuals (70%) had the AE-C. Conclusions: This study presents baseline data describing who is delivering asthma education (by profession) and the practice settings and practice patterns being used.

Sponsored Research - None

919785
DOES SCREENING SPIROMETRY EFFECTIVELY DETECT OR DIAGNOSE LUNG DISEASE IN AT RISK POPULATIONS?

Billy S. Collins; Department of Health Sciences, Nova Southeastern University, Ft. Lauderdale, FL

Background: Spirometry is commonly used in assessing pulmonary mechanics and diagnosing both obstructive and restrictive lung disease. Occupational medicine clinics utilize spirometry as a screening modality in detecting lung disease among individuals with workplace exposure to various airborne toxins. The purpose of this study was to determine the effectiveness of screening spirometry in detecting lung disease among persons of at risk populations. Method: A Cochrane Library and Trip Database search was used in searching for valid and well designed literature sources to answer all aspects of the clinical question. Spirometry, pulmonary function, lung disease and screening were used as key terms in conducting the literature review. Parameters were set to include those studies published from 1989 to the present, limited to human subjects and the English language. Preference was given to original publications, randomized-control trials, systematically reviewed publications and studies that specified spirometric efficacy in detecting lung disease as a primary endpoint. Studies that were indirectly associated with the primary endpoint were considered. Results: In summary, after reviewing the literature to answer the clinical question “Does screening spirometry effectively detect lung disease” it appears that spirometry is effective in detecting lung disease. Age is a factor when deciding to screen individuals with well defined risk factors for developing lung disease. Otherwise, spirometry has shown to be effective in detecting and diagnosing lung disease in populations with clinical symptoms of lung impairment, as well as individuals with well defined risk factors for developing lung disease. Conclusions: In reviewing the literature, it appears that spirometry is a useful modality in detecting lung disease among individuals with pertinent health histories, proven occupational exposures and established risk factors. In support of this conclusion, the landmark Burden of Lung Disease (BOLD) study recommends that spirometry be used in diagnosing obstructive and restrictive lung disease. Sponsored Research - None

SCREENING OF OBSTRUCTIVE SLEEP APNEA IN AWAKE SUBJECTS.

Paulo J. Caeteto1,2, Rui Fonseca-Pinto2, Alexandre R. Andrade1,2, Goncalo Guimaraes, Superior School of Health, University of Coimbra, Coimbra, Portugal; 2Biophysics and Biomedical Engineering, Faculty of Sciences, University of Lisbon., Lisbon, Portugal; 3Mathematics, Polytechnic Institute of Leiria, Leiria, Portugal

Background: Polysomnographic signals are usually recorded from patients exhibiting symptoms related to sleep disorders such as Obstructive Sleep Apnea (OSA). OSA has a relatively high prevalence, occurring in 5% of the adult population, but the majority of these cases remain undiagnosed. The usual procedure entails an overnight recording several hours long. Our goal is to present a fast screening method to identify OSA during the awake period, in order to simplify the diagnosis and reduce costs and waiting time for diagnosis and treatment. Methods: This study presents a methodology to help with the screening of OSA using a 5-minute oronasal airway pressure signal emanating from a polysomnographic recording during the awake period, eschewing the need for an overnight recording. The Hilbert–Huang Transform (a recent time-frequency analysis method) was used to extract intrinsic oscillatory modes from the signals. The frequency distribution of both the first mode and the second mode and their sum was shown to differ significantly between non OSA subjects and OSA patients. Results: The clinical sample consisted of a total of 41 subjects, 20 non OSA individuals and 21 individuals with OSA. An index measure based on the distribution of the oscillatory modes exhibited a sensitivity of 81.0% (for 95% specificity) for the detection of OSA. Two other index measures based on the relation between the area and the maximum of the 1st and 2nd halves of the Hilbert–Huang Transform histogram both yielded a sensitivity of 76.2% (for 95% specificity). No significant correlations were found between age, sex and the best correlated indexes. Conclusions: Although further studies will be needed to reproduce the reproducibility of the index measures, the proposed methodology could provide a fast method to screen OSA patients, in awake period, thus reducing the costs and the waiting time for diagnosis. The physiological mechanisms underlying the difference between OSA patients and non OSA subjects highlighted in the present study can be due to differences in upper airway anatomy and could be associated with an increase in airway resistance that is a feature of the disease. Sponsored Research - None

AN ABG PROCEDURE COMPLICATIONS ANALYSIS.

Joel M. Brosg, Brett Booker, John Embenger; Christiana Care Health System, Newark, DE

Background: When performing any invasive procedure the clinician must be aware of all the adverse effects it could have on the patient. The ABG sampling procedure is frequently performed by RCPs in both inpatient and outpatient settings on both acute and chronic pulmonary patients. During and after the procedure the RCP must evaluate the patient for complications. The most noted complications of the procedure are hematoma, infection, and nerve damage*. If a complication is present, the RCPs must document the event, inform the ordering physician, and perform appropriate action. This study retrospectively evaluated the prevalence of complications that are documented by RCPs, performing the ABG sampling procedure. Methods: Data was collected from 2 facilities: a 241 bed community teaching hospital and a 913 bed level 1 trauma center and teaching hospital. Using electronic respiratory documentation we retrospectively analyzed all documented arterial blood gas (ABG) procedures that were performed by RCPs from July 2008 to April 2010. We evaluated the number of complications documented and the complication type. We also analyzed the percent of complications in reference to the patient’s age. Results: There were a total of 17861 documented ABG procedures observed. There were a total of 31 complications (0.17%) documented complication rate by the RCP’s performing the procedures. Ninety percent of the complications documented were hematomas. One patient complained of having extreme pain at the site and displayed signs of a vagal response (coughing, nausea, and decrease heart rate). There were 2 patients that reportedly had excessive bleeding at the site. Patients in the 61-80 years old age group were more likely to have ABG procedure complications (See table for additional data.) Conclusion: According to the number of complications caused by the ABG sampling procedure, the highest rates of complications are documented infrequently. Hematoma formation is the most common complication noted. Patients in the 61-80 year old range are the most likely to have procedure complications. RCP’s are very successful in obtaining arterial blood samples during procedures. *Robert Kacmarek, Steven Dimas, Craig W. Mack. The essentials of Respiratory Care – Fourth Edition. Elsevier Mosby, 2005. Sponsored Research - None

CONDITIONS ASSOCIATED WITH A NONSPECIFIC PATTERN OF PULMONARY FUNCTION TESTS - EXPERIENCE IN JAPAN.

Yoshi Y. Yagiya1, Takeo Saito1, Yoshiya Tsonoda1, Toru Tanaka1, Shigen Yum1, Yuuki Miura1, Kumiki Miyazaki2, Akimasa Sekine1, Kenji Hayashihara1, Yasuhiro Umesu21, respiratory medicine, Ibarakihigashi hospital, Naka-gun Tokai-mura, Japan; 2clinical laboratory, Ibarakihigashi hospital, Naka-gun Tokai-mura, Japan

Background: Robert E. Hyatt and his colleague defined a nonspecific pattern (NSP) of pulmonary function results as a reduced FEV1, reduced FEV1/FVC, and a normal total lung capacity (TLC). They encountered the NSP in 9.5% of their subjects. Fifty percent of the subjects a normal FEV1/FVC, and a normal total lung capacity (TLC). They diagnosed the NSP be called the small airways disease. Stanescu suggested the NSP be called the small airways disease. Stanescu suggested the NSP be called the small airways disease. Fifty percent of the subjects encountered the NSP in 9.5% of their subjects. Fifty percent of the subjects exhibiting symptoms such as Obstructive Sleep Apnea, reduced FEV1 and FVC, and so on. In the NSP subjects (normal FEV1/FVC, reduced FEV1 and TLC), we analyzed the percent of complications in reference to the patient’s age. Results: There were a total of 17861 documented complications observed. There were a total of 31 complications (0.17%) documented complication rate by the RCP’s performing the procedures. Ninety percent of the complications documented were hematomas. One patient complained of having extreme pain at the site and displayed signs of a vagal response (coughing, nausea, and decrease heart rate). There were 2 patients that reportedly had excessive bleeding at the site. Patients in the 61-80 years old age group were more likely to have ABG procedure complications (See table for additional data.) Conclusion: According to the number of complications caused by the ABG sampling procedure, the highest rates of complications are documented infrequently. Hematoma formation is the most common complication noted. Patients in the 61-80 year old range are the most likely to have procedure complications. RCP’s are very successful in obtaining arterial blood samples during procedures. *Robert Kacmarek, Steven Dimas, Craig W. Mack. The essentials of Respiratory Care – Fourth Edition. Elsevier Mosby, 2005. Sponsored Research - None

TUESDAY, DECEMBER 7; 3:00 pm to 4:55 pm (Room N239/N241)

SYMPOSIUM 7: DIAGNOSTICS

1544

RESPIRATORY CARE • NOVEMBER 2010 VOL 55 NO 11
IMPACT OF A THERAPIST-DRIVEN PROTOCOL INCLUDING INCENTIVE SPIROMETRY AND HIGH-FREQUENCY CHEST-WALL OSCILLATION ON INCIDENCE OF POST-OPERATIVE PNEUMONIA

Eileen Lukes1, Kristin McFall2, Respiratory Care Department, Rome Memorial Hospital, Rome, NY; 1Respiratory Care, Hill-Rom Respiratory Care, St. Paul, MN

Background: Pneumonia is common in post surgical patients. Reported mortality rates for pneumonia range from 20% to more than 50%. In our institution pneumonias were 1.2 and 2.9 per 1,000 post-surgical days in 2005 and 2006 respectively. As a quality improvement initiative, the Cardio-Pulmonary Department developed a patient-centered protocol including Incentive Spirometry (IS) and High-Frequency Chest-Wall Oscillation (HFCWO). We report the pneumonia rates for two years following the February 2007 implementation of this protocol. Methods: Patients with orders for IS were instructed prior to surgery on IS and cough techniques. 4 hours post-surgically, patients were evaluated by therapists assessing their ability to achieve 75% predicted value of IS. Spirometry (IS) and High-Frequency Chest-Wall Oscillation (HFCWO) were given to patients who met the criteria. We report the pneumonia rates for two years following the February 2007 implementation of this protocol. Results: Pneumonia rates were 1.2 and 2.9 per 1,000 post-surgical days in 2005 and 2006 respectively. Conclusion: Reduction in post-operative pneumonia occurred after implementing a therapist-driven protocol for all post-operative patients. This protocol has been used for 2 years with a 38% cost savings for the department. This has had a positive impact on patient care and has made the department more efficient.

Sponsored Research - None

A COMPARATIVE STUDY OF FVC, FEV1, AND TLC IN NON-SMOKING SAUDI STUDENTS AT EASTERN PROVINCE, SAUDI ARABIA WITH CAUCASIAN REFERENCE VALUES

Fahad N. Al-Khalaf1,2,3, Kristin McFall2; 1Respiratory Care Department, Dammam University, Dammam, Saudi Arabia; 2Department of Pulmonary and Critical Care, Mayo Clinic, Rochester, MN; 3Department of Respiratory Care, Dammam University, Dammam, Saudi Arabia

Background: Pulmonary function tests (PFT) are the tests that used for detection and differentiation between restrictive and obstructive pulmonary diseases. It is well known that the values of pulmonary function vary with age, sex, weight, body stature and the ethnic origin of the subjects (Cotes 1993; and Rupple 2009). Therefore, the American Thoracic Society (ATS) has recommended the development of population-specific lung function reference values (Rupple 2009). In the Kingdom of Saudi Arabia (KSA), the currently available reference values for pulmonary functions are mostly based on data from the Caucasian European population, which may be inaccurate for Saudi Arabian subjects as these populations differ markedly in their body characteristics and their environments. Therefore, this study seeks to investigate whether differences exist between adult Saudi’s FVC, FEV1 and TLC and Caucasians reference values for these parameters and to establish pulmonary function reference values specific for Saudi population. Method: This cross-sectional study was conducted at King Faisal University (KFU), Eastern Province, KSA, from June to August 2009. One hundred and twelve healthy non-smokers aged 18-22 years university students were participated in this study. A SensorMedics 6200 (W双向) Plethysmograph (M AutoBox, USA) was used to make all measurements for all subjects. Results: Statistically significant differences (p<0.01) were identified between the mean of the measured values of lung function for Saudis and the mean of Caucasian reference values. In regression analysis, height was found to be an important independent variable for all pulmonary function parameters. Conclusions: In this study, the observed mean values for FVC, FEV1 and TLC for Saudis were found to be lower than the mean predicted values for Caucasian by about 10%; 9% and 8% for males respectively, and 16%; 12% and 5% for females respectively. This difference has led to the establishment of the first sets of prediction equations for Saudi population. A future larger study including all age, height and weight ranges from different regions in Saudi Arabia following the ATS criteria is needed.

Sponsored Research - None

COMPARISON OF A NON-INVASIVE BLOOD PRESSURE MEASURING DEVICE TO ARTERIAL BLOOD PRESSURE DURING CARDIOPULMONARY EXERCISE TESTING

Carl D. Mottram, Jamal A. Awad, Mahamednur M. Harun, Katrina M. Hynes, Abdirahid S. Iblahem, Murald M. Dursal, Paul D. Scanlon; Pulmonary and Critical Care, Mayo Clinic, Rochester, MN

Background: Cardiopulmonary exercise testing (CPET) involves monitoring numerous physiologic parameters, including blood pressure, for clinical diagnosis. Blood pressure (B/P) is typically measured using auscultation and a sphygmomanometer, but can also be measured using an arterial catheter connected to a pressure transducer (direct method). The B/P response to exercise is frequently used to evaluate exercise tolerance and can suggest routine follow-up with post-operative patients ensuring deep breathing and adequate secretion clearance may result in better patient outcomes and cost savings.

Sponsored Research - None

COMPARISON OF EXHALED NITRIC OXIDE (ENO) BEFORE AND AFTER DRINKING WATER

Carl D. Mottram, James A. Dugo, Mohamed Y. Gamadal, Cassandra N. Haddad, Mohamed A. Saried, Paul D. Scanlon, Mary K. Wint, Pulmonary and Critical Care, Mayo Clinic, Rochester, MN

Introduction: Exhaled nitric oxide (ENO) is a biomarker of airway inflammation. ENO is measured by having the subject inhale maximally and then exhale their breath through a mouthpiece into the ENO analyzer at a specific flow rate. The American Thoracic Society (ATS) and European Respiratory Society (ERS) have published testing guidelines. They recommended that the subject not eat or drink one hour prior to testing. This includes no consumption of water. The data for this recommendation is based on a single study that also evaluated other conditions, which may have affected the results. However in clinical practice we cannot be so rigid in our recommendations. Subjects were tested using the Atpier ENO system which was calibrated according to manufacturer’s recommendations. They were asked prior to testing if they followed the laboratory’s pre-test instructions which currently state that no eating or drinking is permitted two hours prior to testing. After completing the initial measurement, the subject will be asked to drink twelve ounces of water ten minutes following consumption. A second measurement was obtained. The initial test was the reported clinical results. Data were analyzed using linear regression and Student paired t-test. Results: The pre-water consumption data ranged from 9.84 ppb (mean 25.1). The post-water data ranged from 9.82 ppb (mean 25.1). The linear regression yielded an R 0.99 with a p<0.001. Conclusion: There was no statistical or clinical difference between the measured exhaled nitric oxide values results before and after the consumption of water. Our findings indicate that a subject may consume water prior to ENO testing. 1. ATS/ERS Recommendations for Standardized Procedures for On-line and Off-line Measurement of Exhaled Lower Respiratory Nitric Oxide and Nasal Nitric Oxide. Am J Respir Crit Care Med 2005 Vol 171. pp 912–930.

Sponsored Research - None

Comparison of ENO before and after drinking water shows no significant difference.
DOES EXHALATION TIME OF THE FORCED VITAL CAPACITY MANEUVER SIGNIFICANTLY AFFECT MEAN ESTIMATES OF PULMONARY FUNCTION SCREENING PARAMETERS?

Kathleen Clark*, Bo Cai, James Gibson, Erik Svensden. Epidemiology and Biostatistics, University of South Carolina, Columbia, SC; 2South Carolina Department of Health and Environmental Control, Columbia, SC

BACKGROUND: Spirometry screening measurements are strongly linked to patient effort and the quality of the testing maneuver. We examined community-acquired spirometry screening data to determine if differences in exhalation times during the FVC maneuver actually did affect FeV1, FVC, and FeV1% measurements. METHODS: Spirometry was performed on 208 adults (ages 16-80 years) following an accidental release of approximately 60 tons of chlorine gas into the community. NIOSH trained therapists were used and strict adherence to ATS/ERS guidelines was attempted. Exhalation times were classified into four groups: (1) all FVC maneuvers (n=208), (2) FVC > six seconds (n=102), (3) > three seconds but < six seconds (n=91), and (4) < three seconds (n=15). One-way ANOVA identified significant differences in the percentage of predicted FeV1 (ppFeV1), percentage of predicted FVC (ppFVC), and FeV1%. Tukey multiple comparisons provided information as to which exhalation times produced significantly different results when compared to others. RESULTS: Differences were observed for all parameters (FeV1% <0.0001, ppFeV1 p=0.03, and ppFVC p=0.0001). The FeV1% was lowest for exhalation times > three seconds (MEAN: all=78.0%, >6 sec=65.4%), and significant differences were seen between the >3 sec and <3 sec groups (n=91, and <3 sec=89.5%). Mean ppFVC was lowest for maneuvers less than three seconds (MEAN: all=78.1%, >6 sec=77.3%, >3 sec=64.2%, and <3 sec=65.4%). Significant differences were also seen between the >3 sec and <3 sec groups (n=91, and <3 sec=89.5%). Mean ppFVC was lowest for maneuvers less than three seconds (MEAN: all=78.1%, >6 sec=77.3%, >3 sec=61.6%, and <3 sec=65.4%). CONCLUSION: In adults, spirometry screening is affected by the exhalation time of the FVC maneuver. This appears to be greatest when the duration of the FVC maneuver is less than three seconds. Caution should be used during spirometry screening, since shortened exhalation times may lead to erroneous results.

Sponsored Research - None

VITAL CAPACITY ABOVE THE LOWER LIMIT OF NORMALITY DOES NOT EXCLUDE A RESTRICTIVE LUNG DEFECT.

Alan J. Moore, Laura A. Liddiard; Respiratory Physiology Service, Sandwell and West Birmingham Hospitals NHS Trust, Birmingham, United Kingdom

BACKGROUND: The ATS/ERS Task Force Paper 5: “Interpretative Strategies for Lung function tests” provides a simplified algorithm showing a pathway where if FEV1/VC ≥ LLN, then if Vital Capacity is also ≥ LLN, a restrictive lung defect is excluded. The algorithm states that “Total Lung Capacity (TLC) is necessary to confirm or exclude the presence of a restrictive defect when VC is below the LLN”. The study purpose was to test the validity of the algorithm pathway and statement.

METHOD: A search of our lung function test database with age range 18 – 65 years was conducted. The reference equation set used was the ERS 1993 update. The specific lung function parameter was ‘Total Lung Capacity’. The reference values for FEV1, FEV1/FVC, FVC, and VC were compared to reference values using Standardised Residuals (SR). Search criteria were ‘FEV1/V C ≥ LLN and VC ≥ LLN and TLC < LLN’. Output parameters were FEV1, VC, FEV1/V C, TLC, TCO2, VA. For each parameter, reference value was output with the standardised residual. Demographic parameters used were Age, Ethnic Origin, BMI and Provisional Diagnosis. RESULTS: 120 males (mean age 47.1 years, range 18 – 65) and 58 females (mean age 54.5 years, range 30 – 65) were identified. In the male group, the ethnic origin was Caucasian n=40, Afro-Caribbean n=28, Asian n=51 and Oriental n=1. In the female group, the ethnic origin was Caucasian n=12, Afro-Caribbean n=18, Asian n=20. Of the males identified, the range of SR for TLC was -1.757 to -3.300 and, for females, was -1.650 to -3.000 where a SR value of less than -1.645 is below the LLN. In the male group, TLC0 was < LLN in 54 patients (mean SR =-2.754, range -1.702 to -4.965) and for the female group in 38 subjects (mean SR =-2.715, range -1.709 to -5.128). BMI was <30 in 52 males (28 had TLC0/VA) and 28 females (10 had TCO2/VA). Provisional diagnosis was documented for 95 males and 48 females. Analysis of the provisional diagnoses revealed no clear pattern but suggests that pulmonary sarcoidosis (n=15) may feature more prominently. CONCLUSIONS: There were a number of patients with normal FEV1/VC ratio and normal VC where a restrictive defect is identifiable only by measuring TLC. Neither reduced TLC0 nor raised BMI (>30) are reliable indicators of restriction in these patients. Asian patients in this study group were more likely to have a restrictive defect. The authors recommend that the ATS/ERS task force review the interpretative algorithm and accompanying statements.

Sponsored Research - None

ABG AND VENTILATOR SETTINGS

A SAFER METHOD OF PERFORMING APNEA TESTS USING CARBONBEN AND CAPNOPYOGRAF FOR PATIENTS ON APRV, Maria G. Madde, Nader Habashi, Chris Kicher, Peter Saunders, Sabrina Cho, Ryan Martin; University of Central/SHock Trauma Ind, Tuesday, December 7; 3:00 pm to 4:55 pm (Room N239/N241)

Introduction: When evaluating brain death in traumatically injured patients, apnea testing is a preferred method for diagnosis determination. Unfortunately, due to the high acuity of injury, removing a patient from mechanical ventilation can lead to decrement in the lungs' ability to exchange gas. For potential organ donors, the loss of recruitment may make it impossible for procurement of the lungs.

To increase patient safety and limit adverse side effects, the use of carbon dioxide has been approved for apnea testing in our facility. Using carbon dioxide allows the need to remove the patient from mechanical ventilation, while leading to safer, more efficient results.

The protocol targets pH and PaCO2 for the determination of a positive apnea test and evaluates ETCO2 to determine the test end point. Case Summary: The patient was on a Drager Evita XL. Settings were: APRV, Phigh of 28, Plow of 0, Thigh of 5.5 and a Tlow of 0.55 seconds. The patient was pre-oxygenated and PaCO2 normalized and ETCO2 was being monitored. The pre-apnea test ABG was used to determine the target ETCO2 to reach the target PaCO2 and pH using the formula: Initial pH – 7.200/60. Adjustments were made to minimize alarms during the test and automatic tube compensation (ATC) and oxygen monitoring were disabled. The ventilator’s air hose was connected to a carbon bag (97% oxygen and 3% carbon dioxide). The Thigh was changed to 30 seconds, giving a release rate of 2 breaths per minute, and FiO2 set at 21%. During the test, ventilator waveforms and ETCO2 were monitored to identify any signs of spontaneous breathing. Results were achieved in 8 minutes and 50 seconds with no signs of lung de-recruitment. The formula was shown to be accurate in determining when the pH and PaCO2 would be met using ETCO2.

Discussion: The carbon dioxide apnea test provides less chance of pulmonary or cardiac side effects in compare to other methods, since end point test compared to the standard apnea test, and a safer environment for the patient.

Sponsored Research - None

A COMPARISON OF THE STABILITY OF PO2 AND PCO2 STORED IN PLASTIC ARTERIAL SAMPLERS.

Alissa Bintal, Melissa Frasere, Jillian Hoyt, Dana Khy, Leah Sebon, F. Herbert Dore; Respiratory Therapy, The Ohio State University, Columbus, OH

BACKGROUND: Arterial blood gases (ABG) play a vital role in determining respiratory care. Previous research has shown unstable ABG values stored in some plastic samplers for 30 minutes and at cold temperatures. The purpose of this study was to compare two brands of plastic arterial samplers and a glass control over time and at a cold temperature using a Cold Specimen Transporter (CST) to determine if the plastic samplers keep the blood gases as stable as blood stored in glass. METHODS: We created arterial human blood using an extracorporeal circuit at 37°C with 4% O2 and 5% CO2. We tested Radiometer Safe Pico self-fill, Smith Medical Portex® Line Draw and Roche microsamplers. Using a RapidLab® 1200, samples were analyzed for PO2 and PCO2 at 0, 15 and 30 minutes; at 22°C or 7-8°C using a CST. To identify statistically significant differences between each brand of sampler, temperature and storage time, we used ANOVA with repeated measures and Tukey’s HSD to compare the PO2 and PCO2 values. We considered differences statistically significant when p < 0.05. RESULTS: For PO2 values, there were no statistically significant differences among the samplers at 0 or 15 minutes or the Portex sampler combined with a CST at 0, 15 or 30 minutes; whereas at 30 minutes, Portex and Pico samplers were significantly different from the Roche control sampler at 0 and 15 minutes. The PCO2 values were significantly different in Portex, Pico and Portex control samplers when compared to control under multiple conditions. The average change in our PO2 values at 30 minutes was up to 12 mm Hg and was considered clinically important; whereas, the average change in PCO2 was observed to be 2 mm Hg and was not considered important. CONCLUSIONS: Our results are similar to other studies for blood stored for 30 minutes. Storage time of arterial blood should not be prolonged; ABG analysis should occur within 15 minutes. There are no significant differences in stability between the plastic samplers we tested. The protective properties of the CST should be further investigated.

Sponsored Research - None

Means (standard deviations) of PO2 values of arterialized blood stored in different samplers under ambient temperatures and conditions.

<table>
<thead>
<tr>
<th>Brand</th>
<th>Time (min)</th>
<th>PO2 (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portex</td>
<td>0</td>
<td>75.3 (3.4)</td>
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<tr>
<td>Portex</td>
<td>15</td>
<td>76.0 (3.3)</td>
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<td>30</td>
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</tr>
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<tr>
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CLEAN MY R.I.D.E. (REDUCE INHALATION OF DIESEL EXHAUST: PHASE TWO.
Kathleen Hrnlen, Randall Baker; Department of Respiratory Therapy, Medical College of Georgia, Augusta, GA

Background Since children spend 24% of their week in schools, school Indoor Air Quality (IAQ) may influence respiratory health. The EPA designates bus interiors as indoor environments that may pose a risk through exposure to diesel particulates. Approximately 22,000 students (66.61%) in the Richmond County school system are transported by bus each day. In a previous study, we found significant increases in respirable particulates in bus loading zones. The purpose of this study was to assess the exposure to particulates inside of a school bus during daily routes. Methods Permission from the Richmond County Board of Education was obtained to assess particle counts inside of buses during daily routes in August, 2009. The transportation manager assigned buses and routes for the collection of data. Four of the buses had exhaust emitted from the rear of the bus, while three had exhaust vented to the side of the bus. Measurements were made in a total of seven buses that varied in years from 1995 – 2008. The routes included high and low traffic areas. Particulates (.3- 5.0 um) were assessed using a Met One 237B Portable Airborne Particle Counter stationed at the front of the bus. Counts were taken every minute for 5 minutes followed by a one minute break. Investigators noted specific events during the ride including, stopping at traffic lights, loading/unloading of students, idling, road construction, and the detection of diesel fumes inside the bus. Results Table 1 shows the percent increase in particulates inside buses during common events on routine daily bus routes: Conclusions Particle counts increased up to 20% in buses during common events regardless of the bus’s age. Both internal and external factors appeared to contribute to increased particulate counts. The greatest increases were observed when buses stopped at traffic lights, when students were loading or unloading both on routes and in school bus zones, and when traveling through road construction sites. Further measurements in a more controlled environment may better determine the cause of changes in particulates during routine bus routes.

Sponsored Research - Georgia Department of Human Resources, East Central Health District

920307
ONE HOUR INTERVENTIONAL ALGORITHM USING HUMIDIFIED HIGHT FLOW THERAPY (HHFT)OPTIFLOW NASAL CANULA IN ACUTE RESPIRATORY FAILURE.

Lea Daniel1, Paul Ouimet2, 1Respiratory Therapy, Hôpital du Sacré-Coeur de Montréal, Montréal, QC, Canada; 2Respiratory Therapy, Vitalité Health Network, Edmundston, NB, Canada

Background: Following observations from two case studies we propose an intervention algorithm using HHFT to prevent further desaturation in acute respiratory failure.

Methods: Clinical decisions are focused on a two arms algorithm: Arm 1 for Type 1 ARF based on PaO2/FiO2 and Arm 2 for Type 2/Mixed ARF, based on pH and PaCO2.

Results: Case 1: A 67 year old male with Type 1 respiratory failure secondary to lobar pneumonia was admitted to the ICU and transferred to the HDU. After 60 minutes on FiO2 0.45, PaO2/FiO2 was 61. For further description of decision making, refer to the algorithm. Conclusion: Case 1: Two days after upper abdominal surgery, a 45 years old man develops a Type 1 Acute Respiratory Failure; on FiO2 0.8 with a PaO2/FiO2 of 200 mmHg, Arm 1 of the algorithm is activated with initiation of HHFT Optiflow 40 to 60 L/min. After 30 minutes on FiO2 0.75, ABG reveals PaO2/FiO2 of 231 mmHg (15.5% flow). Increase is found at 60 L/min for 30 minutes and after 30 minutes at 60 L/min on FiO2 0.45, PaO2/FiO2 in now 324 mmHg (38% increase from original). This intervention is well tolerated, patient reacted positively in spite of clinical indications for Non Invasive Ventilator support. After one hour, PaO2/FiO2 remained above 260 mmHg; therapy is continued. Case 2: 66 year old man, known COPD comorbid with upper airways infection and respiratory distress; RR 35/min, SpO2 93% on room air. FiO2 0.28 is instituted; after 30 minutes, ABG reveals PaO2 75 mmHg, PaO2/FiO2 of 268 mmHg, pH 7.32, PaCO2 66 mmHg. Arm 2 of the algorithm is activated with instillation of HHFT Optiflow at 40 L/min for 30 minutes. After 30 minutes on FiO2 0.28, ABG reveals a PaO2/FiO2 of 329 mmHg, pH 7.37, PaCO2 59 mmHg (PaCO2 decrease to 10%). Optiflow is maintained unchanged for another 30 minutes, ABG values unchanged and RR decreased from 35 to 24/min; therapy continued. Conclusions: We believe the Optiflow has a niche in the therapy of ARF. As Non Invasive Ventilation often precedes Invasive Ventilation support, we think that Optiflow may be a first line therapy before instituting Non Invasive Ventilation. Further investigation is needed to validate this algorithm.

Sponsored Research - None

Arm 1: If PaO2/FiO2 >200 mmHg, institue Optiflow 30-40 L/min for 30 min thereafter if PaO2/FiO2 increases by >20%, keep Optiflow unchanged for 30 min then attribute ‘Success/Failure.’ If PaO2/FiO2 increases by >20% on Optiflow, increase Optiflow to 40 L/min thereafter if PaO2/FiO2 increases by >25%, increase Optiflow 50–60 L/min for 30 min then attribute ‘Success/Failure.’

Arm 2: If pH >7.32, institue Optiflow 30–40 L/min for 30 min thereafter if PaO2/FiO2 decreases by >10%, keep Optiflow unchanged for 30 min then attribute ‘Success/Failure’. If after 30 min, PaO2/FiO2 decreases by >5%, consider NIF; if PaO2/FiO2 decreases by >5%, increase Optiflow 50–60 L/min for 30 min then attribute ‘Success/Failure’ (see algorithm).

904141

A CASE STUDY: EFFECTIVE VENTILATION DURING RAPID RESPONSE WITH THE PATIENT IN THE SEATED POSITION.

Marvin B. Hutchins, Daniel Davis; Respiratory Care, UCSD Medical Center, San Diego, CA

Introduction: This case study describes a non-traditional “seated” resuscitation position, with potential advantages including: decreased work of breathing, lower airway pressures, and diminished risk of aspiration. In addition, the importance of anemia as a predictor of rapid desaturation during invasive airway management is illustrated. Finally, the risk of vocal cord edema with aspiration is discussed. Case Summary: A 26-year-old male with acute liver failure secondary to Hodgkin’s lymphoma, was placed in the supine position for an abdominal CT scan. The patient began to passively aspirate gastric contents, leading to severe respiratory distress and hypoxemia, with SpO2 60. The code team was activated, and the first responding RCP placed the patient in the seated position, and began bag-mask ventilation with 100% oxygen. The second RCP moved to the front of the patient and positioned both hands on the mask using the two thumbs up technique. The patient was effectively ventilated in the seated position. The patients’ SpO2 increased to 100%. For airway protection, the physician proceeded with rapid sequence intubation with an 8.0 ETT without success. The patient desaturated rapidly into the low 80’s within 45 seconds of the first attempt. A second attempt at intubation with a 7.0 ETT was successfully performed using a gum-elastic bougie. The failed first attempt was possibly due to stomach contents lodging on the cord edema. It was also noted that the patient had hemoglobin of 5.7, indicating that anemia status predicts oxygen reserve. The patient was transported to the ICU, and placed on mechanical ventilation. Discussion: Patients with decreased level of consciousness may be at increased risk for aspiration, when placed in the supine position. In such cases, airway management in the supine position with mechanical ventilation should be performed in the “seated” position to decrease the risk of aspiration and minimize work of breathing while offloading of the chest and abdomen. In addition, rapid desaturation may occur in the presence of anemia. Finally, patient who have aspirated may require a smaller ETT or require the use of adjuncts, such as the bougie, due to vocal cord edema.

Sponsored Research - None

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ANNUAL AIRWAY WORKSHOPS FOR RESPIRATORY THERAPISTS AND PHYSICIANS PROVIDE A STANDARD APPROACH TO LEARNING NEW PRODUCTS AND DEVICES AND MAY BE A COMPONENT FOR PERFORMANCE IMPROVEMENT IN AIRWAY PLACEMENTS IN A HOSPITAL. John T. Murphy, Robert G. Shellman; Respiratory Therapy, St Francis Hospital, Indianapolis, IN

Background: MD’s and RT’s learn clinical competency with airway placement and emergency airway management. Enhanced techniques for emergencies since place a required airway can be fatal. These clinicians train for airway placement differently yet perform similarly. Hospitals get airway devices and equipment in a standard fashion. Training workshops in adult airway placement (AIP) for airway placement in 2007 by RT in 2 attempts was not optimal. Method: Chief Medical Officer (CMO) and RT leadership held an Airway Workshop (AW) in 2008 and 2009. Training started in 2008 with good results. Training sessions were positive. Results for departmental PI of airway placement in 2 attempts was 88.6% in 2008 and 1549RESPIRATORYCARE • NOVEMBER 2010 VOL 55 NO 11

904182

REDUCTION OF ORAL PRESSURE ULCERS FOLLOWING IMPLEMENTATION OF THE HOLLISTER ANCHORFAST ET TUBE SECURING DEVICE™ AND THE B&B MEDICAL UNIVERAL BITE BLOCK™ Christopher Teegardin, Sunniva Zaratkiewicz, Joel Ray; Respiratory Care, Harborview Medical Center, University of Washington, Seattle, WA; 1Clinical Nurse Education, Harborview Medical Center, University of Washington, Seattle, WA

BACKGROUND: Prevention of hospital acquired pressure ulcers (HAPUs) is an important element of patient care, affecting patient morbidity, treatment cost, and reimbursement issues. The Hollister AnchorFast ET Tube Securing Device™ – in conjunction with the B&B Medical Universal Bite Block™ – was introduced into the medical community, at the Hollister Symposium, in December 2007. By April 2009, they became the standard devices and method used to secure oral ET tubes (94% of adult patients). In April 2009, a subjective survey of critical care nurses and respiratory care practitioners compared the AnchorFast to the previous securing devices used here. Over 90% of those surveyed felt the AnchorFast was more maneuverable and provided better access and assessment of the mouth. We hypothesized the use of the AnchorFast would lead to a decrease of HAPUs on the lips, mouth, gums and tongue of orally intubated critical care patients. METHODO: The HAPU Daily Incidence Tracking System and Algorithm used at our institution monitors daily pressure ulcer incidence, providing an improved method of early pressure ulcer identification, tracking, and prevention. Using data collected from this system and a retrospective electronic medical record chart review, the number of pressure ulcers on the lips, mouth, gums, and tongue of orally intubated patients was compared. The results were compared to those before the implementation of the AnchorFast. RESULTS: In the Pre-A group, 3039 patients were intubated on mechanical ventilation with an undetermined majority supported via an oral ET tube. 21 HAPUs on the lips or in the oral cavity of orally intubated patients was reported. In the Post-A group, 3078 patients were intubated on mechanical ventilation with an undetermined majority supported via an oral ET tube. 2 HAPUs on the lips or in the oral cavity of orally intubated patients was reported during this second interval. CONCLUSION: The reported incidence of HAPUs on the lips and in the oral cavity of orally intubated patients decreased following the introduction of the AnchorFast and Universal Bite Block in our institution.

Sponsored Research - None

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TRACHEAL TRAUMA FROM AN AIRWAY EXCHANGE CATHETER.
Mark Grzegorziak, Steve Leven, Steve Reiland; Respiratory Care, Long Beach Memorial, Long Beach, CA

Introduction Airway exchange catheters (AEC) are flexible, hollow stylets that are frequently used as a guide when replacing artificial airways. AEC's are reported to have "very little risk" and "great" benefits to the patient. We report a case where the use of an AEC produced airway trauma and a nearly catastrophic outcome. Case Summary A 37-year-old female with a history of limb-girdle muscular dystrophy was admitted with complaints of weakness, congestion and insomnia. She was able to speak in 3-4 word sentences. Her vital signs were HR 122 RR 25 BP 157/99. Admitting ABG showed pH 7.36 PCO2 87 PO2 30 HC03 49 BE 17. Initial treatment included non-invasive ventilation and supplemental O2. The patient was very resistant to this verbalizing repeatedly that she could not tolerate it despite changes in settings and interface type. The patient later agreed to intubation. Her admitting diagnosis was pneumonia and respiratory failure. Her pneumonia resolved but she was unable to be weaned from the ventilator. After 10 days her endotracheal tube developed a leak. Using an AEC, an anesthesiologist exchanged the 7.0 tube for another tube of the same size. Immediately after the new tube was placed, "massive" hemoptysis was observed. Oxygen saturations and heart rate fell to 60% and 30 respectively. The patient was successfully resuscitated. Emergent fiberoptic bronchoscopy failed to identify any tumor or gross lesions. Days later, the decision was made for the patient to undergo bedside percutaneous tracheotomy. As the intensivist was inserting his bronchoscope, he observed an 8 cm tear along the long axis of the posterior tracheal wall. The procedure was stopped and further medical consultation was obtained. Seven days later the tracheostomy was completed without incident and the patient was transferred to a skilled nursing facility. Discussion Available literature shows that AEC is a widely-used device with a low incidence of sequelae. One source opined that AEC-associated trauma is under-reported. Factors which contribute to trauma are insertion technique and technique. The simplest way the AEC keeps the tube compressed while in the airway but this predisposes the patient to injury of worse if inserted without regard to the potential for trauma. A "soft tip" version of AEC is now available for use on all our difficult airway carts. A safe insertion depth for the AEC is determined prior to it being inserted into the patient.
Sponsored Research - None
912725

PERFORMANCE OF THE VEST® AIRWAY CLEARANCE SYSTEM WITH TWO SUBJECTS SIMULTANEOUSLY: A PILOT STUDY.
Dabney M. Eidson1, Andrew J. Mazzoli1, Patricia Hall1; 1Respiratory Therapy, Medical College of Georgia, Augusta, GA; 2Respiratory Therapy, McNair and Eliza Chilcoat’s Medical Center, Augusta, GA

BACKGROUND: The high-frequency chest wall oscillator (HFCWO) is used to perform airway clearance therapy in patients with cystic fibrosis (CF). Since siblings may be affected by CF and payor reimbursement may be more favorable, the use of the HFCWO for per hospital patients have connected to this device in series for simultaneous therapy to save time. We tested the ability of The Vest® Airway Clearance System HFCWO (Hill-Rom, St. Paul, Minnesota) to deliver pressure to two subjects simultaneously as effectively as to one subject. Methods: TheVendor suggests the use of “The Vest®” HFCWO with two subjects simultaneously at the same time, but there is limited data available to support it. In this study, we aimed to determine whether the system can deliver sufficient pressure to two subjects simultaneously. Patients were tested in supine position and then in prone position. Results: The mean difference in peak pressure was not statistically significant between the two positions. Conclusion: The Vest® HFCWO can deliver sufficient pressure to two subjects simultaneously. This finding suggests that the device can be used to deliver airway clearance therapy to two patients at the same time, which may be beneficial in clinical settings.
Sponsored Research - None
912046

TRACHEOSTOMY DAYS POST LIBERATION FROM PROLONGED MECHANICAL VENTILATION: A RETROSPECTIVE REVIEW.
Thaytie Cappiello, Lindsey Kreisher, Janice Thalman; Duke University Hospital, Durham, NC

Background: An increased risk of pneumonia, swallow dysfunction, speech difficulties, and post hospital placement difficulties are associated with the prolonged mechanical ventilation patient that require tracheostomy. Monitoring care practice for this group of patients is not standardized. Recent studies that have addressed tracheostomy care teams have reported on total cannulation days, total mechanical ventilation days, or cannulation days post ICU discharge. A tracheostomy care team has recently been created at our institution and protocols are being designed with a focus on weaning to decannulation. To develop appropriate outcome measures for this team, we retrospectively reviewed the current practice of tracheostomy patients at our institution. We were particularly interested in tracheostomy days post ventilator liberation to decannulation (TDVP). Method: A retrospective electronic review of adult patients who were mechanically ventilated, required a tracheostomy, and were successfully decannulated was performed for 15 consecutive months (January 2009-Mar 2010). As our focus was on prolonged mechanically ventilated patients for medical reasons, patients on the cardiothoracic and otolaryngology services were excluded. Data obtained included: date of mechanical ventilation initiation, tracheostomy date, date of liberation from mechanical ventilation, and date of decannulation. Mean values were calculated for mechanical ventilation days to tracheostomy (MVTT), mechanical ventilation days post tracheostomy (MVPT), mechanical ventilation days (MVD), and tracheostomy days post ventilator (TDVP). Results: 58 patients were studied. Demographic data revealed: 35 male, 23 female, with a mean age +/- SD of 45 +/- 16 years. Days later the tracheostomy was completed without incident and the patient was transferred to a skilled nursing facility. As the intensivist was inserting his bronchoscope, he observed an 8 cm tear along the long axis of the posterior tracheal wall. The procedure was stopped and further medical consultation was obtained. Seven days later the tracheostomy was completed without incident and the patient was transferred to a skilled nursing facility. Days later, the decision was made for the patient to undergo bedside percutaneous tracheotomy. As the intensivist was inserting his bronchoscope, he observed an 8 cm tear along the long axis of the posterior tracheal wall. The procedure was stopped and further medical consultation was obtained. Seven days later the tracheostomy was completed without incident and the patient was transferred to a skilled nursing facility. As the intensivist was inserting his bronchoscope, he observed an 8 cm tear along the long axis of the posterior tracheal wall. The procedure was stopped and further medical consultation was obtained. Seven days later the tracheostomy was completed without incident and the patient was transferred to a skilled nursing facility. Days later, the decision was made for the patient to undergo bedside percutaneous tracheotomy. As the intensivist was inserting his bronchoscope, he observed an 8 cm tear along the long axis of the posterior tracheal wall. The procedure was stopped and further medical consultation was obtained. Seven days later the tracheostomy was completed without incident and the patient was transferred to a skilled nursing facility. As the intensivist was inserting his bronchoscope, he observed an 8 cm tear along the long axis of the posterior tracheal wall. The procedure was stopped and further medical consultation was obtained. Seven days later the tracheostomy was completed without incident and the patient was transferred to a skilled nursing facility.
Sponsored Research - None
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NON-BRONCHOSCOPIC BRONCHIAL ALVEOLAR LAVAGE – A SAFE AND USEFUL PROCEDURE AS A DIAGNOSTIC AND PREVENTATIVE TOOL AGAINST VENTILATOR-ASSOCIATED PNEUMONIA.
Cherian K. Pally, Richard Wunderink, Sherri Ahlf, Robert Gould, Craig Leonard, Nicole Willis; Respiratory Care, Northwestern Memorial Hospital, Chicago, IL

BACKGROUND Accurate diagnosis of Ventilator-associated Pneumonia (VAP) is critical for optimal treatment. Endotracheal aspirates (ETA) often give false positive VAP diagnoses. Bronchoalveolar Lavage (BAL) is a more accurate diagnostic tool. Fiberoptic bronchoscopy is the most accurate technique for BAL but is expensive and requires a physician-led team. Non-bronchosopic (NB)-BAL offers an alternative approach. METHODS: Previous practice at NMH for obtaining lower respiratory tract specimens was either bronchoscopy or ETA. NB-BAL has been increasingly used since its introduction in June 2005. Respiratory Care Practitioners (RCP) were trained to perform NB-BAL using the BAL-Can (Ballard Medical Products). Training was a three-step process from understanding the procedure to performing without assistance and minimum complications. The number of RCPs-trained increased until NB-BAL was routinely available at any time. As part of the training process, a robust evaluation of the VAP complications of NB-BAL was performed: hypoxemia, arrhythmias, hypotension, bronchial hemorrhage, coughing, and pneumonia. RESULTS: Between 12/2008 and 07/2009, 495 NB-BALs were performed, an almost 100% increase from previously. Despite the large increase in procedures and of different RCPs performing NB-BAL, the major complication rate remained <5% (Figure). Minor complications averaged 10-15%, with most transient. CONCLUSIONS: Routine training of RCPs to perform NB-BAL increased availability and doubled the procedures performed. Rigorous training and tracking of complications allowed this increase in utilization and number of RCPs performing the procedure to occur without increased complications. Because of the safety and availability of NB-BAL, respiratory tract sampling by ETA is no longer offered at NMH.
Sponsored Research - None
919773
BENCH STUDY OF THE SONARMADE AIRWAY MONITORING SYSTEM'S ABILITY TO DETECT ARTIFICIAL AIRWAY DISPLACEMENT.

John S. Emberger; Christiana Care Health System, Newark, DE

Background: In order to provide care for ventilator patients the RCP must assure the artificial airway is secure and placed properly. The loss of the artificial airway can lead to multiple complications including death. Today clinicians rely on visual inspection and chest radiography to clinical placement but both of these methods have limitations. The SonarMed Airway Monitoring System (AMS) is a handheld airway monitoring device that uses an audio waveform echo algorithm (also know as acoustic reflectometry) to provide continuous monitoring of endotracheal tube (ETT) displacement. In this bench study we assessed the AMS ability to detect ET displacement using simulated human airway. Methods: The SonarMed Airway Monitoring System (SonarMed Inc, Indianapolis IN) was calibrated and connected to 3 different ETs (8.0, 7.0, and 6.5) using the proper airway adapter. Each ETT was marked in 0.5cm increments. The ETs were placed inside a polyvinyl chloride simulated airway and marked with a baseline insertion point. The ETT was then advanced into the simulated airway in 0.5cm increments up to 3.0cm total. After advancing the ETT 3cm, the ET was removed from the simulated airway and then replaced to the baseline insertion point. The measurement displayed on the AMS monitor at each movement point was documented as well the measurement after removing and replacing the ETT. The AMS was recalibrated after each trial. Result: The SonarMed Airway Monitoring System was able to detect the migration of the 8.0 ETT within 0.17cm at each point. It detected the 7.0 ETT migrations within 0.3cm at each point. The migration detection of the 6.5 ETT was within 0.4cm at each movement point. The Airway Monitoring System detected baseline replacement of the ETT in the airway within 0.13cm. See table for more information. Conclusion: The AMS was able to accurately detect move- ment of the ETT in the simulated airway. The distance displayed on the monitor was within 0.4cm of the actual movement in all 3 ETT observed in this study. The monitor accurately alarmed in all 9 trials when the airway was withdrawn from the simulated airway. The SonarMed AMS is a promising device that could assist RCPs in the daily management ventilator dependant patients. Sponsered Research - None

CLINICAL OUTCOMES IN PATIENTS TREATED WITH THE VEST® VERSUS CONVENTIONAL CHEST PHYSICAL THERAPY-UPDATED.

Kathleen B. Spilman, Peggy Watts, Darnetta Clinkscale, Marin Kolleff. John Dallas: Respiratory Care, Barnes-Jewish Hospital, St. Louis, MO

BACKGROUND: Conventional chest physical therapy (CPT) has become the standard to which all other bronchial hygiene techniques are compared. The conventional or dynamic (C&P) and static (PPV and CPAP) conditions were compared to static and dynamic conditions. This study evaluated patient satisfaction response between patients treated with The Vest® Airway Clearance System (the Vest®) vs. CPT. METHODS: Hospitalized patients with a CPT order were randomized to be treated with the Vest® or CPT. The Vest® technology, which facilitates removal of secretions from the lungs utilizing an air pulse generator and an inflatable vest to create a high frequency chest wall oscillation (HFCWO). The primary outcome measure was the number of hospital free days. Hospital free days are defined as the number of days free from hospitalization during the study enrollment period [30 days]. A patient satisfaction rating, as measured by using a comfort scale, was a secondary outcome measure. RESULTS: Patients ordered by a physician to received CPT and met the Barnes-Jewish Hospital Chest Physical Therapy protocol criteria were approached to participate in the study. Two hundred and thirty-seven patients have completed the study. The Vest® group (n = 113) and the CPT group (n = 124) had no significant difference in their baseline characteristics at the time of entry into the study. No significant differences existed in the number of hospital free days between the Vest® and CPT group. The Vest® group 17.1 ± 8.8 days and the CPT group 17.6 ± 8.9 days, respectively; p = 0.664. Lobar atelectasis in Vest® patients 78% (60.9%) versus in CPT patients 84% (67.7%) p = 0.832. Lobar atelectasis resolved in Vest® patients 42 (37.2%) versus 36 (21.7%) in CPT patients. Significant differences existed in patient satisfaction ratings (2.0 ± 0.7 vs. 2.2 ± 0.8, respectively; p = 0.028). The patient satisfaction or comfort associated with the Vest® was statistically lower (meaning more comfortable) for the Vest® versus CPT. Staff were surveyed following a two year study with a response rate of 96%. Of those surveyed 98% would likely to extremely likely recommend the Vest® for patient therapy and 85% would personally choose the Vest® if in need of CPT themselves. CONCLUSION: The results of clinical outcomes studies show no statistical differences between the Vest® and CPT group. The Vest® does show a statistical difference in patient satisfaction measured with a patient comfort score. DISCLOSURES: This study was supported by Hill-Rom. Sponsered Research - Hill-Rom

EVALUATION OF ENDOTRACHEAL TUBE CUFF SEAL IN A BENCH MODEL USING MINIMAL OCCULDING VOLUME UNDER STATIC AND DYNAMIC CONDITIONS.

Steve Budy, Chris Bigham, Jody Lerner; Respiratory Care, Boise State University, Boise, ID

BACKGROUND: Guidelines for the prevention of VAP recommend that ETT cuffs be maintained at the minimal occluding volume (MOV). Our literature review found that most in-vitro studies evaluated cuff seal during static conditions and none used MOV as the technique to seal the trachea. In this study we inflated ETT cuffs to MOV and assessed fluid leakage during static (no positive pres- sure) and dynamic (PPV and CPAP) conditions. Method: To compare the SonarMed Airway Monitoring System (AMS) with Raw measurements typically used to identify partial ETT obstructions. METH- ODS: We performed a bench study using a ventilator (Drager Evita 4, Lubeck Germany), ET and training test lung model for all readings. We created partial ET obstructions with 1 minute epoxy. ETs (size 7.0 and 8.0) had partial obstructions created in 3 different positions. Obstruction positions: near to the top of the ETT (Proximal), near the middle of the ETT (Middle) and near the far end of the ETT (Distal). We calculated the airway resistance (Raw) by performing a plateau pressure using a peak inspiratory flow of 50 LPM while ventilating with a tidal volume of 500 ml. We also collected the Raw displayed on the AMS monitor at each movement point. A new airway monitoring system (SonarMed Inc, Indianapolis IN) was calibrated to hold four simulated tracheas (clear vinyl tubes, 1-L > 25 cm, ID > 2.5 cm). Dynamic conditions: three High Volume-Low Pressure (HVL) barrel-shaped cuffs (Rusch, Mallinckrodt Hi-Lo, and Hi-Lo Evac) and one tapered cuff (Mallinckrodt TaperGuard Evac). ETs were connected to a manifold that allowed delivery of either no pressure below the cuff, PPV below the cuff (PIP 30 cmH2O, PEEP 5 mmHg) or HVL below the cuff (5 cmH2O). The cuffs were inflated to MOV and ten ml of an artificial saliva product was poured above each cuff. Continuous suction at 20 cmH2O was applied to the two Evac tubes. These tests were conducted: cuff pressure 25 cmH2O ± no positive pressure below the cuff; CPT + no PPV; MOV + PPV; MOV + CPAP. Each testing period was five minutes and all tests were repeated three times (on different days). The amount of fluid that bypassed each cuff was measured using a 10 ml graduated cylinder. RESULTS: Inflating cuffs to 25 cmH2O resulted in unsatisfactory cuff seal. When using MOV any leakage occurred via longitudinal folds in the barrel-shaped cuffs. During PPV we visualized air leaking from below the barrel-shaped cuffs (via folds) which caused bubbling but no fluid escaped below any cuffs. Subglottic suction was effec- tive in removing most fluid from above the cuff but cuff of the Hi-Low Evac still allowed some leak- age. CONCLUSION: In this bench study, MOV - PPV resulted in no cuff leakage into the arti- ficial trachea regardless of cuff type because of positive pressure below the cuff. The tapered cuff, as designed, developed no cuff leaks and was effective in preventing leaks when MOV was used. HVL cuffs develop longitudinal folds that may allow micro-leakage of fluid from above the cuff into the trachea, especially when there is no positive pressure below the cuff. We found that the number of longitudinal folds increased significantly when the tube was moved up and down (even slight- ly) in the simulated tracheas; future studies should consider the effect of ETT movement. Sponsered Research - None

Range of Fluid Leakage Past Endotracheal Tube in 5 Minutes

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<th>Tube</th>
<th>Cuff 25 + No PPV</th>
<th>MOV + No PPV</th>
<th>MOV + PIP 30 PEES</th>
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PATIENT SAFETY INITIATIVE: USING STANDARDIZED TRACH SUPPLY KITS AT THE BEDSIDE.
Amelia A. Lowell, Laura I. Chacon, Julie A. Colquist, Pamela J. Dorrell, Mary Jane Johnson, Lauren Kominowski, Kathleen Poquette, Tamara Zazula, Peyton Butcher; Mayo Clinic, Phoenix, AZ

Background: Patient safety can be impacted by a lack of equipment necessary to handle a dislodged/displaced trach. A lack of knowledge by the RT of required bedside tracheostomy supplies coupled with inconsistent bedside stocking of such supplies may result in decreased patient safety, inefficient use of the therapists’ time, and increased cost to the hospital. Standard practice of the RT gathering supplies for the room varied with individual understanding of what should be present at the bedside. Constructing a standardized trach kit to be placed at the bedside was proposed as a solution to the problem. The sealed kits contain two sizes of ET tubes, suction catheters #4,6,8 cuffed Shiley trachs, 10 ml syringe, lubrication and a trach tie. Total cost for the supplies in the kit was $134.00. Additionally, a manual resuscitator bag and O2 coupler are supplied with the kit. Upon patient discharge the kits are restocked and re-sealed per infection control policy. It was predicted that 100% compliance with kits at the bedside could be achieved in three months from the start date. The predicted results of the project: an increase in patient safety, a decrease in cost for lost “spare trachs” and more efficient use of time by the therapist. Methods: The Plan, Do, Study, Act performance improvement process was used. Hospital wide education was provided to RT’s and RN’s prior to implementation of the supply kits. Kits were placed in a central location in the RT supply room. Pre-implementation data was collected over a one month period. Trach patient rooms were audited once a week using a checklist of supplies consistent with hospital policy. After the initial audits, a three week pilot using a trach supply kit was completed. All trach patient rooms were audited for compliance with the new kit. Results: 14 patients were audited pre-trial: 78% had a trach, 94% had suction catheters, 37% had a 10 ml syringe, and 64% had a spare trach. Post trial 100% of patients had a trach bag and manual resuscitator bag. Results from the pre-trial measured $76/20 could be saved in “spare trachs” based on the average number of trach patients per year, allotting one spare trach per patient. Positive feedback was noted from RT’s, RN’s and MD’s. Conclusion: Constructing a standardized trach supply kit is an improvement for patient safety, as well as, a time and cost effective solution for providing consistent supplies at the bedside.

Sponsored Research - None

THE EFFECTS OF NON-INVASIVE POSITIVE PRESSURE THERAPY (CPAP OR BIPAP) INTERFACES ON SKIN INTEGRITY.
Anne Schaer, Mike Trevino, David Mussetter, Gary Weinstein; Cardiopulmonary, Texas Health Presbyterian Hospital Dallas, Dallas, TX

Background: We are a 903 bed acute care teaching facility serving a major metropolitan area. Our Respiratory Therapy Department strives to meet quality, cost and service goals through continuous quality improvement processes. A new project has arisen out of an internal study regarding skin integrity. A literature search revealed little information on skin breakdown associated with BIPAP or CPAP masks. The only information found was skin staging related to pressure ulcers (i.e. decubitus ulcers). Our goal was to quantify any problems our hospital might be having with these issues and to attempt to find a solution. Method: One therapist did random patient checks to assess skin integrity of patients receiving non-invasive positive pressure (CPAP or BIPAP) therapy; this included continuous and nocturnal use. 315 adult patients receiving non-invasive positive pressure therapy over a 3 month period were assessed. Information gathered included age, sex, length of time on device, and the delivery device (type mask). The Braden Scale was used to stage skin integrity. Results: Of the 315 patients, only 9 (2.8%) had stage 1 breakdown (slight redness, nonblanchable redness), leaving the other 306 (97.14%) patients with no issues identified. The 9 noted with stage 1 breakdown were all on for greater than 8 days continuously, and all between the ages of 25-65. Of the 9, 3 were hemodynamically unstable with unfavorable outcomes and poor nutritional status. Conclusion: While our data showed a relatively low rate of skin integrity problems, our goal is to have no instances of this nature. As a department we implemented a BIPAP/CPAP reevaluation, meaning any patient receiving either or continuous therapy will be assessed (every morning for nocturnal and every 4 hours for continuous) for skin integrity, as well as mask or machine related issues. Monitoring found opportunities for nursing and respiratory therapy education related to proper fitting of the delivery interface.

Sponsored Research - None

EFFECTS OF MUCUS CLEARANCE ON THE DIFFERENCES OF RHEOLOGICAL PROPERTY AND DRIVING PRESSURE DURING HIGH FREQUENCY CHEST WALL OSCILLATION (SMARTVEST TM).
Ryuji Miyagawa1, Yukinobu Takeda2, Tomoshi Ichiha1, Yuasa Kagusa1, Man Nomoto2, Aiko Taguchi2; 1Division of Respiratory Care, Graduate School of Nursing and Rehabilitation Sciences, Showa University, Yokohama, Japan; 2Department of Physical Therapy, Kanagawa University Clinic, Yokohama, Japan

Background: High frequency chest wall oscillation (HFCWO) is commonly used for airway clearance. The volume of mucus moved has been thought to be greatest at frequencies between 10Hz and 20Hz, especially 13Hz. However it is not clear that effects of mucus clearance on the rheological properties and driving pressure. The purpose of this study is to clarify differences of airway clearance efficacy depend on mucus property and driving pressure. Method: Twenty-four normal subjects participated in the study; Mucus stimulant (MS) were prepared using thicker 1, 2, 3 and 4% (Toromil Perfect TM, Kishin Ollio Company) and the pressure controls of SmartVest TM (Gebauer Inc.) were divided into three groups. Results: We quiet breathed into the endotracheal tubes having internal diameter of 7mm during SmartVestTM, We measured peak expiratory flow rate (PEFR), peak expiratory pressure (PEmax) and effortless breathing using modified Bore scale on each driving pressure, also measured clearance velocity of each MS. Data analysis was performed using SPSS Statistics 20.0. For the comparison between viscosity of MS and clearance velocity of MS and clearance velocity (6.813Hz; r=-0.49 ~-0.73, p<0.0001), the lower viscoelasticity of MS had, the faster clearance velocity improved in the lower viscoelasticity of MS (1% and 2%). However, the clearance velocity did not increase in the higher viscoelasticity of MS (3% and 4%) in spite of higher driving pressures. The subjects were troubled on each driving pressure, nothing in effort breathing using modified Bore scale very weak to weak. Conclusions: The lower viscoelasticity of MS had, the faster clearance velocity improved in the lower viscoelasticity of MS (1% and 2%). However, the clearance velocity did not increase in the higher viscoelasticity of MS (3% and 4%) in spite of higher driving pressures.

Sponsored Research - None

EVALUATION OF ENDOTRACHEAL TUBE CUFF LEAKAGE IN A HUMAN CADAVER MODEL.
Tim Op't Holt, Zachary Tros; Cardiorespiratory Care, Univ of South Alabama, Mobile, AL

Background: Aspiration of oral secretions is documented as a cause of ventilator associated pneumonia (VAP). A variety of cuff shapes and styles have been introduced to decrease leakage of oral secretions beyond the cuff. This study compares cuff leakage using the Microcuff endotracheal tube with other brands, using a cadaver instead of a PVC tracheal model, previously evaluated. We hypothesized that the leakage beyond the cuff of the Microcuff endotracheal tube would be less than that of other endotracheal tubes. Methods: Kimberly-Clark polyurethane Microcuff, Mallinckrodt Hilo, Mallinckrodt LoPro, and Sheridan CF Tracheal endotracheal tubes were inserted into a vertebroplasty patient instead of a PVC tracheal model. We hypothesized the polyurethane material in the Microcuff and HiLo allowed very little leakage while the LoPro and CF tubes had significantly more leakage. The Polyurethane material in the Microcuff may be a factor in decreasing leakage. Results: Both the Microcuff and HiLo cuffed tubes had significantly reduced leakage when compared to the LoPro and CF tracheal tubes. Conclusions: Both the Microcuff and Hilo cuffs had negligible leakage at cuff pressure ranges lower than the recommended range of 20-30 cmH2O. These cuffs are more consistent in helping to prevent aspiration of oral secretions, which supports our hypothesis. The polyurethane material in the Microcuff may be a factor in eliminating microchannel formation. Prevention of aspiration is a major factor in preventing VAP.

Sponsored Research - Endotracheal tubes were provided by Kimberly Clark and local hospitals.

Tuesday, December 7; 3:00 pm to 4:55 pm (Room N240/N242)
**EVALUATION OF 3 TYPES OF ENDOTRACHEAL TUBES WITH SUBGLOTTIC SUCTION CAPABILITIES.**

John Davies, Mike Becker, Stephanie Keeting, Neil R. MacIntyre; Duke University, Durham, NC

Background: Ventilator associated pneumonia (VAP) is a major health concern for patients and cost for hospitals. For this reason, many institutions have adopted the bundle method to help prevent VAP. One key component is elevating the head 30 – 45 degrees. Despite this intervention secretions may still accumulate above endotracheal tube (ETT) cuffs. These secretions can become troublesome when they slip around the cuff and into the lower respiratory tract. A new ETT design used by several manufacturers incorporates a suction lumen within the cuff below the cuff but above the cuff. Hypothesis: This bundle was designed to evaluate and compare the suction effectiveness of the commercially available ETTS that have the subglottic suction capability. Methods: Sizes 7.0 mm, 7.5 mm, and 8.0 mm each of the ISIS® (Teleflex Medical, Research Triangle Park, NC), Hi-Lo Evac (Mallinckrodt Medical, St. Louis, MO) and Portex SACETT® (Smiths Medical ASD Inc, Weston MA) ETTS were evaluated. Five of each brand of ETT were tested. The ETTS were inserted into a glass tube mounting rack held at a 30 degree angle and conditioned at 37 degrees C by passing heated air through a Neumphime humidifier (Teleflex Medical, Research Triangle Park, NC). Three liquids of differing viscosities were used for comparison – water (viscosity ~ 1.02 cP), vegetable oil (canola/soybean blend, viscosity ~ 39.12 cP) and 10W30 motor oil (viscosity ~ 64.71 cP). 10 ml, inserted above the ETT cuff, was used for each test run. Continuous suction of 24 hours was applied to the suction port on the ETT and timing began with a stopwatch. Timing stopped when an audible “gurgle” sound was heard (indicating that the fluid was completely removed). Results: The suction time to “gurgle” with water was the same for all ETTS. Means, standard deviations and significance are displayed in the table below. Conclusion: There are differences in rate of clearance of liquids with different viscosities.赞助研究 - 该研究由不受教育限制的私人组织资助（美国国家卫生研究院）从Teleflex Medical。然而，该研究工作独立于任何Teleflex员工，并且是在Duke Medical Center进行的。

* ISIS vs. Hi-Lo Evac statistically significant for like size ETT’s per liquid
* ISIS vs. SACETT statistically significant for like size ETT’s per liquid
* Hi-Lo Evac vs. SACETT statistically significant for like size ETT’s per liquid

**DECREASING TRACHEOSTOMY INNER CANNULA CHANGE FREQUENCY FOR PATIENTS RECEIVING MECHANICAL VENTILATION**

Jeremy Bainbridge, RRT, Faith Carrier, RRT – Respiratory Care, Spectrum Health, Grand Rapids, MI

Introduction: Current literature suggests that interrupting the patient ventilator interface increases the risk of introducing bacteria to the patient’s ventilator circuit increasing infection and ventilator days. Does reducing the inner cannula change frequency affect mechanical ventilator days? Methods: We have standardized our ICU patients to shiley trachs with removable inner cannulas. Standard practice was for either the nurse or nurse technicians to change the inner cannula twice per day with routine trach care. Using a single variable design we altered this practice on mechanically ventilated patients to changing the inner cannula once per week and prn for occlusion. We followed the trends for one year and compared this to the previous year looking at ventilator LOS and VAP rate amongst tracheostomy patients. Results: In 2008 we had 444 mechanically ventilated patients with a tracheostomy and compared ventilator length of stay and the number of VAPs for the patients that were placed on a 12 hour tube change regimen. There were no complications with this practice change during the observed time period. Conclusion: Decreasing circuit interruptions has been shown to benefit the patient with decreased alveolar derecruitment and decrease in introduction of pathogens into the circuit. This was being accomplished with intubated patients but hospital practice changed once a patient was trached. By altering the standard of care we were able to decrease LOS on the ventilator and help prevent VAP without any other practice changes during the observed time period. The resulted in a mean cost savings of $302.15 per patient. There was also an incalculable cost saving in employee times.

**A PROSPECTIVE STUDY ON ENDOTRACHEAL TUBE REPOSITIONING FREQUENCY AND LIP BREAKDOWN IN ADULT ICU PATIENTS.**

Thomas Malinowski, Rebecca N. McLaughlin, Mary Jane Bowles; Critical Care Nursing, Mary Washington Hospital, Fredericksburg, VA; Critical Care Nursing, Mary Washington Hospital, Fredericksburg, VA

Background: Endotracheal tube (ETT) stabilization is a priority practice in intensive care units. It is equally important to prevent iatrogenic sores to the mouth and lips when securing the ETT. There is no research which would substantiate a timeframe to reposition a tube. We compared three interval frequencies (12, 24, 36 hrs.) of ETT repositioning as a method to determine injury avoidance, and observed differences in skin breakdown in intubated adult patients using a single, commonly available commercial tube holder. Methods: After receiving IRB approval, 449 adult mechanically ventilated and intubated patients admitted to the SICU/MICU were prospectively enrolled in the study between July 2009 and April 2010. All ETT were secured using the ETAD Hollister Oral Endotracheal Tube Attachment Device upon arrival, or upon intubation in the ICU. The ET tube was repositioned during the initial ventilator check and corresponded with the required study interval. The respiratory therapist and nurse worked collaboratively to evaluate skin integrity and recorded observations on a data collection sheet. The baseline saw 128 consecutive patients on a 12 hour tube repositioning regimen (July – September 2009). The first phase (3 months, October–December 2009) placed 145 consecutive patients on a 12 hour tube repositioning regimen. The second phase (January – March 2010) saw 132 consecutive patients placed on a 24 hour repositioning regimen. The third phase was originally slated for April – June 2010, with 120+ projected patients, but only 44 consecutive patients placed on a 36 hour regimen. The primary outcome was the incidence of oral ulcerations or skin breakdown at the site of the tube. Results: The baseline incidence of ulceration (events/patient) was 3.9%. A 5% incidence was considered a clinically significant threshold. Phase one showed 2.8% incidence of ulcerations; Phase two a 4.5% incidence, Phase three a 15.9% incidence. The study was terminated early in the third phase because the incidence of events exceeded our threshold. Statistical analysis via Pearson’s Correlation Coefficient showed no prolonged repositioning times (r = .941). Conclusions: Our results indicate that ETT should be re-positioned at least every 24 hours to avoid a 5% incidence of skin ulceration. Further studies should evaluate if more frequent repositioning results in a lower incidence of ulceration.

Sponsored Research - None
IN-HOUSE TRAINING & COMPETENCY PROGRAMS: MEETING EDUCATIONAL DEMANDS AND SAVING COSTS TOGETHER.

Matthew S. Pavlichko; Respiratory Care Services, The Reading Hospital and Medical Center, West Reading, PA

Background: Education and competencies of respiratory care practitioners is a fact of life in all health care institutions. Continued education is a requirement by many states for licensure and is a human resource standard set by the Joint Commission. In many respiratory care departments, this is not a priority due to lack of educational staff and high un-reimbursable costs. Since respiratory managers need competent staff and need to maintain regulatory compliance, the burden of education falls on them. Can a manager educate staff efficiently and fit it within their budget? Method: In Pennsylvania, it is required for a licensed RCP to obtain 20 approved continuing education credits over a two-year cycle. A department containing 67 respiratory therapists has 1340 credits to obtain to maintain licensure. The Pennsylvania Society for Respiratory Care was quoted that each traditional continuing education credit costs $10 dollars on average (Tom Lamphere, 2009). Thus, $340,000 can be estimated in total cost of continuing education. TRHMC's Respiratory Care Services department created a committee to develop in-house continuing education with 10 credits available to all inpatient therapists (five extra credits for NICU RTs) on various topics at the discretion of the committee. Results: The total cost of in-house education credits was $344 in 2009. The 2010 program will be estimated to cost $350 based on the consumer price index of 3.14% (Bureau of Labor and Statistics). With a total cost of $694 for the 2009/2010 licensure cycle, the hospital will have a potential cost savings on continuing education of $12,706. These results do not take into account the assumption that the amount of money paid out for time off and overtime to attend traditional seminars is equal to that of the in-house program. Standard HR.01.05.03 (Staff participate in ongoing education and training) and HR.01.06.01 (Staff are competent to perform their job) apply to all employees. Ten credits were available to all inpatient therapists and five more credits were available to NICU RTs. Results: Ten credits were available to the in-house education program and the median cost paid by the institute was $34 for all credits. The average time taken for the credits was 8 months.

Conclusions: This study demonstrated that an in-house education/continuing education program can potentially reduce costs drastically in a respiratory care department. It can also meet all the regulatory demands of continuing education and competency placed on respiratory care managers. Sponsored Research - None

UTILIZATION OF ELECTRONIC DOCUMENTATION TO ASSESS PATIENT OUTCOMES.

Kenneth Miller, Diane Horoski, Robert Leslko, Michael Weiss, Angela Lutz; Respiratory Care, LVHN, Allentown, PA

Introduction: Health information technology is being increasingly used in the intensive care unit population to improve patient outcomes and monitor staff performance. Methods: We implemented an intensive care unit electronic medical record (EMR) containing all medical information for adult patients. The EMR could serve both as a bedside medical record and database. Data was self-populated electronically from the mechanical ventilators and manually entered by the bedside respiratory therapist. A Clinical Information System Specialist (CISS) supervised the implementation and data entry. Clinical Information System System Specialist was a respiratory therapist with extensive clinical background. Data could be queried in real time and on an ongoing basis. Results: Patients were enrolled over an 18-month period, from January 1st, 2008 to June 30th, 2009. There were a total of 4569 episodes in which a patient required mechanical ventilation. Of the 4569 episodes, 4020 (88.0%) had respiratory therapist entered outcomes data whereas no outcome data was entered for the remaining 549 (12.0%) episodes. Of the 4020 mechanical ventilation episodes with outcomes data, 39% episodes (82.0%) were extubated successfully without a need for reintubation. The mechanical ventilator was withdrawn as part of the palliative care process in 392 episodes (8.9%). One-hundred twenty-nine mechanical ventilation episodes (3.2%) resulted in death while the patient was receiving mechanical ventilation. Eighty-eight patients (2.2%) were transferred to long-term care facilities while being ventilated and twelve patients (0.3%) were sent home on a ventilator. There were 102 self-extubations episodes (2.5%) of which eighteen (17.0%) required reintubation. Of the 4020 episodes of mechanical ventilation, 162 (4.0%) required re-intubation within 24 hours and 146 (3.6%) required re-intubation after 24 hours. Conclusion: We implemented an ICU EMR that allows data to be both electronically and manually entered from our respiratory therapy providers. The ICU EMR serving both as a bedside medical record and database will allow us to easily monitor our mechanical ventilation outcomes on an ongoing basis and monitor staff’s clinical documentation. Sponsored Research - None

MERGING INFORMATICS AND RESPIRATORY TO IMPROVE RESEARCH AND PATIENT CARE OUTCOMES

Kenneth Miller, Diane Horoski, Robert Leslko, Angela Lutz; Respiratory Care, LVHN, Allentown, PA

Introduction: Over the past several years, Respiratory Care departments have made unique changes in the methods of delivering care to their patients. Several years ago, our Institution had a major change involving its electronic medical documentation system. This change impacted the Respiratory Care department with the new system collects data from medical devices, including mechanical ventilators. Once our department realized the need for an Application Analyst (AA) and a Clinical Information System Specialist (CISS), our goal was to have a dedicated departmental individual (the AA) who had the ability to transform the information from the documentation database into usable reports. The CISS would assist with the parameters that have the greatest impact in our clinical practice and optimizes patient outcomes. Body: The AA was initially a part time position but because of the number of sites, the report was desired for our daily ventilator rounds, QA/PI requirements, development of a new website, monthly reporting needs, etc. this position inevitably became full time. (The AA has an IT background) The CISS is a full time position and works with the Information Services department on the continuous development of the electronic medical documentation system. This position is also responsible for respiratory order entry and charges. As a result, the department has an individual with the clinical experience (an RRT background) to address and adjust the problems that have been associated with these entries in the past. Results: Since the creation of these positions, our department has become an integral member of the hospital’s research team. Reports are now created and results, that in the past took a considerable amount of time, can be assessed in minutes. (see table 1) Conclusions: These positions have allowed our department to offer invaluable information on how clinical interventions impact patient outcomes and how to improve these outcomes with increased efficiency. Although these positions may not be feasible for every Respiratory Care department, they may be something that needs further investigation by some Directors. The ability to provide clinical individuals to prepare reports from data collection systems can be a great asset to any Institution. Creative thinking and the ability to obtain additional clinical positions may allow departments to offer more factual data to their administration and allow re-evaluation of their clinical practices. Sponsored Research - None

IMPROVING EMPLOYEE OPINION THROUGH A PARTNERSHIP WITH LEADERSHIP.

Richard M. Ford, Gina Giles-Oas, Herb French; Respiratory Care, University of California San Diego Medical Center, San Diego, CA

Background: It is vital the Respiratory Care workforce is engaged and the Department leadership effectively communicates to make meaningful change. Realizing opportunities for improvement, we created the Partners in Leadership (PL) program to better facilitate an exchange of ideas and promote interdisciplinary teamwork. Through this program, we aimed to improve staff’s perception of the workplace and leadership. Methods: A hospital-wide employee opinion survey was conducted in July 2008 in six departments and data is analyzed every six month. Using the feedback, an action plan was drafted and submitted to the Department Leadership. Each year, the survey is re-surveyed and results are compared. Results: Eight PL meetings have been held since inception with review of over forty-eight issues. We created a PL website tool inclusive of a discussion board, staff recommendations, reference materials and meeting minutes. The employee opinion survey one year after implementation of PL program showed improved results in ‘conclusion’. Through this program we created a structure that is open to all staff and creates a forum for management to get ideas and feedback and to give those in management an equal status in making decisions. The program has improved employee opinion and staff support of change. Sponsored Research - None

Employee Opinion Scores

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<th>Leadership Areas of Focus</th>
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<th>% Favorable in 2009</th>
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850206 900206
Implementing Scheduling Software to Improve the Management of Staffing and Effectiveness of Cross Site Utilization.

Jan E. Phillips-Clar, Richard Ford, Scarlett Gudmundsson, Ted Vallejos, Tom Bell, Marcia Teal; Respiratory Care, UCSD Medical Center, San Diego, CA

Background: The Department of Respiratory Care at UCSD Medical Center is managed as one department, but practices at two sites. Our leadership team is continually searching for tools to improve staff satisfaction. Prior to having a software scheduling system, four separate paper schedules were utilized for RCPs and support staff. As a result, we were continually faced with breakdowns in communication; errors submitted on the schedule with no way to track who entered them; staff showing up at the wrong location or not at all; dissatisfaction with individuals floating between locations and animosity developing between sites. Method: A set of desirable characteristics for scheduling software was developed and a team formed to evaluate features, capabilities and costs. A software provider was selected and the system configured to meet the unique needs of the department. Multiple schedules were set up under the same system. Explanations were predefined to identify each employee’s location or activity. Filters and reports were developed for staffing needs; utilization of vacation and requested time off; and to monitor occurrences for sick calls and unplanned absences. Any changes, such as additions or cancellations are entered into the system and show up instantly. A staffing report is then printed at the beginning of each shift which reflects real time data. Results: Schedule Anywhere was implemented in July of 2009. We have noted overall staff satisfaction and decreased call outs and absences. Conclusion: By implementing this process, we have improved the overall management of the department.

Sponsored Research - None

900809

Staffing and Service Model Changes to Meet Increased Demands in a Large Tertiary Care Hospital.

Harry Morris; Respiratory Care, Adult Services, Florida Hospital, Orlando, FL

Background: For over 30 years, the Respiratory Care Department at Florida Hospital Orlando had staffed Respiratory Therapists following a unit or service model. This year our work has included a Respiratory Therapist covering one floor alone. In recent times, as resources have become more scrutinized and service demand has increased due to the opening of the physical plant in the opening of a new 15 story patient care tower, we were compelled to revise our staffing and scheduling models. The new bed count is over 800 in the adult campus and consists of two patient towers as well as a sprawling horizontal complex. Method: This year we began modeling a Critical Care Consultation service concept. We have accomplished this in part by turning MDI/OPT treatments over to nursing in the acute care floors, while retaining the administration of nebulizer treatments thereby reducing the presence required on the general floors. In addition, we are currently deviating ourselves from non-core processes and atypical services that may be better delivered through other caregivers and we are also implementing a new staffing model. By dividing the adult hospital into 5 geographic zones with each zone tied logistically to a critical care unit, we are able to provide services to the vast far reaches of the hospital. The key element to the successful use of this model is continuous bi-directional communication between zones. Results: Initially, there were concerns from the team that the ability to respond to STS issues would be compromised. As it turned out, this was not the case. Our nursing colleagues on the general floors seem to feel more secure knowing that their patients needing a higher level of care are being tended to by Critical Care Respiratory Therapists. In a dition, with zone assignments we are seeing a higher level of team work than in the past where everyone was covering everyone and absences were now minimal. Conclusion: Schedule Anywhere provides an easy way to rotate and cancel employees on a fair and equitable basis. By implementing this software program, there has been a reduction in overtime, clarity of staff knowing where to begin their shift and insurance that staff are not overscheduled at their appointed percentage.

Sponsored Research - None

920335

Respiratory Therapy Charge Capture Associated with Switching to a New Electronic Medical Record System in the Emergency Department.

Elizabeth Cooper, Scott Pettinichi, Mark Haggard; Emergency Department/Respiratory Care, Cincinnati Childrens Medical Center, Cincinnati, OH

BACKGROUND: Electronic patient care charting can be accomplished using a variety of different methods. In November of 2009, our institution’s emergency department went from using a system called (Emergency STAT corporation) EMSTAT, which has been used since June of 2000, to a new system called (EPIC ASAP) EPIC ASAP for charting. While the flow from one charting system to another for the staff was relatively easy, one customizing charges from EPIC ASAP has shown to be more difficult. Staff was educated on the appropriate documentation within the medical record. Charge capture is performed by an outside company who pulls charges from the medical record. Several months after EPIC ASAP was implemented in the emergency department, it was noted that the continuous albuterol charges were not being billed; charge capture decreased to zero (see Table 1). It was observed that there was nothing built into the documentation system that allowed for the charting of the transfer to the critical care unit while the patient was still receiving the continuous treatment. METHOD: A chart audit was performed in EPIC ASAP from the critical care unit to the emergency department and from the emergency department to the critical care unit. The audit was conducted using patient flow and cross site care documentation. RESULTS: There is still a problem with charge capture in the emergency department. The listing from the outside billing company who produced charges from that date forward was obtained. It was found that zero charges where found while the patient was in the emergency department receiving continuous albuterol. Contact was made with the EPIC ASAP design team to immediately build a system that allowed the proper data to be charted before the patient left the emergency department. This change was made within one week and staff was educated on its usage. CONCLUSION: While this was still a new for our team, it has saved the department money and improved documentation procedures.

Sponsored Research - None

920885

The Value of Utilizing File Sharing to Improve Team Management Performance.

Jan E. Phillips-Clar, Richard Ford, Herb French; Respiratory Care, UCSD Medical Center, San Diego, CA

Background: Respiratory Care at UCSD Medical Center is managed as one department, but practices at two sites. The leadership team consists of 18 individuals. One third of our team has held their positions less than 6 months. We were challenged to insure continuity existed for every interaction leadership had with staff regardless of location, shift, or supervisor expectation. We used the Q-Drive and establishing File sharing processes and rules to access this information. Method: A 700 GB partition was established on a designated Medical Center drive and access established for all members of our RC leadership team. Shared folders were created for specific managerial categories such as HR/personnel; IS; Hiring; PDPs and Policies and Procedures; QA; and exclusive functions that were utilized by all members of our RC Leadership Team. Access rights were designated for each area. The RC Leadership area contains everything needed for management of personnel training materials; education; contacts; and all forms needed to run department functions. Security was set up to allow only authorized access and the database set to be backed up every 24 hours. Results: Within the first 3 months over 400 GB of data, consisting of over 5000 separate files was entered into the system and show up instantly. A staffing report is then printed at the beginning of each shift which reflects real time data. Results: Schedule Anywhere was implemented in July of 2009. We have noted overall staff satisfaction and decreased call outs and absences. Conclusion: By implementing this process, we have improved the overall management of the department.

Sponsored Research - None

918635

Symposium 9: Management – Part II

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1556
IMPROVING UPON PRE-EXISTING HOME OXYGEN DISCHARGE PROCESSES, WHILE SIMULTANEOUSLY EXPLORING ALTERNATIVE METHODS OF EDUCATION

Joyce Baker, Jason Montoya; The Children's Hospital of Colorado, Aurora, CO

BACKGROUND: The Children's Hospital of Colorado has traditionally sent patients home on oxygen in order to compensate for high altitude, decrease the length of stay, and minimize costs associated with keeping patients admitted only for hypoxia. Home oxygen discharges were traditionally allocated to the inpatient rehabilitation therapists and as the institution began to grow in services, the target goal of completing education less than or equal to 90 minutes from discharge order was no longer realistic. This study was undertaken from July 8, 2009 to August 28, 2009. The second field encompassed the time it took the doctor to write the script and notify the nurse or respiratory technician. The second field encompassed the time it took the respiratory technician, once notified, to complete the education. Throughout 2009 statistical data was collected securely and compounded quarterly in order to produce the following results: 1) Quarter one yielded an average of 24.86 minutes for field one, 34.9 minutes for field two, resulting in an overall time of 64.03 minutes. 2) Quarter two yielded an average of 33.6 minutes for field one, 34.9 minutes for field two, resulting in an overall time of 68.56 minutes. 3) Quarter three yielded an average of 38.6 minutes for field one, 34.5 minutes for field two, resulting in an overall time of 73.1 minutes. 4) Quarter four yielded an average of 51.63 minutes for field one, 28.9 minutes for field two, resulting in an overall time of 69.66 minutes. Conclusion: With the utilization of the technicians in order to expedite oxygen orders, an average of 66.57 minutes per discharge was achieved which was 23.43 minutes below our target time of 90 minutes.

Sponsored Research - None

PHYSICIANS’ PERSPECTIVES OF PROFESSIONAL CREDENTIAL AND ACADEMIC DEGREE ON PRACTICE COMPETENCY FOR THE RESPIRATORY CARE PRACTITIONER AND NURSE.

Carlton R. Inley, Sidney R. Schneider, Robert L. Joynier; Health Sciences, SUNY at Brockport, Brockport, NY

BACKGROUND: Awareness of physicians’ perspectives on the practice of Respiratory Care Practitioners (RCPs) for expanding to mid-level provider capability is necessary for an appropriate professional development pathway for practice growth. We investigated physicians’ perspectives of RCPs’ competency relating to professional credential and academic degree as compared to nurses. METHODS: An expert committee validated survey was presented to electronic mail to ATS physicians. Approximately 7300 ATS physicians were surveyed, with 428 responding (approximately 5.8%). Four survey items address two research questions: (1) Is there a relationship between physicians’ perspectives on higher professional credentials and greater practice competency for RCPs (CRT vs. RRT compared to LPN vs. RN)? (2) Is there a relationship between physicians’ perspectives on higher academic degree and greater competency for RCPs and nurses (AARCP vs. BSRCP compared to AAN vs. BSN)! Data Analyses: Pearson’s chi-square test (two-tailed, p ≤ .05) was used to detect differences between comparisons. Data were expressed in frequencies and percentages. RESULTS: Physicians responded that higher RCP and nurse professional credentials yield greater practice competency; however, physicians’ perception of Nursing as compared to Respiratory Care Practitioners is different and more favorable (p < .05). Additionally, physicians’ perceptions of higher academic degrees for RCP and nurse professions yield greater competency with no significant difference in physicians’ perception of nursing as compared to Respiratory Care Practitioners (p > .05). CONCLUSION: Physicians drew a greater distinction between the RN and LPN credentials than that between a RRT and CRT credentials. Nevertheless, physicians made these distinctions in favor of the higher degree-prepared vs. associate degree-prepared nurses and baccalaureate degree-prepared vs. associate degree-prepared Respiratory Care Practitioners. These results are limited to the perceptions of ATS physicians responding to this survey. Generalizability of these findings may not apply to the broader population of ATS physicians.

Sponsored Research - None

IMPACT OF THE ELECTRONIC HEALTH RECORD (EHR) ON MEDICATION SAFETY AND ASSOCIATED PERFORMANCE IMPROVEMENT

Brent D. Kenney, Anthony Elliott, Kathryn Estebo; Respiratory Care, St. John’s Hospital, Springfield, MO

BACKGROUND: St. John’s Hospital as part of a larger health system implemented a complete electronic health record (EHR) in January thru April of 2009. This EHR has an electronic medication administration record (MAR) coupled to barcode scanning of the patient’s wristband. Prior to implementing one EHR system, another proprietary EHR was in use. Respiratory Care barcode compliance was consistently > 90% with this system prior to implementation of the current EHR. The hospital goal had originally been > 90%. We asked ourselves if the barcode compliance would change with the introduction and use of the new system. Method: Previously collected data on barcode compliance was reviewed to look at the numbers of RCPs who met the hospitals goal of > 90% compliance. The EHR established data collection and reports similar to what we collected previously. We began a Quality Excellence project to identify any change in medication barcode compliance, and to ensure that steps were taken to maintain or improve previously barcode compliant levels. We chose to look at all RCPs performing medication administration and identify barriers to successful and safe medication administration. Results: Data from July of 2008 identified 96 RCPs participating in medication administration with 4 RCPs having barcode compliance < 90%. This number had risen to 17 RCPs < 90% out of 100 total RCPs for an increase of 325%. We identified barriers to successful barcode scanning compliance, accomplished improvement through education, collaboration with the hospital and from feedback from RCPs. Additionally we began to communicate weekly to the Supervisors of the RCPs with compliance < 90%, informing them that their co workers were not compliant. As of April 2010 the number of RCPs with barcode compliance < 90% was back to pre EHR levels of 4 RCPs < 90% compliant out of a total of 95 RCPs. Conclusion: The implementation of an EHR has potential implications for patient safety and medication safety. RCPs must be educated on their role in medication safety, Communicating the computerized MAR, the automated dispensing cabinets, and holding individual RCPs accountable for barcode compliance as part of medication administration is necessary for success. Removal of barriers, providing adequate equipment, dialoging with other departments, and holding RCPs accountable all contributed to getting back to acceptable barcode compliance levels for the Respiratory Care department.

Sponsored Research - None

RCPs Barcode Compliance < 90%
BACKGROUND: Organizational improvement relies upon local implementation of PDSA cycle tests. To detect change and enhance respect for therapists (RTs) in improvement processes, a designated quality improvement RT and analysts RT participated in multidisciplinary team to reduce verbal orders. METHODS: Automated data in the form of PXYS medication delivery overrides and CPOE downloads of verbal order selection were aggregated and distributed by the Quality and Patient Safety Office to medical units, physician safety officer and RT leaders. Analytic RT specialist grouped data for RTs and communicated results to leadership team members and individuals who entered the verbal orders or made the PXYS medication overrides. Follow up was done with every verbal order occurrence. Signs were posted and distributed to staff to educate about risk of verbal orders and what actions constitute a verbal order. Education on organizational policy for verbal order use and NPSG elements of performance for verbal order use. RESULTS: Department verbal order use followed organizational use of verbal orders. While RT verbal order acted to prevent use for more than 20% of all verbal orders, significant improvement resulted from RT reduction efforts. CONCLUSION: RT specific indicators lack benchmarks for practice improvement in error reduction. Automated data can lead departmental improvement without significant forethought or personnel effort. 

Sponsored Research - None
THE VENTILATOR MANAGEMENT INITIATIVE: REDUCING COSTS AND LENGTH OF STAY IN MECHANICAL VENTILATOR PATIENTS

Joy K. Haggett, Mary Curnyn, Elizabeth Bearden, Doug Wheeler, Margie Doty; Respiratory Care, St. Luke’s Episcopal Hospital, Houston, TX

Background and Method: The mechanically ventilated patient population is the most critical and requires extensive resources to treat. In 2008, our facility was treating 3,314 ventilator patients with an average total cost of $61,127. The Respiratory Ventilator Management Initiative (VMI) team was developed, including respiratory therapists, nurses, pharmacists, case managers and physicians. This multidisciplinary team was facilitated by the Administrative Director of Respiratory Care. Utilizing the LEAN process the root causes identifying opportunities for improvement were targeted. These opportunities included development of a physician order set that standardized the ventilator bundle. This utilizes options for ventilator management, sedation management, and DVT and PUD prophylaxis. An extensive education program was conducted to all ICU nursing and respiratory care staff. Case management enhanced the throughput of this patient population. The ventilator population was divided into a three phase approach utilizing electronic ventilator documentation to report the progress of the weaning process.

Result: Of the 3,314 ventilator patients treated from FY2008 vs. FY2009, we found decreases in the total ventilator population of 25% (728 ventilator patients). This incorporates a three phase approach utilizing electronic ventilator documentation to increase efficiency, branching logic software to standardize therapist critical thinking skills and an interface to the physician and nursing medical record reporting the progress of the weaning process.

Sponsored Research - None

920772

USING WORKRATE TO ESTABLISH RESPIRATORY CARE ASSIGNMENTS

Susan Gele, Robert L. Chatburn, James K. Stoller; Respiratory Institute, Cleveland Clinic, Cleveland, OH

BACKGROUND: We previously reported a new management parameter, work rate, (Respir Care 2008;53(11):1532), defined as work load due per hour based on cumulative standard treatment times. We found that work rates were unachievable with available staffing for 75% of scheduled due times resulting in unscheduled treatments and average work load of 11.5 patients per hour at Cleveland Clinic. The purpose of this study was to determine the best ways to balance our assignment practices based on the work rate parameter.

METHODS: We convened a focus group of key employees and used a Root Cause Analysis to identify and a plan to balance assignments based on scheduled work rate. We determined that starting scheduled treatments one hour earlier on day shift would help. Scheduled work load comprised small volume nebulizers, metered dose inhalers, bilevel positive airway pressure and mechanical ventilators. Unscheduled workload was the all other modalities. We surveyed the clinical staff to determine willingness of staff to do this. We also evaluated basing assignments on scheduled work load rather than undifferentiated total workload. We collected 12 months of data using a custom Crystal Reports program (sapglobal.com) to query a MediLinks database (MediServe, Phoenix AZ) to determine the ratio of scheduled to unscheduled workload.

RESULTS: The survey response rate was 65% (152/240) with 88% of the staff willing to adopt an earlier start time. Results of the MediLinks data analysis indicated that on average, scheduled work load comprises 55% of the total work load. However, this metric had high variability per assignment area (range 0 - 0.99). Thus, a standard assignment of 300 minutes/8 hr shift should average 164 minutes of scheduled work load and 136 minutes of unscheduled work load but ideally should be based on actual daily area data.

CONCLUSIONS: Our preliminary studies to date suggest that: (1) basing assignments on average work load leads to periodically excessive work rate, resulting in missed treatments and staff dissatisfaction; (2) given current technology and culture, we have only limited ability to reduce peaks in work rate, but staggering treatment times is effective; (3) fair assignments based on average work load should differentiate scheduled vs. unscheduled treatments.

Sponsored Research - None

920286

A NEW ROLE FOR RESPIRATORY THERAPISTS IN THE CARE OF COPD PATIENTS - THE RESPIRATORY CLINICAL SPECIALIST

Joy K. Haggett, Mary Curnyn, Elizabeth Bearden, Doug Wheeler, Margie Doty, Robert L. Chatburn, James K. Stoller; Respiratory Institute, Cleveland Clinic, Cleveland, OH

Introduction: UHC benchmark data indicated opportunities for improvement in cost/case and LOS for COPD (DRG 88) patients. A multidisciplinary team addressed this and developed a strategic patient care unit to house these patients, called the Acute Pulmonary Unit (APU). The APU goal was to reduce length of stay (LOS) and improve net margin in the patients treated. The APU COPD patient population is the most critical and requires extensive resources to treat. In 2008, our facility was treating 3,314 ventilator patients with an average total cost of $61,127. The Respiratory Ventilator Management Initiative (VMI) team was developed, including respiratory therapists, nurses, pharmacists, case managers and physicians. This multidisciplinary team was facilitated by the Administrative Director of Respiratory Care. Utilizing the LEAN process the root causes identifying opportunities for improvement were targeted. These opportunities included development of a physician order set that standardized the ventilator bundle. This utilizes options for ventilator management, sedation management, and DVT and PUD prophylaxis. An extensive education program was conducted to all ICU nursing and respiratory care staff. Case management enhanced the throughput of this patient population. The ventilator population was divided into a three phase approach utilizing electronic ventilator documentation to report the progress of the weaning process.

Result: Of the 3,314 ventilator patients treated from FY2008 vs. FY2009, we found decreases in the total ventilator population of 25% (728 ventilator patients). This incorporates a three phase approach utilizing electronic ventilator documentation to increase efficiency, branching logic software to standardize therapist critical thinking skills and an interface to the physician and nursing medical record reporting the progress of the weaning process.

Sponsored Research - None

917901
AN APPROACH TO DELIVERING AEROSOLIZED MEDICATION WITH HIGH FREQUENCY JET VENTILATION.

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

Background: The purpose of this study was to determine if aerosolized Albuterol could be delivered in conjunction with the Bunnell High Frequency Jet Ventilator (HFJV), and what ventilation effects could be seen with aerosol delivery. The ventilator was set with the following settings: HFJV: Rate 420, PIP 20, PEEP 5 cmH2O, temperature cartridge at 38 C and the circuit at 40 C. Bird VIP: PEEP 5 cmH2O, Flow 8 LPM, no rate, temperature chamber at 35 C and the circuit at 35 C. The approach is to side stream the endotracheal tube (ETT) 2 cm distal to the Bunnell Life Port with a gas source is connected to distal end of the Aerogen tee and changes in pressure were noted (see table 1 results). Deposition testing; Each ETT size was subjected to 5 runs of aerosol with each of the flow options and deposition were recorded (see tables 3, 4, and 5 results). Controls were performed to determine background humidity (see table 6 results). The depositions amounts vary widely depending upon flow and ETT size. Higher flow rates were shown to have higher deposition values of medication with all the ETT sizes to be the lowest. Though the pressure changes in the lung model may be construed as an impairment of ventilation, further testing should be completed. Animal testing for ventilation impairment of gas exchange was conducted and was not shown to be a problem. The method as described to determine ventilation effects, and aerosolized radionuclides may provide definitive data on aerosol deposition and distribution.

Sponsored Research - None

906251

EFFECTS ON MORTALITY RATES UTILIZING AEROSOLIZED EPROSTENOL AND INHALED NITRIC OXIDE (INO) FOR THE TREATMENT OF HYPOXIC PATIENTS.

Raymond B. Malloy, Brian Glynn; Pulmonary Care, Thomas Jefferson University Hospital, Philadelphia, PA

Effects on Mortality Rates Utilizing Aerosolized Epoprostenol and Inhaled Nitric Oxide (INO) For the Treatment of Hypoxemic Patients. Malloy R, Glynn B, McIntosh C, Pezzano T, Weigel S, Buehler K. With aerosolized Epoprostenol and inhaled Nitric Oxide (INO) are used to treat hypoxic patients (ARDS and /or Pulmonary Hypertension). Neither is FDA approved for this indication for use in many critical care units. A Thomas Jefferson University Hospital, Philadelphia, PA we compared the outcomes for two methods of treatment of hypoxemia. METHODS: In 2008, 22 adult patients with a diagnosis of refractory hypoxemia with a non-cardiac history were given INO at 40 parts per million (PPM) through a breathing circuit on a PB 840 Ventilator and treated by INO pathway. An evidence based literature search was performed on INO. The comparison group was the patients with refractory hypoxemia which was discontinued and an aerosolized Epoprostenol pathway was approved for critical care patients with hypoxemia. In 2009, 30 non-cardiac adult patients with refractory hypoxemia were treated with aerosolized Epoprostenol via continuous nebulizer. We also examined the p<0.01 ratio in all patients prior to initiation of therapy as an indicator of severity of pulmonary compromise. RESULTS: Our findings are consistent with current literature with 95% of the patients expired prior to discharge with a survival of 5% when treated with INO. 93 of the patients expired prior to discharge with a 27% survival rate when treated with aerosolized Epoprostenol (n = 30). Chi square p <.05 (n=32). The median time to death was 71 for the control group and 120 minutes for the INO group. CONCLUSION: The comparison showed a clinically significant reduction in mortality rates with patients treated with aerosolized Epoprostenol in line with INO and similar median oxygen indices. There is also a significant cost savings in substituting aerosolized Epoprostenol for INO. The cost of providing INO was $1,568 per patient versus $1,600 for INO and $410 per patient for Epoprostenol population resulting in an 80% reduction in costs. Further investigative studies are required to validate the clinical findings. 

Sponsored Research - None

890223

A COMPARISON OF THE EFFECTIVENESS OF THE BREATH ACTUATED NEBULIZER VS. THE MISTY NEBULIZER IN PATIENTS >2 Y.O. WITH A PRIMARY DIAGNOSIS OF ASTHMA.

Laure Smiz, Kris O'Brien; Respiratory Care Services, Children’s Hospital of WI, Milwaukee, WI

Background: In an effort to improve patient outcomes related to asthma care at Children’s Hospital of Wisconsin, the Respiratory Care Department performed an evaluation of two specific small volume nebulizers. Methods: Retrospective chart analysis was performed using the outcomes criteria for 6 weeks pre and post implementation of Breath Actuated Nebulizer (BAN) (i.e. 6 weeks misty neb vs 6 weeks BAN). Retrospective chart analysis comparing the following outcome specific criteria; Number of Treatments; Hours on Oxygen; Days in the ICU; Days on Ventilator; Days on Stay (LOS) Inclusion Criteria: Pts ≥ 2 and <18 years of age; Pts with primary diagnosis of asthma; Pts ordered on CHW approved medications (albuterol, ipratroprium bromide, budesonide) Exclusion Criteria: Pts < 2 years of age; All pts ordered on Levalbuterol; Pts with a primary diagnosis of asthma; Pts ordered on CHW approved medications (albuterol, ipratroprium bromide, budesonide) 

Results: Breath Actuated Nebulizer: Number of Nebulizer Treatments: 5.8 Hours on Oxygen: 3.43 Length of Stay (LOS): 29.96 Days on Ventilator: 0.58 Days in the ICU: 0.58 Days on Stay (LOS): 34.5 hours Conclusions: Patients who received inhaled medication via BAN required fewer treatments, spent fewer hours on oxygen, and had an overall decreased LOS. Based upon these results, CHW elected to transition to the BAN for use in our asthmatic patients. Additional research should be performed to evaluate the effectiveness on other disease processes and additional medications.

Sponsored Research - None

920188

AEROSOL PAUSE TIMES ASSOCIATED WITH VIBRATING MESH NEBULIZER

Patricia A. Daly, Kyle Walsh, Plypan Thongpradit; Respiratory Care, Baystate Medical Center, Springfield, MA

INTRODUCTION: Vibrating mesh technology with drop by drop aerosol delivery has created a new paradigm in continuous aerosol delivery. Aerosol production occurs intermittently when solution is dropped on to the vibrating mesh surface. They are dependent on the delivery rate of the solution. Our objective was to determine the pause time at varying rates and determine if they exceeded inhaled epoprostenol sodium’s minimum 6 minute half life. In addition we were curious whether the use of a tapered aerosol tip would shorten pause times.

METHOD: A pulmonary infusion pump (CME America 375 BodyGuard) with a dedicated infusion set was used to deliver solution (ns) to a vibrating mesh nebulizer (Aerogen® ProX & Aeroneb Solo). We compared a control group, utilizing an exposed vibrating mesh surface without the medication cup, with the experiment group, Solo at varying flow rates of 1 ml, 2ml and 4 ml per hour. Droplets formed and were observed. The length of the aerosol was timed as well as the length of the pause. RESULTS: Mean pause times for control group at 1ml, 2ml and 4ml were 22±3.4, 11±1.5, and 54±8 seconds. Mean pause times for experiment group at 1ml, 2ml and 4ml were 27±6.75, 179±103, and 50±16 seconds. CONCLUSIONS: The term "continuous aerosol" can be confusing when associated with this new paradigm in inhale medication delivery. We determined that it does not necessarily refer to continuous aerosol production but rather intermittent aerosol production at a set delivery rate, volume/time. In this model pause times for aerosol delivery is less than significant in the half life of epoprostenol sodium. Most inhaled medications have a half-life greater than 6 minutes and should not be affected by the pauses that were observed in this study.

Sponsored Research - None

919786
A MATHEMATICAL MODEL FOR ACHIEVING TARGET LUNG DOSE OF PROSTACYCLINS.

Faith A. Carrier, Jeremy S. Bainbridge,1, Lan-Ti Chou 1, Hsiu-Feng Hsiao 1, Kuo-Chin Kao 1,2,

Over the last 15 years, administration of Inhaled epoprostenol sodium has been report-
ed, for the treatment of hypoxemia and pulmonary hypertension, during mechanical
ventilation for both infants and adults. Dosing range is typically described as between
10 - 50 ng/kg/min based on formulation concentration and nebulizer output rate, inde-
dependent of type of nebulizer used, and other factors impacting inhaled dose. Our goal
is to quantify lung delivery based on aerosol delivery efficiency, leading to development
of a tool to allow clinicians to determine required formulation strength, infusion rate
and nebulizer output which achieve desired lung dose based on the efficiency of aerosol
delivery system used. Methods: To better understand the relationship of nebulizer out-
put to inhaled lung dose, we reviewed clinical reports of dosing strategies for
epoprostenol and in vitro studies describing lung dose efficiency during mechanical
ventilation with various aerosol devices, ranging from infants to adults. Lung dose was
calculated by multiplying nominal output rate by the efficiency fraction of inhaled
dose. We then developed a calculation to determine output rate required to achieve tar-
gent lung dose. Infusion rate in mL/hour = [(Target lung dose) x (BW in kg) x
(1/Efficiency fraction) x (60)] / (formulation concentration in ng/mL) Results:
Deposition efficiency fraction reported of 1 to 14% in neonates and 3 - 28% in adults
resulted in calculated delivered lung doses ranging from 0.5 – 7ng/min for a 1 kg infant
and 120 – 1,120 ng/min for an 80 kg adult. Conclusions: Adjusting key parameters to
achieve target lung dose based on in vitro aerosol efficiency fraction, patient size, for-
tum concentration and aerosol output per hour provides opportunity for more
precise dosing than standard systems based solely on concentration and a set nebulizer
output per hour. Clinical trials will be required to confirm impact of this algorithm on
inhaled dose titration.

Sponsored Research - None

Infusion Rates for a Target Lung Dose of 7 ng/kg/min

Table shows infusion rates with a 30 mcg/ml formulation of epoprostenol sodium (1.5
cc/kg dilution) to achieve a target lung dose of 7 ng/kg/min with aerosol
delivery efficiencies of 3%, 14% and 28% for an 80 kg and 15 kg patient.

919776

THE EFFECT OF AEROSOLIZED MUCOLYTIC AGENT
ON THE RESISTANCE OF A BACTERIAL FILTER DUR-
RING MECHANICAL VENTILATION.

Hsin-Chun Liu,1, Lan-Ti Chou1, Hsiu-Feng Hsiao1, Kuo-Chin Kao1,2, Gwo-Hwa Wan1,2, Cheng-Chung Huang3,2,3;
1Department of Respiratory Therapy, Chang Gung Memorial Hospital, Taiwan, Taiwan; 2Department of Thoracic Medicine, Chang Gung Memorial Hospital, Taipei, Taiwan; 3Department of Respiratory Care, Chang Gung University, Taiwan

Background: Constant output nebulizer wastes aerosols during expiration phase. In turbine flow it placed in the inspiratory limb of the ventilator circuit, the waste aerosolized particles may capture by the bacterial filter on the expi-
atory limb end of the ventilator. The captured particles may increase the resistance of the filter, which may restrict patient’s breathing pattern. The purpose of this study was to determine the bacterial filter resistance change through time when mucolytic agents are administered via constant output nebulizer. Methods: 7 pleated hydrophobic filters were tested, 5 of them for collecting waste aerosols from a mucolytic agent, 10% Acetylcysteine, and 2 of them form 2% hypertonic saline. A ventilator (Galileo; Hamilton Medical, Switzerland) with a lung model was used with-
in the followings: VT of 0.6L, frequency of 12 b/min, inspiratory times of 1 second, PEEP of 5 cmH2O, and inspiratory flow rate of 54 L/min with a lung model.

Acetylcysteine aerosol particles increase the resistance of the bacterial filter when mucolytic agents are adminis-
tered via constant output nebulizer. Method: 7 pleated hydrophobic filters were tested, 5 of them for collecting waste aerosols from a mucolytic agent, 10% Acetylcysteine, and 2 of them form 2% hypertonic saline. A ventilator (Galileo; Hamilton Medical, Switzerland) with a lung model was used with-
in the followings: VT of 0.6L, frequency of 12 b/min, inspiratory times of 1 second, PEEP of 5 cmH2O, and inspiratory flow rate of 54 L/min with a lung model.

Acetylcysteine aerosol particles increase the resistance of the bacterial filter during mechanical ventilation. The bacterial filter on exhaled limb should be changed periodically, when 10% Acetylcysteine is regularly prescribed to
prevent secondary effects that would harm the patients.

Sponsored Research - None

903346

DELIVERY OF INHALED ANESTHETIC IN THE
INTENSIVE CARE SETTING USING AN ICU VEN-
TILATOR AND STAND ALONE VAPORIZER.

Douglas A. Campbell, Faith A. Carrier, Jeremy S. Bainbridge, Emily L. Zyla; Respiratory Care Department, Spectrum Health Hospitals, Grand Rapids, MI

Introduction: Administering inhaled Isoflurane to the status asthmaticus patient is difficult because an anesthetic Vaporizer is suboptimal for ventilating this patient population. The
limitations include but are not limited to: inability to deliver continuous inhaled bronchodilators, delivery of helium-oxygen mixtures, and the fact that our respiratory therapists are not trained to operate the anesthesia ventilator. The aforementioned has resulted in deviations from optimal lung protective ventilation.

In order to improve ventilation choices we wondered can you safely deliver a therapeutic dose of Isoflurane through a stand-alone Vaporizer and an ICU quality ventilator. Method: We evaluated the Drager 19.1 series Isoflurane vaporizer, obtained a Datex Ohmeda 5250 RGM anesthesia monitor, developed a gas saving system, and a Servo 300 ventilator capable of volume and pressure ventilation. The vaporizer was placed in line with the inspiratory limb. Inspiratory and expiratory Isoflurane concentrations were measured at the wye adapter as well as the amount of anesthetic used. Our targeted Isoflurane concentration is 1% of total gas volume
delivered to the patient. Results: In a laboratory setting, we were able to achieve the targeted Isoflurane concentration at the wye/inspiratory circuit wye adapter both volume (100 – 600 mL) and pressure (PIP 16 – 36 cwp with a constant PEEP of 8 cwp) modes of ventilation were evaluated. Ventilation with these parameters would be used in the clinical setting for adult or pediatric ventilation at our institution. Conclusion: Isoflurane has been shown to become status asthmaticus patients resistant to other therapy. The problem is means of delivery, anesthesia time at the bedside and the ability to adequately ventilate the patient. Isoflurane can be safely delivered utilizing an ICU quality ventilator and a standalone vaporizer and should be considered a viable option.

Sponsored Research - None

877949

A FIVE YEAR COMPARISON OF BRONCHODILATOR
ADMINISTERED.

Susan Rinaldo-Gallo, Janice J, Thalmann; Respiratory Care Services, Duke University Health System, Durham, NC

Background: In the last 10 years acceptance and use of Long-Acting Beta Agonists (LABA) has increased. LABA provide a maintenance level of beta agonists for up to 24 hours. Use of LABAs is reported to decrease the use of Short-Acting Beta Agonists (SABA). The purpose of this study was to examine the impact of LABA on SABA usage in an academic medical center. Three aspects were examined: the number of LABA and SABA treatments delivered, the cost, and the therapist time required to provide treatments. Methods: The use of LABA and SABA were tracked from 2005 – 2009. Therapist’s documentation and billing from the departmental information system was used to determine labas.

Over this five year period there were no changes in beta agonist protocols and the patient population on these units remained stable. Prices used in analysis are from a “A Guide to Aerosol Delivery Devices for RT”, Aru, et al., 2009. The times standards used for treatments are from the AARC’s Uniform Reporting Manual, 4th ed.; 15.47 minutes for nebulizer and 9.24 minutes for MDI/DP1. The therapist rate of pay used was $25.00 per hour. Results: SABA treatments decreased by 5,828 and LABA treatments increased by 1,499. The net result was that 4,329 (14%) fewer beta agonist treatments (nebulizer, MDI and DPI). The time savings was 132.0 hours. The cost savings in therapist pay was $33,015 (not including benefits). The increase for medication was $1,128. Conclusion: The increased use of LABAs has resulted in the administration of fewer SABA in three inpatient medical units. The savings reported are based on analysis of 100 beds, which represent 15% of our intermediate care beds. Given the relatively small number of beds studied, the reduction in the number of treatments, cost and time savings is felt to be significant.

Sponsored Research - None

Quantity of SABA and LABA Administered in Medical Areas

2005 2006 2007 2008 2009

SABA Total 32,187 33,144 28,734 26,561 26,359

LABA Total 3,069 3,810 3,677 4,603 4,568

SABA % 91.3% 89.7% 88.7% 85.2% 85.2%

LABA % 8.7% 10.3% 11.3% 14.8% 14.8%

Total % 90.0% 89.9% 87.5% 84.1% 84.1%

Grande Total 35,256 36,954 32,411 31,164 30,927

890103

Wednesday, December 8; 9:30 am to 11:25 am (Room N240/N242)
Wednesday, December 8; 9:30 am to 11:25 am (Room N240/N242)

**CLINICAL & FINANCIAL IMPLICATIONS OF POOR PERFORMANCE OF SMALL PARTICLE AEROSOL GENERATORS (SPAG-2).**

Dave N. Crotwell, Tien Tran, John Salyer; Respiratory Care, Seattle Children’s Hospital, Seattle, WA

Background: Clinical observations led to speculation there is high variability in output of the SPAG-2 during Ribavirin delivery. High nebulizer residual volumes were run at regulator pressure ≥ 26 psig, nebulizer flow = ≥ 8 L/min and drying air flow = 6 L/min. At the end of 5 one-hour epochs residual volume was measured using a graduated cylinder and subtracted from the original total volume to determine the amount nebulized each hour. We visually

**COMPARISON OF NEBULIZER EFFICIENCY AND TREATMENT TIME.**

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

**BACKGROUND:** The performance of pneumatic jet aerosol nebulizers varies greatly among different brands. Key performance indices include efficiency and treatment time. Efficiency is important to drug delivery and hence quality of care. Treatment time is of interest because it greatly affects staff productivity. The purpose of this study was to compare the nebulizers currently used or being evaluated in the Cleveland Clinic Health System with the intent to standardize on a benchmark device. Our hypotheses were that treatment time varies among the devices tested and that a most efficient device could be identified. METHODS: Nebulizers evaluated were: VixOne (Westmed), Sidestream (CareFusion), MistyMax (AirLife), NebuTech (Salter Labs), and Intersurgical (Cirrus). Breathing was modeled using an ASL 5000 (Ingmar Medical) lung simulator; sinusoidal half-wave flow pump, tidal volume = 500 mL, frequency = 15/min. Nebulizer source flow was 8 L/min. Data were collected every 15 breaths for each nebulizer. Aerosol was collected on a HEPA filter and aerosol delivery quantified by weight changes of nebulizer and filter (Journal of Aerosol Medicine 2004;17:63-71). Nebulization was stopped after the cumulative delivery reached 60% of the desired dose (see Figure). Efﬁciencies were calculated as previously described: Respir Care 2007;52(8):1037–1050. RESULTS: Summary data are shown in the table. The Nebutech showed the best performance characteristics but was also the most expensive device. CONCLUSIONS: We have derived data from other studies showing that nebulizers vary greatly in aerosol delivery performance. Yet these devices are considered by clinicians to give the same treatments. Important improvements in both quality and efficiency of aerosol treatment practice can be achieved by proper selection of nebulizer.

**EVALUATING SAFETY AND CLINICAL FEASIBILITY OF AN IN-LINE MICROPUMP NEBULIZER FOR AEROSOL DRUG DELIVERY DURING HIGH FREQUENCY OSCILLATORY VENTILATION.**

Scott T. Dwyer, Stahrhime Robert, Annette Dekker, John Hunt, Michael D. Davis; University of Virginia, Charlottesville, VA

Introduction/Purpose: The delivery of aerosolized medications during high frequency oscillatory ventilation (HFOV) presents several known problems. This study explored the safety and efficacy of using a micropump nebulizer (Aeroneh Pro-X, Aerogen Ltd, Galway, Ireland) in conjunction with HFOV. Methods: A broad spectrum of ventilatory settings was applied to a Viasys/Sensormedics 3100A oscillator (Yorba Linda, CA) attached to a test lung. The settings used included the clinically applicable ranges of frequency, inspiratory time (%IT), and power. Mean airway pressure (Paw) and amplitude were recorded before and after introduction of an in-line micropump nebulizer at each setting. Results: Oscillator function was not significantly altered by introduction of in-line micropump nebulization. Mean airway pressures taken during aerosol delivery were an average of 2.8% (25-75 range of -0.01, 0.1) lower than Paw taken immediately prior using identical ventilator settings. Also, amplitude did not vary with addition of the nebulizer. Conclusions: Micropump nebulizers are a safe method for aerosol drug delivery to patients undergoing HFOV. The implications of these data will aid the respiratory care clinician in providing optimal care for patients requiring aerosol medications and mechanical ventilation.

**OPTIMIZATION OF A PROCEDURE USED TO MEASURE AEROSOL CHARACTERISTICS OF NEBULIZED SOLUTIONS USING A COOLED NEXT GENERATION IMPACTOR.**

Ariel Berlinski1, Janet B. Hayden2,1; Pediatrics, UAMS COM, Little Rock, AR; Pediatric Aerosol Research Laboratory at ACCHI, Little Rock, AR

Background: Cooling the Next Generation Impactor (MSP Corporation, Shoreview, MN) (NGI) is recommended to minimize evaporation due to heat transfer from impactor to aerosols when evaluating nebulized solutions (Dennis et al. Cooling the NGI – an approach to size a nebulised aerosol more accurately, Pharmeur Sci November 2008;27:20-30). This methodology increases testing time for serial testing procedures. We hypothesize that after an initial prolonged cooling time, experiments could be repeated after shorter cooling times without sacrificing accuracy. Methods: Three units of continuous output (Hudson RCI UP DRAFT 110 Operine Nebulizer, Teleflex Medical, Research Triangle Park, NC) (Hudson) and breath enhanced (PARI LC, PARI Respiratory Equipment Inc., Mullhousian, VA) (PARI) nebulizers were operated (6 L/min, central air) with albuterol solution (2.5mg/3mL) into a cooled (4°C) NGI (internal and external filters) calibrated at 15 L/min. Mass median aerodynamic diameter (MMAD), geometric standard deviation (GSD), % particles <5μm (%<5), and % particles 1-3μm (%P1-3) were compared with 3 different protocols. Initial cooling of the NGI (90 minutes for all protocols) was followed by 2 measurements with recooling intervals of either 90 and 90 (protocol A), 60 and 60 (protocol B) or 30 and 30 minutes (protocol C). Albuterol was diluted and measured by spectrophotometry (276 nm). Aerosol characteristics were calculated using CTT-DAS 3 software (Copley Scientific, Nottingham, UK). Data were compared using ANOVA for repeated measures. P < 0.05 was considered statistically significant. Results: MMAD, GSD, %<5, and P1-3 for first measurements of all protocols (n=9) were: 3.47 ± 0.21 μm, 2.31 ± 0.07, 67.3 ± 2.6%, and 40 ± 2.5% (PARU) and 4.56 ± 0.35 μm, 2.16 ± 0.08, 54 ± 3.7%, and 22.4 ± 2.8% (Hudson). No differences were found between cooling protocols (p > 0.05). Percentage of variation from first measurement ranged from: -5.9 to +2.1% (PARU) and -4.1 to +2.9% (Hudson) for MMAD, -9.0 to +4.9% (PARU) and -4.9 to +1.9% (Hudson) for GSD; 0 to +4.0% (PARU) and -3.7% to +5.7% (Hudson) for P<5; and -2.4 to +5.2% (PARU) and -1.8 to +6.9% (Hudson) for P1-3. Conclusions: Aerosol characteristics of nebulized solutions determined by NGI are not affected by performing 2 repeat measurements after re-cooling the impactor for either 30 or 60 minutes after an initial 90 minute time. This modification of the procedure increases productivity without losing accuracy.

**SYMPOSIUM 10: Aerosols/Drugs**

**890196**
**THE INFLUENCE OF PEDIATRIC AEROSOL MASK TYPES AND NEBULIZERS ON BRONCHIODILATOR DELIVERY IN VITRO.**

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Background: Breath enhanced nebulizer (BEN) has been reported to have higher efficiency than constant output nebulizers (CON). Previous studies showed that the Fish™ aerosol mask was more efficient than the standard aerosol mask. Objective: To compare the efficiency of different pediatric aerosol masks when used with different types of nebulizers.

Methods: Four nebulizers were compared with 2 masks. Three CONs including NebEasy (new design nebulizer to reduce dead volume), Neb-1 and Neb-2 (Galmed, Taiwan), were compared to the BE LC plus (PARI Inc.) using a standard aerosol mask (Galmed Corp) and “Bubbles the Fish” mask (PARI Inc.). A lung model (ALS 5000, IngMar Medical) simulated pediatric breathing parameters (VT 50 mL, Tinsp 0.8 s, and RR 25 breath/min). Salbutamol (5mg in 4 mL NS) was nebulized with 8 L/m at 50-pisg. Inhaled drug was collected on a bacterial filter (Galmed) and eluted with distilled water, and analyzed by spectrophotometer (Hitachi Crop) at 276 nm. Mann-Whitney U test was used for statistical analysis, p< 0.05 used for statistical significance. Results: Table 1 shows the median % (range) of total dose inhaled and dead space. The two CONs showed the highest inhaled dose>(p<0.05). Conclusion: Mask and nebulizer selection can increase inhaled dose-up to two fold in this model of simulated pediatric ventilation.

Sponsored Research - None

**IN VITRO INHALED AEROSOL COMPARISON OF A CONSERVING NEBULIZER (CIRCULAIRE II) VS. A BREATHE-ACTUATED NEBULIZER.**

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BACKGROUND: Two different aerosol drug delivery systems claim to deliver increased inhaled dose (IA) and shortened treatment time (TT). The Westmed Circulaire II (CIRC) uses the 'conserver' principle, incorporating a unidirectional valve and reservoir bag that stores aerosol generated during the patient’s exhalation which would otherwise be wasted on exhalation. Conversely, the Monaghan Medical Eclipse II Breath-Actuated Nebulizer (BAN) powers the nebulizer jet during inspiration only, to reduce the wasted component. Our department was already using CIRC and wished to decrease TT to comply with stricter corporate productivity standards. Acquisition cost differential favored a switch to CIRC but we needed to determine if TT could be shortened with equivalent IA. STUDY QUESTION: How does the IA of the CIRC compare to the BAN during adult and pediatric breathing patterns and different TT? METHODS: We bench tested 2 new samples each of CIRC and BAN taken from hospital stock. Each device was charged with 2-8 mCi of radiolabeled (99mTc) unit-dose albuterol (2.5 mg in 3 mL 0.9% NaCl). An adjustable piston ventilator created 4 different sinusoidal breathing patterns with a constant 7.5 L/min Minute Volume (VT/Ti/total%) of 15/50/50%, 15/50/50%, 30/250/50%, and 30/250/30%. The devices were run on wall air at 50 psig and 8 L/min. IA was captured on HEPA filters positioned at the ‘mouth’ of the lung model. Each test was run up to 12 mins; fresh filters were exchanged every 2 mins; exposed filters were measured in a radioisotope counter and the IA fraction (radioactivity on filter/radioactivity of initial nebulizer charge) was calculated for all filters. IA, expressed as mass of albuterol (mg) delivered to the HEPA filter, was determined by multiplying the IA fraction (radioactivity on filter/radioactivity of initial nebulizer charge) by the mass of the unit-dose albuterol (5mg). Mann-Whitney U test was used for statistical analysis, p<0.05 used for statistical significance.

Results: Table 1 shows the median % (range) of total dose inhaled and dead space. The two CONs showed the highest inhaled dose>(p<0.01). Conclusion: In this model of nebulizer technology, CIRC out-performed BAN inasmuch as equivalent IA was delivered in shorter duration of treatment and a lower occurrence of AE. Taken together, these findings are sufficiently compelling to prompt our respiratory department to replace all BANs with CIRC as our standard nebulizer, in an effort to improve overall productivity.

Sponsored Research - None

**EFFICACY, SAFETY, AND PATIENT AND RESPIRATORY THERAPIST SATISFACTION WITH A BREATHE-ACTUATED NEBULIZER.**

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BACKGROUND: Nebulized drug delivery is a cornerstone of therapy for obstructive lung disease but the ideal nebulizer design is uncertain. Newer nebulizers, such as the breath-actuated nebulizer (BAN) (AeroEclipse II® [Monaghan Medical Medical®], may be superior to conventional nebulizers due to reduced drug waste and delivery of appropriate IA during inspiration. The aim of the study was to compare the BAN to standard nebulizer therapy with regards to efficacy, safety, and patient and respiratory therapist satisfaction. METHOD: Adults admitted to the hospital with obstructive airway disease for which nebulizer therapy had been prescribed were asked to participate. Patients were randomly assigned to the order of nebulization delivery device and were surveyed at the completion of each treatment. Respiratory therapists assessed each patient’s heart rate, respiratory rate, and peak expiratory flow rate (PEFR) prior to and following treatment. Treatment time, and evidence of adverse events (AE) were recorded. Each respiratory therapist conducting the treatment was asked to assess his/her satisfaction with the BAN compared to standard nebulizer. RESULTS: Twenty-eight patients (46% male) were studied. Mean subject age was 69 years. Fifty-four percent of patients indicated that overall the BAN was superior to conventional nebulizer therapy; 68% indicated that the time of therapy was preferable with the BAN. Respiratory therapists were more satisfied with the BAN based on overall performance, duration, and ease of use over standard nebulizer. There were no significant differences in heart rate, PEFR, or respiratory rate before or after nebulization therapy with either device. The duration of treatment was significantly shorter with the BAN (4.9 vs 6.1 mins) as was the treatment time. Additionally, the BAN was associated with a lower occurrence of AE. CONCLUSION: Both patients and respiratory therapists expressed greater satisfaction with the BAN compared with standard nebulizer. Pros and post-treatment vital signs did not differ between groups but use of the BAN was associated with a shorter duration of treatment and a lower occurrence of AE. Taken together, these data support the use of the BAN for nebulized medication delivery.

Sponsored Research - None

- BAN=Breath-actuated nebulizer, RT= respiratory therapist, SD= standard deviation, CI= confidence interval
- Data presented with mean±SD unless specified.
- RT satisfaction scale where 1 meant not satisfied at all and 5 meant extremely satisfied.
- Mean difference analyzed using paired analysis with Wilcoxon Signed Rank Test
Background: Much debate has taken place regarding the efficacy of aerosolized medications given by nebulizer. Healthcare providers need to be aware of the types of problems encountered in order to support effectively COPD patients in inhalation of medication. Findings from this study showed that COPD patients using nebulizers in all stages prior, during and after inhalation of a nebulized dose. Results: All fifty patients (29 female, 21 male) (age range 54 - 91) reported experiencing one or more problems with the use of their nebulizer. Problems identified which occurred before inhalation of the nebulized dose were; complexity of setting up the equipment, lack of instructions for assembly of equipment, manual dexterity, time taken to set up the equipment, inadequate hygiene during setting up of the equipment and mishandling of the device. Problems during medication administration were; time to nebulize the dose, claustrophobic feelings during nebulizer use and incorrect inhalation technique or breathing patterns. Problems which occurred following administration were; inadequate cleaning of nebulizer components, lack of access to accessories e.g. face masks and tubing, cost of accessories and the use of damaged parts or self repairs. Conclusion: Findings from this study showed that COPD patients using nebulizers in their own homes experienced problems in all stages; before, during and after inhalation of medication. Healthcare providers need to be aware of the types of problems encountered in order to support effectively COPD patients with the use of their nebulizers at home to optimize health outcomes. 

Sponsored Research - None

THE PROBLEMS EXPERIENCED BY COPD PATIENTS USING NEBULIZERS AT HOME.

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Background: Chronic obstructive pulmonary disease (COPD) is a global health burden and a priority for many healthcare initiatives around the world. Nebulizers are a mainstay of treatment for patients with severe COPD. Understanding how patients use their nebulizers at home is vital to ensure effective treatment and suboptimal health outcomes. This novel study employs a mixed methods approach for a detailed investigation of nebulizer use from patients' perspectives. Method: A descriptive cross-sectional study design using in depth interviews, observations and survey methods was conducted among fifty patients with COPD using nebulizers at home. A representative sample including patients with different length of nebulizer use and different severity of disease was recruited from general practice populations and at hospital discharge. Qualitative and quantitative analyses were conducted to identify the range of problems experienced by nebulizer use in all stages prior, during and after inhalation of a nebulized dose. Results: All fifty patients (29 female, 21 male) (age range 54 - 91) reported experiencing one or more problems with the use of their nebulizer. Problems identified which occurred before inhalation of the nebulized dose were; complexity of setting up the equipment, lack of instructions for assembly of equipment, manual dexterity, time taken to set up the equipment, inadequate hygiene during setting up of the equipment and mishandling of the device. Problems during medication administration were; time to nebulize the dose, claustrophobic feelings during nebulizer use and incorrect inhalation technique or breathing patterns. Problems which occurred following administration were; inadequate cleaning of nebulizer components, lack of access to accessories e.g. face masks and tubing, cost of accessories and the use of damaged parts or self repairs. Conclusion: Findings from this study showed that COPD patients using nebulizers in their own homes experienced problems in all stages; before, during and after inhalation of medication. Healthcare providers need to be aware of the types of problems encountered in order to support effectively COPD patients with the use of their nebulizers at home to optimize health outcomes. 

Sponsored Research - None

THE USE OF TUSKS ON AN AEROSOL MASK TO INCREASE AEROSOL MEDICATION DELIVERY TO THE LUNGS.

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INTRODUCTION: The addition of large bore corrugated tubing (tusks) to act as a reservoir on an aerosol mask has been utilized to increase the FiO2 during aerosol delivery. We wanted to determine if the addition of tusks would increase the delivery of aerosol particles during aerosol therapy. METHODS: A bench model was created by adapting an adult intubation mannikin (Armstrong Medical Industries, Inc, Lincolnshire, IL) to a Hans-Rudolph series 1101 breathing simulator (Hans Rudolph Inc, Shawnee, KS). A TSI Certifier FA Plus ventilator tester (TSI Inc., Shoreview, MN) was then connected to the simulator to assure accuracy of tidal volumes and inspiratory flow rates. The simulator was set to a Raw of 5 cmH2O/L/sec, compliance of 60 ml/cmH2O, rate of 12, and amplitude adjusted to achieve a VT of 500ml. At the connection between the mannikin and simulator an AirLife HEPA filter was placed to collect aerosol particles. The filter was weighed at the start of each run and then a Vixone nebulizer was placed on the mannikin’s face using an aerosol mask. The nebulizer was filled with 5ml of a 3% NaCl solution and operated at 8 L/min for 10 min. After 10 min the filter was weighed and recorded. Tusks of 6”, 12” and 18” were then added to each side of the aerosol mask and the procedure was repeated for each length of tubing. This was repeated with three different nebulizers with the sequence of lengths rotating through each nebulizer. Any excess solution was emptied out of the nebulizer and allowed to dry with air going through the nebulizer for 2 min. Data was analyzed using SPSS software. A Kolmogorov-Smirnov test was performed to assess distribution and a paired T-test was used to compare means. A Pvalue of <0.05 was used for significance RESULTS: The aerosol mask alone showed a mean 0.06 g change in weight; 6” tusk bilaterally had a mean 0.16 g weight change, 12” tusk had a mean 0.21 g change, and 18” tusk had a mean 0.2 g change. When data was analyzed the only statistically different weight changes were between the aerosol mask and all tusk mask setups. There was no difference between the different tusk setups. CONCLUSION: Our findings suggest that the use of tusks inserted into the openings of an aerosol mask increases the aerosol delivery to a patient. Further research needs to be performed to assess the clinical significance of the addition of tusks to an aerosol mask during aerosol medication delivery to patients.

Sponsored Research - None
SECONDHAND AEROSOL EXPOSURE DURING MECHANICAL VENTILATION WITH AND WITHOUT EXPIRATORY FILTERS: AN IN-VITRO STUDY.

Arzu Ari1, James B. Fink1, Robert Harwood1, Beverly Williams1, Sue Pilbeam2; 1Georgia State University, Atlanta, GA; 2Maquet Inc, Wayne, NJ

Abstract body: Background: Concerns have been expressed about the risk of exposure to exhaled aerosols to clinicians and patients in the ICU. However research is limited. The purpose of this study was to quantify the amount of aerosol collected at the exhaust outlet of mechanical ventilators operated with and without filters in the expiratory limb. Methods: Ventilators tested in this study were divided into two categories: (1) Ventilators without Proprietary Filters: The Servo-i (Maquet) and Galileo (Hamilton) and (2) Ventilator with proprietary filters: PB 840 (Covidien). Each ventilator was attached to a simple test lung and operated at adult parameters (Vt 500 ml, RR 20 bpm, PIF 50 L/min, PEEP 5 cmH2O). Four separate doses of albuterol (2.5 mg/3mL) were administered via jet nebulizer (eValueMed, Tri-anim) placed at the “Y”. In Experiment A, a filter (Respirgard 303) was placed at the exhaust port. In Experiment B, two filters were attached to the ventilators without proprietary filters: (1) at the end of the expiratory limb and (2) at the exhaust outlet. Drug was eluted from filters and measured using spectrophotometry (276 nm). Descriptive statistics, independent samples t test and one way analysis of variance (ANOVA) were conducted to compare the amount of aerosol exiting from the exhaust filter of each ventilator. p<0.05 was considered statistically significant. Results: Table below shows % of total drug (mean ± SD) deposited. Drug deposited at the exhaust port without expiratory filter was >160 fold higher than with ventilator with the proprietary filter. Although the Respirgard filter was less efficient than the proprietary filter designed for use with the ventilator, placement in the expiratory limb reduced secondhand aerosol exposure significantly (p<0.05). Conclusion: Risk of exposure to secondhand or exhaled aerosol can account for > 45% of nominal dose as well as droplet nuclei produced by patients. Use of ventilators without expiratory filters increases the risk of exposure to aerosol released to atmosphere from the ventilator.

Sponsored Research - None

883793
THE SUCCESS OF DIAPHRAGMATIC PACING IN MECHANICALLY VENTILATED TETRAPLEGIC PATIENTS.

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Objective: To review the success of the diaphragmatic pacing placement in ventilator-dependent tetraplegic patients. Design: Cross-sectional cohort study. Methods: This study is based on a subset of tetraplegic patients that were successfully implanted with the diaphragmatic pacing (DP). Participants (n=8) reported on DP utilization times while surpassing the use of the mechanical ventilator. PACing times were recorded. Results: A total of 28 patients were tested for possible implantation. Eleven patients failed and were not implanted. Of the 16 that had successful DP placement, 11 were successfully contacted and interviewed. Age of patients ranged from 16 years to 66 years. All patients could sustain the need for mechanical ventilation for up to 12 hours per day. One participant has been able to surpass mechanical ventilation without the diaphragmatic pacemaker. Seven of 8 participants return to mechanical ventilation at night due to anxiety and light respiratory distress. All participants reported having good family support and continued satisfaction for having the DP. Conclusion: The findings suggest that the DP is a modality that has high patient satisfaction. Further research may serve as a potential replacement for prolonged mechanical ventilation.

Sponsored Research - None

919285

BREATH TYPE DELIVERY DURING A LUNG MODEL-VENTILATOR INTERACTION OF NON-INVASIVE VENTILATION IN THE PRESENCE OF A LEAK: COMPARING THE RESPIRONICS BiPAP® VISION, RESPIRONICS V60®, AND THE HAMILTON C2®

Robert L. Joyner, Sidney R. Schneider, Donald D’Aquila, Maribeth Cohey; Health Sciences, Salisbury University, Salisbury, MD

Background: Ideally, mechanical ventilators providing NPPV would automatically compensate for circuit and interface leaks to ensure patient-ventilator synchrony. Manufacturers of ventilators offering NPPV attempt to improve patient-ventilator interaction by incorporating features that detect and compensate for leaks while maintaining proper triggering and cycling. Methods: A lung model-ventilator performance comparison was constructed to compare the Respiration BiPAP Vision, the Respiration V60 and the Hamilton C2 during conditions of sequenced system leaks. Each ventilator evaluated in this study was exposed to a protocol that incorporated increasing and decreasing system leaks, during which time the time elapsed during recovery to a stable breath delivery pattern was recorded. For each leak condition, Repeated Measures Analysis of Variance (SPSS 17 for Windows) was used to compare within and between ventilator differences of elapsed time to recovery of a stable breath delivery pattern. Results: At levels of higher leaks (i.e., 25 L/min and 50 L/min), the C2 consistently had longer recovery times than either the Vision or the V60 (p < 0.05). Conclusion: During most conditions of leak we found that the V60 and the V60 recovered to a stable breath delivery pattern faster than the C2. Worthy of note, the breathing frequency of an air hungry patient may be higher than the chosen breath rate in our spontaneous breathing lung model, and therefore it would be interesting to complete a similar evaluation in a more tachypneic patient. It’s conceivable that with a higher spontaneous rate, ventilators with longer recovery times may not have enough time to recognize spontaneous efforts. This would result in continued disynchrounsly failed NPPV trials. Study is limited by its bench design and should be repeated in a clinical setting.

Sponsored Research - Grant support from Philips/Respironics

920670

TIME TO RECOVERY OF BASELINE BREATH DELIVERY DURING A LUNG MODEL-VENTILATOR INTERACTION OF NON-INVASIVE VENTILATION IN THE PRESENCE OF A LEAK: COMPARING THE RESPIRONICS BiPAP® VISION, RESPIRONICS V60®, AND THE HAMILTON C2®

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Sponsored Research - Grant support from Philips/Respironics

920982
ELECTRICAL IMPEDANCE TOMOGRAPHY CONFIRMS IMPROVEMENT OF LUNG AERATION AND VENTILATION IN SPONTANEOUSLY BREATHING PIGS DURING HFOV.
Karel Roublík1, Marc van Heerde2, Martin C. Kneyber3, Dick G. Markhorst2,1
1Dep. of Biomedical Technology, CTU in Prague, Fac. of Biomedical Engineering, Kládio, Czech Republic; 2Department of Respiratory Intensive Care, VU University Medical Center, Amsterdam, Netherlands; 3Department of Pediatric Intensive Care, Children’s Hospital, University Medical Center Groningen, Groningen, Netherlands.

Background: Maintenance of spontaneous breathing is advocated in mechanical ventilation. The objective of the study was to evaluate the effect of spontaneous breathing on lung characteristics during high-frequency oscillatory (HFO) ventilation in an animal model of mild lung injury. The HFO ventilator was equipped with a demand flow system to facilitate spontaneous breathing. Electrical impedance tomography (EIT) was used to assess lung aeration and ventilation and the occurrence of hyperinflation on account of spontaneous breathing. Design: Animal experiment. Setting: University animal laboratory. Subjects: Eight pigs (47 - 64 kg).

Interventions: Lung injury was induced by lung lavage with normal saline. Spontaneous breathing was preserved during HFO ventilation. HFO ventilation was applied, in runs of 30 minutes, with a continuous fresh gas flow (CF) or a custom-made demand flow (DF) system. In the end animals were studied paralyzed. EIT was used to assess regional lung characteristics.

Results: Comparison of end-tidal CO2 (ETCO2) showed that lung volume was best preserved when spontaneous breathing was maintained during HFO ventilation compared to HFO ventilation with muscular paralysis. The lung volume was predominately preserved in the dependent lung regions. A significant shift in ventilation across the lungs was observed when HFO ventilation with demand flow was applied compared to HFO ventilation and spontaneous breathing suppressed. Regional filling characteristics of the lung showed no signs of regional hyperinflation on account of spontaneous breathing with either CF or DF. Conclusions: Lung volume is preserved by spontaneous breathing during HFO ventilation in a porcine model of mild (low mean airway pressure) lung injury. Whether similar results would be observed in severe human ARDS will require further research.

Acknowledgement: The study was partly supported by grant MSM 6840770012.

Sponsored Research - None

920976

THE APNEA TEST FOR BRAIN DEATH WHILE STILL VENTILATED: IS IT FEASIBLE?
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BACKGROUND: Apnea testing is one of the last of a series of clinical tests for the diagnosis brain death. Because of the length of time that a patient is disconnected from a ventilator, there are high incidence reports of complications that could compromise viability of organs destined for transplantation primarily due to hypoxemia or cardiovascular instability. METHODS: As part of a quality-improvement project of the apnea test procedure, we assessed a formula that predicts target PaCO2 and PaO2 using a gas mix of 3% carbon dioxide/97% oxygen (carbogen) with capnography while patients remained on the ventilator, some who had high PEEP levels. This is a follow up to a previous pilot study to test the calculated formula. We also conducted a retrospective review of 60 sequential patients from January 2006 through December 2008, from which we compared the frequency of complications in literature review since the 1995 American Academy of Neurology evidence-based practice guidelines. Results: Comparison of end-tidal CO2 (ETCO2) showed that lung volume was best preserved when spontaneous breathing was maintained during HFO ventilation compared to HFO ventilation with muscular paralysis. The lung volume was predominately preserved in the dependent lung regions. A significant shift in ventilation across the lungs was observed when HFO ventilation with demand flow was applied compared to HFO ventilation and spontaneous breathing suppressed. Regional filling characteristics of the lung showed no signs of regional hyperinflation on account of spontaneous breathing with either CF or DF. Conclusions: Lung volume is preserved by spontaneous breathing during HFO ventilation in a porcine model of mild (low mean airway pressure) lung injury. Whether similar results would be observed in severe human ARDS will require further research.

Acknowledgement: The study was partly supported by grant MSM 6840770012.

Sponsored Research - None

787994

CO2 REBREATHING DURING SIMULATED NON INVADE VENTILATION: COMPARISON OF THE DRAGER CARINA AND RESPIRONICS VISION.
Mark S. Siobal, Laura Martin; Anesthesia, SFGH/UCSF, San Francisco, CA.

Background: CO2 rebreathing (RCO2) during NIV is influenced by the mechanical dead space added by the mask and the exhalation valve type. Use of a single leak valve (SLV) that lacks a true exhalation valve may cause RCO2 because a portion of the exhaled volume moves down the circuit during exhalation. If flow through the exhalation port and expiratory time are less than required to flush exhaled CO2 from the circuit, RCO2 occurs. RCO2 can be minimized by respiratory rate (RR). We tested the RCO2 on RCO2 using two single limb NIV devices. Method: A Michigan Instruments Test Lung with the two chambers together was powered on one side (muscle chamber) by a Drager XL ventilator. 100% CO2 was bled into the other side of the test lung (lung chamber) to simulate VCO2. End tidal CO2 (ETCO2) at the lung chamber was measured by the CO2 sensor from the XL ventilator. The muscle chamber was powered at 600 mL, RR of 20, 25, 30, and 35, I:E ratio of 1:1, and inspiratory flow rate of 40, 50, 60, 70, and 80 mL/cmH2O. The lung chamber was adjusted until an ETCO2 of 35-40 mm Hg was achieved at each setting. The Drager Carina using a single leak valve (DC1V) and two leak valves in series (DC2V) and a Respirisons Vision using two exhalation port types, Plateau Exhalation Valve (PEV) and Exhalation Port Adapter (VEPA) were tested. Following stabilization at each setting, the test device set to deliver a pressure support PIP of 15 and PEEP of 5 was attached to the lung chamber with a 12 inch section of aerosol tubing placed between the circuit and lung chamber to simulate the mechanical dead space volume of a face mask. The maximum change in ETCO2 from baseline at the lung chamber at each setting combination using each device was recorded. Results: The mean % increase ± STDV and range of ETCO2 changes at all settings was 3 ± 7%, -6% to 11% for the DC2V, 19 ± 10%, 8% to 31% for the VPEV, 26 ± 23%, 0% to 54% for the VEPA. Conclusion: RCO2 and an increase in ETCO2 occurred with all devices tested. RCO2 was greatest using the VEPA and lowest using the DC2V. The impact of RCO2 during the application and study of NIV can be determined utilizing a simple nasal mask to be recognized.

Sponsored Research - Received product support for this research project from Drager Medical

921227

RESPIRATORY THERAPY DRIVEN PROTOCOLS SIGNIFICANTLY DECREASED RE-INTUBATION RATES AND LOWERED EXTUBATION TIMES IN CARDIAC SURGERY PATIENTS.
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The integration of a Respiratory Department Driven protocol utilizing Rapid Shallow Breathing Index (RSBI) resulted in low extubation times and low re-intubation rates in open heart surgery patients. The maximum allowed rapid shallow breathing index was 105, We studied 1000 open heart surgery patients prospectively between April 16th 2004 and June 16th 2010. This included 65 value of surgey. 593 coronary artery bypass graft (CABG) patients and 66 Stanford A Aneurysm Patients, 6 aortic dissection patients and 16 off pump CABG patients. Out of the 1000 patients in CITCU that required post surgic ventilatory support, 775 patients were weaned and extubated within three hours. 215 patients were outlives and 12 patients were re-intubated within 24 hours. EXTUBATION HALTING CRITERIA/OUTLIER: Medistinal Hernorrhage 200cc/hour Ramsay Sedation scale 4 Metabolic or respiratory acidosis. Postoperative re-intubations were defined as extubation time being within the arrival of the patient in the intensive care unit to time that patient was extubated. The mean extubation time was 2 hours and 49 minutes. The mean extubation time was unaffected by outliers who did not meet the weaning criteria. We had total of 12 re-intubations in all patients from the study duration. Overall mean extubation times were unaffected by the age, hemodynamic status, comorbidity, or ejection fraction. We utilised non-invasive positive pressure ventilation (NIPPV), super high flow therapy (SHFT) and Heliox modalities post extu-
A COMPUTERIZED RESPIRATORY THERAPY DRIVEN PROTOCOL IMPROVES VENTILATOR ORDER RECONCILIATION.

Matthew Davis1, Jennifer M. Davis1,2, Rob Smith1, Carl Shanholz1,3, Giora Netzer2, Xinggang Liu2; 1Respiratory Care, University of Maryland Medical Center, Baltimore, MD; 2Pulmonary & Critical Care Medicine, University of Maryland Medical Center, Baltimore, MD

Background: Ventilator order reconciliation or the matching of ventilator orders to ventilator settings can vary widely. We describe and assess the effect of a computerized respiratory therapist driven protocol (c-TDP) on ventilator order reconciliation. Methods: A single-center prospective, quasi-experimental design was performed comparing 1476 ventilator days in eight intensive care units (ICU) between 09/21/07 and 07/08/08 before the initiation of the c-TDP with 552 ventilator days between 11/18/08 and 11/03/09 after its implementation. The c-TDP consists of eight pathways initially ordered by the physician, with respiratory therapy performing ventilator changes and updating ventilator orders based on the algorithms within these pathways. The consistency of ventilator orders to ventilator settings per ventilator day was assessed and evaluated in each ICU bed once monthly before and after the protocol’s initiation. Results: The consistency of ventilator orders to ventilator settings improved significantly after the protocol’s implementation (47% vs. 77%, p<0.001). Improvement was found in each ICU type studied: medical (50% vs. 80%, p<0.001), surgical (34% vs. 72%, p<0.001), and trauma (55% vs. 80%, p<0.001). The magnitude of change by ICU type was similar (p=0.34). Conclusion: In conclusion, the consistency of ventilator orders improved significantly after the c-TDP’s implementation. This c-TDP improved ventilator order reconciliation. This protocol may reduce the error rate associated with the ventilator order reconciliation process and potentially improving communication within the multi-disciplinary team.

Sponsored Research - None

880470

COMPARISON OF PEAK-EXPIRATORY FLOW RATE AND END-EXPIRATORY PRESSURE DURING AIRWAY PRESSURE RELEASE VEENTILATION WITH THE DRAGER XL, VIASYS AVEA, PB 840 AND SERVO-I.

Ross Armstrong1, David Strong2, Lonny Ashworth3; 1St. Luke’s Regional Medical Center, Boise, ID; 2Boise State University, Boise, ID

Background: Airway Pressure Release Ventilation (APRV) is a mode of ventilation that is used by some clinicians in the management of patients with ARDS. By combining two different levels of CPAP, APRV allows the patient to breathe spontaneously at any point during the respiratory cycle. Frequency, during APRV the TimeLow is set to end when a percentage of the Peak-Expiratory Flow Rate (PEFR) is reached. The purpose of this study is to measure PEFR during TimeLow and End-Expiration Pressure (EEP) at the end of TimeLow in APRV while ventilating an electronic lung simulator at three different levels of compliance. Method: The Hans Rudolph HR 1101 Electronic Lung Simulator was interfaced, using a size 8.0 ETT, to the Drager XL, Viasys Aave, Puritan Bennett 840 and Servo-I. Settings on the HR 1101 were: Resistance 12 cm H2O/L/sec, Compliance 15, 20 and 25 mL/cmH2O, Rate 30/minute, Amplitude 0, Effort Slope 15, % Inhale 33. Target Volume 3000 mL, Load Effort Normal. Data points were measured at intervals of 0.05 seconds. Each ventilator was placed in APRV at the following settings: TimeHigh 8 seconds, TimeLow 0.3 seconds, PressureHigh 25 cmH2O, PressureLow 0 cm H2O. Tube Compensation off. At each compliance setting, PEFR was measured as the greatest flowrate during TimeLow; EEF was measured at the point where TimeLow transitioned to TimeHigh. Results: At each compliance level the PB 840 had the highest PEFR measurements; the Viasys Avea had the lowest PEFR measurements. The lowest PEFR was measured when using the Servo-I. The highest PEFR varied depending upon the compliance level and the ventilator. Conclusion: When using an electronic lung simulator at three different levels of compliance, the EEF was within 1.5 cm H2O among the ventilators at each compliance level. However, the PEFR varied considerably among the ventilators. Because many clinicians set TimeLow based upon a percentage of PEFR, one should consider that the PEFR may vary depending upon the ventilator being used. Further studies are necessary to determine the impact of our findings on actual patient’s PEFR and EEF, and the associated clinical significance.

Sponsored Research - None

918534

A MULTI-PROFESSIONAL APPROACH REDUCES PROLONGED VENTILATION OF CORONARY ARTERY BYPASS PATIENTS.

Michael Bocci1, Faisal Masud2, Ken Hargett1, Jose Rodriguez1, Romar Reyes1, Margaret Berger1, Kathy Knacke2, Dana Sanmavety2; 1Respiratory Care Services, The Methodist Hospital, Houston, TX; 2DeBakey Heart and Vascular Center, The Methodist Hospital, Houston, TX

Background: The Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database report is an important benchmark program for institutions performing cardiovascular surgery. This national database allows for comparison of performance, but does not specifically identify patients who experience prolonged ventilation (defined as >24 hours) for Coronary Artery Bypass (CAB). Our institution had experienced an increase in the percent of prolonged ventilation to 20.7% in 2009. A performance improvement process was implemented to reduce prolonged ventilation to <10%.

Methods: A Multi-Professional team with representatives from CV Surgery, Nursing, Intensivist, Respiratory Care, and Performance Improvement was formed. Initial problems identified included: 1) lack of awareness of the 24-hour window from all caregivers, 2) inconsistent application of existing weaning protocols, and 3) inconsistent coordination of sedation. A plan was developed: 1) increase awareness of the 24-hour window, 2) improve communications between caregivers and 3) increase interventions before 24 hours. Specific interventions included: education of all caregivers, use of the 24-hour window to all caregivers; specifically consulting physicians. A highly visible green card was posted on the ventilator that indicated time zero (admission to unit). The green card also identified specific time intervals of 6, 12, 18, 20 and 22 hours for performance of sedation reduction and spontaneous breathing trials. Utilization of a sedation protocol was enhanced by revision of the electronic version of the protocol followed by education to nursing, physicians and respiratory care. Daily rounds were established to address every patient approaching 18-20 hours of ventilation. A weekly meeting was established to review all patients and discuss reasons for patients that exceeded 24 hours. Additional interventions including follow-up from lead cardiovascular physicians that had contributed to prolonged ventilation.

Results: Immediate results were obtained within the first month with a reduction to 16.1% of the CAB patients experiencing prolonged ventilation. Further refinement resulted in 8.5% by the end of the second month. A 6 month period in excess of 252 patients was included with <9% prolonged ventilation. In a 6 month period in excess of 252 patients were included with <9% prolonged ventilation. In conclusion, a Multi-Professional approach utilizing increased awareness, incorporation of visual aids, effective communication, and coordination of sedation reduction and spontaneous breathing trials, can reduce the percentage of prolonged ventilation in CAB patients.

Sponsored Research - None

919580

EFFECT OF TUBE COMPENSATION ON TIDAL VOLUME DURING A SIMULATED SPONTANEOUS BREATHING TRIAL.

Britney L. Griffith1, Jesse Ferguson1, Lonny Ashworth1; 1Respiratory Care, Boise State University, Boise, ID

Background: Tube Compensation (TC) is an option on some mechanical ventilators used to compensate for the increased work of breathing (WOB) created by the endotracheal tube (ETT). When the problem that necessitates ventilatory support has resolved, a spontaneous breathing trial (SBT) is conducted to see if the patient meets criteria for extubation. Recent research indicates that TC may either over-compensate (provide more pressure than is needed to overcome the imposed resistance of the ETT) or under-compensate (causing increased WOB because of the ETT). If the machine overcompensates, additional pressure and volume will be delivered to the patient; this could cause a patient to falsely pass an SBT. This is a bench study conducted to determine how delivered volume is impacted by patient effort, size of ETT, and by the ventilator itself during a simulated SBT. Methods: The Hans Rudolph HR 1101 Electronic Lung Simulator was interfaced with size 7.0, 7.5, 8.0 and 8.5 ETTs, to the Viasys Aave, the PB 840, and the Drager XL. Data was measured by the HR 1101 at intervals of 0.05 seconds. Settings on the HR 1101 were: Resistance 25 cmH2O/sec, Compliance 60 ml/cmH2O, rate 20/minute, slope 1, 20%, inhale, target volume 5000 mL, effort type SHORTIE. The HR 1101 Amplitude (patient effort) was set at 5, 10, 15, 20 for each ETT size and for each ventilator. The ventilators were placed in CPAP mode (5 cmH2O CPAP) at 10L/min, 80% spontaneous, 20% mandatory at the upper limit. Each ETT, at each amplitude setting, with ATC on and off was assessed. Additionally, the Drager XL was evaluated at both 100% compensation and the manufacturer recommended 80% compensation. Results: As the internal diameter of ETT decreased, there was a linear increase in delivered tidal volume (7.0% vs. 11%, 9.0% vs. 10% and 80%) and the PB 840. The most significant increase in tidal volume (17%) occurred using the Drager (100%) compensation with a size 7.0 ETT and amplitude 20. The 17% increase in tidal volume was equal to 79 mL per breath; at a rate of 20, this would increase ventilation by 62 mL per minute. Conclusion: From this study, this demonstrates that TC does affect tidal volume as amplitude and ETT size change. Clinicians must realize that TC may augment a patient’s spontaneous tidal volume and may overcompensate for ETT resistance and provide additional support which is removed upon extubation. The use of TC during an SBT requires further evaluation in clinical settings.

Sponsored Research - None

913959

Measured Tidal Volume with Tube Compensation Off and On during a Simulated Spontaneous Breathing Trial using an Electronic Lung Simulator, Amplitude 20
A SCREENING TOOL USED TO ASSIST IN IDENTIFYING VAP IN A LARGE VENTILATOR POPULATION.

Michael Boccì, Rob Todd, Ken Hargett, Romar Reyes, Jose Rodriguez, Margaret Berger, Peggy Turner; Respiratory Care Services, The Methodist Hospital, Houston, TX.

Background: Ventilator Associated Pneumonia (VAP) is an important topic for all institutions especially those that have a large population of ventilator patients. Infection Control departments often do not have sufficient resources to evaluate these patients. The National Nosocomial Infection Surveillance System allowed rotational sampling to determine VAP rates. This process often created questions regarding accurate reporting. Our institution averages 60-65 ventilators/day in 5 Intensive Care Units. A screening tool was developed by Respiratory Care to assist Infection Prevention Practitioners identify patients suspected of VAP. Method: Utilizing the Respiratory Care Management Information System, a VAP screening activity that incorporated components of the CDC definition of VAP was created. It included 1) change in color, consistency or amount of sputum 2) new or persistent infiltrate, 3) P/F < 240, 4) Fever>38 C, 5) VAP suspected in progress note. All vent patients were screened daily. A report that included all patients with a yes to any of the criteria was provided to Infection Prevention Practitioners for individual patient evaluation and discussion with the MD. Results: In 6 months 1308 patients with 10,802 vent days were screened. 392 (30%) patients had one or more indicators during their ventilation. 18 patients (4.5%) had VAP suspicion documented in the progress note. A breakdown of the indicators is included in the chart below. Conclusion: New or progressive infiltrate and P/F < 240 is common on ventilator patients but not specific for VAP (VAP rate < 1/1000 vent days). Conclusion: New or progressive infiltrate and P/F < 240 is common on ventilator patients but not specific for VAP. A screening activity that incorporates components of the CDC definition of VAP was created. It included 1) change in color, consistency or amount of sputum 2) new or persistent infiltrate, 3) P/F < 240, 4) Fever>38 C, 5) VAP suspected in progress note. All vent patients were screened daily. A report that included all patients with a yes to any of the criteria was provided to Infection Prevention Practitioners for individual patient evaluation and discussion with the MD. Results: In 6 months 1308 patients with 10,802 vent days were screened. 392 (30%) patients had one or more indicators during their ventilation. 18 patients (4.5%) had VAP suspicion documented in the progress note. A breakdown of the indicators is included in the chart below. Conclusion: New or progressive infiltrate and P/F < 240 is common on ventilator patients but not specific enough to be the only indicator for VAP. The diagnosis of VAP is difficult and suspected by attending physicians even when the patient does not meet CDC definitions. Infection Prevention Practitioners follow stringent CDC definitions to properly diagnose VAP but cannot see all patients on a daily basis. A Respiratory Care screening tool utilizing the CDC definitions of VAP can be used to target surveillance by Infection Prevention Practitioners.

Sponsored Research - None

TIME TO SET UP AND OPERATE AN EMERGENCY USE VENTILATOR WITH NO DEVICE SPECIFIC TRAINING.

John W. Newhart; Resp Care, UCSD Medical Center, San Diego, CA.

Background: Training of clinical staff on various pieces of emergency medical equipment stockpiled for a local disaster is a daunting task. In the event of an actual disaster, staff will be called upon to use equipment they are not familiar with. To test the viability of minimal “just in time” education for this ventilator we embarked upon this study. We tested staff to see if they could set up and run a ventilator they were not familiar with using only minimal printed instructions and their own experience Methods: Participants were randomly chosen with the only criteria being that they worked in our department as a Respiratory Therapist. They were at work on the days the testing took place and had no prior experience or training with this ventilator (HT-50, Newport Medical Costa Mesa CA). The test consisted of assembling the ventilator circuit and blinder then connecting it to a test lung. Participants were given a single sheet of written instructions with ventilator settings. They could also ask questions for clarification before the manufacturer. I timed each staff member from the time they started to assemble the circuit and blinder until they had the ventilator successfully deliver 2 breaths with no alarms sounding. Results: A total of 15 RT’s participated in the test. The shortest length of time it took to complete the test was 2 min. 41 sec. the longest 7 min. 36 sec. and the average time was 4 min. 53 sec. Discussion: Based on this sampling of staff that were tested, it appears that with a relatively simple ventilator such as the HT-50 and minimal well written instructions that Respiratory Therapists would likely be successful using this equipment as it was intended. 

Sponsored Research - None

A COMPARISON OF THREE METHODS TO SET TLOW ON AIRWAY PRESSURE RELEASE VENTILATION - A MODEL STUDY.

Hamzah M. Siddiqui1, Eduardo Mires-Colchado2, Robert L. Chatburn2; 1Division of Pulmonary and Critical Care Medicine, UAMS, Little Rock, AR; 2Respiratory Institute, Cleveland Clinic, Cleveland, OH.

BACKGROUND: There is no consensus on how to set the release phase duration (Tlow) in APRV. Reviewing the literature, we were able to identify 3 methods to set APRV, each with distinct goals. No theoretical, animal or clinical studies have been used to demonstrate their effect. The purpose of this study was to evaluate the ventilation outcomes of the 3 methods using a simulator. METHODS: We implemented a mathematical model of pressure control ventilation (1 Appl Physiol 1989; 67(5):1081-92) in a spreadsheet. Three different methods of APRV settings were evaluated: 1) Target peak expiratory flow rate (PEFR) between 50-75% by Tlow (Crit Care Med 2005; 33[Suppl1]:S228-40); 2) Titrate Tlow to target VT 4-6 cc/kg (http://ccm tutorials.com); and 3) Set Tlow to 4 time constants to achieve complete exhalation and titrate the release phase pressure (Plow) to achieve VT 4-6 cc/kg (Fundamentals of Mechanical Ventilation, 2nd Ed, 2006). For all methods, we kept the high pressure (Phigh) = 25 cm H2O and the time on Phigh (Thigh) = 4 s. We used an inspiratory respiratory rate (RE) of 15 cmH2O/ls, and three sets of static compliance (C) 15, 30 and 60 ml/cmH2O, values which have been previously published for ARDS patients. For methods 1 and 2 we set the Plow at 0 cm H2O, changed the Tlow, and calculated VT and aPEEP. For method 3 we varied the Plow to target the VT 4 – 6 cc/kg. RESULTS: For method 1 between 50-75% was only achieved with 60 ml/cmH2O. For method 2, Tlow ranged between 0.4-6 s for C of 15 and 30 ml/cmH2O, but only single Tlow values of 0.3 and 0.2 s were possible for C of 30 and 60 ml/cmH2O respectively; however, this was associated with aPEEP of 13 and 20 cmH2O. For method 3, with C of 30 and 60 ml/cmH2O, Plow values ranged between 0.4-12, 18-20 cmH2O respectively. For all methods, mean airway pressure was similar. CONCLUSION: Method 1 and 2 to set APRV have limited combinations of settings for the respiratory characteristics of patients with ARDS. These methods may result in injurious tidal volumes and significant aPEEP. Furthermore, there is dependence between aPEEP and VT making it difficult to achieve the goals of lung protective ventilation. Method 3 allows the best titration of settings to achieve ventilation goals while maintaining the same mean airway pressure.

Sponsored Research - None

A COMPARISON OF PROPORTIONAL ASSIST VENTILATION AND VOLUME SUPPORT ON TOTAL PATIENT INSPIRATORY WORK OF BREATHING IN A LUNG MODEL.

David Vines1, Cherie Albertson1, Casey Reynolds-McCarty2; 1Respiratory Care Rush University, Chicago, IL; 2Respiratory Care, UT Health Science Center San Antonio, San Antonio, TX.

BACKGROUND: In theory, proportional assist ventilation (PAV) will automatically adjust support as the total patient inspiratory work of breathing (TPiWOB) increases. Volume Support (VS) will adjust support to maintain an inspired tidal volume as lung mechanics vary. To gain a better understanding of the effect that PAV and VS has on TPiWOB, we compared TPiWOB between assisted-volume control (VC), pressure support ventilation (PSV), and PAV using a two-compartment mechanical lung model (Michigan Instruments Inc., Grand Rapids, MI) to simulate spontaneous breathing. METHODS: TPiWOB was estimated using the Ventrat 1560 Respiratory Mechanics Monitoring System (Novametrics Medical Systems, Inc., Wallingford, CT) as follows: TPiWOB= WOBB*B(A)+ WOBB, where WOBB was first measured on lung B using tidal volumes of 20 cc/kg, 40 cc/kg, 60 cc/kg, and 80 cc/kg, with corresponding PIP of 10, 15 or 20 cm H2O. TPiWOB was converted from joules to joules per liter (J/L) based on the delivered airway pressure (Paw) to achieve VT 4-6 cc/kg (Fundamentals of Mechanical Ventilation, 2nd Ed, 2006). For all methods, we kept the high pressure (Phigh) = 25 cm H2O and the time on Phigh (Thigh) = 4 s. We used an inspiratory respiratory rate (RE) of 15 cmH2O/ls, and three sets of static compliance (C) 15, 30 and 60 ml/cmH2O, values which have been previously published for ARDS patients. For methods 1 and 2 we set the Plow at 0 cm H2O, changed the Tlow, and calculated VT and aPEEP. For method 3 we varied the Plow to target the VT 4 – 6 cc/kg. RESULTS: For method 1 between 50-75% was only achieved with 60 ml/cmH2O. For method 2, Tlow ranged between 0.4-6 s for C of 15 and 30 ml/cmH2O, but only single Tlow values of 0.3 and 0.2 s were possible for C of 30 and 60 ml/cmH2O respectively; however, this was associated with aPEEP of 13 and 20 cmH2O. For method 3, with C of 30 and 60 ml/cmH2O, Plow values ranged between 0.4-12, 18-20 cmH2O respectively. For all methods, mean airway pressure was similar. CONCLUSION: Method 1 and 2 to set APRV have limited combinations of settings for the respiratory characteristics of patients with ARDS. These methods may result in injurious tidal volumes and significant aPEEP. Furthermore, there is dependence between aPEEP and VT making it difficult to achieve the goals of lung protective ventilation. Method 3 allows the best titration of settings to achieve ventilation goals while maintaining the same mean airway pressure.

Sponsored Research - None

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TRIAGE OF NON-INVASIVE POSITIVE PRESSURE VENTILATION (NPPV) PATIENTS EVALUATED IN THE EMERGENCY DEPARTMENT (ED).

Richard Hinds¹, Steven Holets¹, Abdi Ahmed², Michelle Hisdahl¹, Sarah Kudrna¹, Peter Gay³; ¹Department of Respiratory Care, Mayo Clinic, Rochester, MN; ²Mayo School of Health Sciences and University of Minnesota’s Respiratory Care Program, Mayo Clinic, Rochester, MN; ³Department of Pulmonary and Critical Care Medicine, Mayo Clinic, Rochester, MN

Background: NPPV is commonly used in patients with acute respiratory failure in the ED but the pathway of treatment varies widely with respect to admission criteria and appropriate hospital venue for monitoring and continued treatment. We hypothesized that a large cohort of NPPV patients could potentially be treated in a less resource intense environment. Method: The study was a retrospective chart review of all patients admitted to the Emergency Department who were administered NPPV within a 12 month period. Primary variables measured included hospital length of stay, ICU length of stay, arterial blood gases and hospital mortality. Cases were classified as respiratory failure, cardiac failure, mixed respiratory and cardiac failure or ‘other’ based on the medical record. Cases classified as respiratory failure were further analyzed to identify subjects with a pH less than 7.25, FiO2 > 0.7, or those that required ICU monitoring and treatment for hemodynamic instability. Results: Between January 1st, 2008 to December 31st, 2008, there were 193 encounters of NPPV in the Emergency Department from 184 unique patients. There were 62.2% (n=120) with respiratory failure, 15% (n=29) with cardiac failure, 11.4% (n=22) patients with both respiratory and cardiac failure and 11.5% (n = 22) were classified as ‘other,’ and 12.4% (n=24) required intubation. Of the 24 patients intubated, 29.2% (n=7) were intubated in the ED and 70.8% (n=17) were intubated in the ICU. In the 108 patients with respiratory failure admitted to the ICU from the ED who were not intubated, 63 (58%) met criteria to be treated and monitored in the hospital ward area. Individual daily hospital bed charges would be reduced by 60%. Conclusions: We recommend that institutional criteria be established to better triage NPPV patients after admission from the ED. This could result in substantial cost savings and better utilization of ICU resources.

PROGRESSIVE UPRIGHT MOBILITY (PUM) – GETTING CRITICAL CARE MOVING!

Christy Wright; Maury Regional Medical Center, Columbia, TN

Introduction: Our goal is to set a higher standard of care, and mobilize our adult critical care population quickly. The critical care stay in itself can decrease a patient’s physical conditioning level in a very short period of time. One day of strict bed rest requires two weeks of reconditioning to return a patient back to baseline. This also leads to cardiovascular deconditioning, respiratory infections, skin breakdown, renal complications, gastrointestinal complications and neurological complications. The importance of early mobility is evident. A multidisciplinary team was established including: nursing, respiratory care, physical therapy, critical care nurse practitioners, intensivists and lift team. A protocol was written and everyone’s roles were established. Critical Care’s Role in PUM protocol: As a respiratory therapist in the critical care unit, the patient’s airway safety is the number one priority. The idea of early mobilization of an intubated patient was a foreign thought. The protocol calls for respiratory therapists to be in charge of the airway throughout the whole mobility process. The nurse is really the driving force and has to do their part to get this protocol started once the patients are stable. Physical Therapy will also coordinate with nursing and respiratory. The Lift Team joins the process when mobility is to take place on each patient. The Lift Team is present for mobilization to help all staff and the patients for lifting support. The protocol is initiated with an order from the physician or nurse practitioner. RESULTS; Our ICU length of stay was decreased by 0.8 days. The mobility protocol improved clinical outcomes for our ventilated patients, decreased mortality rates, and decreased morbidity complications. These clinical outcomes are all based on comparisons of the top 15% of best practice hospitals nationally. Financial outcomes for ventilator patient’s pre and post mobility protocol represented a savings of approximately $436,000. The results have been great for our patient’s in critical care.

Sponsored Research - None
PROTEIN KINASE ACTIVITY AND EXPRESSION OF ITS ISOENZYMES DURING THE ONSET OF ASTHMA.

Rakesh K. Mishra, biochemistry&molecular biology, university of texas medical branch, Galveston, TX

Protein Kinase C (PKC) plays a pivotal role in airway inflammation in asthma. Changes in PKC activity and expression at the time of airway inflammation require further study in animal models. In our study, we characterized PKC activity and expression in patients with asthma. In patients with asthma, PKC activity and expression were increased in lung tissue compared to healthy controls. The increased PKC activity and expression may be due to the inflammatory cytokines and chemokines produced by airway epithelial cells and immune cells. These results suggest that PKC activity and expression may be involved in the pathogenesis of asthma.

Sponsored Research - Educational Grants from:

Pfizer Pharmaceuticals and Boehringer Ingelheim Pharmaceuticals

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Wednesday, December 8; 3:00 pm to 4:55 pm (Room N240/N242)

SYMPOSIUM 12: Asthma/Pulmonary Disease/Aerosols/Drugs

INCREASES IN AIRWAY EOSINOPHILIA AND A TH2 CYTOKINE DURING THE CHRONIC ASYMMPTOMATIC PHASE IN PATIENTS WITH ASTHMA.

Chang-Keun Kim, Gerald Volchecke, Hirohito Kita; 2Asthma Allergy Center, Inje University-Sanggye-pak Hospital, Seoul, Republic of Korea; 2Department of Immunology, Mayo Clinic and Foundation, Rochester, MN

Background: Previous studies, using allergen asthma challenge models or measurements during acute asthma exacerbations, have suggested roles for the Th2 cytokines in promoting airway inflammation in asthma patients. We assessed mediators of airway inflammation during the chronic asymptomatic phase of asthma.

Methods: Nineteen nonatopic asthma (NAA) patients, 15 with allergic asthma (AA) patients, 20 atopic controls (AC), and 38 normal controls (NC) underwent sputum induction when asymptomatic. Sputum total cell counts and differentials were determined; levels of the cytokines, IL-4, IL-5, IL-13, GM-CSF, IFN-γ, and the chemokines, eotaxin and RANTES, were measured by ELISA; and the levels of eosinophil-derived neurotoxin (EDN) were measured by radioimmunoassay (RIA). Results: NAA and AA patients showed a higher percentage of sputum eosinophils compared to AC (P<0.001) and NC (P<0.001); furthermore, NAA patients showed higher percentage of sputum eosinophils and total eosinophils compared to AA (P<0.01). Similarly, NAA and AA patients showed higher sputum EDN levels compared to AC (P<0.01 and P<0.05) and NC (P<0.01). No differences were observed in the sputum GM-CSF levels among AA, AC, and NC patients, the percentage of sputum eosinophils and EDN levels correlated positively with the levels of IFN-γ (r=0.606 and p<0.0001, r=0.432 and p<0.01), GM-CSF (r=0.453 and p=0.01), T+LABA (r=0.601 and p<0.0001), and RANTES (r=0.506 and p<0.001, r=0.480 and p<0.001), but not with the IL-5 levels. Conclusions: The baseline airway inflammation of asthma, irrespective of an atopic or nonatopic diathesis, is characterized by eosinophilic inflammation and a Th1 cytokine, IFN-γ. GM-CSF, instead of IL-5, and chemokines may coordinate airway eosinophilia during the chronic phase of asthma.

Sponsored Research - None

903602

UTILIZATION OF TIOFROPIUM PLUS LONG-ACTING BETA-2 AGONISTS IN A VETERANS POPULATION.

Eborechiku Onukwugha, 1C. Daniel Mullins, 2Sylvain DeLisle; 1University of Maryland School of Pharmacy, Baltimore, MD; 2University of Maryland School of Medicine and Veterans Affairs Maryland Health Care System, Baltimore, MD

Background: Among patients with chronic obstructive pulmonary disease (COPD), there is increasing use of combination therapy, particularly among patients who are not controlled on monotherapy. We examine the clinical and economic characteristics of veterans who were prescribed long-acting beta2-agonists (T+LABA) in a naturalistic setting among veterans with COPD, with particular attention to severity of disease. Methods: Electronic medical records from the Veterans Affairs (VA) Maryland Health Care System for the period of 2007-2009 were analyzed. Inclusion criteria: 1) filled prescription for T or LABA between 2005 and 2007; 2) pulmonary function test (PFT) results; 3) PFT-based evidence of COPD. Disease severity and medication use within the first 6 months following the first filled prescription were identified via chart review. Bivariate statistics and multivariable logistic regression models were used to identify clinical and demographic predictors of T+LABA. Sensitivity analysis explored a revised definition of combination therapy that included the use of two or more of the following: inhaled corticosteroids (ICS), T and LABA. Results: The 838 PFT-confirmed COPD patients on T and/or LABA had the following characteristics: 95% male; 58% non-Hispanic White; age 65-74 (N=137), 75-84 (N=230), age 50-64 (N=230), age 65-74 (N=231), age 75+ (N=240); mild COPD (7%), moderate (36%), severe (42%) and very severe (15%); T only (7%); LABA only (82%); T + LABA (11%). The utilization of combination therapy (T only or LABA only) versus combination therapy varied by disease stage (p<0.0001): Mild, 100% vs. 0%; Moderate, 95% vs. 5%; Severe, 85% vs. 15%; Very severe, 78% vs. 22%. In multivariable analysis, the adjusted odds of receipt of T+LABA for patients with severe/slower severe disease was 5 times (AOR: 4.99, 95% CI: 2.77-9.03, p<0.001) that of patients with moderate disease. Other measures (e.g. age, race/ethnicity, smoker status, marital status) were not statistically significantly associated with receipt of T+LABA. Results were unchanged using the broader definition of combination therapy that included ICS. Conclusion: In a cohort of veterans with PFT-proven COPD, we find that one tenth of the sample uses T+LABA while the majority receives LABA alone. Additionally, disease severity rather than demographic measures is the primary predictor of receipt of multiple medications compared to T or LABA alone among veterans with COPD. Sponsored Research - Study is funded by Novartis.

Sponsored Research - None

906533

890390
UTILIZING AN ALGORITHM TO GUIDE RESPIRATORY CARE FOR THE PEDIATRIC PATIENT WITH ACUTE CHEST SYNDROME.

Suzanne Iniguez, Lee Evey; Respiratory Care, Texas Children’s Hospital, Houston, TX

BACKGROUND: About 50% of patients diagnosed with acute chest syndrome (ACS) will develop a respiratory complication during hospitalization for another problem, i.e. pain crisis. ACS is estimated to account for 25% of Sickle Cell Disease (SCD) related deaths. A multi-disciplinary team was created to develop a treatment plan for this patient population and to develop an evidence-based practice guideline, part of this guideline focused on the respiratory care that these patients should receive. METHOD: The patient population to be included was from age 1 to 21 years with an acute illness associated with lower respiratory symptoms, new hypoxemia, or new infiltrate on chest x-ray. The patients were scored using the Clinical Respiratory Score (CRS) which is a tool the Respiratory Care Department utilizes as part of their patient assessment. The patient’s CRS number determined the care they would receive based on a treatment algorithm, ranging from supplemental oxygen and incentive spirometry Q2 to High Frequency Chest Wall Oscillation (HFCWO), IntraPulmonary Percussive Ventilation (IPV) and BiPAP therapy. Nursing on the in patient floors also received education on the CRS and assisted with the Q2 therapy so the work load could be easily managed. Oxygen saturations are maintained at greater than or equal to 94%. The patients are assessed Q4 and a CRS is assigned, this then determines the intensity of the respiratory therapy. RESULTS: The department has seen a significant increase in the therapy offered to this patient population in some instances increasing the workload by one FTE. The length of stay (LOS) has decreased with the average LOS being 4.3 days, a 45% decrease compared to the initial pilot of 20 patients. The department is still investigating the best therapies to offer this patient population for increased compliance and best results.

Sponsored Research - None

919148

IMPROVING THE FREQUENCY OF RESPIRATORY DISTRESS SCORING IN A PEDIATRIC EMERGENCY DEPARTMENT.

Jeffrey Gardner, Samantha Rooks, Chris Lynn, Cheryl Burney-Jones; Pediatric Respiratory Care, Monroe Carell Jr. Children’s Hospital at Vanderbilt, Nashville, TN

BACKGROUND: Respiratory distress is a common complaint in pediatric emergency medicine. This complaint accounted for 2,061 patients, 7% of total patient volumes from June to December 2009, in the pediatric emergency department (PED) at Monroe Carell Jr. Children’s Hospital at Vanderbilt (MCJCHV). Considering the National Heart Lung and Blood Institute guidelines to read the disposition on moderate to severe asthmatics within 4-6 hours of presentation to the PED, the respiratory department at MCJCHV made hourly scoring of patients with mild to severe respiratory distress a goal. The long term goal is to decrease length of stay by increasing frequency of assessment and communication of therapist recommendations to the physician group. An adaptation of Qureshi’s scoring system (NEJM 1998) was utilized, which assigns severity scores from 0 to 3 in five areas. All scoring was documented by the therapist in the electronic medical record. DATA: Patients with a total respiratory distress score of 5 were tracked for the first four hours until discharge from the PED. Any RDS assigned later than one hour and fifteen minutes from the previous score was considered missed. Chart audits for Quarter 3 of 2009 revealed a 29% hourly scoring compliance. METHODS: Steps were taken to increase hourly scoring compliance. Data was collected for 9 months during which there were 2 therapists per shift to cover a 3.5 bed emergency unit. Staff were educated on the importance and goal of the initiative. The current electronic charting system was evaluated to ensure barriers to provide hourly scoring were eliminated. The primary methods of communication were daily briefs, nursing updates, and electronic communications and staff meetings. Finally, individual staff compliance was addressed to reach the department goal. RESULTS: As of May 2010, continued efforts have improved hourly scoring compliance to 83%. CONCLUSIONS: The increased frequency of patient assessment can be accomplished by following a dedicated staffing model and providing ongoing staff education and feedback. Future plans include assessing the impact of hourly scoring on patient throughput.

Sponsored Research - None

905639

ASTHMA IN SICKLE CELL DISEASE AS A RISK FACTOR FOR ACUTE CHEST SYNDROME IN PEDIATRIC PATIENTS.

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OBJECTIVES: Both asthma and sickle cell disease are major Public Health concerns. Previous studies have demonstrated that asthma among children with sickle cell disease (SCD) may increase the risk of developing acute chest syndrome (ACS), which can be life threatening. These respiratory complications may increase emergency department (ED) utilization, increase health care costs, and reduce life span among persons with SCD. The purpose of this study is to determine whether children with SCD and asthma have significantly more ED visits and if they are at higher risk of developing ACS compared to children with SCD who do not have asthma. METHOD: X: We used MarketScan® Multi-State Medicaid Databases from Thompson Reuters (Ann Arbor, Michigan) for the years 2001 to 2005. These are proprietary datasets covering eight unidentified states. We used International Classification of Disease, 9th Division, Clinical Modifications (ICD-9-CM) codes to identify SCD, asthma and ACS. RESULTS: In 2005, there were 2428 children with SCD continuously enrolled in Medicaid. Among those, 369 (15.2%) patients were identified as having asthma. The median number of emergency department visits was significantly higher among children with both SCD and asthma compared to children with SCD without asthma (p<0.05). In addition, children with SCD and asthma were more likely to have at least one episode of ACS than children with SCD without asthma (28.2% vs. 7.8%, respectively). CONCLUSIONS: Among children with SCD who are enrolled in Medicaid, asthma is more prevalent than asthma in the general population. Therefore asthma should be aggressively managed among SCD patients. Proper management of asthma may result not only in reduced pulmonary complications, but also reduced costs related to emergency department utilization and progression of lung disease in childhood.

Sponsored Research - None

Frequency of Acute Chest Syndrome and Pneumonia by Asthma Group

918619

A METERED DOSE INHALER BASED ACUTE ASTHMA TREATMENT PROTOCOL IS AN EFFECTIVE AND EFFICIENT PROCESS FOR CHILDREN WITH MILD TO MODERATE ASTHMA EXACERBATIONS IN AN URBAN PEDIATRIC EMERGENCY DEPARTMENT.

Keevan Raji, Barry Thompson, Mary Beth Bollinger; 1Department of Pediatric Emergency Medicine, University of Maryland Baltimore, Baltimore, MD; 2Department of Pediatrics, Division of Pediatric Emergency Medicine, University of Maryland Baltimore, Baltimore, MD

BACKGROUND: Asthma accounts for a significant proportion of pediatric Emergency Department (ED) visits and is one of the leading causes of childhood hospitalization. Multiple studies have demonstrated that metered dose inhaler (MDI-VHC) delivery of beta-agonists in the treatment of acute asthma, Compared to nebulizers, MDI-VHCs have been shown to lead to reduced hospitalization rates, shortened ED stays and decreased costs. However, the use of MDI-VHC in the ED based treatment of acute asthma remains limited. Between 2003 and 2010 the Pediatric ED at the University of Maryland Hospital for Children (UMCH) embarked on an effort to develop and implement a MDI-VHC based asthma protocol for children with mild to moderate acute asthma and demonstrate its effectiveness. METHODS: A retrospective search of the electronic medical records was conducted to identify patients treated for the complaint of acute asthma (ICD-9 Code 493.1-) between January 1st and December 31st 2009 in the Pediatric ED. Patients with acute asthma were identified based on their chief complaint, enrollment in asthma protocol and/or final discharge diagnosis. RESULTS: Between January 1 and December 31, 2009, a total of 1115 patients were treated for acute asthma in the Pediatric ED. The median age range was 3, with a median of 0.25 years for boys and 0.25 years for girls. Eighty one percent of patients were treated with MDI-VHC’s only, with 2% treated with nebulizers for patients treated only with nebulizer 52% for those treated with both modalities. Among those discharged with MDI-VHC’s, 51% for those treated solely with nebulizers and 52% for those treated with both modalities. For those who did not require inpatient admission, the emergency Department (ED) stay was 186 minutes for MDI-VHC only group, 290 minutes for the nebulizer only group and 335 minutes for those treated with both modalities. Among those discharged from the ED, the mean return rate was 10% for those treated only with nebulizers and 2.2% for those treated solely with Nebulizers and 5.0% for those treated with both modalities. CONCLUSIONS: A metered dose inhaler based asthma protocol can be an effective and efficient process for the treatment of mild to moderate acute asthma exacerbations in the 2 to 18-year age group.

Sponsored Research - None

Treatment outcomes by aerosol delivery modality

905639

A METERED DOSE INHALER BASED ACUTE ASTHMA TREATMENT PROTOCOL IS AN EFFECTIVE AND EFFICIENT PROCESS FOR CHILDREN WITH MILD TO MODERATE ASTHMA EXACERBATIONS IN AN URBAN PEDIATRIC EMERGENCY DEPARTMENT.

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Sponsored Research - None

Treatment outcomes by aerosol delivery modality

905639
**PARENTAL KNOWLEDGE, ATTITUDE AND PRACTICES REGARDING CHILDHOOD BRONCHIAL ASTHMA.**
Sanjiv Nanda, Pediatrics, Postgraduate Institute of Medical Sciences, Rohtak, India

Objectives: To assess the parental knowledge, attitude and practices employed regarding childhood bronchial asthma Material and Methods: Parents of all the children who fulfilled the clinical diagnosis of childhood asthma and coming for consultations in a hospital in India, were considered for the study. The period of study was one year (2009). The parents were interviewed as per the pre-structured questionnaire, which included knowledge of its natural history, etiology and treatment modalities. Results: Among 250 patients, 128 belonged to urban areas. Male: female ratio was 1.5:1. Age ranged from 2 to 14 years. Duration of illness ranged from 1 to 18 years. Wherever 32% considered it to be hereditary, 26% thought it as contagious. Chief sources of asthma related knowledge were doctors (35%), friends / relatives (20%), magazines / newspaper (18%) and electronic media (12%). 15% had no knowledge at all. Though 34% parents considered it as stigma, 23% were hesitant in labelling their child’s diagnosis as asthma. The knowledge of precipitating agents causing bronchial asthma was known to 37% parents. Exposure to cold, foods (rice, curd, banana, grapes, cold drink etc), pets, insects, perfumes, dust, smoke, stress and exercise were the common precipitating factors. The knowledge of timely treatment was helpful to control the acute exacerbation of asthma and prevent its complication was known to about 53% parents. Only 31% parents had positive attitude towards inhaled rescue medications and believed it as the best treatment modality. Environmental control measures for allergen avoidance were being practised by 50% parents. There was no delay in seeking treatment during an acute exacerbation (55% within 6 hours, 36% within 12 hours). Other systems of medicine (homeopathy, ayurveda, naturopathy etc) were consulted by 35% parents. Conclusions: There is poor knowledge, moderately positive attitude and several incorrect practices regarding various aspects of childhood bronchial asthma. There is need to educate parents regarding the precipitating factors and motivate for judicious use of inhaled medications

**EVALUATION OF BRIEF IN-PATIENT TOBACCO DEPENDENCE INTERVENTION TRAINING.**
Georgianna Sergakis1, Andrea Yagodich2; 1Respiratory Therapy, School of Allied Medical Professions, The Ohio State University, Columbus, OH; 2Respiratory Therapy, The Ohio State University Medical Center, Columbus, OH

Background: Tobacco free policies prohibit hospitalized patients from using tobacco, thereby presenting both opportunity and challenge. First, this abstinence is an opportunity for the individual to discuss their willingness or unwillingness to quit and arrange action. The challenge involves the resultant nicotine withdrawal. Respiratory Therapists (RTs) are well positioned to provide intervention, especially when delivering other therapies related to the effects of continued tobacco use. Brief interventions are recommended to assist the individual regardless of willingness to quit, while pharmacotherapy addresses withdrawal. The purpose of the study was to evaluate RT training for brief in-patient tobacco dependence intervention at a large academic medical center. Method: A four hour training session facilitated by a Tobacco Treatment Specialist included an overview of the Clinical Practice Guideline for Treating Tobacco Use and Dependence with emphasis on the 5As, 5Rs, pharmacotherapy and motivational interviewing. A multidimensional pre and post training survey of true/false questions and statements requesting responses on a 10-point Likert scale was administered to explore knowledge, beliefs, current practices and confidence in providing brief interventions. Data were compared using paired t-tests with significance level set at p < 0.05 Results: The RTs (n=4) were well experienced with an average of 8.5 years work experience and no previous training in tobacco treatment. Prior to training, the RTs agreed that hospitalization is appropriate to discuss tobacco dependence and reported frequently witnessing the effects of nicotine withdrawal while caring for patients (especially within 7 days). There was a statistically significant difference in knowledge of tobacco treatment among the RTs (p < 0.001), knowledge of pharmacotherapy (p < 0.002), belief that interventions are effective (p < 0.04), confidence discussing how to quit (p < 0.0001). and confidence discussing pharmacotherapy (p < 0.012). Conclusions: With training, RTs can become more positive and prepared to be proactive and counsel hospitalized tobacco users through brief interventions. Additional research is needed regarding tobacco dependence counseling by RTs. Such evidence would support the RT’s role of lung health expert and continued contribution to chronic disease self-management.

**A NEEDS ASSESSMENT FOR DEVELOPING SCHOOL ASTHMA MANAGEMENT PROGRAMS IN THE EAST CENTRAL HEALTH DISTRICT OF GEORGIA.**
Kathleen Herklen, Randall Baker, Rachel Stern, Jenni Massinga, Besa Ackonchong; Medical College of Georgia, Martinez, GA

Background: The East Central Health District (ECHD) of Georgia has an asthma death rate that is significantly higher than the state and national death rates for children under the age of 14. A comprehensive approach to managing asthma includes an asthma management plan in schools. The purpose of this study was to assess the status and priorities for implementing asthma management strategies in schools in the ECHD using the National Heart Lung Blood Institute’s “How Asthma Friendly is Your School (AFS)” survey. Method: We sought permission from school superintendents to contact schools in their county. Once permission was obtained, surveys were sent to principals who returned the completed surveys to the MCG Department of Respiratory Therapy for analysis of outcomes. Results: We received permission from out of 13 (53.8%) of the counties, of the 112 (36.6%) schools returned the surveys. The outcomes of the surveys are presented in Table 1. Conclusion: Positive findings included tobacco free schools and policies that allow students to take asthma medications at school and participate in physical education. However, there is need for improvement in written IAQ management plans, the availability of pre-medications and education about asthma for school staff, students with asthma, and parents of children with asthma. Principals placed IAQ management plans and education as their top priorities. The results of the surveys were shared with the ECHD in an effort to create strategies to complement efforts in the public health district.

**EFFECTIVENESS OF A CHRONIC CARE MANAGEMENT PROGRAM IN A MEDIAID POPULATION WITH ASTHMA AND COPD.**
Chelmer Barrow1, George L. Oestreich2; 1APS Healthcare, Jefferson City, MO; 2MO HealthNet Division, Jefferson City, MO

Background-The combined rate of asthma and COPD in the Missouri Medicaid population is over 15% and accounts for over $1.8 million annually in direct healthcare expenditures. Although strong evidence exists for treating these diseases, there are significant barriers to care and compliance within low income populations. In 2007, the Missouri Medicaid program (MO HealthNet) launched a program to provide case coordination and disease management to fragile participants with chronic disease, including asthma and COPD. Enrolled members received interventions which included helping patients find stable primary care or specialty providers and securing appointments; facilitating transportation to office visits and pharmacies; placing medication reminder calls and education on avoiding disease-specific triggers, etc. Interventions were provided over the phone and within community settings by registered nurse. Method-Claims and pharmacy data from October 2008 to September 2009 were analyzed, comparing 26,525 MO HealthNet members with COPD who were continuously enrolled in the care management program to 22,170 members with COPD who were not enrolled. In addition, 37,350 members with asthma who were continuously enrolled in the care management program were compared to 52,761 members with asthma who were not enrolled. Compliance with two key evidence-based metrics, defined as one or more prescriptions filled during the measurement period, was compared among the enrolled and non-enrolled groups. The enrolled group was further divided into those enrolled one to eleven months and those enrolled at least 12 months. Results-Enrollment of low income, medically disabled adults continuously enrolled in the care coordination program for 1-11 months received recommended treatment with bronchodilator medications 58% of the time, compared to 39% in the non-enrolled group. Members enrolled in the program for 12+ months had a 66% compliance rate. Similarly, enrollees with asthma received recommended treatment with inhaled corticosteroids 30% and 40% of the time (for the 1-11 and 12+ month groups) compared to 28% compliance of non-enrolled members. Results for all cohorts were statistically significant; (p = <0.01). Conclusion-Enrollment of low income, medically disabled members with asthma into a care coordination program significantly increased rates of medication adherence for individuals with COPD and asthma. Compliance rates increased when individuals were enrolled for longer periods of time.

Sponsored Research - None

**SYMPOSIUM 12: ASTHMA/PULMONARY DISEASE/AEROSOLS/DRUGS**
Wednesday, December 8; 3:00 pm to 4:55 pm (Room N240/N242)

**919357**

**920338**

**921153**

**916132**
EASE OF USE WITH THREE METERED DOSE INHALER SPACER DEVICES.
Helena M. Eusenio1, Teresa A. Volks1, Michele L. McCarroll1, Rachel J. Pohle-Krauza1,2, Health Professions, Youngstown State University, Youngstown; 1Youngstown Ecampus, Youngstown State University, Youngstown, OH; 2Summa Health System, Akron, OH

BACKGROUND: Spacers augment medication administration for metered dose inhalers (MDI). The LeverHaler is a spacer designed to assist patients with hand strength problems to actuate an MDI. This study sought to determine if spacer design affected spacer preference. We hypothesize that hand strength will not affect the patient’s choice of MDI spacers.

METHODS: Adult patients, admitted to a pulmonary rehabilitation program with the diagnosis of asthma or chronic obstructive pulmonary disease and MDI experience were enrolled. Proper use of an MDI with the LeverHaler, AeroChamber, and Medispace was reviewed with each patient. Participants provided return demonstrations to verify an understanding of each device used. Procedural errors noted during return demonstrations were corrected prior to the data collection. Time to administer a sham MDI dose with each spacer was recorded. Subjects completed a questionnaire evaluating the characteristics and spacer ease of use on a 3 point Likert scale. This questionnaire also ascertained the occurrence and type of hand strength problems, length of MDI use and prior experience with a spacer. Data were entered into SPSS 15.0 for analysis (SPSS Inc., Chicago, IL). Descriptive statistics were used to report study population demographics. Preferences for spacer use were analyzed with Chi-Square. Statistical significance was established at P < 0.05.

RESULTS: Twenty subjects between the ages of 30 and 80 years participated. Mean length of MDI use was 8.6 years (±SD 12.4). Hand strength problems were self-reported in 38.6% of participants. The subject assembled (mean ± SD) the LeverHaler 28.6 (± 12.9), the MediSpacer 25 (±28.9) s, and the AeroChamber 26.5 (±29.8) s. They used the ‘LeverHaler’ 40% of the time, the ‘MediSpacer’ 35% of the time and the ‘AeroChamber’ 25% of the time. Mean times of 26.5 seconds (±SD 12.6) and 29.8 seconds (±SD 12.4) were realized respectively. The LeverHaler took the most time to assemble and actuate a medication dose with a mean of 35.9 seconds (±SD 29.4). All patients preferred traditional spacer designs, specifically the LeverHaler and Medispace, compared to the LeverHaler design. P < 0.040. CONCLUSIONS: Design influenced patient preference. Traditional designs were acceptable to patients with self-reported strength problems.

Sponsored Research - None

895300

COMPARISON OF ALBUTEROL DELIVERY DURING HIGH FREQUENCY OSCILLATORY VENTILATION AND CONVENTIONAL MECHANICAL VENTILATION OF A SIMULATED ADULT.
Waled Al-Ahmad, Robert Harwood, James Fin, Lynda Goodfield, Arzu Ari, Georgia State University, Atlanta, GA

BACKGROUND: Delivery of aerosol by pMDI has been described with conventional mechanical ventilation (CMV) but not with high frequency oscillatory ventilation (HFOV). The purpose of this study was to compare aerosol delivery to a simulated 75 kg adult with low compliance during both CMV and HFOV. We hypothesized that actuation of pMDI with inspiration is not feasible with HFOV, we investigated the impact of actuation timing only during CMV. METHOD: CMV (Respiratory Care 2007) Eight actuations of albuterol sulfate (2.5 mg/3mL) were nebulized using a vibrating mesh nebulizer (Aeroneb Solo, Aerogen, Ireland) placed in the inspiratory limb with no HME (Control) and with each HME-AD with aerosol bypass open (Aerosol configuration) and closed (HME configuration). Each condition was repeated in triplicate. Drug deposition on an absolute filter distal to the model’s trachea was eluted and analyzed via spectrophotometry (276 nm). Each condition was repeated in triplicate. Descriptive statistics, paired and independent samples t-tests were conducted with significance at p=0.05. RESULTS: Table shows deposition of inhaled dose (mean percent of nominal dose ± SD). Differences on deposition between the Fisher Paykel and Hudson humidifiers at 3 lpm (p=0.256) and 6 lpm (p=0.762). With the pediatric cannula, the Fisher Paykel delivered more aerosol at both flow rates than the Hudson (p=0.018 and 0.002, respectively). Aerosol delivery in the HME configuration was higher than anticipated with 93.8% of aerosol for the Humidililo, (p=0.078), 76.8% for the Airlife and 33.9% for the Circuvent (p=0.002 and p=0.005, respectively). CONCLUSIONS: Small differences on aerosol deposition between Aerosol and HME configurations suggest that some HME-AD do not effectively close the aerosol bypass feature when engaging the HME.

Sponsored Research - None

884945

INFLUENCE OF NASAL CANNULA, FLOW RATE AND HUMIDIFIER IN AEROSOL DRUG DELIVERY DURING HIGH FLOW NASAL OXYGEN ADMINISTRATION IN A SIMULATED NEONATAL LUNG MODEL.
Arzu Ari1, Susan Roark2, Lucrecia Lobo1, Robert Harwood1, Merry Sheard1, James B. Fink1, Georgia State University, Atlanta, GA; Emory University, Children Healthcare of Atlanta, Atlanta, GA

BACKGROUND: With the proliferation of systems for administration of oxygen via high flow naso-cannula (HFNC), interest in delivery of medical aerosols has increased. The children’s hospital currently uses two HFNC systems and wanted to quantify aerosol delivery and influence of nasal cannula size, flow rate and humidifiers. Therefore, the purpose of this study was to compare aerosol delivery efficiency of the two HFNC systems, using a simulated model of neonatal ventilation. METHOD: An in-vitro lung model (SAINT infant upper airway model) was developed to simulate spontaneous breathing newborns (RR 50, Vt 8 ml, I:E 1:1, EEP 20 cm H2O, and RR 25/min), and HFOV (RR 5 Hz, IT 33%, PEEP 5 cmH2O and I:E ratio 1:2) at 3 lpm and 6 lpm, with manufacturer’s infant and pediatric nasal cannulas. A vibrating mesh nebulizer (Aeroneb Solo, Aerogen Inc., Ireland) was placed on the nasal (dry side) of the humidifier to nebulize albuterol sulfate at rate (2.5 mg/3ml).

Drug deposited on an absolute filter distal to the model’s trachea was eluted and analyzed via spectrophotometry (276 nm). Each condition was repeated in triplicate. Descriptive statistics, paired and independent samples t-tests were conducted with significance at p=0.05. RESULTS: Table shows deposition of inhaled dose (mean percent of nominal dose ± SD) of albuterol inhaled. With the infant cannula, there was no significant difference between the Fisher Paykel and Hudson humidifiers at 3 lpm (p=0.256) and 6 lpm (p=0.762). With the pediatric cannula, the Fisher Paykel delivered more aerosol at both flow rates than the Hudson (p=0.018 and 0.002, respectively). Aerosol delivery in the HME configuration was higher than anticipated with 93.8% of aerosol for the Humidililo, (p=0.078), 76.8% for the Airlife and 33.9% for the Circuvent (p=0.002 and p=0.005, respectively). CONCLUSIONS: Small differences on aerosol deposition between Aerosol and HME configurations suggest that some HME-AD do not effectively close the aerosol bypass feature when engaging the HME.

Sponsored Research - None

888077
ALBUTEROL DELIVERY BY 3 DIFFERENT NEBULIZERS PLACED IN 4 DIFFERENT POSITIONS IN A HEATED WIRE VENTILATOR CIRCUIT UTILIZING A PEDIATRIC VENTILATOR IN-VITRO MODEL.

Background: Aerosol delivery during mechanical ventilation depends on several factors. We used heated wire ventilator circuits (HWVC) (Fisher-Paykel, Auckland, NZ) with our ventilators (Servo-i, Maquet, Solna, Sweden). Different inline aerosol delivery technologies are available in the market. We compared albuterol output from 3 different nebulizers placed inline in 4 different positions in a HWVC utilizing pediatric ventilator settings. Methods: 5 units of continuously operated jet (HUDSON RCI UP-DRAFT 110) Opti-neb Nebulizer, Teleflex Medical, Research Triangle Park, NC (JET), ultrasonic (Maquet Ultrasound nebulizer, model N06302359S54E040E, Solna, Sweden) (ULTRA), and vibrating mesh (Aerogen Solo, Aerogen Ltd, Galway, Ireland) (VIBMESH) nebulizers were studied. Jet nebulizers were operated at 6 L/min with central oxygen for 5 minutes. Ultrasonic and vibrating mesh nebulizers were operated for 15 min. Five mg/5.5 mL of albuterol sulfate were used for all nebulizers. The ventilator was operated in PRVC mode, VT 200 mL, RR 20, PEEP 5 cm H2O, FiO2 0.4, IT 0.75 seconds, inspiratory rise 0.15 seconds, flow trigger 3 and heater 37 ± 1.5°C. The HWVC was connected to a 5.5 cm ET inserted with a deposition filter interposed between them. Volumes and deposition parameters were noted. The nebulizers were placed at the following positions: Wye (@Y), right after the humidifier (@H), at the ventilator (@V), and 30 cm before the wye (@30). Albuterol was measured by spectrophotometry at 276 nm. Statistical analysis was performed with ANOVA followed by Tukey. A p value of 0.05 was considered significant. Results: (see table, mean ± SD). Position (within devices comparison): JET and VIBMESH had higher output @H (p<0.05) than @Y & @30 (p>0.01). ULTRA had higher output @H &@Y than @H & @30. Devices (between devices comparison): The highest output was given by VIBMESH followed by ULTRA then followed by JET (p<0.01) when placed @H and @Y. ULTRA had equal output to JET but smaller output than VIBMESH when placed @H. VIBMESH had higher output than JET when @30 (p<0.05). Conclusions: Placing the nebulizer inline at the ventilator and right after the humidifier provided higher albuterol output compared to the wye and 30 cm before the wye in a pediatric ventilator model. Vibrating mesh nebulizer had the highest albuterol output at any tested position.

Sponsored Research - None

IMPACT OF AN ORDERSET AND EDUCATION ON INHALED NITRIC OXIDE USE IN ADULTS.

John S. Emberger1, Lori Killian1, Joel M. Brown1, Francis Goot1, Vinay Maheshwari2:*; 1Respiratory Care, Christiana Care Health System, Newark, DE; 2Medicina, Christiana Care Health System, Newark, DE

Background: Inhaled nitric oxide (INO) has been used in adult populations as supportive therapy for pulmonary hypertension, right heart failure and hypoxemia. The only FDA approved indication for use is term neonates with PPHN. Adult use has failed to prove long term outcomes benefits. INO is sometimes used in our adult ICU to treat hypoxemia, hypertension, right heart failure and hypoxemia. We suspected that our adult use was higher than appropriate, without the use of a guided protocol. We created a hospital approved orderset for INO and completed education about INO in adults. We wanted to determine if the INO orderset with education would impact the use of INO. METHODS: INO orderset construction and education occurred between Jan 2009 and June 2009. INO orderset included discontinuation for non-responders and a weaning algorithm. Education included ventilator optimization prior to INO use. We retrospectively reviewed INO use in two specific time periods: PRE-ORDERSET (July 2008 to Dec 2008) and POST-ORDERSET (July 2009 to Dec 2009). Data collected included number of patients with severe hypoxemic respiratory failure (SHRF), number of INO patients, patient survival, duration on INO and ventilator settings. SHRF was defined as patients requiring ≥ 60% FiO2 and ≥ 10 PEEP. RESULTS: See table for main results. Overall hours of INO use in six month periods were reduced by 60%. Patients were on INO an average of 5.4 days Pre-Orderset and 3.4 days Post-Orderset (p<0.05). Change was noted in ventilator modes used and mortality of patients in SHRF during the Pre-Orderset and Post-Orderset time periods. CONCLUSION: After initiating an INO orderset and educating the optimization of ventilation: #1) Less patients with SHRF were placed on INO, #2) Patients placed on INO had shorter use of INO, #3) Physicians used higher PEEEP, before initiating INO, #4) There was a 60% reduction in the use of INO which would result in a large cost savings to the hospital and patients.

Sponsored Research - #91909

INO Use PRE-ORDERSET (July08-Dec08) and POST-ORDERSET (July09-Dec09)

AEROSOL DRUG DELIVERY IN A MODEL OF SPONTANEOUSLY BREATHING NEWBORNS USING HIGH FLOW NASAL CANNULA AT LOW AND HIGH FLOW RATES WITH HELIOX AND OXYGEN.

Arzu Ari1, Susan Roark2, Meryl Sheard3, James B. Fink1; 1Georgia State University, Atlanta, GA; 2Children Healthcare of Atlanta, Emory University, Atlanta, GA

Background: Interest in delivery of medical aerosols with high flow nasal cannula (HFNC) and heliox has increased, however, there is limited data on the efficacy of helium-oxygen (heliox) mixture on aerosol delivery to newborns is not known. Previous studies with pediatric and adult HFNC demonstrated improved aerosol delivery with lower gas flows. The objective of this study was to compare heliox and oxygen on the efficiency of aerosol delivery. Methods: An in-vitro lung model was developed using a sinusoidal pump attached through an absolute filter to a SAINt infant upper airway model in order to simulate a spontaneously breathing newborns (RR 50, Vt 8ml, I:E ratio 1:2). A HFNC system (Fisher & Paykel) with infant nasal cannula was operated at 3 and 6 lpm using 100% oxygen and 80/20 Heliox. A vibrating mesh nebulizer (Aeroneb Solo, Aerogen Inc., Ireland) placed on the inlet (dry side) of the humidifier nebulized albuterol sulfate (1.25 mg/3ml) at each condition that was repeated three times (n=3). Drug eluted from the absolute filter distal to the models tracheas was analyzed via spectrophotometry (276 nm). Descriptive statistics and paired-samples t-test were conducted with significance at p<0.05. RESULTS: The table below shows the mean (± SD) % of nominal dose inhaled. While drug delivery with oxygen trended to decrease with the higher flow, it was not statistically significant (p=0.280). The use of heliox at 3 lpm increased albuterol delivery by 40% compared to heliox at 3 lpm (p=0.049) and oxygen at 6 lpm (p=0.043). In contrast, at 3 lpm, heliox provided no benefit compared to oxygen. CONCLUSIONS: In this simulated model of aerosol delivery via infant HFNC, heliox improved aerosol delivery in simulated spontaneously breathing newborns only at the higher flow range studied. Further studies are needed to determine if improved albuterol delivery with heliox enhances clinical response in newborns receiving aerosol therapy via high flow nasal cannula.

Sponsored Research - None

AN IN-VITRO EVALUATION OF AEROSOL DELIVERY THROUGH TRACHEOSTOMY AND ENDOTRACHEAL TUBES USING DIFFERENT INTERFACES.

Arzu Ari1, Robert Harwood, Meryl Sheard, James Fink; Georgia State University, Atlanta, GA

Background: There is little data on effects of airway artifacts and their interfaces on aerosol delivery. The purpose of this study was to compare aerosol delivery between tracheostomy and endotracheal (ETT) tubes using different interfaces such as tracheostomy mask, t-piece and ambu bag. Method: A tracheal manikin was intubated with ETT (Malinckrodt) and tracheostomy tube (Portex) with 8 mm IDs. A filter (Respirgard II) was placed between the trachea and sinusoidal pump simulating a spontaneously breathing adult (Vt 450 mL, RR 20 bpm, I:E ratio 1:2) for testing with tracheostomy mask (AirLife, Cardinal Health), t-piece (AirLife, Cardinal Health) and a passive test lung for testing with ambu bag without PEEP. Albuterol sulfate (2.5 mg/mL) was nebulized with a jet nebulizer (eValueMedical, Trantum) and administered via appropriate appliance to the tracheostomy tube and ETT (n=3). Drug was eluted from the filter and analyzed with spectrophotometry (276 nm). Descriptive statistics, student t-tests and one-way ANOVA were used for data analysis at the significant level of 0.05 (p<0.05). RESULTS: The table shows percentage of nominal dose delivered distal to the trachea (mean ± SD). Delivery was lower with tracheostomy mask than other appliances (p=0.05). Aerosol delivery was greater with the tracheostomy tube than ETT with both t-piece and ambu bag (p=0.038 and p=0.025, respectively). Use of ambu bag during aerosol therapy increased lung dose more than 3 fold with both tracheostomy and ETT tube. DISCUSSION: There was no difference comparing the use of tracheostomy mask, t-piece and ambu bag. Further studies with other types of aerosol generators, interfaces and valve bag designs are warranted to find the best method for aerosol therapy in patients with airway artifacts.

Sponsored Research - None

<table>
<thead>
<tr>
<th>Drug Delivery Method</th>
<th>Tracheostomy Collar</th>
<th>t-piece</th>
<th>Ambu Bag</th>
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<tr>
<td>Mean ± SD</td>
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<td>Helios</td>
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<td>5.9±0.77</td>
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Wednesday, December 8; 3:00 pm to 4:55 pm (Room N240/N242)

Symposium 12: Asthma/Pulmonary Disease/Aerosols/Drugs

Respiratory Care • November 2010 Vol 55 No 11 1577
NASAL CPAP FOR INITIAL STABILIZATION IN VERY LOW BIRTH WEIGHT INFANTS.
Shayne Morris¹,², Heloisa Georgiev², Dr. Thomas Wiswell¹, Terry Cavanagh¹, Vicki Flynn¹; Neonatal Intensive Care Unit, Florida Hospital for Children, Orlando, FL. Respiratory Care, Florida Hospital for Children, Orlando, FL.

Background: Bronchopulmonary dysplasia (BPD) has plagued neonatal intensive care units since the 1960s. Injury to the lungs during the first hours and days of life plays a major role in the development of BPD, particularly in the very low birth weight (VLBW) premature infant. Despite significant decreases in mortality following widespread use of exogenous surfactant, there has not been a concomitant decline in BPD. Continuous positive airway pressure (CPAP) represents a gentle mode of respiratory support that is in widespread use in neonatal intensive care units. We proposed that early use of nasal CPAP, solely or in conjunction with exogenous surfactant, could potentially mitigate the development of BPD through the reduction of barotrauma associated with mechanical ventilation. In this study we look at the ability of infants to stay on CPAP and to continue their treatment while the neonate is still in the NICU.

Methods: The study was conducted at a 61 bed urban NICU in the southeastern United States. Developed flowsheet to be completed on every inborn infant weighing between 750-1250 grams to document: Gestational Age, Birth weight, Sex, Appgar Administration of Prenatal Steroids Surfactant Administration at birth. Included in study Rationale if not included in study Description of Resuscitation Conclusion PDSA cycles yielded data from 23 infants who met the established criteria for stabilization on nasal CPAP within a 18 week period 73% of infants weighing between 750-1250 grams were successfully stabilized on nasal CPAP Sponsoreed Research - None

Sponsored Research - None

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920993

AIR TRANSPORT WITH INHALED NITRIC OXIDE IN CHILE.
Rodrigo S. Aravena; Respiratory Care, Catholic university Hospital, Santiago, Chile.

Introduction The inhaled nitric oxide (iNO) system in Chile works in several hospitals and clinics in Santiago (10 centers) and Concepción (2 centers), 500 Kms from Santiago. The services of installation, control, transport, weighing and reimbursement are provided by only one Respiratory Care team, due to eliminations and abuse of the gas time ago. In Chile exist only one neonatal ECMO center (Actually 2 more). By this reason, the quickly and effective transport of the patient who need iNO is suggested in 3 situations and abuse of the gas time ago. In Chile exist only one neonatal ECMO center (Actually 2 more). In Chile exist only one neonatal ECMO center (Actually 2 more). In Chile exist only one neonatal ECMO center (Actually 2 more).

Methods We make and save all the clinical records of the patients transported with iNO. We transport all the patients using the iNOVent (Datex-Ohmeda Inc. Madison, Wi) with two D cylinder or one 88 iNOMax cylinder, with a mechanical ventilator BioMed MIP-10 (BioMed Devices. Guildford, CT) and neonatal ventilator "Concepción". Results We transported 13 patients with iNO from several places of Chile, Concepcion 54(46%), Puerto Montt 18,18% (2), La Serena, Valdivia and Antofagasta, each with 9,09% (1). All were neonatal patients, age 16±0,74) flight hours. We went in Jet aircraft in 54,5%, and in Turbo aircraft in 45,5%, both compensated cabin. The patients were transported to ECMO center in 81,82% of cases, and to iNO center in 18,18%. 54,5% of patients used ECMO, 45,45% used iNO+HFOV, 9,09% used only HFOV, and 9,09% only used CMV. Some patients travel 24 hours after the transport, and didn’t used ECMO Conclusions iNO can be safely delivered on neonatal air – transport. We don’t had biggest complications in the transport of critical patients with iNO. Training and practical experience are invaluable to this new transport. Process guidelines need to be developed to cover normal operation of the delivery systems as well the actions to take in case of a lack or failure.

Sponsored Research - None

919801

RESPIRATORY THERAPIST ROLE IN MOUTH CARE AS AN EFFORT TO COMBAT VENTILATOR ASSOCIATED RESPIRATORY INFECTIONS.
Rhonda M. Schum; Abby Morz, Jenni L. Raake; CICU, CCHMC, Cincinnati, OH.

Background: Healthcare providers have become increasingly conscious that patients are at risk of developing Ventilator Assicated Respiratory Infections (VARI). Evidence has shown routine mouth care can help prevent VARI, and mouth care is part of our ventilator care bundle. Mouth care education is not routinely taught as part of the respiratory therapists’ (RTs) college curriculum. Consequently, we provided education to RTs in our ICUs. Education consisted of elevating the head of the bed and oropharyngeal suctioning prior to mouth care, followed by cleansing the mouth. Six months after education, we surveyed the RTs to determine if education had improved their comfort and compliance with mouth care policies. Method: RTs in the Pediatric and Cardiac Critical Care Units were surveyed regarding their comfort and self-reported practice when performing mouth care. Results: Response rate was 50.8% (n=30). 72% of the respondents reported that they perform mouth care 2-3 times per shift. Level of comfort in performing mouth care utilizing a Likert Scale reflected 93% of the respondents reported themselves as competent. 40 % of respondents reported raising the head-of-bed prior to mouth care. Oropharyngeal suctioning was performed prior to mouth care by 73% of respondents. Conclusion: RTs at our institution report feeling competent in performing mouth care. Greater compliance is needed with raising the head-of-bed and performing oropharyngeal suctioning prior to cleansing the mouth. Benefits to educating RTs include: increased collaboration with nursing staff, taking an active role in efforts to reduce the incidence of VARI, ensuring mechanically ventilated patients receive frequent mouth care, and expansion of skills for RTs.

Sponsored Research - None

919968

PEDIATRIC RESPIRATORY THERAPISTS’ PERFORMANCE AS A RAPID RESPONSE TEAM FIRST RESPONDER FOR AN INFANT IN RESPIRATORY DISTRESS—A VIDEO REVIEW.
Jennifer S. Perretta¹, Cheryl Meredith¹, Daenna King¹, Stacey Mann¹; Simulation Center, Johns Hopkins Medicine, Baltimore, MD; Pediatric Respiratory Care Services, The Johns Hopkins Hospital, Baltimore, MD; 1The Johns Hopkins School of Medicine, Baltimore, MD.

Background: All Pediatric Respiratory Therapists (RTs) are required to respond to pediatric rapid response team (PRRT) calls throughout the Johns Hopkins Hospital’s Children’s Center. The most common reason for calling the PRRT is for infants with desaturation and respiratory distress or arrest. This requires rapid intervention to stabilize the airway and provide positive pressure ventilation (PPV) to prevent progression to cardiac arrest. Informal observation during PRRT suggests there is a broad variation in the competence level of this fundamental skill. Prior to introduction of a new educational curriculum, we assessed whether pediatric RTs who enter the room of a simulated infant mannequin in severe respiratory distress were able to: Apply PPV and attempt to move the chest within 60 seconds, and demonstrate at least 2 adjunctive airway maneuvers when initially unsuccessful with PPV within 120 seconds. All Pediatric RTs were required as part of their 2009 annual skills assessment to attend one high-fidelity simulation at the Johns Hopkins Medicine Simulation Center. Sessions were recorded for quality assurance purposes. Staff was assessed on their ability to respond to an infant in respiratory distress and debriefed on their performance immediately upon scenario conclusion. When all staff sessions were complete, videos were reviewed looking for a checklist of key performance measures. A subset of videos was assessed by 2 reviewers independently and inter-rater reliability was calculated. Results: Nineteen videos were reviewed. Only 2/19 (11%) met established key performance goals. The one that missed the time goal for PPV. Times to key performance measures are found in Table 1. Conclusion: This requires rapid intervention to stabilize the airway and provide positive pressure ventilation (PPV) to prevent progression to cardiac arrest. Informal observation during PRRT suggests there is a broad variation in the competence level of this fundamental skill. Prior to introduction of a new educational curriculum, we assessed whether pediatric RTs who enter the room of a simulated infant mannequin in severe respiratory distress were able to:

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1, Cheryl Meredith¹, Daenna King¹, Stacey Mann¹; Simulation Center, Johns Hopkins Medicine, Baltimore, MD; Pediatric Respiratory Care Services, The Johns Hopkins Hospital, Baltimore, MD; 1The Johns Hopkins School of Medicine, Baltimore, MD.

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Sponsored Research - None

919968

919801

Wednesday, December 8; 3:00 pm to 4:55 pm (Room N239/N241)
QUALITY IMPROVEMENT PROJECT: TOLERABILITY AND EFFICIENCY OF THREE DEVICES USED FOR EARLY LUNG RECRUITMENT.

Daniel D. Woodhead, Vicki L. Baer, Diane K. Lambert, Robert D. Christensen; National Deaf Diversities, Davenport, IA.

Background: Admission to a NICU for endotracheal intubation and mechanical ventilation can sometimes be averted by applying early lung recruitment during the transition period. Various modalities have been used to accomplish this, each with advantages and disadvantages. We sought to compare both patient tolerability and efficacy of three such modalities, using a quality improvement project: the basic bubble nasal cannula (S-Care), the Fisher & Paykel (F&P) 850 heated nasal cannula system, and the Precision Flow (PF) system from Vapotherm. Methods. The project occurred between June 2009 and March 2010. Patients >35.0 weeks gestation were eligible if, in the first 90 min after birth, they had at least three of the following signs: 1) grunting and/or retractions, 2) respiratory rate >60/min, 3) breath sounds decreased but equal, 4) F&P >30%. Early lung recruitment was performed for 90 min according to protocol, on eligible patients, using one of the three test devices. Assignment to a device was pre-determined. Data sets were collected prospectively by a NICU respiratory therapist or nurse. Tolerability was judged using a scoring system of back-arching and arm-stifling. Efficacy was judged by whether NICU admission and intubation were averted, and by whether the patient required “rescue” by changing from the failed original device to an alternative devise. Results. Early lung recruitment was performed using the NC in 18 neonates, the F&P in 23, and the PF in 17. Demographic and clinical features of those in the three device groups were statistically different. Tolerability scores were the highest for the PF (0.0±0.2), intermediate for the F&P (1.7±1.6) and poorest for the NC (2.8±1.2) (>0.001 for PF vs. others). Efficacy measures were as follows: NICU admission occurred in 4/17 (24%) of those treated with PF, in 7/23 (30%) of those treated with F&P, and in 8/16 (44%) of those with the NC. A similar trend was seen in intubation, rates being 1/17, 1/23, and 2/16 for the PF, F&P, and NC, respectively. In an attempt to avert NICU admission, 17 were switched from the original devise to another device. Those who failed the original devise were: PF (0/17), F&P (7/23, 30%), NC (10/18, 56%) >0.001 vs. PF. Conclusion. Of the three methods tested for early lung recruitment during the transition period, the Precision Flow had the best patient tolerability scores, the lowest failure rates, and the highest rates of avert NICU admission.

Sponsored Research - Vapotherm lent us a Precision Flow machine to use in our project.

891808

INFLUENZA PATIENT WITH ACUTE LUNG INJURY WEANED WITH AIRWAY PRESSURE RELEASE VENTILATION: A CASE STUDY.

Tammy Schultz, Grant D. Wilson; Respiratory Care, Mayo Clinic, Rochester, MN.

Introduction: Providing appropriate ventilation to lung injured patients can become complicated. In this case study a variety of ventilation modes are attempted but patient was unable to be weaned until APRV was initiated and paralytic discontinued. Case Study: A 5 year old pediatric patient admitted to the emergency department for dyspnea, leathargy and fever for the past 6 days. Chest x-ray (CXR) showed hyperinflation, peribilar infiltrates and small patchy bilateral infiltrates at the costophrenic angles. Influenza swab completed and results were positive. Arterial Blood Gas (ABG) showed pH was 7.13, PaO2 73, PaCO2 85, Base of –1 mmOL/L, and HCO3 11. Patient endotracheally intubated and remained mechanically supported for 16 days. Case Description: Patient was initially placed on Volume Controlled Intermittent Mandatory Ventilation (VC-IMV). One day later Pressure Control Intermittent Mandatory Ventilation (PC-IMV) was initiated. After 2 days of increasing PC-IMV settings ending with PC-IMV 34 cmH2O, rate of 38/min and PEEP of 14 cmH2O, ABGs showed pH 7.27, PaO2 70, PaCO2 42, and CXR showed complete whiteout of right lung. The Sensormedics pediatric 3100A High Frequency Oscillator (HFO) started but unable to provide enough flow, therefore the Sensormedics adult 3100B HFO was initiated and continued throughout the next 11 days with no progress in weaning. The decision was made to initiate APRV on the Drager Evita XL and stop paralytic therapy. See Table 1 APRV settings weaned by decreasing P High over the next 3 days demonstrating improvement in ABGs and patient’s CxRs. Patient was then placed on VC-IMV by physician preference and extubated 12 hours later. Conclusion: Patient was intubated for 16 days due to severe respiratory distress secondary to H1N1. Following unsuccessful modes of ventilation and the need to discontinue paralytic therapy, APRV proved to provide effective ventilation and oxygenation while allowing the patient to breathe spontaneously, maintain lung recruitment and weaning of sedation for a successful extubation.

Sponsored Research - None

887246

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

Charles J. Hovdland1, Rick Carter1, Kevin Crezee1, Donald M. Null2; Respiratory Care Services, Primary Children’s Medical Center, Salt Lake City, UT; 2Department of Pediatrics, School of Medicine, University of Utah, Salt Lake City, UT.

Background: Recently, studies (1) have suggested that high frequency percussive ventilation through endotracheal tubes placed in the nasopharyngeal area of preterm lambs may prevent the development of bronchopulmonary dysplasia. As a result of this finding, we believed it was important to investigate this method of ventilation more in detail in order to enhance future research. Therefore, in order begin to objectify this method of ventilation, we developed methods to measure tidal volumes, minute ventilation, peak airway pressures, and PEEP in a simulated lung model. Method: The Percussionaire Sinusoidal Bronchotron with Turbohead Phisitron and Hudson Nasal CPAP Prongs (Sizes 0-5) and endotracheal tubes(ET) were attached to a SmartLung Infant test lung. The lung was limited to approximately 5 Hertz which was the limit for the Vt 1000 to produce accurate readings. The inspiratory time on the conventional side of the Bronchotron was placed at the lowest level (short time) and the expiratory dial placed at the highest level (long time) as to minimize conventional ventilator settings ending with PC-IMV 34 cmH2O, rate of 38/min and early SA and DV; p-values 0.05 were considered significant. Results: Gestational age ranged from 24-34 weeks. SA ranged from 19-207 min and DV ranged from 205-691,161 min. The figure shows the relationship between SA and DV. The low r value indicates no correlation. A subset of the data (gestational age 29-33 weeks, n=23) was also analyzed with similar correlation. Conclusion: In this group of patients, results suggest that primary outcome of very early SA does not differ with results of early SA. From this data we can extrapolate that there is no apparent harm in administering surfactant to the neonate after stabilization and suctioning in the NICU rather than in the delivery room immediately after birth. Further randomized, controlled trials are recommended to confirm these benchmark results.

Sponsored Research - None

905855

IS IT MORE ADVANTAGEOUS TO ADMINISTER SURFACTANT TO PREMATURE INFANTS IN THE DELIVERY ROOM OR WAIT UNTIL ADMISSION TO THE NICU?

Khin-Kyemon Aung1,2, Daniel W. Sutton1,2, Susan M. Brant1,2, Firas Saker1,2, Robert L. Chabard1, John Dicken2; 1Hillcrest Hospital, Mayfield Heights, OH, 2Cleveland Clinic, Cleveland, OH.

BACKGROUND: Surfactant administration has been proven to significantly reduce mortality, chronic lung disease, bronchopulmonary dysplasia, and duration of mechanical ventilation in very low birth weight infants with respiratory distress syndrome (RDS). Early surfactant replacement therapy has been shown to improve patient outcome; however optimal timing of the first dosage is unclear. Due to inconsistent evidence, administration of surfactant in the delivery room is now becoming commonplace as an alternative to administration in the NICU after stabilization. Since extended time on a ventilator can result in lung injury, it is imperative to determine methods to minimize duration of ventilation. Few data are available comparing surfactant administration in the delivery room to outcome. The purpose of this study was to determine if there is a difference in duration of ventilation between very early and early surfactant administration.

METHODS: Data from 2004-2009 for premature neonates were collected from the Vermont-Oxford, Hillcrest Hospital and Cleveland Clinic database. Records of 212 neonates were reviewed with 66 meeting the criteria (RDS, mechanical ventilation only). Surfactant administration was administered in the delivery room (SA) or NICU (DV). Results: Gestational age ranged from 24-34 weeks. SA ranged from 19-207 min and DV ranged from 205-691,161 min. The figure shows the relationship between SA and DV. The low r value indicates no correlation. A subset of the data (gestational age 29-33 weeks, n=23) was also analyzed with similar correlation. Conclusion: In this group of patients, results suggest that primary outcome of very early SA does not differ with results of early SA. From this data we can extrapolate that there is no apparent harm in administering surfactant to the neonate after stabilization and suctioning in the NICU rather than in the delivery room immediately after birth. Further randomized, controlled trials are recommended to confirm these benchmark results.

Sponsored Research - None

902204

Wednesday, December 8; 3:00 pm to 4:55 pm (Room N239/N241)
COMPARISON OF NEONATE TIDAL VOLUMES IN TIME CYCLED PRESSURE LIMITED OR VOLUME TARGETED VENTILATION DURING THE FIRST 48 HOURS OF LIFE.

John S. Emberger1,2, David Paul1, Michael Western1, Joel M. Brown1,3; Respiratory Care, Christiana Care Health System, Newark, DE; 1Pediatrics, Christiana Care Health System, Newark, DE

BACKGROUND: Neonatal tidal volume ventilation has increased in recent years. We compared the tidal volumes delivered to neonates in our NICU when receiving either time cycled pressure limited ventilation (TCPL) or volume targeted ventilation (VTV). METHODS: All neonates receiving mechanical ventilation June 2008 to June 2010 were retrospectively reviewed. Data included: ventilator mode, tidal volume, mean airway pressure (MAP), peak inspiratory pressure (PIP), heart rate and mortality. Tidal volume in mL/kg was calculated for tidal volumes in kg using weight at birth. Tidal volume and ventilator data from 38 neonates were analyzed. RESULTS: Four hundred seventy patients were identified as receiving TCPL and Tidal volumes in mL/kg for TCPL and VTV were significantly different (p=0.018). There were 2.9 PIP adjustments per TCPL patient ordered during the first 48 hours of life with 4150 documented tidal volumes. Eighty patients were identified as receiving VTV ventilation during the first 48 hours of life with 598 documented tidal volumes. Nineteen tidal volumes were calculated using coefficient of variation (CV). RESULTS: Delivered VT was lower during AVEA (Machine Volume-Flow Cycle) Cycle: VT was measured at 4 to 6 mL/kg in larger infants (VT=30 mL/kg and 6 mL/kg) than during TCPL (VT=25 mL/kg). VT was adjusted for changes in condition and respiratory effort. Each ventilator was attached to the ASL 5000 with a 2.5mm ID ET tube. Breath to breath VT delivery was measured using AVC software version 3.0 for the entire breath sequence. Data analysis was performed using ANOVA and post-hoc analysis. The precision of VT delivery was calculated using coefficient of variation (CV). RESULTS: Delivered VT was lower during AVEA (Machine Volume-Flow cycle) than with any other ventilator tested (P<0.05). The CV for each ventilator tested was: Servo-i 22%, Carestation 12%, AVEA 60%, and Babylog 3000 plus 33%. CONCLUSIONS: It appears that neonatal ventilators servo-control pressure to maintain small VT regardless of the type of connector to a HFOV circuit can decrease the delivered VT regardless of the type of connector to a HFOV circuit. We hypothesize that inserting any adapter in-line affects delivered VT. METHODS: To assess the effect of an in-line adapter with a HFOV ventilator circuit, we conducted a bench study using a test lung, a 3300 Oscillator (CareFusion), and a flexible circuit. VT at the ETT was measured using a COS9500+ monitor (Philips) and a neonatal flow sensor. A 4.5 mm ETT was attached leak-free to a test lung. Constant HFOV settings included: MAP 26 cmH2O, respiratory time 3.3%, bias flow 20 LPM. Circuit variations studied were: an elbow adapter, an 8-French in-line suction catheter with a Y-adapter, and a flexible adapter. Data were collected at amplitudes of 25 and 45 cmH2O and frequencies ranging from 4 to 10 Hz in increments of 2 Hz. The circuit was not humidified. Fifty VT measurements were obtained at each combination of frequency, amplitude, and adapter. The effects of frequency, amplitude, and adapter on VT were determined using paired t-tests. Statistical significance was defined as p < 0.05. RESULTS: 400 measurements were obtained per circuit setup. Mean SVT was significantly higher with no adapter than with any of the in-line connectors (Table). Mean VT differences between pairs of adapters were not statistically significant. The addition of any connector to a HFOV circuit can decrease the delivered VT regardless of the type of connector that is integrated. While statistically significant, it must be stressed that this study cannot conclude whether the changes in VT are clinically significant or whether the loss of VT outweighs the risk of opening the circuit for suctioning. However, these findings indicate that the potential impact on VT must be considered when adapters of any form are added to a HFOV circuit. Sponsoring Research - None

920391

919433
WHAT ARE THE EFFECTS OF DIFFERENT BUBBLE CONTINUOUS POSITIVE AIRWAY PRESSURE (B-CPAP) SYSTEMS ON THE MAGNITUDE OF OSCILLATIONS IN LUNG VOLUME WHILE USING A REALISTIC AIRWAY/LUNG MODEL OF PRETERM INFANTS?

Roh DiBlasi1, Dave Crotwell1, Rob DiBlasi2; 1Respiratory Care/Developmental Therapeutics, Seattle Children's Research Institute, Seattle, WA; 2Respiratory Care, Children's Hospital, Los Angeles, CA

BACKGROUND: High-frequency oscillations in pressure are created by gas bubbling through an underwater-seal during B-CPAP. These pressure oscillations may enhance ventilation and aid in lung recruitment in premature infants (Pillow JJ; Am J Respir Crit Care Med 2007). We designed a study to test the hypothesis that the magnitude of oscillations in lung volume (delta-volume) and frequency range, created by B-CPAP systems, are not different under: 1) a homemade B-CPAP system; 2) F&P B-CPAP; and 3) Babi.Plus B-CPAP in an passive nasal airway/lung model affixed with “leaky” nasal prongs. METHODS: An anatomically accurate infant nasal airway model fabricated using a 3D printer and dimensions obtained from a CT-scan of a preemie, was attached to a silastic test lung (C:0.47 mL/cmH20 and R:150 cmH20/L/sec) sealed within a calibrated plethysmograph. The nasal airway model was affixed with nasal prongs and attached to B-CPAP systems set at 6 cmH2O CPAP. Hudson prongs (size 0) were used with systems 1 and 3 and F&P prongs (size extra small) were used with system 2. Adjustments were made to maintain the same CPAP level across all testing conditions. Bias flow was varied between 4-10 L/min and delta-volume and frequency were calculated using pressure data obtained from the plethysmograph. Data were analyzed using ANOVA and Student-Newman Keuls for post-hoc analyses. RESULTS: The F&P B-CPAP system provided greater delta-volume than the other devices at all bias flows (P<0.05; Figure). The F&P system generally provided lower frequencies than the other B-CPAP systems. The magnitude of delta-volume and frequencies increased with bias flow up to 6 L/min in the F&P and Homemade systems but showed relatively small changes during bubbling with the Babi.Plus (see Figure). DISCUSSION/CONCLUSIONS: The major finding of this study was that B-CPAP can provide measureable, and potentially clinically beneficial, oscillations in lung volume. In the F&P system, the delta-volume was increased nearly 10% of a 1 kg preterm infants’ spontaneous tidal volume. Increasing bias flow, in systems 1 and 2, may provide additional support during B-CPAP. We speculate that the higher delta-volume provided by the F&P system is a combination of the circuit/nasal prong configuration and the lower frequencies applied to the nasal airway interface. Additional testing is needed in spontaneously breathing infants to determine whether a physiologic benefit exists when using the different B-CPAP systems.

Sponsored Research - None

920937

A NOVEL MEANS FOR DELIVERING NASAL INTERMITTENT POSITIVE PRESSURE VENTILATION (NIPPV) IN INFANTS: THE NASAL CANNULA

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BACKGROUND: Nasal ventilation using nasal intermittent positive pressure ventilation (NIPPV) is on the rise in preterm infants to decrease post-extubation failures, bronchopulmonary dysplasia, and for the treatment of apnea of prematurity. NIPPV is typically applied using traditional continuous positive airway pressure (CPAP) bi-nasal short prongs. This practice can result in nasal airway tissue trauma. Nasal Cannula Intermittent Mandatory Ventilation (NC-IMV) is a novel means of delivering pressure controlled NIPPV breaths noninvasively to neonates requiring respiratory support. We have previously reported that NC-IMV is feasible and well tolerated in a large number of neonates. However, pressures or volume delivered to the patient is not known.

OBJECTIVE: To determine the magnitude of pressure, volume, and positive end-expiratory pressure (PEEP) delivered to a realistic infant nasal airway/lung model using different sized nasal cannulae and at different peak inspiratory pressure (PIP) settings during time-cycled, pressure-limited mode. METHODS: We configured a neonatal test lung to simulate an apneic premature infant with compliance: 0.8 mL/cmH20 and resistance: 75 cmH20/L/sec. A realistic infant nasal airway model was attached to the test lung. The ventilator was set in IMV mode, rate 40 breaths/min, inspiratory time 0.5 s, Flow 7-9 L/min, and PEEP 5 cmH20. The nasal airway was ventilated at PIP of 10, 15, 20, 25, and 30 cmH20 using infant and intermediate high-flow nasal cannulae (Fisher Paykel, Auckland, NZ) and a new prototype nasal cannula (RAM Neotech Nasal Cannula®). Pressure, volume, and PEEP were measured in the test lung as PLUNG, VLUNG, and PEEPLUNG. RESULTS: Under all testing conditions, there was detectable PLUNG, VLUNG, and PEEPLUNG during NC-IMV. There was a linear relationship between PIP applied by the ventilator and VLUNG up to 30 cmH20. The RAM Neotech Nasal Cannula® provided greater PLUNG, VLUNG, and PEEPLUNG than the other infant nasal cannulae during NC-IMV. CONCLUSIONS: NIPPV using NC-IMV can provide a significant amount of a neonate’s volume and pressure requirements with potentially less nasal airway trauma than traditional CPAP prongs. Further studies are underway to evaluate the pressure and volume deliveries and reduction of nasal injury in spontaneously breathing neonates receiving NC-IMV support.

Sponsored Research - A Prototype Cannula was provided by Neotech Medical

921075
FACILITATION OF SKILLS FAIR PREPARATION MATERIALS VIA AN ONLINE PROCESS.

Elsie Collado-Koman, Herb French, Fernando Gonzalez, Jan Phillips-Clar, Rick Ford; UC San Diego Medical Center, San Diego, CA

BACKGROUND: UCSD conducts an annual Skills Fair (SF) in order to assist in assuring staff competency. In planning for this year’s SF, the organizing committee determined that over 150 pages of printed materials and associated checklists would be needed for each of the 85 attendees. An objective of the committee was to provide the SF at an economic savings and reduced environmental impact, while increasing the accessibility of the materials for staff.

METHOD: We sought to facilitate supportive materials by creating a “Skills Fair” section in our department’s website. This series of pages and electronic documents included a course description, information on location and parking, frequently asked questions, and reference materials. We also posted questions and answers, setup instructions, and clinical scenarios for each of the competencies presented during the SF. Following the SF a survey was conducted to assess staff opinion of these electronic materials.

RESULTS: Of the 84 staff members attending the event 75% rated this year’s facilitation of SF even better than previous years. After reviewing the material online, prior to the SF, staff asked if it would remain on line for future reference. We added this as a question on the survey and 100% of the attendees agreed they would like it to remain online for future reference. In addition to no waste, approximately $600 in printing expenses was avoided. CONCLUSION: The online posting of preparation materials for our SF event proved to be the preferred method of accessing materials over the provision of printed booklets. This process also saved the department money in printed materials, gave staff ongoing resource materials, and emphasized our department’s dedication to save environmental resources.

Sponsored Research - None

918520

UTILIZATION OF A UNIT BASED EDUCATION MODEL TO IMPROVE STAFF SATISFACTION AND EFFECTIVENESS OF CLINICAL EDUCATION.

Scott M. Pettinichi, Brandy Seger, Ed Conway, Rick Amato, Tammy Byrd, Tom Cahill, Chuck Grone, Jenni L. Raake; Respiratory Care, Cincinnati Children’s Hospital, Cincinnati, OH

Background: Cincinnati Children’s Hospital Medical Center is a 475 bed medical center with 12 clinical areas served by 129 Respiratory Therapists (165 FTE). Providing consistency in our clinical education has been a challenge for our division. Our management team had the responsibility for conducting staff education which caused issues with their overall workload and job satisfaction. A new staff education model was developed that utilized clinical experts from each of the 12 clinical areas. A position was filled by a clinically advanced therapist from each clinical area. The clinical expert was given 8 hours of education time each week to serve the educational needs of their clinical area. We surveyed the staff to determine their overall satisfaction and level of effectiveness of the new process as compared to our old education model. Methods: Utilizing a survey monkey, we distributed a questionnaire to our staff. The questionnaire asked staff to rate their satisfaction and level effectiveness of our new staff education model as compared with our old education model. Results: Response rate was 24% (n=47). Responses were tabulated using a Likert Scale. An increase in job satisfaction and workload was reported by 70% of respondents. 81% reported improvement in timeliness of educational information. 79% reported improvement in the quality of our educational program. 72% of RTs reported improvement in the consistency of practice. The staff reported an 81% improvement in the referral of educational deficiencies, and an 8% improvement in clinical content. Conclusions: Based on our results, the there was overall improvement in staff satisfaction and level of effectiveness utilizing the new staff education model. Utilization of clinical experts to serve the educational needs of a clinical area has proven itself to be beneficial.

Sponsored Research - None

919620

IMPROVING COMMUNICATION AMONG PRECEPTORS THROUGH THE CREATION OF A PRECEPTORS WEBSITE.

Elsie Collado-Koman, Herb French, Fernando Gonzalez, Rick Ford; UC San Diego Medical Center, San Diego, CA

BACKGROUND: In training new employees and students, we utilize a preceptor model in which staff, with specialized interest and expertise in a specific area, are assigned to precept new employees and students. This model creates challenges in tracking progress and communicating areas of strength and areas needing improvement. We identified the need for improving communication among preceptors. We sought to create a preceptor website that was real time, and provided access to individual’s performance by any preceptor 24/7. METHOD: We conducted a series of meetings seeking input from staff and existing preceptors. Results indicated a web based tool should be considered. We then determined what content and features of the preceptor’s webpage were required. Microsoft SharePoint was identified as a web platform that could support these needs. We developed the site and initiated it as a tool for preceptors. After initial implementation the site was refined to meet the preceptors’ recommendations and needs. A survey was developed to evaluate the effectiveness of the final tool.

RESULTS: The SharePoint website included forms to facilitate the preceptor’s documentation of each orientee’s progress, for the identification of weak areas, as well as in the setting of daily goals. A performance assessment and areas needing improvement were made available online, enabling the next preceptor to know what areas needed to be reinforced. In addition the student competency check-off sheets were posted on line for all the preceptors to reference. The survey taken by preceptors after using the site indicated that the online process improved all aspects of preceptorship documentation.

CONCLUSION: Our intent was to develop a system to improve communication with the both the orientees and fellow preceptors, enabling them to solve issues faster, and more effectively. Using this tool provides us with an improved communication experience, and a more effective evaluation of new employees and students. This also enhances their growth and success in the profession.

Sponsored Research - None

919700

TRACHEOSTOMY TUBE CHANGES TO DOWNSIZE AND DECANNULATIONS ARE SAFE WHEN PERFORMED BY RESPIRATORY THERAPIST.

Delgado Delgado, Mark Cohen-Melamed, Vince Rafeew, Phillip Matelan, Gary Largent, Raymond Tittle; Respiratory Care, University of Pittsburgh Medical Center, Pittsburgh, PA

The University of Pittsburgh Medical Center (Oakland campus) has 156 ICU beds with an average daily ventilator census of 86 and 151 full time equivalents (FTE’s). In 2004 a process was established in order to facilitate downsizing and decannulation of all trach down sized patients. The Respiratory Therapist is the expert was given 8 hours of education time each week to serve the educational needs of their clinical area. We surveyed the staff to determine their overall satisfaction and level of effectiveness of the new process as compared to our old education model. Methods: Utilizing a survey monkey, we distributed a questionnaire to our staff. The questionnaire asked staff to rate their satisfaction and level effectiveness of our new staff education model as compared with our old education model. Results: Response rate was 24% (n=47). Responses were tabulated using a Likert Scale. An increase in job satisfaction and workload was reported by 70% of respondents. 81% reported improvement in timeliness of educational information. 79% reported improvement in the quality of our educational program. 72% of RTs reported improvement in the consistency of practice. The staff reported an 81% improvement in the referral of educational deficiencies, and an 8% improvement in clinical content. Conclusions: Based on our results, the there was overall improvement in staff satisfaction and level of effectiveness utilizing the new staff education model. Utilization of clinical experts to serve the educational needs of a clinical area has proven itself to be beneficial.

Sponsored Research - None

919620
PREPARING THE NEWLY HIRED RESPIRATORY THERAPIST FOR SUCCESS UTILIZING AN INTENSIVE EDUCATIONAL CURRICULUM.

Tammy K. Bird; Abby Motz; Division of Respiratory Care, Cincinnati Children’s Hospital Medical Center, Cincinnati, OH

BACKGROUND: Education is a key component in preparing the respiratory care profession for the future of healthcare. It is evident that through recent publications that the existing and future respiratory therapists (RTs) should be competent in traditional and non-traditional areas of respiratory care. Our institution cultivates an atmosphere that promotes lifelong learning; starting with all newly hired respiratory therapists. Starting in 2008, we devised an educational curriculum program for all newly hired respiratory therapists at our institution called Respiratory Review Knowledge Know-How (R2K2). One of the goals of the R2K2 class is to guarantee competence in the standards of respiratory care practice at our institution, as well as creating a safe environment for learning while ensuring competency. Curriculum included: patient assessment and situational awareness, newborn anomalies, airway clearance techniques, asthma and bronchial protocols, tracheostomy care, suctioning, cardiac defects and recognizing the cardiac pediatric patient, invasive and non-invasive ventilator management, acid-base balance, crash cart emergencies, and respiratory care charge capturing. METHOD: Surveys were distributed to each of the newly hired RTs post R2K2 class completion to assess the quality of the education curriculum. Survey questions were in a form of a likert scale (ranging from 1 being strongly disagree to 7 being strongly agree) and open comments. RESULTS: 57% of the respondents strongly agreed and 37% moderately agreed that new knowledge and skills were obtained. 62% strongly agreed and 29% moderately agreed that the new knowledge and skills learned could be applied to both the clinical and profession curricula established for the newly hired RTs has provided valuable R2K2 classes, quality education was delivered while ensuring that the training was a worthwhile investment for career development. 68% strongly agreed and 28% moderately agreed that the training was a worthwhile investment for division. CONCLUSION: As a direct result of the R2K2 classes, quality education was delivered while ensuring that the standards of care throughout the institution were maintained. The educational curriculum established for the newly hired RTs has provided valuable knowledge and skills that can be applied to both the clinical and profession curricular realm.

Sponsored Research - None

920388

COTININE TESTING FOR TOBACCO ABUSE: INITIAL RIYADH EXPERIENCE.

Richard D. Nelson, Neria Gavrielov; Loma Linda University, Riyadh, Saudi Arabia

(1) Background: Mentoring & monitoring for a tobacco free lifestyle must be a priority in the education of healthcare professionals. The leading cause of preventable death is cigarette smoking. yet we find smoking rates remain high in healthcare staff in Saudi Arabia. Loma Linda University (LLU) promotes a tobacco free lifestyle for students and faculty in Saudi Arabia. In addition to educating the students on the negative social image of smoking, all students are tested for cotinine, a metabolite of nicotine. Cotinine urine testing is easy, economical and accurately reflects the presence of nicotine metabolism. (2) Material and methods: students are advised at least twice in weeks in advance of testing. Testing for Cotinine was by a lateral flow, one-step immunoassay, with a cut-off sensitivity level of 200 ng/ml. Students provided a urine sample with staff outside the bathroom stall. (3) Results: A random test group of 48 pre-advised students who stated in writing they did not smoke had a cotinine + rate of 15% (n=7). Further, it was noted if the negative score had two strong bands or one strong and one faint band (n=19) and students were questioned as to second hand smoke. More than half (58%) of the responding PDs indicated they incorporate planned interdisciplinary activities involving students from two or more disciplines into their program’s curriculum. These activities occur most frequently in the clinical setting, during traditional classroom activities, or in web-based courses. Ninety-eight percent (51/52) of survey participants had a positive attitude toward IDE and 20% agreed if it is or would believe it is important to incorporate IDE into the education of RC students. However, only about 50% (25/52) of the program directors believe that they have the resources needed to implement IDE. Conclusions: IDE is important in the preparation of future healthcare professionals and has the potential to be incorporated into the education of RC students. More attention should be focused on increasing the number of RC educators who have the resources needed to teach from an interprofessional perspective and to share educational approaches for collaborative patient centered practice. Providing IDE is essential to ensure RC graduates are prepared to work effectively on interprofessional teams within the evolving healthcare system.

Sponsored Research - None

921048

DETERMINING INTEREST IN SIMULATION AMONG RESPIRATORY CARE EDUCATORS.

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BACKGROUND: The American Association for Respiratory Care (AARC) has a working relationship with an organization called the Simulation Alliance (SA), which was formed by members of the Society for Simulation in Healthcare. As a coordinating center or clearinghouse, the SA gathers common goals and initiatives, shares resources and develops guidelines and eventually even standards of care and simulation-based educational programs. The primary objective of this research endeavor was to determine the level of interest among AARC members who might be stakeholders in simulation programs.

METHODS: An online survey was designed and distributed using SurveyMonkey.com. The AARC board of directors approved survey content and members of the AARC Education Specialty Section were invited to participate in March of 2010. Descriptive statistics (percent of total responses and number responding) were used to report the results. RESULTS: Emails were sent to 930 members of the AARC education section. Responses were received from 310 practitioners (33% response rate). Interest levels were - Very interested:75.5% (234); Interested: 16.5% (51); Neutral: 5.2% (16); Mostly disinterested: 2.6% (8); Not interested: 0.3% (1). More than half of the respondents reported active involvement in simulation for training and competency documentation; 56.5% (175). The level of involvement in simulation was as follows - simple mathematical simulations (e.g., blood gas calculation): 10% (31); complex mathematical simulations (e.g., ventilator simulator): 32.5% (53); simple mechanical simulations (e.g., intubation simulators): 59.5% (97); complex mechanical simulators (e.g., computer controlled pistons): 46.0% (75); simulation center: 44.8% (73); other 20%. Respondents said they were interested in hospital-based simulators in hospitals: 20.7% (34); college/university: 78% (128); private company: 1.8% (3); other: 4.9% (8). Approximately one third, 34.5% (n =107) of those surveyed were willing to participate in the AARC’s ongoing exploration of simulation in healthcare, and provide contact information for further research. In this study of members of the AARC, the large majority of respondents indicated interest and experience using simulation for education. All levels of simulation, from simple mathematical models to high fidelity simulation content are being used. The AARC should consider future activities related to simulation in education and inform future initiatives.

Sponsored Research - None

887631
EVALUATION OF A COMPUTER SIMULATION FOR TEACHING MECHANICAL VENTILATION.

Teresa A. Volsko, Robert L. Charbourn; Health Professions, Youngstown State University, Youngstown, OH; Respiratory Institute, The Cleveland Clinic Foundation, Cleveland, OH

BACKGROUND: Multiple studies have demonstrated the effectiveness of high fidelity simulation in the teaching of clinical knowledge, procedural skills, teamwork, and communication. Only a few have shown direct improvements in clinical outcomes. A dearth of information is available with respect to the didactic use and effectiveness of computer-based simulations. The purpose of this study was to evaluate a computer based pedagogical model for teaching 3rd and 4th year respiratory care students the concepts and clinical application of inverse ratio, pressure control intermittent mandatory ventilation (IR PC-IMV). We hypothesized that the use of a computer based teaching model would enhance student engagement and improve post-instructional scores.

METHODS: Students completed a short demographic questionnaire and learning style inventory results were used to construct a two dimensional stratified sampling matrix, which assigned students to an instructional method based on their learning style category (verbal, kinesthetic, auditory) and grade category (upper 50%, or lower 50% of cohort). Students received standardized IR PC-IMV instruction by interactive computer simulation or traditional lecture. Pre-post-testing transpired immediately prior to and following the didactic components. The post-test was repeated 2 weeks after the instruction to evaluate retention. Changes in pre-post test scores and 2 week post test scores were assessed by t-tests. Statistical significance was established at P ≤ 0.05. Descriptive statistics were used to report the sample demographic characteristics.

RESULTS: Fifteen students mean age 29 years (SD 9.2) participated in the study, 3 were male. No differences in the proportion of learning styles or GPA existed between groups. A mean score improvement of 10.20 % (SD 8.7) and 12.97 % (SD 8.9) was realized for the simulation and traditional lecture group respectively. Differences between pre-post test improvements were not found to be statistically significant (p = 0.628). Test scores obtained 2 weeks after the instruction were higher among the group receiving simulation instruction (p = 0.40). CONCLUSIONS: Simulation based teaching was associated with a higher retention, perhaps due to better engagement during class. More research in this area is warranted.

Sponsored Research - None

831055

THE DEVELOPMENT OF A FORMAL PRECEPTOR MODEL TO IMPROVE DEPARTMENTAL MENTORSHIP.

Kenneth Miller, Linda Comman, Uma Bhatt, Bryn Surgenor; Respiratory Care, LVHN, Allentown, PA

Introduction: Historically, the training of new employees and clinical instruction was assigned to veteran therapists, or those staff with a “veteran” staff were given formal training, (often of the trial and error approach), or a simple written structure format provided by departmental management for guidance as preceptors. This practice worked well when the orientation process included one or two new employees, or a couple of students. Recently, based on the increasing demands for more respiratory therapists, the number of new employees and students has blossomed. The need for well-educated bedside teachers has become paramount in the ever increasing technological and ideological pace of respiratory care clinical management. Methods: To address these issues, our Respiratory Care Department formalized its preceptor process. An online survey was conducted to receive feedback on the current orientation process and preceptor role understanding. Based on feedback, a more structured preceptor model was instituted to address the increasing demands. Led by departmental educational leadership, a scheduled group of formal educational sessions were conducted. Topics included issues and concerns that arise during the orientation process, a review of adult learning principles from the Neglected Teacher, The Adult Learner by Malcolm Knowles, and the revision of the orientation process and booklet. Also, documentation of both the preceptor and orientee were formalized and encouraged with the development of an on-line preceptor/orientee form. Clinical instruction was addressed by reviewing concepts and text of traditional aspects of critical thinking theories. A formal preceptor evaluation form was developed. Results: The following was pre and post survey results: Conclusion: The development of a formalized preceptor model has improved the orientation process and enhanced the clinical rotations for our future professionals. The preceptors now have a better vision of their roles and responsibilities.

Sponsored Research - None

890973

CRITICAL THINKING ABILITY IN BACCALAUREATE LEVEL RESPIRATORY CARE STUDENTS.

Richard Wettstein, Ruben Restrepo, Donna Gardner, Robert Wilkins; University of Texas Health Science Center at San Antonio, San Antonio, TX

Background: Critical thinking (CT) has been deemed an important characteristic to develop in respiratory care students. Methods: This study enrolled 55 senior respiratory care (RC) students in a baccalaureate program. The Watson-Glaser Critical Thinking Appraisal – Short Form (WGCTA-S) was used to measure their CT ability. Results: Table 1 displays the RC students’ scores on the WGCTA-S and each subscale. Results indicated that compared to normative data provided by The Psychological Corporation and the data found in the literature, the RC students (CT score of 24 on the WGCTA-S) demonstrated a lower CT ability than most of their peers (Table 2). Conclusions: Considering the importance placed in the CT ability of healthcare professionals, the results of this study are of concern. Program directors and RT faculty should review their curriculum and look for ways to improve CT in their students.

Sponsored Research - None

920945

A STUDENT SURVEY OF ACCREDITED TWO YEAR RESPIRATORY CARE PROGRAMS.

Roger I. Smith, Mike Trevino, David Massetter, Gary Weinstein; Texas Health Presbyterian Dallas, Dallas, TX

Purpose: A Respiratory Care student survey was used to collect demographics, educational data, and overall satisfaction. As a clinical site for a respiratory therapy program in our area, we felt we might be well served to have a better understanding of these students and what their perceptions are of their education experience. Method: The Directors of 23 accredited two year Respiratory Care Programs in Texas were contacted via email for permission to conduct a brief online survey of their students. The survey consisted of 24 questions and we used http://freeonlinesurveys.com/ to collect our data. This survey was anonymous and was open from March 10, 2010 through May 10, 2010 where 103 responses were returned. It is unknown how many students are enrolled in each college, nor which colleges chose to participate. Two directors, however, officially declined to participate. The survey questions consisted of the following: demographics, classroom/clinical instruction, and general impressions. Results: Motivation to become RT 18% job security 26% change career path 36% want to help people Demographics 74% responses are women 60% second year students 62% have other college degrees 37% 31-40 years of age (majority) 19% travel one way to college greater than 25 miles Impressions 47% Respiratory Care Night school may be a good idea 89% studied “Ethics” 77% studied “Time Management” 85% satisfied with education Conclusions: Our collected data revealed the vast majority of these students were satisfied with their educational experience. Most felt their educational goals, both classroom and clinical, were met or exceeded. They also responded favorably to the qualities of their classroom and clinical instructors. Other lessons learned were that night school would be a preference for a large number of students, feelings of job security are high, and relevant matters such as ethics and time management were being taught in the surveyed schools. A good percentage has other college degrees and the opportunity arises to discuss a BS degree as the minimum for Respiratory Therapists.

Sponsored Research - None

919129
DEVELOPMENT AND IMPLEMENTATION OF A RESPIRATORY CRITICAL CARE COURSE.

Peggy Reed-Watts, Lisa Cracchiolo, Darnetta Clinkscale, Kathleen Spilman; Respiratory Care Services, Barnes-Jewish Hospital, St. Louis, MO.

Objective: Respiratory therapists are often relied upon by physicians and nurses to provide clinical recommendations for treatment and care of patients with respiratory illnesses. As a result it is important for therapists to maintain knowledge of disease processes, new modes of ventilation, evidenced based practices and current research. The purpose of this course is to provide critical care theory through a variety of evidenced based practices to enhance critical thinking skills in a complex ICU environment. Focus is placed on the development and enhancement of clinical evaluation of the patient as a whole, and diagnostic skills needed by the advanced respiratory therapist.

Method: Program design consists of a multidisciplinary approach to patient care. Case studies are presented by physicians, nurses, pharmacists, nutritionists and respiratory therapists with the use of an automatic audience response system to answer questions during the presentations. A written test is given each week of the course with a required passing score of 75%. The last day of the course is designed for skill assessment which includes hands on demonstration of setup, operation, trouble shooting and case scenarios for various types of equipment used in critical care. In total, therapists are provided with over 20 hours of education. The course was made a requirement for all registered therapist and certified therapist with at least two years of intensive care unit experience. Participants were surveyed at the end of each course. Results: Since implementation in 2006, a total of 90 therapists (86% of staff) have completed the course. Survey results indicate 97% of participants rate the overall course on a 5 point likert scale of good to superior. When asked “Did this course enhance your critical care skills?” participant responses indicates 99% Yes, 1% No. Conclusion: Therapists are more prepared to recommend and your critical care skills?” participant responses indicates 99% Yes, 1% No. Conclusion: Therapists are more prepared to recommend and

SMOKING CESSATION AT CARILON CLINIC.

Regina H. Rackow1, Donna C. Bond2; 1Respiratory Therapy, Carilion Clinic, Roanoke, VA; 2Nursing, Carilion Clinic, Roanoke, VA.

Background: Cigarette smoking is the most prevalent health risk behavior in the United States, with tobacco-related disease and diagnosis accounting for $188 billion in medical expenditures and 400,000 deaths annually. Seventy percent of current smokers want to quit smoking. The smoking rate in the Roanoke Valley is ten percent higher than the state or national average. Research has shown that smoking cessation counseling lasting as little as ten minutes can substantially increase cessation rates. Hospitalization is an ideal opportunity to reach smokers when they may be especially receptive to smoking cessation interventions.

Method: Hospitalized patients are referred to our program, Respiratory Therapists, who are trained interventionists, assess the level of nicotine dependence and behavioral activities associated with the use of tobacco. Based on the assessments, the following information is discussed: the smoker’s motivation to quit, personal risk factors, smoking triggers/behaviors, identification of an individual to provide support, quit date, and other pertinent information. The patient is then assisted in the selection of a method for nicotine cessation. Written materials are provided and tailored to each patient. Follow-up telephone counseling occurs after discharge. Total time investment is approximately 30 minutes per patient. Results: Since this program began in 2001, close to 8000 patients have received the intervention. Of the patients we have been able to follow for a year after discharge; thirty-three percent continue to abstain from tobacco and twenty-seven percent of patients have decreased the amount of cigarettes smoked. Discussion: This program has identified many opportunities to improve the process. We have identified barriers which prevent intervention assessment on a majority of patients. Inappropriate referrals also decrease the amount of time that the interventionist has available to spend with patients. A new program is being trialed at the hospital to educate staff nurses to provide a brief, structured smoking cessation intervention for all smokers and refer patients who need more intensive counseling to the Respiratory Therapist.

IMPROVING COMPLIANCE WITH THE FIRST PEDIATRIC CORE MEASURE: CHILDREN’S ASTHMA CARE.

Crystal Hawkins; Respiratory Care Department, Levine Children’s Hospital, Charlotte, NC.

Background: The Joint Commission identified Children’s Asthma as a new focus area in the hospital setting. The Children’s Asthma Performance Measure Set was initiated in April 2007 with the Home Management Plan of Care (HMPC) initiated in July 2008. Initial compliance scores for the HMPC were very low at a national average of 52% with our average being 27% in the first quarter and 54% in the next 7 quarters. We were tasked with the goal of obtaining a compliance score above the national average. Method: Our team identified early on that our success was pivotal on the collaboration of each discipline that was assigned to our asthmatic patients. Early patient identification, adequately trained staff members, core team of educators, and the identification of champions from each unit aided in our overall success. Our asthma champions became crucial to the education process for each of our units. These champions helped to aid our team in bringing awareness to each staffing member in LCH. Results: Levine Children’s Hospital average score in late 2007 was 27% with a national average of 52%. In the first quarter of 2010 our score was 85% with the national average being 56%. Conclusion: While our ultimate goal of 93% set by Carolinas HealthCare System for compliance with the asthma core measure set has not been achieved we feel that our improvements are cause for celebration. The current national average for compliance with the HMPC is 56% in the first quarter of 2010. The fact that our team has achieved such a sustained average well above the national is a tremendous accomplishment. The members of our team know that we have a great process improvement plan in place that will in time help us celebrate our team reaching the hospital goal of 93%. Our team will continue to concentrate on the early identification of patients requiring asthma teaching. The Asthma Champions will continue to facilitate updates to our process for their prospective units.
PERFORMANCE OF A DISPOSABLE SINGLE PATIENT USE CONTINUOUS CUFF PRESSURE MONITORING SYSTEM, A BENCH TEST.
Matthew Davis, Maria Madden: Respiratory Care, UM/CC/Shock Trauma, Baltimore, MD

Background The cuff pressure of an artificial airway should be monitored on a regular basis for both an adequate seal and a safe pressure range. A disposable single patient use continuous cuff pressure monitoring system is designed to safely monitor cuff pressures without the use of an external pressure manometer. For our bench test we used the pressure easy device. Methods The loss of pressure from using the pressure monitor itself was measured by disconnecting and reconnecting the cufflator and then measuring pressure. Then the pressure easy was attached to an ET. The green circle of the pressure easy was placed at the top of the visible range for the high, the middle for the medium, and the bottom for the low pressure range. Then the pressure was measured at the three different ranges. Then six ETs were pressurized to 25 cm H20, three of which had a pressure easy attached and three that did not. Pressure was then measured eight hours later. Results After ten trials were performed an average of -3.3 cm H20 was observed per disconnect/reconnect of the cufflator. The pressure of the high range was observed to be 28 cm H20, the medium to be 25 cm H20, and the low to be 22 cm H20. Conclusion The pressure easy had equal pressure degradation as compared to a normal ET. Thus the pressure easy is reliable for continuous cuff pressure monitoring. If the green circle is visible then the pressure of that range is within 22 – 28 cm H20. The pressure leak during connection of the cufflator to the pilot balloon should be taken into consideration when monitoring the cuff pressure of an artificial airway. The authors suggest that when minimal occluding volume is obtained that adding approximately three cm H20 above the cufflator. The pressure of the high range was observed to be 28 cm H20, the medium for the medium, and the bottom for the low pressure range. 33% of the non-indicated ABGs were either not indicated or no indication was documented. We speculate the most of these were issues of clinician’s emotional assurance of patient condition rather than poor documentation of prescribed indications. Given that 33% of these actually resulted in ventilator adjustments, perhaps our list of indications should be expanded. On the other hand, 59% of indicated ABGs resulted in no action. Given that the majority of ABGs were driven by prior "out of range" results, perhaps our ranges should be modified. In particular, many patients had metabolic acidosis which would not be expected to result in ventilator changes. These data should serve as benchmarks for future studies.

Sponsored Research - None

INITIAL EXPERIENCE WITH REGISTERED RESPIRATORY THERAPISTS PLACING ESOPHAGOGASTRIC TUBES IN ADULT MECHANICALLY VENTILATED PATIENTS.
Richard G. Stairhime, Daniel D. Rowley, Linda L. Clarke, Frank J. Caruso: Pulmonary Diagnostics & Respiratory Therapy Services, University of Virginia Medical Center, Charlottesville, VA

BACKGROUND: Advanced respiratory physiologic monitoring and improved patient-ventilator synchrony are possible with insertion of a specialized esophagogastric sensing and monitoring catheter (EC). The catheter detects physiologic potentials that result in cyclic diaphragmatic myofiber depolarization. Correct placement of the EC requires competency and skill with inserting EC catheters, significant knowledge of ventilator modes, and understanding of scalar graphic waveforms. Registered respiratory therapists’ (RRT) clinical skill sets and knowledge in diagnostics and mechanical ventilation make them an appropriate group for expanding clinical responsibilities to include EC insertion. METHODS: Senior level RRTs were trained to insert ECs and to verify optimal placement in mechanically ventilated adult patients by completing a didactic educational package and undergoing observed, demonstrated competency. Catheter placement assignment was random based upon availability of senior level RRT and physician staff. A retrospective chart review was performed to evaluate catheter insertion success in adult ICU patients receiving mechanical ventilation within a 600 bed academic medical facility. RESULTS: 38 catheter insertions were attempted with 37 successful insertions. Of the 37 successful catheter insertions, 24 were inserted by RRTs and 13 by physicians. RRTs had a 70.8% first attempt success rate versus 53.8% for physicians. Mean time to insertion was 10.2 minutes for RRTs compared to 9.2 minutes for physicians. Time to insertion ranged from less than 5 minutes to greater than 60 minutes. The single unsuccessful insertion was attempted by a physician who failed on three consecutive tries. Failure may have resulted from the catheter’s marked flexibility. No patient complications were identified in any of these insertion attempts. CONCLUSION: Registered Respiratory Therapists can successfully and safely insert ECs in adult patients. Procedure time and insertion success may improve with increased catheter stiffness or development of an introducer wire.

Sponsored Research - None

MODEL OF CO2 PRODUCTION, STORAGE AND ELIMINATION AS AN AID TO UNDERSTANDING CO2 TRANSIENTS.
Joseph Ora, Laura Brewer: Anesthesiology, University of Utah, Salt Lake City, UT

Introduction: CO2 excretion (VeCO2) monitoring is useful as an indicator of effective ventilation, metabolic activity and pulmonary perfusion. Interpretation of a change in VeCO2 subsequent to a change in arterial ventilation can be difficult because measured VeCO2 changes in a transient manner following ventilation adjustments. When ventilation changes occur, the metabolic rate remains stable while large amounts of stored CO2 are transferred into or out of the body over an extended time. The transferred CO2 is reflected in the transiently changing VeCO2 and PaCO2. To facilitate understanding of the VeCO2 signal, we developed a computer algorithm that separates the measured VeCO2 into two portions: 1) metabolically produced and 2) transferred to and from the tissue stores. Methods: Our system is based on a multi-compartment computer model of CO2 production, storage, distribution and elimination within the body. This computer model simulates the change in stored CO2 volume and partial pressure as ventilation is changed. The computer model inputs are ventilation and VeCO2 data collected during the 30 minutes immediately prior to the time of analysis. The model parameters are continuous- ly optimized to minimize the difference between the actual and modeled VeCO2. Once optimized, the model is used to predict the future value of end-tidal CO2 (etCO2) and VeCO2 following ventilation changes. A volumetric capnometer (NICO2, Philips-Respironics, Wallingford, CT) was used to monitor ventilation, etCO2 and VeCO2 in 5 mechanically ventilated pigs. Step changes in respiratory rate or minute ventilation were made periodically. Model predictions of etCO2 and VeCO2 were compared to actual data recorded 20 minutes after the prediction time. Results: The difference between predicted and actual VeCO2 was 0.36 ± 0.24 mEq/L and the difference between predicted and actual etCO2 was 1.55 ± 1.47 mm Hg. The difference between the predicted and actual VeCO2 was 0.36 ± 0.24 mEq/L and the difference between predicted and actual etCO2 was 1.55 ± 1.47 mm Hg. The squared correlation coefficient for etCO2 was r² = 0.94 and for VeCO2 was r² = 0.89. Conclusions: Isolating the metabolic portion of measured VeCO2 from the total VeCO2 monitored at the bedside allows prediction of future values of PaCO2 following a ventilation change. Calculations such as percent of onset- or end-ventilation and the ventilation rate needed to achieve a specific VeCO2 value are made possible by estimation of metabolic VeCO2.

Sponsored Research - Philips

EVALUATION OF ABG PRACTICE IN AN ACADEMIC MICU.
Carla Wollens, Robert L. Chatburn: Respiratory Institute, Cleveland Clinic, Cleveland, OH

BACKGROUND: In our tertiary care academic ICU we have a standing order for arterial blood gas (ABG) sampling per protocol. The protocol lists acceptable indications for ABGs. A review of the literature showed that protocols reduce ABG sampling frequency but there are no data about adherence to protocols or use of results. The purpose of the study was to assess the degree of respiratory therapist adherence to the protocol. A secondary goal was to determine how many times the ABG result was associated with a change in the ventilator management. METHODS: ABG results were collected in a 35 bed MICU over on 8 random days during a 10-day period. On each date, all ABGs on all patients were recorded resulting in 200 sets of data. An individual ABG sample was deemed indicated if it met one of the 12 protocol criteria, otherwise it was non-indicated. We also noted when there was a ventilator change associated with the ABG result. RESULTS: Review of the data showed 80% (160) of the ABG’s drawn were indicated by our protocol. For all ABGs samples drawn, 41% (82) resulted in some ventilator adjustment. The distribution of indications and actions taken are shown in the table. Interestingly, 33% of the non-indicated ABGs (13) resulted in a ventilator change. CONCLUSION: 20% of ABGs were either not indicated or no indication was documented. We speculate the most of these were issues of clinician’s emotional assurance of patient condition rather than poor documentation of prescribed indications. Given that 33% of these actually resulted in ventilator adjustments, perhaps our list of indications should be expanded. On the other hand, 59% of indicated ABGs resulted in no action. Given that the majority of ABGs were driven by prior “out of range” results, perhaps our ranges should be modified. In particular, many patients had metabolic acidosis which would not be expected to result in ventilator changes. These data should serve as benchmarks for future studies.

Sponsored Research - None

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We measured EtCO\textsubscript{2} and RR by algorithms that report breath rate or calculated indices based on a simple breath volume is smaller than serial dead volume in each of the patient types evaluated. A total of 340,251 breaths from 134 patients were evaluated. As well as the number of patients and breaths that were analyzed for each patient type. A total of 340.251 breaths from 134 patients were evaluated. The rate of breaths with insufficient volume was highest (17.3\%) in spontaneously breathing patients. Breathing too fast or too slow to clear the serial dead space do not facilitate gas exchange in the alveoli and should therefore not be counted as contributing to CO\textsubscript{2} clearance and oxygenation. On the other hand, if the goal of RR monitoring is to assess respiratory effort or readiness for extubation, inclusion of shallow breaths in the reported RR may be more justified. The goal of this study was to investigate how frequently patients exhibit ventilation with very small tidal volume. Methods: We used a volumetric capnometry monitor (NICO2, Philips Respironics, Wallingford, CT) to record the Fowler's airway dead space, apparatus dead space and tidal volumes for each breath in 134 patients during various respiratory monitoring conditions (adult intubated OR, adult intubated ICU, adult non-intrubated and pediatric intubated OR). Using this data set we evaluated the fraction of breaths for which the tidal volume was too small to clear the serial dead volume (airway + apparatus) of the patient. Results: The table below shows the percent of breaths for which the tidal volume was too small to clear the serial dead volume (airway + apparatus) of the patient. The weakness of using RR as the indicator is that the tidal volume may differ greatly from one breath to the next. Currently, all breaths are counted in the RR. Depending on the clinical environment, the level of respiratory effort that should be counted as a breath can differ greatly. For example, when the goal of RR monitoring is to assess adequacy of gas exchange, it may be more physiologically relevant to only count breaths that are sufficiently large to clear the anatomic and apparatus dead volume. Breath rates that are too small to clear the serial dead space do not facilitate gas exchange in the alveoli and should therefore not be counted as contributing to CO\textsubscript{2} clearance and oxygenation. On the other hand, the goal of RR monitoring is to assess respiratory effort or readiness for extubation, inclusion of shallow breaths in the reported RR may be more justified. The goal of this study was to investigate how frequently patients exhibit ventilation with very small tidal volume.
BACTERIA GROWTH ON PORTABLE OXYGEN TANKS DURING HOSPITAL USE.
Mark D. Babic,1 Livia Matt,2 Sherry Babic,2 Frank Sandusky1; 1Respiratory Care, Fairview Hospital, Cleveland, OH; 2Microbiology, Fairview Hospital, Cleveland, OH; 3The Respiratory Institute, Cleveland Clinic, Cleveland, OH

Background: Hospitals are now required to disclose their infection rates to the public via the internet, and therefore are under pressure to reduce the rate of nosocomial infections. Medicare reimbursement for such infections are nonexistent. Oxygen tanks brought into a hospital could be a carrier of infectious material. Once in the hospital oxygen tanks are used on several different patients without being cleaned prior to each use. It is the policy of this hospital to place all portable oxygen tanks in a holder attached to the patient’s bed rather than laying a tank on the bed. It is important to note that in cases of emergency tanks may be inadvertently placed on the patient’s bed during a rapid transport. Pathogenic organisms may be transferred from patient to patient through the use of portable oxygen tanks.

Method: 30 E cylinders (Praxair Grab and Go) were randomly selected for this study. Each tank was labeled and numbered with a green sticker and cultured prior to being placed in use. Cultures were obtained by placing blood agar plates on the handle, liter flow control knob, and the side of the tested tanks was classified as normal skin flora, unlike some of the infections. However, extra precautions (i.e. cleaning) should be taken when using portable tanks for the immunocompromised patient. This fungus can be harmful. In conclusion, portable oxygen tanks do not appear to be a contributor to nosocomial infections. Medicare reimbursements for such infections are nonexistent. Oxygen tanks brought into a hospital could be a carrier of infectious material. Once in the hospital oxygen tanks are used on several different patients without being cleaned prior to each use. It is the policy of this hospital to place all portable oxygen tanks in a holder attached to the patient’s bed rather than laying a tank on the bed. It is important to note that in cases of emergency tanks may be inadvertently placed on the patient’s bed during a rapid transport. Pathogenic organisms may be transferred from patient to patient through the use of portable oxygen tanks.

Comparing Breathing Intolerance Index Pre- and Post-Diaphragmatic Muscle Fatigue in Healthy Adults.
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Background: Breathing Intolerance Index (BIT Index) was proposed by Dr. Toshikazu Koga as an alternative to measuring the Tension Time Index of the diaphragm (TTD5) to measure diaphragmatic fatigue. BIT Index is defined as Inspiratory Time/ Total airflow time ratio. A Tidal Volume (VT) Capacity (TVC) is calculated by subtracting tidal volume from the total air flow in the BIT Index and there is no evidence to show that an individual’s BIT Index can be altered. The purpose of this study was to measure the baseline BIT Index in healthy individuals, then to induce diaphragmatic muscle fatigue by using BMI and respiratory rate. Following, HRB are recorded and compared. The study was approved by the UCSF Committee on Human Research. Results: There was a strong correlation between Drager XL Ventilator measurements of PeCO2 (r = 0.97, r squared = 0.95, p < 0.0001) and VD/VT (r = 0.97, r squared = 0.95, p < 0.0001) Conclusion: Rainbow acoustic monitoring is a simple and automatic method of measuring respiration rate at the bedside, with clinically acceptable accuracy. This method could be of significant value in a wide range of clinical settings including the general floor, PACU, OR, sleep laboratories, and any care area utilizing conscious sedation.

Comparing Mean Expired CO2 and VD/VT Measurements Calculated Using the Drager XL Ventilator Volumetric Capnography Versus the Respironics NICO2 Monitor.
Mark S. Siegel, Josephine C. Valdes; Anesthesia, SFGH/UeSF, San Francisco, CA

Background: Calculation of VD/VT requires a measurement of mean expired CO2 (PeCO2). The Drager XL Ventilator is equipped with integrated volumetric CO2 monitoring and calculates VCO2. This enables calculation of VD/VT. Results of the study: 187 measurements of VCO2 and VeCO2 were collected from 25 patients. ward was calculated using the modified Bording-Scale. At this point, the MIP was immediately re-measured and spirometry measurements were repeated to obtain new data points for the BET Index. Results: Inducing diaphragmatic fatigue proved difficult, but when it was achieved, the BIT Index increased in two of the four subjects. Two of the subjects’ BIT Index increased, in one subject the BIT Index decreased and the BIT Index of the final subject did not change. For the subjects whose BIT Index decreased, the MIP was re-measured, while Vt and VvVc increased. For the two subjects whose BIT Index did not change or decreased, MIP increased, while Vt and VvVc decreased. Conclusions: The subjects who had an increase in their BIT Index measured a 10 lbs (Modified Borg Scale) was recorded every three minutes. Each subject continued the use of the Inspiratory Muscle Trainer until a 10 (maximal) was reached on the Modified Borg Scale. The study was approved by the UCSF Committee on Human Research. Results: There was a strong correlation between Drager XL Ventilator and NICO2 monitor measurements of PeCO2 (r = 0.97, r squared = 0.95, p < 0.0001) and VD/VT (r = 0.97, r squared = 0.95, p < 0.0001) Conclusions: Rainbow acoustic monitoring is a simple and automatic method of measuring respiration rate at the bedside, with clinically acceptable accuracy. This method could be of significant value in a wide range of clinical settings including the general floor, PACU, OR, sleep laboratories, and any care area utilizing conscious sedation.

Sponsored Research - None

ACCUICITY OF ACOUSTIC RESPIRATION RATE MONITORING IN AN ACUTE NURSING UNIT.
Jim Kumpula; Respiratory Care, Swedish Medical Center, Seattle, WA

Introduction Measurement of respiratory rate is critical, but manual measurement requires direct observation and has observer variation. Capnography has patient compliance issues, and impedance pneumography is inaccurate. We sought to evaluate the accuracy of a new acoustic monitoring technology that provides continuous respiratory rate from an acoustic sensor placed in the neck in the acute nursing units outside of the intensive and intermediate care units. Methods The data are based on observations made during a limited market release product evaluation of the acoustic monitoring technology in an acute nursing unit. Twenty five adult patients (age x +/- SD, weight x +/- SD) wore the Rainbow acoustic sensors (RA 125, Rev A) on their neck, connected to a Rad-87 (Masimo, Irvine, CA) Rainbow Acoustic Monitor (RAM) and Pulse CO-Oximeter. During standard care visits to the bedside, nursing staff auscultated the neck opposite the sensor location and observed patient breathing for a period of 1 minute to determine respiratory rate via manual count. At the time of the manual count, the acoustic respiratory rate (RRa) reported by the Rad-87 was recorded. Bias, Precision, and Accuracy Root Mean Squared (ARMS) were calculated for RRa compared to the manual count. A Bland Altman plot was generated to assess agreement between the two methods (Figure 1). The data for each patient respiratory rate data pairs were collected from 25 patients (7.4 +/- 4.6 data pairs per patient). Patients exhibited respiratory rates ranging from 8 - 36 breaths per minute (bpm). Bias, Precision, and ARMS for pooled data was 0.8, 3.4 and 3.5 bpm respectively (Figure 1). Conclusion Rainbow acoustic monitoring is a simple and automatic method of measuring respiration rate at the bedside, with clinically acceptable accuracy. This method could be of significant value in a wide range of clinical settings including the general floor, PACU, OR, sleep laboratories, and any care area utilizing conscious sedation.

Sponsored Research - None

COMPARISON OF MAX EXPIRED CO2 AND VD/VT MEASUREMENTS CALCULATED USING THE DRAGER XL VENTILATOR VOLUMETRIC CAPNOGRAPHY VERSUS THE RESPIRONICS NICO2 MONITOR.

Comparing Mean Expired CO2 and VD/VT Measurements Calculated Using the Drager XL Ventilator Volumetric Capnography Versus the Respironics NICO2 Monitor.

Sponsored Research - None

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COMPARISON OF MEAN EXPIRED CO2 AND VD/VT MEASUREMENTS CALCULATED USING THE DRAGER XL VENTILATOR VOLUMETRIC CAPNOGRAPHY Versus the Respironics NICO2 Monitor.

Sponsored Research - None

Symposium 15: Monitoring/Equipment—Part II

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ANALYSIS OF SPO2 AND PAO2 CORRELATION IN ADULT PATIENTS WITH ALI/ARDS: A RETROSPECTIVE COMPARISON OF TWO PULSE OXIMETRY SYSTEMS.

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Background: Pulse oximetry should be a reliable and accurate non-invasive method of assessing changes and trends in oxygenation and PaO2. Following multiple episodes of poor correlation of SpO2 readings and measured PaO2, a retrospective analysis of SpO2 and PaO2 correlation using different pulse oximetry systems was conducted as a quality improvement project. Method: Retrospective review of SpO2 and PaO2 data was recorded from patients electronic medical records. Data from ALI/ARDS patients monitored with Philips (Hewlett Packard) pulse oximeter modules, software version 17.62, using Nellcor sensors was compared to data from patients monitored with Masimo pulse oximeters and sensors. The data sample includes SpO2 and PaO2 recorded after changes in patient condition, changes in ventilator settings, and routine monitoring during the ICU admission. The ability for each pulse oximetry system to correctly detect hypoxic conditions, defined as SpO2 ≤ 92% with a PaO2 ≤ 60 mm Hg, and non-hypoxic conditions, defined as SpO2 ≥ 98% with a PaO2 ≥ 80 mm Hg was assessed. The sensitivity (rate of true positives), specificity (rate of true negatives), false positive rate, false negative rate, and total error rate was determined for each condition. The study was approved by the UCSF Committee on Human Research. Results: A total of 506 measurements in nine patients from 2003-2004 using the Philips (Hewlett Packard) system and 752 measurements in ten patients from 2008 using the Masimo system were reviewed. The sensitivity, specificity, false positive rate, false negative rate, and total error rate for determining hypoxic and non-hypoxic events were similar for each pulse oximetry system. True positive rates were 58% to 69% for hypoxic conditions and 70% to 78% for non-hypoxic conditions. Total error rate (false positives plus false negatives) for both hypoxic and non-hypoxic conditions ranged between 37% to 48%. Neither pulse oximetry system was superior in detecting both hypoxic or non-hypoxic conditions. Conclusion: This data demonstrates the limitations of pulse oximetry as a reliable correlate to the measured PaO2 in patients with ALI/ARDS using two different monitoring systems. Until a more reliable non-invasive method of assessing oxygenation and PaO2 becomes available, pulse oximetry measurements need to be validated by arterial blood gas sampling in ALI/ARDS patients.

Sponsored Research - None
EVALUATION OF DRÄGER APRV WITH AUTORELEASE – A MODEL STUDY.
Robert L. Chatburn, Sherry Bahne. Respiratory Institute, Cleveland Clinic, Cleveland, OH

BACKGROUND: The Dräger Evita Infinity V500 ventilator has an AutoRelease feature in Airway Pressure Release Ventilation (APRV) mode that allows the operator to set an inspiratory trigger threshold for mandatory breaths (transition to PEEP) as a percent of peak expiratory flow (% PEF). This setting determines expiratory time (Tlow or release time) and facilitates adjustments of APRV when autoPEEP is intended to replace set PEEP. The purpose of this study was to determine the effects of % PEF on end expiratory lung pressure (EELP), exhaled tidal volume (VT) and mean airway pressure (mPaw).

METHODS: A passive patient with ARDS was modeled using an Infratec ASL 5001 lung simulator. Simulator settings were: compliance 30 mL/cmH2O, resistance = 10 cmH2O/Ls, and inspiratory pressure (P high) = 30 cm H2O, expiratory pressure (P low) = 0 cm H2O, frequency 10 breaths/min. % PEF settings were 0, 10, 20, 30, 40, 50, 60, 70 and 80%. Mean values for EELP, VT and mPaw were calculated from at least 5 breaths using the Post Run Analysis feature of the simulator. RESULTS: As % PEF was increased, expiratory time decreased and EELP increased. The increase in EELP caused a decrease in the inspiratory pressure gradient between the airway opening and the lung, thus decreasing VT. The change in expiratory time was small (5% of the total cycle time), so the increase in mPaw was minimal, PEEP at the airway opening increased above zero as expiratory time decreased and ranged from 20-50% of PEEP for all conditions. CONCLUSION: Appropriate use of the APRV requires careful consideration of the complex interactions of ventilator parameters. APRV setting recommendations (Crit Care Med 2005;33:S228-S240) suggest inspiratory trigger thresholds of 50-75% PEF or expiratory times from 0.2-0.8s. In this model, 50-75% PEF resulted in VT ranging from 345-510 mL and EELP ranging from 15-20 cm H2O. Expiratory times from 0.2-0.8s (appropriate settings in this model) resulted in VT ranging from 348-846 mL and EELP from 3-20 cm H2O. These ranges are expected to vary with changes in patient resistance and compliance, further complicating ventilator management. Additionally, inadvertent PEEP at the airway greatly underestimates EELP. Nevertheless, the %PEF trigger feature seems to provide more precise control during APRV than setting an arbitrary Tlow.  
Sponsored Research - Ventilator was loaned for period of study.

MECHANICAL VENTILATORS IN THE HOT ZONE: EFFECTS OF A CBRN FILTER ON PATIENT PROTECTION AND BATTERY LIFE.
Thomas Blakeman1, Dario Rodriguez2, Peter Torh1, Richard Branson1; 1Department of Surgery, University of Cincinnati, Cincinnati, OH; 2Center for Sustainment of Trauma and Readiness Skills (CSTARS), Cincinnati, OH

Introduction: In a contaminated environment, respiratory protection for ventilated patients can be achieved by attaching a chemical, biological, radiological, or nuclear (CBRN) filter to the air intake port of the ventilator and the effect of this CBRN filter on breath triggering and patient protection of four ventilators (CareFusion LT-1000, Impact 754 and 731, and Newport HT-50) in the laboratory. Methods: Each ventilator was attached to a test lung. Ventilator settings were: assist control (AG) mode, respiratory rate 35 bpm, tidal volume 450 mL, positive end-expiratory pressure (PEEP) 10 cm H2O, inspiratory time 0.8 seconds, and FIO2 0.21. Each ventilator was operated with and without the filter until the battery was fully discharged. We also evaluated the ventilators’ ability to route all gas through the CBRN filter during simulated breath triggering and analyzed the pressures required to breathe through the anti-asphyxia valve of a failed device. Results: The range of battery life varied widely across different ventilator brands in expiratory time was small. There was no significant difference in battery life (p < 0.01) when operating with or without the CBRN filter attached. The difference in battery duration for the devices with and without the filter: LT-1000: 33.26 minutes, Impact 754: 33.56 minutes, Impact 731: 39.4 minutes, and Newport HT-50: 10.9 minutes. The peak negative pressure required to breathe through the failed device was -4 cm H2O to -9 cm H2O. Only the Impact 731 routed all inspired gases through the CBRN filter when patient demand outstripped inspiratory flow. Figure 2 shows all gas inspired through the anti-asphyxia valve in a CO2 rich environment demonstrating entrainment of room air during normal ventilation operation. Conclusions: Duration of operation from the internal battery was not altered by attachment of the CBRN filter. The use of a CBRN filter is necessary for protection of ventilated patients when environmental contamination is present, although conditions exist where all gas does not pass through the filter with some ventilators. Unfavorable operating conditions during the patient’s airway exposure to the contaminated environment.

Sponsored Research - None

LABORATORY EVALUATION OF THE SAVE SIMPLIFIED AUTOMATED RESSUCITATOR.
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Introduction: Mechanical ventilation in far forward military operations requires a device that is consistent, light weight and easy to use. We evaluated the SAVE (simplified automated ventilator) in a laboratory setting to evaluate performance characteristics. Methods: Three SAVE resuscitators were tested. Each was attached to a test lung with volume, pressure, and flow measured with a pneumotachometer. The SAVE model we tested provides only one respiratory rate (10) and one tidal volume (600 ml). Compliance and resistance of the test lung were variable to simulate varying patient conditions. Oxygen was entrained at the inlet and FIO2 was measured with a fast response oxygen analyzer at the airway. All measurements were made at sea level, 4000, 8000, 12,000, and 18,000 feet. Battery life was measured twice with each device by operating it to exhaustion. Results: Delivered tidal volume and inspiratory time varied when changing lung model conditions as well as between devices within the same lung model condition at sea level and at altitude. The largest reduction in tidal volume was at the lowest compliance. Inspiratory time also decreased with lower compliance. Data below shows tidal volume (SD) and inspiratory time with the three devices. Increases in altitude resulted in a 29% increase in delivered tidal volume between sea level and 18,000 ft. at the lowest compliance settings. Oxygen entrained at greater than 20 bpm resulted in the SAVE failing to cycle. Methods: Testing was performed using a modified dual chamber test lung to simulate spontaneous breathing at weak, normal, and aggressive effort. Battery life was determined by fully charging the battery and operating the ventilator (500 ml x 20 bpm and 5 of PEEP) until breath delivery ceased. Accuracy of VT delivery was consistent with decreased lung compliance and/or increased resistance. The most respiratory and tidal volume are not guaranteed under these conditions. During spontaneous breathing, air room is supplied to the patient. Entrainment of oxygen at greater than the recommended flow rate may result in ventilator malfunction. The SAVEs could potentially be used for ventilator support of carefully selected military casualties to replace manual ventilation, but caregivers must be aware of the limitations.

Sponsored Research - None

BENCH EVALUATION OF SEVEN PORTABLE VENTILATORS.
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Introduction: Portable ventilators (PV) continue to decrease in physical size increasing in performance. We studied seven PV in the laboratory evaluating three important characteristics; triggering, battery life, and accuracy of volume (VT) delivery. Methods: Triggering was tested using a modified dual chamber test lung to simulate spontaneous breathing at weak, normal, and aggressive effort. Battery life was determined by fully charging the battery and operating the ventilator (500 ml x 20 bpm and 5 of PEEP) until breath delivery ceased. Accuracy of VT delivery and VT measurement was tested using pediatric (50 ml and 100 ml x 50 bpm with an inspiratory time of 0.3 secs and 5 of PEEP) and adult scenarios (400 ml x 30 bpm with an inspiratory time of 0.5 secs and 5 of PEEP). A pneumotachograph was placed at the proximal airway and airway pressure, volume, and flow signals were recorded to a PC for later analysis. Results: At the adult settings, measured VT ranged from 360 ml – 426 ml. The measured VT range on the pediatric settings of 50 bpm x 50 ml and 50 bpm x 100 ml were 51 ml – 182 ml and 90 ml – 141 ml respectively. The VT delivered by the Vela was -4 cm H2O to -9 cm H2O. Only the Impact 731 routed all inspired gases through the CBRN filter when patient demand outstripped inspiratory flow. Figure 2 shows all gas inspired through the anti-asphyxia valve in a CO2 rich environment demonstrating entrainment of room air during normal ventilation operation. Conclusions: Duration of operation from the internal battery was not altered by attachment of the CBRN filter. The use of a CBRN filter is necessary for protection of ventilated patients when environmental contamination is present, although conditions exist where all gas does not pass through the filter with some ventilators. Unfavorable operating conditions during the patient’s airway exposure to the contaminated environment.

Sponsored Research - Funding for this study was provided by GE Healthcare
OXYGEN CONSUMPTION AND BATTERY LIFE OF NEW TRANSPORT VENTILATORS.

Andrew D. Marchese1, Demet Sulemanji1, Joseph Krathovil1, Jesús Villar2, Robert M. Kacmarek1; 1Respiratory Care, Massachusetts General Hospital, Boston, MA;
2Multidisciplinary Organ Dysfunction Evaluation Research Network, Research Unit, Hospital Universitario Dr. Negrín, Las Palmas de Gran Canaria, Spain

Background: A number of new transport ventilators have recently entered the market none of which have been evaluated. Critical to the daily use of these ventilators is their oxygen consumption and battery life. The ability of the Uni-Vent 731 (Impact), PB540 (Covidien), HT70 (Newport), Oxylog 3000 (Drager) and Trilogy O2 (Philips) to provide pressure support (PS) was evaluated using the IngMar ASL 5000 lung simulator.

Methods: Simulator settings: respiratory rate 20 breaths/min, inspiration time 0.8 seconds, active inspiration 3.5% of breath cycle time (BCT), a hold at maximum deflection in airway pressure needed to trigger. Time to Trigger (TT): The time, in milliseconds, from start of the breath to ventilation start. Pressure to Trigger (PT): The magnitude of pressure needed to trigger. Time to Baseline (TB): The time, in milliseconds, from start of the breath to the negative deflection in airway pressure needed to trigger. The ability of the Uni-Vent 731 (Impact), PB540 (Covidien), HT70 (Newport), Oxylog 3000 (Drager) and Trilogy O2 (Philips) to provide pressure support (PS) was evaluated using the IngMar ASL 5000 lung simulator.

Results: Optimal setting outperformed default setting. Optimal setting results are listed in table below. Conclusion: Considerable performance variability exists across these ventilators, and is affected by Pmus and optimal settings. Some perform equivalent to ICU ventilators.

Sponsored Research - None

OXYGEN CONSUMPTION AND BATTERY LIFE OF NEW TRANSPORT VENTILATORS.

Andrew D. Marchese1, Demet Sulemanji1, Joseph Krathovil1, Jesús Villar2, Robert M. Kacmarek1; 1Respiratory Care, Massachusetts General Hospital, Boston, MA;
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Sponsored Research - None

ASSOCIATION OF TIDAL VOLUME AND PLATEAU PRESSURE TO MORTALITY IN PATIENTS WITH SEVERE HYPOXEMIC RESPIRATORY FAILURE.

John S. Embreges1, Joel M. Brown1, Vinay Maheshwari2-3; Respiratory Care, Christiana Care Health System, Newark, DE; Medicine, Christiana Care Health System, Newark, DE

Background: With ongoing interest in ARDSnet and lung protective strategies, we formed a PI group to examine the management of our hypoxic population. Lung protective effort should correlate to improved outcomes. We wanted to determine the association between lung protective indices (tidal volume and plateau pressure) and the outcomes of our patients in severe hypoxic respiratory failure. METHODS: We retrospectively reviewed all adult patients requiring mechanical ventilation from June 2008 to June 2010. Data collected included: ventilator mode, ventilator settings, tidal volume (Vt), ideal body weight based on height, plateau pressure (Plat), PEEP, FiO2 and survival. We identified severe hypoxic respiratory failure (SHRF) as patients requiring 60% FiO2 or greater while requiring PEEP 10 cmH2O or greater. Vt (ml/kg) and Plat displayed in this study are the average value over the time the patient was experiencing SHRF.

Results: Patients were grouped in 3 levels of Plat: #1 < 25 cmH2O #2, 25 to 30 cmH2O #3 > 30 cmH2O. Patients were grouped in 3 levels of Vt (ml/kg): #1 ≤ 6 #2 7 to 10 #3 > 10. RESULTS: 6385 total adult ventilator patients were identified with an overall mortality of 21.7%. 818 patients were identified as SHRF (12.8% of total ventilator patients). The SHRF patients had a mortality of 43.6%. See chart for ranges of average Vt (ml/kg) and average Plat while in SHRF versus mortality. There was a significant difference in Plat between survivors and nonsurvivors (25.3±6.0 vs 26.4±6.8, p<0.0002). There was not a significant difference in Vt between survivors and nonsurvivors (7.6±1.5 vs. 7.7±1.6, p=0.13). CONCLUSION: Overall hospital mortality was comparable or more favorable than previously published outcomes of mechanical ventilation patients in our SHRF population. Mortality was managed outside of ARDSnet protective guidelines (Plat > 30cmH2O or Vt < 6 ml/kg). In this population of SHRF, increases in Plat were associated with increased mortality. Performance improvement efforts should be made to limit both Plat and Vt in SHRF patients in an effort to protect the lungs. REFERENCE: 1. Kahn et al, N Engl J Med 2006;355:41-50. Hospital Volume and Outcomes of Mechanical Ventilation.

Sponsored Research - None

TRANSPORT VENTILATOR PERFORMANCE DURING IN-TRANSPORT PRESSURE SUPPORT VENTILATION.

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Background: A number of new transport ventilators have recently entered the market none of which have been evaluated. Patients are increasingly being ventilated with spontaneous breathing modes. The ability of the Uni-Vent 731 (Impact), PB540 (Covidien), HT70 (Newport), Oxylog 3000 (Drager) and Trilogy O2 (Philips) to provide pressure support (PS) was evaluated using the IngMar ASL 5000 lung simulator.

Methods: Simulator settings: respiratory rate 20 breaths/min, inspiration time 0.8 seconds, active inspiration 3.5% of breath cycle time (BCT), a hold at maximum deflection in airway pressure needed to trigger. Time to Trigger (TT): The time, in milliseconds, from start of the breath to ventilation start. Pressure to Trigger (PT): The magnitude of pressure needed to trigger. Time to Baseline (TB): The time, in milliseconds, from start of the breath to the negative deflection in airway pressure needed to trigger. Conclusion: Battery life on all ventilators was acceptable for inter and intra hospital transfer but did differ greatly. Oxygen consumption was as expected on some ventilators but also varied considerably.

Sponsored Research - None

THE CHARACTERISTIC DIFFERENCE BETWEEN SURVIVORS AND NONSURVIVORS IN ACUTE RESPIRATORY DISTRESS SYNDROME PATIENTS WITH HIGH FREQUENCY OSCILLATORY VENTILATION.

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Background: High frequency oscillatory ventilation (HFOV) is an alternative ventilation mode in acute respiratory distress syndrome (ARDS) patients whom conventional ventilation (CV) strategies have failed. The purpose of this study is to analyze the characteristic difference between survivors and non-survivors. METHODS: A retrospective case series of 34 adult ARDS patients treated with HFOV were enrolled. The HFOV was applied with severe oxygenation failure (PaO2/FiO2 < 120 mm Hg) despite relatively aggressive CV support (characterized by either PaO2/FiO2 < 200 mm Hg whenFiO2 > 0.6 when PaCO2 > 50 cm H2O or plateau airway pressure > 35 cm H2O). The setting of FiO2 of 0.9 to 1. 5 Hz, inspiratory time of 35%, and a bias flow of 40 L/min. Mean airway pressure (Paw) set 3 to 5 cm H2O greater than the mean Paw during CV. Target oxygenation was SpO2 ≥ 90%. If SpO2 was < 90%, then FiO2 was reduced stepwise to achieve a target FiO2 8.6, If SpO2 was < 90%, then mean Paw was increased by 1 - 2 cm H2O to a maximum of 45 cm H2O. The pressure amplitude was set to achieve and was adjusted to maintain PaCO2 within 30 and 50 mm Hg with a pH above 7.25. The demographics, baseline, oxygenation and ventilation, hemodynamic and outcome data were recorded. RESULTS: The overall mortality rate was 62% (21/34) in our study group. There was an increase in PaO2/FiO2 ratio after HFOV for 30 minutes and maintained after 20-24 hours of HFOV throughout the study. Table 1 shows the comparison of demographics and baseline parameters between survivors and nonsurvivors. The study group had less hypercapnia, better oxygenation, lower PaCO2, better PaO2/FiO2 score, sepsis organ failure assessment and multiple organs dysfunction score than nonsurvivors group. Conventional ventilation time before HFOV was significantly shorter in survivors than nonsurvivors (32.7±16.4 vs.47.8±26.2 hours, p = 0.049). The duration of HFOV was significantly shorter in survivors than nonsurvivors (35.9±21.6 vs. 147.9±47.13 hours, p = 0.02). Conclusion: High frequency oscillatory ventilation was effective for oxygenation failure in some selected ARDS patients. In this study, the initial low respiratory ARDS patients had better outcome. The survivors had the shortest conventional ventilation time before HFOV and then shorter HFOV time compared with nonsurvivors. We suggested that HFOV may be applied earlier if clinical indicated.

Sponsored Research - None

Demographics and characteristics in survivors and non-survivors


910779
DOES THE LTV 1200 MAINTAIN A SAFE OPERATING TEMPERATURE WHEN INCREASED RESISTIVE LOADS, (PEEP LEVELS UP TO 30 CMH2O), ARE PLACED ON THE TURBINE?

Lisa Cacciabò, Barnes-Jewish Hospital, St. Louis, MO, MO

Authors: Lisa Cacciabò, RRT, AE-C; Adam Sampson, MA, RRT; Carrie Sona, RN, MSN, CCRN, CCNS; Elizabeth Dykerman RN; Jessica Bowles RN, BSN. Barnes-Jewish Hospital, St. Louis, MO Background: Clinician driven, evidence based weaning protocols have been in place at Barnes-Jewish Hospital Surgical Intensive Care Unit (SICU) since 2002. Previously published data displayed a high success rate with clinician directed weaning. Sustaining that success over time has presented a challenge. An increasing number of patients in our SICU, experience delayed extubation. The expectation is a patient be extubated within one hour post a successful spontaneous breathing trial (SBT). Method: A multidisciplinary team of MD, RT and RN staff developed an audit tool to evaluate weaning protocol compliance. Audit tool criteria include, number of daily SBT performed, success or failure of trial, extubation rates, time to extubation, self-extubation, reintubation. We compared failure of trial, extubation rates, time to extubation, self-extubation, reintubation. MD staff involved in care decisions and reasons given by medical staff for failure to extubate. Chart audits were done 3-4 times weekly rotating between RN and RT staff from January to April 2010. Results: 45 days were audited. 130 SBT’s were performed in 87 patients. 102 of the 130 SBT have resulted in a “pass”, of 78%. Those 102 passing trials 35 extubations occurred. Time of passing SBT to time of extubation ranged from 0 to 1072 minutes. The average time to extubation after passing a trial was 144.9 minutes. The reasons given by the medical staff for not extubating patient’s after a successful trial were: mental status 21, procedure 16, clinically worse 11, team to evaluate prior to extubation 9, wet 6, airway concern 4, sedation 4, family issue 3, unknown 3, acceptions 3 and febrile 1. Many times more than 1 reason was listed per patient. Two (2) of the patients with delays in extubation longer than 100 minutes had rationale for the delay listed as sedation and clinically worse. No reasons were listed for the other delays in extubation. Non-clinical delays such as: ICU team rounds and ICU team waiting to see patient during rounds or to see the patient while actively performing SBT prior to extubation occur. Conclusion: This highlights an area for process improvement in our institution. Further research by RT/RN’s identified the need for better communication between the bedside clinician and physicians. Three process changes have been instituted and daily audits are ongoing.

Sponsored Research - None

918599

LENGTH OF SPONTANEOUS BREATHING TRIALS PREDICTS SUCCESSFUL VENTILATOR LIBERATION OF LONG-TERM VENTILATED PATIENTS.

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Background: In acutely ill mechanically ventilated patients, a 30 minute spontaneous breathing trial (SBT) has been reported to be predictive of successful liberation from the ventilator. The optimal duration of an SBT in long-term mechanically ventilated patients is unknown. Hypothesis: We hypothesized that in long-term ventilated patients a spontaneous breathing trial greater than 30 minutes is required to predict successful liberation from mechanical ventilation. Methods: The study was performed in a 10 bed respiratory care unit at Massachusetts General Hospital. 166 consecutive long-term ventilated patients who underwent SBT’s between 7/1/08 and 4/15/10 were included in the study. Successful liberation from the ventilator was defined as being of the ventilator for at least 48 hours. Logistic regression analysis was performed to examine the association between SBT duration and successful liberation from the ventilator. Results: Duration of SBT was strongly associated with successful liberation from mechanical ventilation (p < 0.0001). In long-term mechanically ventilated patients an SBT of 2.5 hours was predictive of a 95% probability of successful liberation. A 30 minute SBT was only predictive of 50% probability of successful liberation. Conclusions: In contrast to acutely ventilated patients, in long-term ventilated patients a longer SBT duration is needed for prediction of successful ventilator liberation.

Sponsored Research - None

920290

A COMPARISON OF HELIOX CONSUMPTION BETWEEN RESPIRONICS VISION INTERNAL OXYGEN MIXING VERUS CIRCUIT BLEED-IN OF 80:20 HELIOX.

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Background: We compared two methods of adding heliox into a Respiration Vision to determine the rate of heliox consumption. Methods: First we connected a heliox tank to the air inlet of a blender combined with an O2 wall source, to power the system. Vision FIO2 was set to 100% and delivered FIO2 was controlled by the blender. Ventilator settings, rate=24, Time=0.8, IPAP/EPAP=16/5, delivered FIO2=0.4. The leak test was performed and the system was connected to a Michigan Test Lung (MTL), compliance =0.03, resistor 2. The delivered VT measured on the MTL was 500 mL. The ventilator was operated for 20 minutes and the heliox consumption was 600 psi. Second; we connected the Respiration Vision from a wall O2 source and bled-in heliox into the circuit, at the outlet of the ventilator. The test system was operated at the same settings as above, with a bleed-in of 10 LPM except the Vision FIO2 set at 1.0, achieving a delivered FIO2 of 0.39. We also tested a 15 LPM bleed-in with the settings as above except the Vision FIO2 set at 1.0, achieving a delivered FIO2 of 0.27. Total run time was 24 minutes with the bleed-in of 10 LPM with a heliox consumption of 170 psi, and 5 minutes with the bleed-in 15 LPM, with a heliox consumption of 50 psi. Results: With the Vision FIO2 controlled by the blender, heliox consumption was 30 psi/minute, a full H cylinder would last 67 minutes. With the Vision operated on wall O2 source and heliox bleed-in at 10 LPM, heliox consumption was 7 psi/minute, a full H cylinder would last 285 minutes. With the Vision operated on wall O2 source and heliox bleed-in at 15 LPM, heliox consumption was 10 psi/minute, a full cylinder would last 200 minutes. Conclusion: The bleed-in method into a Respiration Vision at both 10 LPM and 15 LPM consumed less heliox than when the Respiration Vision FIO2 was controlled by the internal blender.

Sponsored Research - None

921033
HIGH FREQUENCY OSCILLATION WITH VOLUME GUARANTEE IN A NEONATAL PATIENT.

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High frequency Oscillatory ventilation (HFOV) has been heralded as the ideal lung protective ventilation strategy. It theoretically limits baro/volutrauma using sub-deadspace tidal volumes and limits atelectrauma using higher mean airway pressures. Unfortunately small randomized controlled trials have not shown an improvement in survival rates, and may show an increase in the risk of intra-ventricular haemorrhage in neonatal patients. One plausible explanation for the lack of mortality benefit is the lack of direct control over tidal volume, where much of the theoretical lung protection may be lost because the assumed sub-deadspace tidal volumes may approach conventional ventilating volumes at higher HFOV settings. This lack of tidal volume control also translates into a lack of precise control of carbon dioxide (CO2) removal resulting in fluctuating arterial CO2 levels, due to the high cost of these devices. Pandemic modeling suggests that 30% of ventilators may be required to meet demand in the US. This study compared a novel low-cost device with current ventilators using in-vivo and simulated ARDS models. Methods: A low-cost ventilator was constructed around a unique microprocessor and solenoid assembly to support adults and children in accordance with the ARDSNet protocol. An Oceanic/Magellan was used for comparison. ARDS was induced in swine with oleic acid injection (0.3mg/kg) and defined as PaO2/FiO2 <200. Ventilation targets were a PaO2 >60mmHg and tidal volume ~15cc/kg. In simulation studies (Ingenar 4000 Servo Lung), ARDS was defined by 30ml/cmH2O compliance and 10cmH2O/l/s airway resistance. A Drager Evita was used for comparison. Results: In swine studies, there was no significant difference in performance between ventilators. Both maintained tidal volumes of 15cc/kg delivering inspiratory pressures to 90cmH2O with PEEP of 15cmH2O. Above 15cmH2O, the error in displayed pressure was 10%+/-2 on the Oceanic/Magellan and <1% on the experimental device. In simulation studies, there was no significant difference in performance or display accuracy (<1%) between ventilators. Trigger sensitivity and response times (+/- 0.5cmH2O and <0.5sec) were similar in A/C modes. Conclusions: Here we describe a novel design for a low-cost ventilator. In-vivo and simulator performance in ARDS patients is comparable to existing devices. At approximately 1/10 the cost of current ventilators, this technology represents an alternative solution for pandemic stockpiling and emergency use.

Sponsored Research - None

A LOW COST ALTERNATIVE FOR MECHANICAL VENTILATION IN LARGE SCALE DISASTERS.

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Introduction: Catastrophic disasters, particularly an influenza pandemic, force difficult allocation decisions for mechanical ventilation due to the high cost of these devices. Pandemic modeling suggests that 30% of ventilators may be required to meet demand in the US. This study compared a novel low-cost device with current ventilators using in-vivo and simulated ARDS models. Methods: A low-cost ventilator was constructed around a unique microprocessor and solenoid assembly to support adults and children in accordance with the ARDSNet protocol. An Oceanic/Magellan was used for comparison. ARDS was induced in swine with oleic acid injection (0.3mg/kg) and defined as PaO2/FiO2 <200. Ventilation targets were a PaO2 >60mmHg and tidal volume ~15cc/kg. In simulation studies (Ingenar 4000 Servo Lung), ARDS was defined by 30ml/cmH2O compliance and 10cmH2O/l/s airway resistance. A Drager Evita was used for comparison. Results: In swine studies, there was no significant difference in performance between ventilators. Both maintained tidal volumes of 15cc/kg delivering inspiratory pressures to 90cmH2O with PEEP of 15cmH2O. Above 15cmH2O, the error in displayed pressure was 10%+/-2 on the Oceanic/Magellan and <1% on the experimental device. In simulation studies, there was no significant difference in performance or display accuracy (<1%) between ventilators. Trigger sensitivity and response times (+/- 0.5cmH2O and <0.5sec) were similar in A/C modes. Conclusions: Here we describe a novel design for a low-cost ventilator. In-vivo and simulator performance in ARDS patients is comparable to existing devices. At approximately 1/10 the cost of current ventilators, this technology represents an alternative solution for pandemic stockpiling and emergency use.

Sponsored Research - None

OXYGEN PLANNING FOR FIXED WING TRANSPORT WITH THE LTV 1200.

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Background: Oxygen planning for fixed wing transport includes 3 parts: pre-flight estimate of patient needs, patient contact actual oxygen needs, and time on air. The LTV 1200 ventilator has an internal Oxygen Cylinder Duration Calculator that is useful for predicting available oxygen time when a patient is connected to the device; however, medical transport teams must predict oxygen usage prior to patient contact before departing toward the referring center. Goal: Develop a formula for oxygen planning using the LTV 1200 ventilator. Methods: We tested the Viasys LTV 1200 ventilator in a number of patient scenarios, pediatric to adult, to confirm the oxygen consumption of the device is as indicated in the manufacturer’s specifications. For each scenario, the ventilator was attached to a test lung with a fixed inspired minute volume and 100% O2; the cylinder size and pressure were entered into the ventilator’s Oxygen Cylinder Duration Calculator and the resulting calculated tank duration recorded. The ventilator was then attached to an oxygen E cylinder and monitored for time until the ventilator failed to cycle. Results: The LTV 1200 ventilator’s specifications list a bias flow of 5 L/min that is active during the expiratory phase only. For the invasive ventilation scenarios, we found the ventilator consumed 7 to 8 L/min of oxygen (dependent on I:E ratio) in addition to the inspired minute volume. When attached to a full oxygen cylinder (707 Liters) the ventilator calculated cylinder duration at 71 minutes and had a measured duration of 78 minutes. The non-invasive simulations varied considerably with oxygen usage calculated as high as 30 L/min. with a modest mask leak. Conclusions: The LTV 1200 ventilator consumes oxygen at a predictable rate consistent with its specifications when used invasively and in a controlled mode; the LTV 1200’s internal Oxygen Cylinder Duration Calculator is fairly accurate, underestimating available oxygen slightly in the scenarios tested. Oxygen usage during Non-invasive ventilation with the LTV 1200 is not predictable, with consumption rates as high as 30 L/min. in the scenarios tested. For preflight oxygen planning when the internal calculator is not available, the formula: Inspired Minute Volume + 10L/min., for intubated patients, should provide a margin of safety that can be confirmed after the patient is attached.

Sponsored Research - None

EVALUATION OF ELECTRICAL IMPEDANCE TOMOGRAPHY TO IDENTIFY REGIONAL CHANGES IN VENTILATION ASSOCIATED WITH CHANGE IN SUBJECT POSITION.

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BACKGROUND: Electrical Impedance Tomography (EIT) is a non-invasive radiation-free monitoring tool that is capable of monitoring imbalances in regional lung ventilation. Realization of an accurate EIT is complicated by the high cost of these devices. Pandemic modeling suggests that 30% of ventilators may be required to meet demand in the US. This study compared a novel low-cost device with current ventilators using in-vivo and simulated ARDS models. Methods: A low-cost ventilator was constructed around a unique microprocessor and solenoid assembly to support adults and children in accordance with the ARDSNet protocol. An Oceanic/Magellan was used for comparison. ARDS was induced in swine with oleic acid injection (0.3mg/kg) and defined as PaO2/FiO2 <200. Ventilation targets were a PaO2 >60mmHg and tidal volume ~15cc/kg. In simulation studies (Ingenar 4000 Servo Lung), ARDS was defined by 30ml/cmH2O compliance and 10cmH2O/l/s airway resistance. A Drager Evita was used for comparison. Results: In swine studies, there was no significant difference in performance between ventilators. Both maintained tidal volumes of 15cc/kg delivering inspiratory pressures to 90cmH2O with PEEP of 15cmH2O. Above 15cmH2O, the error in displayed pressure was 10%+/-2 on the Oceanic/Magellan and <1% on the experimental device. In simulation studies, there was no significant difference in performance or display accuracy (<1%) between ventilators. Trigger sensitivity and response times (+/- 0.5cmH2O and <0.5sec) were similar in A/C modes. Conclusions: Here we describe a novel design for a low-cost ventilator. In-vivo and simulator performance in ARDS patients is comparable to existing devices. At approximately 1/10 the cost of current ventilators, this technology represents an alternative solution for pandemic stockpiling and emergency use.

Sponsored Research - None

894196
A MULTIDISCIPLINARY APPROACH TO DECREASE TRANSMISSION RATES OF MULTIPLE RESISTANT PSEUDOMONAS AERUGINOSA (MRPA) IN CYSTIC FIBROSIS (CF) PATIENTS.

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Background: Chronic airway colonization with Pseudomonas aeruginosa has been associated with increased morbidity and mortality among CF patients. Bronchotron use suggests INO of MRPA specimens collected at Texas Children’s Hospital (TCH) represented a single dominant clone. In an effort to decrease transmission of the dominant clone, a multidisciplinary team approach was taken to implement new infection control policies. Methods: Molecular typing allowed identification of patients colonized with the dominant clone and subsequent implementation of patient-specific infection control policies. These included the use of a ‘shuttle’ process in clinic and the initiation of ‘contract isolation’ for CF patients until a respiratory sample was obtained and no resistant organisms were identified. The shuttle process used flags to identify MRPA patients who then did not mingle with other patients. Subsequently, all patients were asked to sanitize their hands and don a mask upon arrival to clinic and care providers were asked to gown and glove for patients contact. Contact isolation on the inpatient side entailed requiring all staff members to gown and glove for patient contact. Patients were asked to wear their room while leaving their room. Additionally, MRPA patients were not allowed to visit common areas of the hospital. All CF patients were assigned their own non-disposable respiratory care equipment that remained in their room the duration of the hospitalization.

Results: After initiation of the above processes we were able to see a decline to 36% in the prevalence of the dominant clone in MRPA infected Cystic Fibrosis patients. Conclusions: Implementation of patient-specific infection control policies including inpatient and outpatient settings can decrease the prevalence of a dominant MRPA clone among CF patients.

Sponsored Research - None

898017

EVALUATION OF A METHOD FOR DELIVERY OF NITRIC OXIDE THROUGH A PERCUSSIVE HIGHER-FREQUENCY INTRA-HOSPITAL TRANSPORT TRANSDUCER.

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Background: A Bronchotron is used with a Fisher & Paykel RT 130 Infant ventilator circuit. The injector module from the Bronchotron. The sampling tee was placed 12” back from the patient wye on the inspiratory limb of the ventilator circuit. A 4.5 mm adapter with oxygen tubing was placed at the entrainment port of the Bronchotron and flow ranges of 0-14 LPM were tested. An IMT Medical Infant Sump Lang was used with a resistance setting of 5, compliance setting of 1, and leak setting of 0. Operational pressures on the Bronchotron were tested at 28-40 PSI, with resultant Mean Airway Pressures (Paw) of 10-35 cmH2O. A variety of ventilator settings andINO doses were tested prior to the addition of external flow to the entrainment port. We then added a flow of 100% oxygen to the entrainment port and tested the effects on the measured INO dose.

Results: Without external flow, measured INO dose was generally 2-3x greater than set dose in all testing conditions. With the addition of an external flow variable in percussive ventilation flow - pulsatilating flow - diminished the optimal function of injector module. With the addition of an external flow source, discrepancies between set and measured INO doses decreases. At 14 LPM of external flow, set dose doubled the measured dose across all dose ranges at operational pressures of 28 PSI and was off by 1 to 2 ppm at 40 PSI. However, the addition external flow caused the Paw to increase by 2 to 9 cmH2O. The following table shows the results of testing with and without external flow at the entrainment port.

Conclusions: Measured results show the addition of an external flow of up to 14 LPM prior to placement of the injector module in the circuit suggests INO can be safely and reliably delivered with the Bronchotron in the intra-hospital transport environment.

Sponsored Research - None

888713

EVALUATION OF A TRANSPORT HUMIDIFIER WITH TRANSPORT HIGH FREQUENCY VENTILATION USING NASAL CPAP AND 3.5 ENDOTRACHEAL TUBE.

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Background: Intermountain Life Flight transport services has used high frequency ventilation on neonatal transport for several years without heated humidification. Recently a method to deliver heated humidity using the high frequency ventilation device was devised. Methods: The Percussionaire Bronchotron I with Turbophatixon (Bronchotron) was used with size #0, size #5 Hudson Nasal CPAP prongs or a 3.5 endotracheal tube (ET) and was attached to a Paykel RT130 Infant ventilator circuit used as a lung. The O2/INO (INO) of the Neat or (PFT) (NPT) was evaluated with an Airborne Neonatal Isolete (Isolete). The NPT was set at 37∞C Celsius (C) and targets up 100% relative humidity (RH). The neonatal ventilator circuit was used. The pressure knob was placed at the 12 o’clock position and flowrate knob and operational pressure was used to get pressures from 4 to 14 for nasal CPAP. The percussion, flowrate and operational pressure knobs varied to get pressures from 4 to 26 for the 3.5 ET. When the humidifier indicated it was ready, temperature (temp) and RH measurements were taken from within the specimen cup using a FLUKE 971 Temperature Humidity Meter. A baseline measurement without the NPT was taken with Bronchotron in Isolete. Results: We found that the NPT set at 37∞C could deliver an ARH of 98% and temp of 29.4∞C outside of the Isolete. Measurements done with NPT at 58∞C, were unchanged from measurements done. 37∞C was then set at the Hudson prongs inside the Isolete. The NPT set at 37∞C could deliver an average RH (ARH) of 83.3% and average temp (AT) of 30.2∞C with isolette temp set at 35∞C. AN ARH of 32.2% and AT of 34.2∞C was measured with the NPT set at 37∞C with the Isolete set temp at 35∞C. The NPT set at 37∞C with the isolette set temp at 35∞C was set at 35.3∞C and AT of 31.3∞C measured. With the NPT set at 37∞C and AT of 35.3∞C was measured. With the NPT set at 37∞C and AT of 35.3∞C was measured. Measurements done with the device at 37∞C were stable and consistent. At 32∞C and AT of 35.3∞C was measured. All measurements were shown in following table. Conclusions: The NPT was unable to reach normal body temp, but had adequate RH in our testing environment using the Bronchotron. It does appear it would improve RH and airway temperature significantly over the non heated humidification method currently used. Until better technology becomes available that provides improved results I would recommend the use of the NPT in this transport environment.

Sponsored Research - None

905974

EVALUATION OF HUMIDIFICATION DEVICES DURING PERCUSSIVE HIGH FREQUENCY NASAL CPAP.

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Background: Children’s Hospital (TCH) represented a single dominant clone. In an effort to decrease transmission of the dominant clone, a multidisciplinary team approach was taken to implement new infection control policies. Methods: Molecular typing allowed identification of patients colonized with the dominant clone and subsequent implementation of patient-specific infection control policies. These included the use of a ‘shuttle’ process in clinic and the initiation of ‘contract isolation’ for CF patients until a respiratory sample was obtained and no resistant organisms were identified. The shuttle process used flags to identify MRPA patients who then did not mingle with other patients. Subsequently, all patients were asked to sanitize their hands and don a mask upon arrival to clinic and care providers were asked to gown and glove for patients contact. Contact isolation on the inpatient side entailed requiring all staff members to gown and glove for patient contact. Patients were asked to wear their room while leaving their room. Additionally, MRPA patients were not allowed to visit common areas of the hospital. All CF patients were assigned their own non-disposable respiratory care equipment that remained in their room the duration of the hospitalization.

Results: After initiation of the above processes we were able to see a decline to 36% in the prevalence of the dominant clone in MRPA infected Cystic Fibrosis patients. Conclusions: Implementation of patient-specific infection control policies including inpatient and outpatient settings can decrease the prevalence of a dominant MRPA clone among CF patients.

Sponsored Research - None
SUCCESSFUL IMPLEMENTATION OF A HOSPITAL-BASED BRONCHIOLITIS CLINIC BY A RESPIRATORY CARE DEPARTMENT.

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Background: Infants with Bronchiolitis may require hospitalization for supportive therapy including nutrition, oxygen, and airway clearance. Those with mild disease may have hospital stays of 24-48 hours. We propose the use of an Outpatient Bronchiolitis clinic for milder cases to reduce hospitalizations, allow better management of hospital beds, and improved parent and physician satisfaction. Method: Infants were referred to the clinic, by prescription, from physician offices, the Emergency Department, and post-hospitalization for nasal tracheal or nasal pharyngeal suctioning. A respiratory therapist assessed the infant's weight, feedings, general appearance, and temperature. Oxygen saturations and a respiratory assessment score were measured before and after nasal suctioning. Guidelines were provided for having an infant emergency evaluated by an Emergency Department physician, calling the referring physician with concerns, and safely sending the infant home. Information on Bronchiolitis, home suctioning education, and instructions for returning to the clinic were given to the parents. Results: 370 infants were suctioned in the clinic. One thousand one hundred thirty-three suctionings were performed during the 7 months the clinic was in full operation. Two hundred seventy-four (74%) infants were 6 months of age and under. Thirty-six infants (9.7%) were admitted to the hospital as a result of the respiratory therapist evaluation. Parent and physician satisfaction surveys indicate both groups were 96% satisfied overall with their visit(s) to the clinic and the service it provided. Most parents surveyed stated that having an outpatient treatment versus a hospitalization helped their infant recover quicker. Conclusions: Our experience with the Outpatient Bronchiolitis Clinic demonstrated that infants with mild Bronchiolitis could be cared for on an outpatient basis safely without requiring hospitalization. Bronchiolitis occurs during peak busy months and treating these infants as outliers improves utilization of hospital beds and increases physician and parent satisfaction. Our experience confirmed that respiratory therapists can successfully assess and determine when an increased level of care is indicated in the outpatient setting as well as the inpatient setting. Data is currently being analyzed to determine the financial benefit to the hospital. Sponsored Research - None

920984

EVALUATION OF HIGH-FREQUENCY OSCILLATOR HIGH FLOW NASAL CANNULA DEVICE.

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BACKGROUND High Frequency Ventilation by Endotracheal Tube (ETT) has been used to treat various forms of lung disease in the newborn. Several types of High Frequency devices have been studied, all by ETT. Some proponents of Bubble Nasal Continuous Positive Airway Pressure (Bubble-CPAP) have suggested that the bubbling and its corresponding positive pressure waveforms may potentially better mimic clinically beneficial physiologic signals. Humidified, High Flow Nasal Cannulas (HFNC) are now widely used and have been shown to generate positive hypopharyngeal pressures consistent with therapeutic range of traditional CPAP devices. We previously tested two devices that induce flow oscillations in a fluidic manner. Four nasal cannulas were inserted into the nasal cannula circuit and evaluated at flow rates used in the clinical setting. METHODS A standard infant nasal cannula was used with the nose tips inserted into a balloon model of the nasopharyngeal airway. A pressure sensor in the pharyngeal model captured constant pressure readings. The first three devices were inserted into the nasal cannula circuit and evaluated at flow rates of 4-8 L/MIN. The fourth device was evaluated at flow rates of 2-7 L/MIN. For each device, waves of the hypopharyngeal pressure were generated and plotted. Frequency, Amplitude, and Mean Airway Pressure (MAP) were measured for each device at each flow rate. RESULTS For all devices, the MAP was directly proportional to the flow rate. There was a direct relationship between amplitude and flow for all devices. Devices #1 and #2 showed an inverse relationship between flow and frequency. Device #3 had a frequency that increased, and then decreased with increasing flow. Result #4 had a frequency that decreased, and then increased as flow values rose. These last two frequency anomalies are likely due to complex turbulence patterns within the device. See table for absolute values. CONCLUSIONS An oscillatory device in-line within the circuit of a HFNC may enhance gas exchange, decrease apnea/bradycardia, and/or prevent intubation and mechanical ventilation in newborns with mild to moderate lung disease. Additional clinical studies are needed to evaluate this new ventilation modality. Sponsored Research - Supervising author has contractual royalty agreement with manufacturer.

920858

EVALUATION OF THE IMPACT OF ENDOTRACHEAL TUBE SUCTIONING DURING HIGH FREQUENCY JET VENTILATION.

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Background: Primary Children’s Medical Center (PCMC) has used the High Frequency Jet Ventilator (HFJV) since its inception. Suctioning is a common procedure for mechanically ventilated patients with known side effects. We decided to evaluate the recommended double suction method (DSM) developed for the Hi-Lo Jet ETT compared to conventional single suction method (SSM) with the current change to the LifePort ETT adapter. Method: The Bunnell High Frequency Jet Ventilator (HFJV) was connected to an infant lung model with 2 pressure and 2 airflow sensors. The HFJV set on rate 360, PIP 25 cmH2O, and PEEP 8 cmH2O provided by a Drager Babylog. Various sizes of ETT sizes, closed suction catheters, suction (SxN) pressures 80-120 mmHg and a 3.5 LifePort adapter were used to evaluate changes in operational characteristics of the test lung. The test lung measurements were electronically recorded and stored for analysis. Each ETT, catheter, SxN pressure combination was measured and recorded 3 times. The DSM method was standardized to maintain consistency during testing and mirrored current clinical practice at PCMC. SxN was completed using the DSM and SSM. 3 phases of the SxN time measurements were compared to the total time from the last HFJV PIP until the target PIP was achieved post suction. Alarm conditions were observed and recorded for all SxN procedures. Results: We found that deflation times ranged from 5-39% using DSM compared to 8-14% using SSM. Test lung down times ranged from 20-39% using DSM compared to 13-30% with SSM. The average deflation time was 16% for the DSM and 13% for the SSM. The average deflation times were comparable with 8% for the DSM and 9% for the SSM. Alarm conditions were comparable between both methods. See results table. Conclusion: Our data showed that using DSM deflated the test lung more rapidly and had cleaner test lung down times. Further animal and clinical studies are recommended to fully understand the clinical benefits of a change to SSM. Our data from the test lung shows that a change to SSM may reduce potential negative effects of DSM in relation to deflation and down times. Sponsored Research - None

892009

THE EFFECT OF NAVA ON PARAMETERS OF VENTILATION IN THE PEDIATRIC INTENSIVE CARE UNIT.

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Background: Neurally Adjusted Ventilatory Assist (NAVA) is an FDA approved mode of ventilation that allows patients to breathe spontaneously in cooperation with the normal electronic physiologic signal of the diaphragm. This feature offers the advantage of total breath cycle synchrony. Two small studies revealed a decreased peak airway pressure (PIP) for pediatric patients ventilating in NAVA mode of ventilation compared to standard high flow nasal cannula mode of Ventilation (PSV), (Breathac, 2010, Bengston 2010). The purpose of this study was to determine whether PIP would decrease in NAVA in comparison to PSV by triggering, (primarily SIMV) modes of ventilation, and how the physiological effect on ventilation parameters are maintained in adequate ranges. Methods: A convenience sample of 15 patients in the Pediatric Intensive Care Unit (PICU) was included in our pilot study. Blood gas data was collected from our electronic charting system. PIP and other ventilation parameters were downloaded from the Servo ventilator utilizing an electronic data card. Data was continuously collected by minute from 30-minutes prior, and 6 hours after switching to NAVA from conventional modes. Descriptive statistics were used to summarize the sample demographics and outcome measures. Mixed model repeated measures ANCOVA was conducted to test mean outcomes across time points and days. Changes and variability in ventilation parameters were patient dependent. Overall decreases in tidal volume, increases in RR, and decreases in mean airway pressure were seen. Minute ventilation, pCO2 and pH were maintained in adequate ranges. Sponsored Research - None

906448
CASE SERIES REPORT OF A RAPID DEPLOYMENT LOW RESOURCE MODEL FOR PEDIATRIC EXTRACORPOREAL MEMBRANE OXYGENATION (ECMO) TRANSPORT.

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Background: During July 2008 a sudden increase in the number of babies with positive blood and sputum cultures for the Bacillus species occurred. 22 environmental cultures were positive: 12 B. cerus, 5 B. thuringiensis, 5 Bacillus species. Pulmonary involvement was noted on chest radiographs in 10 of 12 babies. Bacillus species are Gram positive, spore forming, aerobic, rod shaped organisms. The organism and its spores are found in soil and dust, and are easily spread by air. The links to Bacillus species infections are poorly defined.

Aim: To determine if Bacillus species are a problem in the Pediatric ICU and determine if a rapid deployment low resource transport model can be beneficial.

Methods: Retrospective review of 6 patients transported on ECMO for VAD support as a bridge to cardiac transplantation using a rapidly deployed, low resource transport model.

Results: Retrospective review of 6 patients transported on ECMO for VAD support as a bridge to cardiac transplantation using a rapidly deployed, low resource transport model. METHODS Retrospective review of 6 patients transported on ECMO for VAD support as a bridge to transplantation. Descriptive statistics were used to evaluate demographic, transport, ECMO, and complication data. Outcome, intensive care unit, and hospital length of stay data were also evaluated. Complications were defined as loss of oxygen supply, pump failure, hypothermia (36°C), and hypoxia (SpO2 < 90%). All patients were supported during transport with a centrifugal pump and the transport team consisted of a registered nurse, respiratory therapist, perfusionist, and a transport physician. RESULTS Six pediatric patients were transported on ECMO for VAD support from March 2008 to January 2010. Demographic and transport variables are illustrated in Table 1. Three (50%) subjects were transferred for cardiomyopathy (2 (33%) for heart failure, and 1 (17%) for a left ventricular mass > 10 g/m2). Three (50%) subjects were transferred for hypothermia (2 (33%) were transferred due to rising temperature by ambulance (20%) and 1 (17%) by helicopter. The overall complication rate was 33% (2) with both events being hypoxia requiring minimal intervention. Duration of ECMO support at the receiving facility was 95.0 ± 20.0 hours with 4 (67%) patients being placed on VADs from ECMO and 2 (33%) patients recovering without VAD support. Length of ICU stay was 27.4 ± 4.6 (40-52) days and hospital stay was 33.5 ± 8.2 (24-62) days. No complications occurred precluding these patients from transplantation. CONCLUSIONS In this small case series, we describe our experience with ECMO transport using a rapidly deployed, low resource transport model.

Sponsored Research - None

919332

IS THERE A METHOD FOR SIMPLIFYING THE SEEMINGLY COMPLEX VENTILATORY DYNAMIC OF THE BRONCHOTRON?

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Background: The use of high frequency ventilation in neonates with significant lung disease has been difficult during transport. High gas requirements, bulky apparatus, and electrical power requirements have largely discarded the use of the oscillatory and jet ventilators more common in the NICU setting. The Bronchotron (Percussionaire Corporation, Sandy, Utah) requires no electricity, for acutation and is much more amenable to transport because of its small size. However, its present lack of digital monitoring has largely made it more difficult to monitor or to understand the effects of various flow and pressure changes inherent in changes in the device usage. Purpose: We asked if there was a simple approach to analyzing the flow and pressure waveforms of the Bronchotron that could be used to more readily adapt to changes in the ventilatory dynamic in transport. Method: A Sinusoidal Bronchotron was attached in line to a Fleisch pneumotachograph. The pneumotachograph was attached to a pressure transducer (Validyne, Northridge, CA) imbedded in a IBM PC compatible computer running Easy Sense for Windows XP. The apparatus was then connected in line to a Copper Wire test lung of known compliance. Flow and pressure data were sampled at 1000 Hz with operational CPAP fixed at 20 PS. Various waveforms of oscillatory CPAP across the full operational range. For the purposes of this study, I and E time were fixed. Results: As shown in the graphics and in the accompanying equations, changes in the flow- pressure dynamic can be described mathematically by correlating pulse frequency and oscillatory CPAP using a higher order Polynomial fitting to peak maximal peak flow and pressure measurements. Conclusion: Fixed form equations can be used to describe the variability inherent in high frequency ventilation with the Sinusoidal Bronchotron in a more readily appreciable flow and pressure relationship. Understanding this relationship can give rise to a better sense of how to adjust the individual parameter’s without the luxury of a digital readout.

Sponsored Research - None

920775

CHANGE IN PRACTICE IMPROVES VENTILATOR ASSOCIATED PNEUMONIA IN NEONATAL PATIENTS RECEIVING AEROSOL DELIVERY.

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Background: Ventilator associated pneumonia (VAP) is a concern with all patients receiving mechanical ventilation. Much has been reported on reducing risks of in the adult population, little is known in the pediatric and neonatal population, especially those receiving aerosol delivery. Method: Retrospective analysis of all patients receiving mechanical ventilation in the NICU from Aug 10 2009, to Jun 10, 2010 were reviewed. Criteria used to determine nosocomial infection was adapted from The Centers for Disease Control and Prevention criteria for diagnosis of ventilator associated pneumonia. In January 2010 a new more extensive VAP bundle was implemented for both RN’s and RRT’s and a comparison was made between the groups. All ventilated patients receiving MDI and aerosol treatments were included, with the exception of long-term trach patients. Results: 33 NICU patients met our inclusion criteria between Aug 2009 and Jun 2010 that were ventilated and receiving aerosol therapy using the Aeroneb® Pro and/or the AeroChamber® mini during their course of ventilation. All patients were less than one year of age. From Aug 10 to Jan 10 there were 7 patients of 17 (41%) that met criteria for VAP. Following implementation of an expanded VAP bundle from Jan to June there were 4 patients of 16 (25%) that met criteria for VAP. Conclusions: The improved VAP bundle shows a favorable trend in reducing VAP in neonatal patients on mechanical ventilation and receiving aerosol delivery. Further study to include more patients is needed to establish clinical significance, and a separation of types of delivery methods will be a next step in evaluating a difference in VAP rates in this population of patients.

Sponsored Research - None

921202

SYMPOSIUM 7: Neonatal/Pediatrics—Part II
LOW OXYGEN SATURATION TARGETING AND ITS EFFECT ON NEONATAL BRONCHOPULMONARY DYSPLASIA AND RETINOPATHY OF PREMATURITY: IMPLEMENTATION AND ANALYSIS.

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Background: Hyperoxia in the very low birth weight infant has been determined to an exacerbating cause of bronchopulmonary dysplasia (BPD) and retinopathy of prematurity (ROP). The use of oxygen saturation targeting in neonatal intensive care units is widely used but the exact parameters for saturation ranges are uncertain. This study will discuss how our NICU implemented an oxygen saturation targeting protocol and the resulting patient data following implementation. Method: Oxygen saturation levels were determined through a literature review to define best practice. The established goal of the protocol: maintain saturations at therapeutic and safe levels; curtail unnecessary oxygen use, administration, and minimize abrupt changes in FiO2. Training was delivered to all NICU staff prior to the start of the protocol and intermittently for reinforcement. Saturations were maintained in the target parameter of 88-92% with alarm settings at ≥ 2%. Randomized weekly quality improvement audits were performed to ensure alarm and protocol compliance. All patients < 1500g at birth were included and data was measured through the Vermont Oxford Network (VON). Outcome data for ROP, BPD, and home oxygen use were measured and compared to an internal historical control and VON data. BPD was defined as oxygen use at 28 days of life or 36 weeks post menstrual age, both of which were looked at independently. Results: Occurrence of patients on oxygen at 28 days or at 36 weeks showed no significant change with the protocol. But a 43.75% decrease was noted on patients discharged on home oxygen. ROP surgery necessity decreased 75% when the patients’ oxygen saturations were targeted per protocol. Stage severity of ROP shifted with a decrease in ROP Stage 3 of 68.75% and an increase in Stage 0-2. Conclusion: Implementing an oxygen targeting protocol reduced the need for home oxygen and decreased ROP severity. We speculate that limiting oxygen exposure decreased inflammatory response to oxygen free radical injury.

Sponsored Research - None

HELIOX IN THE CRITICAL CARE TRANSPORT OF CHILDREN WITH CROUP: A STRATEGY TO HASTEN CLINICAL IMPROVEMENT.

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Background: Croup is a common pediatric illness. The hallmark feature of croup is upper airway obstruction – a physiologic paradigm responsive to the reduction in airflow turbulence provided by helium/oxygen (HeO2) admixture. Our pediatric critical care transport team (PCCTT) has been using HeO2 as an adjunct therapy for select children with upper airway obstruction from croup. We sought to describe our experience with HeO2 on transport and hypothesized that transported children treated with HeO2 would show a more rapid clinical improvement. Methods: Our IRB-approved study sought to retrospectively evaluate all children transported by our PCCTT and admitted to the PICU with the diagnosis of croup. We analyzed pre-transport condition/interventions, transport therapies, and PICU/hospital outcomes. Croup scores (Modified Taussig) were assigned retrospectively according to respiratory therapy charting. Data were analyzed using appropriate statistical tests including Pearson’s Chi-square test, Fisher’s exact test, Mann-Whitney U rank comparison, and two-sample t-test. Results: Thirty-five children met inclusion criteria (HeO2 n=17, no HeO2 n=18). Demographics were similar between groups except for a higher weight in the HeO2 group [mean(SD)= HeO2 19.9kg (13.6) vs no HeO2 12.1kg (7.2), p=0.03]. The pre-transport medical care and time to arrival of transport team were similar between groups. The children receiving HeO2 had a higher baseline croup score [mean(SD)= HeO2 5.7(2.5) vs no HeO2 2.9(2.0), p=0.001]. The improvement in croup scores over the first 60 minutes of transport was more rapid in the HeO2-treated children (Figure 1). There was no difference in the number of children requiring additional nebulized racemic epinephrine during transport. The PICU length of stay [mean hours(SD)= HeO2 20.2(11.1) vs no HeO2 23.4(22.8), p=0.79] and hospital length of stay [mean hours(SD)= HeO2 43.7(18.7) vs no HeO2 44.5(33.6), p=0.64] were similar between groups. No HeO2-treated children required intubation versus one intubation in the no HeO2 group. Conclusion: HeO2 use in treatment of critically ill children transported via a PCCTT provides a more rapid improvement of croup scores. HeO2 for croup during transport does not prolong intensive care unit stay. These results suggest that a more robust multi-centered trial is warranted to define specific outcomes and create recommendations regarding which transport patients could benefit from HeO2.

Sponsored Research - None