BENCH STUDY OF HELIOX TANK DURATION WHEN USING THE LTV 1200 VENTILATOR.

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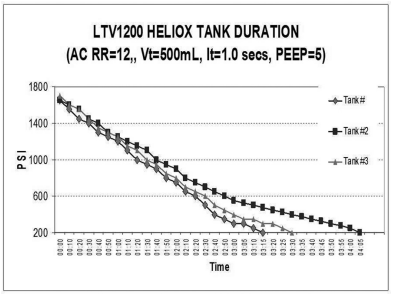
Background: In the event of severe respiratory distress, due to obstructive airway pathology, heliox can be used to reduce the patients overall work of breathing. A RCP most often delivers heliox via a NRB mask, but also has been asked to deliver this gas mixture via mechanical ventilation both invasive and non-invasive. Over the past 4 years we have used Pulmonetics turbine driven ventilator LTV 1200 (LTV) as both a transport and critical care ventilator. In this study we wanted to determine if the LTV could accurately deliver heliox throughout the duration of the heliox tank. The tank used in the study was an "H" sized heliox 70/30 mixture. Method: This bench study was performed using a Michigan Instruments Inc. Dual adult test lung with the lung compliance set at 50 ml/cm H20 and a 5 cm H20/L/sec fixed airway resistor in line. The Novametrix NICO Cardiopulmonary Management System was used to obtain Exhaled Vt and PIP data at the test lung. The NICO was set to monitor heliox 70/30. We obtained a calculated Exhaled VT and Insp flow by multiplying the data found on the LTV patient monitoring screen by the heliox density factor of 1.6. An "H" sized heliox tank 70/30 was supplied to the LTV1200 ventilator via high pressure oxygen inlet. A total of 3 trials were performed using a new ventilator circuit for each one. The following ventilator settings were used for each trial: Volume Assist Control, RR=12, Vt=500mL It= 1.0second, PEEP=5cmH20. Results: The actual exhaled Vt from the LTV was 486mL +/- 20.0. The calculated Vt from the LTV was 777 +/- 32mL while the Vt on the NICO was 750 +/- 40.0mL. The LTV PIP was 21.01 +/- 1.13cmH2O and the NICO PIP was 21.05 +/-1.04cmH20. The "Low O2 Pressure" alarm, which is triggered when gas inlet pressure is less then 35 PSI, was activated at the end of each trial. The Vt on the NICO dropped shortly after the low gas pressure alarm activated. With a tank pressure of 1650 PSI the average tank duration was 3 hours 36 minutes +/- 25 minutes. The tank pressure decreased at a predictable rate (see graph for more information). Conclusion: The LTV 1200 accurately delivered the calculated Vt to the patients through all 3 trials. The PIP remained consistent for all 3 trials. The LTV appropriately alarmed when the tank pressure was below 50 PSI. The heliox was depleted from the tank at a predictable rate.

Sponsored Research - None



919104

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

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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 bidirectional through the one-way-valve during HFOV. Accordingly, 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 performed pre-use procedure for both 3100A and 3100B. Connected test lung to 3100A and 3100B circuits. 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 cmH2O 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. The measured ΔP without one-way-valve: 4 cmH2O. Bias Flow measured 10 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: 6 cmH2O. Bias Flow measured 20 L/min pre and post one-way-valve and 20 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 administering iNO during HFOV. Additionally, measured bias flow was consistent with and without the one-way-valve in both the 3100A and 3100B circuit. Accordingly, iNO injected into the HFOV circuit may be the same with or without the one-way-valve. Discussion: Both HFOV and iNO are technical in nature and entail utmost attention to detail when administering 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 most importantly eliminate medical errors that 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

823449

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

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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 physician direction when the patients status changes. In order to remove 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 COPD patients that required NIPPV before and after the RTDP was implemented. Methods: 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. Using electronic respiratory documentation we retrospectively analyzed all adult COPD 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 (LOSniv), hospital length of stay (LOSh), 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 COPD patients in the Pre RTDP group and 132 (17.3%) of them received continuous NIPPV. We identified 853 COPD 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 LOSniv and LOSh. More patients were transferred to the stepdown unit and fewer patients were transferred to the ICU for care in the Post RTDP group. Although the RCP's used the same IPAP settings, 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 COPD patients requiring continuous NIPPV.

Sponsored Research - None

Pre and Post NIPPV RTDP Data

	Pre RTDP (n=132)	Post RTDP (n=160)
IPAP Setting	12.6 +/- 2.3 cmH2O Press	12.6 +/- 2.6 cmH2O Press
LOSniv	2.9 +/- 1.2 Days	2.3 +/- 1.1 Days*
LOSh	5.99 +/- 4.4 Days	5.1 +/- 3.6 Days*
NIPPV <48hr of Discharge	38%	35%
NIPPV < 24hr of Discharg	29%	16%
NIPPV <12hr of Discharge	12%	6%
Admitted to Stepdown Unit	28%	56%
Admitted to ICU	5%	3%

*p=≤0.01

919100

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

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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 now report the use of NAVA in the pediatric population, but none of these mention NAVA in conditions with severe obstructive conditions such as asthma. The following case series will present 3 patients 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 (RAD). On PD (patient day) 2 she was intubated, placed on conventional ventilation, received continuous albuterol, solumedrol, and magnesium sulfate. While on the ventilator she received multiple doses of a neuromuscular blockade(NMB)to prevent patient ventilator asynchrony (PVA). PD 5 Nitric Oxide (NO) was initiated to optimize her oxygenation and she was transitioned to NAVA to improve PVA. PD 7 she was extubated. Patient 2 is an 18 month old 7.2 kg, former 30 week preemie with chronic lung disease (CLD) and RAD, female admitted to the PICU with pneumonia. PD 2 she was intubated and received continuous albuterol and solumedrol. Throughout her course she was placed on high frequency oscillatory ventilation (HFOV) and NO for oxygenation and ventilation, received multiple doses of NMB, and an ECMO consultation. PD 11 she was transitioned back to conventional ventilation, PD 17 she was placed in NAVA remaining on 20 ppm NO, and PD 21 she was extubated. Patient 3 is a 6 yr old 18.8 kg asthmatic male that was admitted for pulmonary hemorrhage. On PD 1 he was intubated and treated for an anomalous aorta to pulmonary artery fistula. PD 5 he became septic having frequent and prolonged episodes of desaturations requiring him to be placed on HFOV, NO of 20 ppm, and surfactant administration. PD 11 he was transitioned to conventional ventilation and placed on continuous albuterol. PD 13 he was placed into NAVA and on PD 16 he was extubated. Discussion: NAVA appears to be a safe mode of ventilation for patients that have obstructive lung disease. Our 3 pediatric NAVA patients with obstructive disease components were successfully extubated and able to self regulate their I:E ratio, maintain adequate Vt's, C02, and oxygenation in NAVA. Further studies are needed to show the benefits of NAVA in pediatric patients with obstructive disease components.

Sponsored Research - None

NAVA Data

	Total # of vent days	Vent day transitioned to NAVA	Days on NAVA	Ph Pre NAVA	Ph Post NAVA	C02 Pre NAVA	C02 Post NAVA	Fi02 Pre NAVA	Fi02 Post NAVA
Case #1	6	5	3	7.38 abg	7.43 abg	71	54	50	55
Case #2	20	16	2	7.48 vbg	7.40 vbg	54	58	65	55-60
Case #3	16	13	4	7.37 abg	7.41 abg	61	47	60	30

921132

PROCEDURAL VENTILATION BY RT MANAGED HIGH FREQUENCY OSCILLATION VENTILATION (HFOV) DURING CARDIAC TISSUE ABLATIONS IN THE EP LAB IMPROVES CATHETER STABILITY AND DECREASES PROCEDURE TIMES.

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Background Electrophysiologists (EP) use radiofrequency catheter ablation to treat tachyarrhythmias. Spontaneous breathing (SB) performance or conventional ventilation (CV) can produce excessive cardiac motion via cardiac-thoracic coupling, which contributes to catheter instability. Excess cardiac motion increases procedural difficulty and time, and can result in damage to adjacent tissue. EP physicians consulted respiratory therapy (RT) for high frequency oscillatory ventilation (HFOV) methods seeking cardiac motion reduction and improved catheter stability. Methods RT proposed HFOV to limit chest motion to a wiggle, eliminating cyclic inflation and deep diaphragmatic excursion. Each patient was sterilely draped under fluoroscopy throughout the procedure and Anesthesiology placed arterial lines for ABG analysis. RT connected to HFOV from CV after recruitment maneuver of 30 cwp for 30 seconds. FiO2 was set to 0.60, Mean Paw was set to 5 cwp above Mean Paw on CV, Rate was 9Hz (540 bpm), bias flow was 30 lpm, power set at 6 was adjusted upward watching for chest wiggle from the clavicle to upper thigh for optimal chest wiggle factor (CWF). ABG interval was 45-60 minutes, trending TcPCO2 used. Permissive hypercapnea strategy allowed PCO2 levels of 40-70, to maintain pH > 7.20. Standard CareFusion 3100B adjustments were planned with rate ≥ 8 Hz to reduce cardiac motion. Results Chest motion reduction from HFOV wiggle and other method adjustments improved catheter stability compared to SB and CV method cases. HFOV minutes decreased to an average of 175,compared to some cases where SB and CV methods were used. Initial Mean Paw was 18.8 cwp and the average PaCO2 was 44 mmHg. Patients receiving ablations for atrial fibrillation and AV node reentry tachycardias (AVNRT) tolerated HFOV satisfactorily. This method permitted quick extubation post HFOV averaging 18 minutes. Conclusion Two patients who had failed AVNRT ablation with SB had success with HFOV. Catheter stability is improved by limiting cardiac motion. Our facility has adopted respiratory therapy managed HFOV as the standard method of ventilation for atrial fibrillation ablations and the preferred method of mechanical ventilation for ablations in the EP lab.Decreased procedure times occur using HFOV over some SB and CV method cases.

Sponsored Research - None

Table 1- Patient data, Ablation type, HFOV minutes, mean Paw start, mean Paw range, High PaCO2, Avg. PaCO2, minutes to extubate after HFOV

Case	M/F	Age	Diagnosis	Ablation Type	HFOV time in minutes	Start Mean Paw cwp	Range Mean Paw cwp	Average PaCO2 mmHg	Highest PaCO2 mmHg	Minutes to extubation after HFOV
1	M	46	A-Fib	A-Fib	210	12	12-18	39.9	43	25
2	M	43	SVT/AVNRT	AVNRT	192	22	18-23	53.8	62	40
3	M	60	A-Fib	A-Fib	224	25	15-25	45.5	50.8	10
4	F	36	AVNRT	AVNRT	145	23	23-23	35.5	43	15
5	F	66	AVNRT	AVNRT	104	12	12-12	47.2	55	2
AVG.		50.2			175	18.8	12-23	44	50.8	18.4

900113

DECREASING UNPLANNED EXTUBATIONS IN A LEVEL IV NEONATAL INTENSIVE CARE UNIT.

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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 practice 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, decreased patient anxiety, and decreased VAP risk. CONCLUSIONS: Unplanned extubations could largely be 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

900142

IMPORTANCE OF TRACHEOSTOMY TO THE WEANING SUCCESS IN PATIENTS WITH CONSCIOUS DISTURBANCE IN RESPIRATORY CARE CENTER.

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Background: Extubation is particularly controversial in patients with depressed mental status. Using the cutoff of Glasgow coma scale (GCS) ≥ 8, favored by many investigators, is questionable. Patients and Results: We enrolled a total of 138 consecutive patients (90 of male patients; age: 71±17 years) who were admitted to Respiratory Care Center (RCC) of our hospital from Oct 2009 to Mar 2010. Effects of coma scale on the patients' outcomes and weaning rate were evaluated. The results showed the mortality rate was significantly higher in patients of RCC with GCS < 7t (p=0.04) or derivate GCS <10 (p<0.05). There were more, but insignificantly, patients with high GCS (GCS ≥ 7t or derivate GCS ≥10) undergoing tracheostomy than those who with low GCS. Moreover, in patients with low GCS (GCS< 7t or derivate GCS <10), the weaning successful rate was significantly higher in patients with tracheostomy than patients without tracheostomy (GCS: 92.9% vs. 36.4%, p=0.004; or derivate GCS: 93.3% vs. 36.4%, p=0.003). But in patients with high GCS, the tracheostomy did not affect the weaning successful rate (p=NS). Conclusions: Consciousness grading by GCS did affect the outcomes in patients of our RCC. Tracheostomy affected the weaning successful rate of patients with low GCS. The low tracheostomy rate in patients with low GCS affected the weaning rate, which may contribute to the higher mortality in patients of RCC.

Sponsored Research - None

912329

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

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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 Respironics ComfortGel full 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 Timed, Rate 4 breaths/minute, EPAP 5 cmH2O, IPAP 15 cmH2O, rise minimum allowed by the ventilator. HR 1101 settings: Resistance 25 cmH2O/L/sec, Compliance 60 ml/cmH2O, Rate 15 breaths/minute, Amplitude 8, Effort slope 15.0, % 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 compared 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 0.14 seconds for the Vision and 0.20 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 patients with COPD.

Sponsored Research - None

	Inspiratory Time (seconds)	Trigger Delay (seconds)
ST/D	1.75	0.20
Vision	1.00	0.14
V60	0.93	0.10

914013

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.

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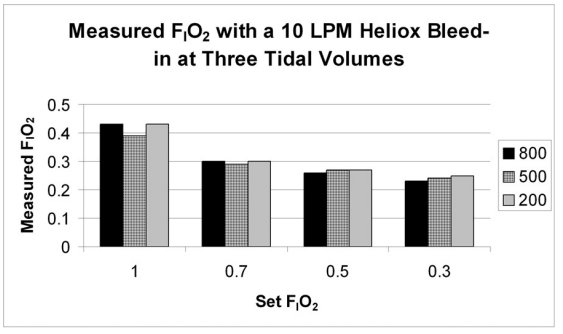
BACKGROUND: We measured the effect of a 10 LPM 80:20 Heliox bleed-in on the delivered FIO2 for a Respironics Vision delivery system. We were also concerned that combining a fixed bleed-in with different tidal volumes might lead to significant variation in delivered FIO2. So, we compared three delivered tidal volumes and measured FIO2. METHODS: We connected the Respironics 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 assessed 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 (Catalyst Research). 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 into a Respironics Vision at 10 LPM 80:20 heliox resulted in a stable delivered FIO2 at the settings tested.

Sponsored Research - None



921074

DIAGNOSING DIAPHRAGMATIC DYSFUNCTION WITH CONTINUOUS DIAPHRAGMATIC MUSCLE ACTIVITY MONITORING.

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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. Neurally adjusted ventilator assistance (NAVA) is a new mode of mechanical ventilation (MV) that uses a special esophagogastric tube with embedded electrodes to detect diaphragm myofiber electrical activity (Edi) during contraction. 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 ECG waveform color changes on the ventilator's monitor when Edi signals occurred. Airway and Edi scalar waveforms was then recorded. Transthoracic ultrasound was performed to assess diaphragm 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 initiated breaths. Bedside transthoracic ultrasound revealed ascites and diaphragmatic paralysis; unilateral in one case and bilateral in two. CONCLUSION: Our findings reveal that patients may pneumatically trigger assisted breaths during MV despite having markedly suppressed, or absent, diaphragm myofiber electrical activity. Flexion of accessory muscles may explain why pneumatic breath triggering occurs 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

866088

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

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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 end expiratory lung pressure and volume. **METHODS**: A spontaneously breathing ARDS patient was modeled with a lung simulator (IngMar ASL 5000): compliance = 30 mL/cm H_2O, resistance = 10 cm H_2O/L/s, respiratory rate = 10/minute, and muscle pressure = 5 cm H_2O. Ventilator settings: P High (25 cm H_2O) and number of releases (10/min) were the same in both modes. T Low was set to one time constant (1τ) = 0.3 seconds in APRV (I:E = 19:1) to generate predicted auto-PEEP of ≈ 9 cmH_2O and 5τ in BIPAP = 1.5 seconds (I:E = 3:1) to minimize auto-PEEP. P Low was 0 cmH_2O in APRV and 9 cmH_2O 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 strategy needs to be validated in a human trial to compare the effects on oxygenation, ventilation and hemodynamics between both modes.

Sponsored Research - None

Variable	APRV	BIPAP	P
Spontaneous breath volume (mL)	176.8	176.8	NS
Mandatory breath volume (mL)	379.7	510.1	< 0.001
Minute ventilation (L/min)	5.56	6.87	< 0.001
Mean airway pressure (cm H_20)	25.2	22.4	< 0.001
Total PEEP (cm H_2O)	14.34	10	< 0.001

886082

AUTO-PEEP DURING APRV VARIES WITH THE VENTILATOR MODEL.

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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 most modern ventilators though under different names. This mode is used usually with very short release time (T Low) to create auto-PEEP and prevent alveolar collapse at end of the T Low. No data are available to estimate the amount of auto-PEEP in APRV using varying T Low. No studies have been done to compare ventilator performance in regards to auto-PEEP and flow delivery. The purpose of this study was to compare auto-PEEP levels, peak expiratory flows (PEF) and flow decay profiles among 4 common intensive care ventilators. METHODS: A passive ARDS patient was modeled with a lung simulator (IngMar ASL 5000): compliance = 30 mL/cm H_2O, resistance = 10 cm H_2O/L/s, with time constant (TC) of 0.3 seconds. Ventilator settings: P High (25 cm H_2O), P Low (0 cm H_2O). T Low settings were varied from 1 to 6 TC, i.e. from 0.3 seconds to 1.8 seconds. T High was held constant. We measured auto-PEEP and flow as %PEF at each TC, where time was measured from the start of expiratory flow. Delay was defined as the time between start of expiratory flow and PEF. System TC was defined as the time for flow decay from PEF to 37% of PEF. Four ventilators were evaluated: Carefusion Avea, Draeger Infinity, Covidien PB 840, Maquet Servo I. Mean values from at least 5 breaths were compared with 1 way ANOVA on ranks. RESULTS: Mean data are summarized in Table below. At all T Low the Servo-i had the lowest and Avea the highest auto-PEEP. CONCLUSIONS: All tested ventilators did not follow the mathematical model as expected and resulted in significantly different auto-PEEP, flow decay, and PEF regardless of the T Low settings. An unexpected finding was that peak flow was delayed from the start of expiratory 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 higher than expected auto-PEEP.

Sponsored Research - None

auto-PEEP (cm H_2O)

TC	Predicted	Servo-I	Infinity	PB-840	Avea	P value
1	9.20	10.08	12.06	13.37	14.34	<0.001
2	3.39	5.00	5.71	7.54	7.76	<0.001
3	1.25	2.06	2.26	4.05	4.21	<0.001
4	0.46	0.87	1.19	2.46	2.28	<0.001
5	0.17	0.32	0.79	1.67	1.27	<0.001
6	0.06	0.16	0.51	1.43	0.93	<0.001

Flow (% PEF relative to start of expiratory flow)

TC	Predicted	Servo-I	Infinity	PB-840	Avea	P value
1	37	73	74	70	81	<0.001
2	14	35	35	36	43	<0.001
3	5	14	15	17	23	<0.001
4	2	6	3	9	11	<0.001
5	1	3	2	4	5	<0.001
6	0	1	1	2	2	<0.001

	Servo-I	Infinity	PB-840	Avea	P value
system TC (s)	0.429	0.4474	0.4744	0.497	<0.001
Delay (s)	0.1116	0.1144	0.1024	0.1674	<0.001
PEF (L/min)	93.87	95.91	88.42	83.87	<0.001

886238

EVALUATION OF ELECTRICAL IMPEDANCE TOMOGRAPHY IN VARIOUS MODES AND SETTINGS OF MECHANICAL VENTILATION.

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BACKGROUND: Electrical Impedance Tomography (EIT) is a non-invasive radiation- 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 data was recorded using the Draeger Medical EIT Evaluation Kit 2. We also recorded an average tidal volume (Vt) obtained by the minute ventilation for the corresponding ventilator settings. For data analysis a Pearson correlation coefficient was calculated for each individual and is summarized in Table I. 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 that the two variables (global tidal variations and measured Vt) are 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 graphic images of ventilation can be useful. However, using the data from the EIT device and ventilator to quantify any changes would require additional methods. Future clinical studies are needed to assist in finding those methods which would be most beneficial to the bedside clinician.

Sponsored Research - None

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

Grateful Acknowledgement to Ed Peterson PhD. ; Department of Biostatistics and Research Epidemiology, Henry Ford Health System

891539

HFOV FOR ARDS AND H1N1 INFLUENZA: A RETROSPECTIVE REVIEW.

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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 HFOV patients. STUDY DESIGN: Retrospective review of the following from a HFOV database: gender, ARDS trigger, BMI, mortality, use of iNO and ECMO, incidence of air-leaks, and duration of ventilation. OI, and PaCO2 were recorded at 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 43 + 20 years and a BMI of 40 + 10 vs 32 + 10 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 was 3.3 + 4 (H) vs 3.6 + 3 d (NH). Mean duration of HFOV was 3.9 + 3 (H) vs 2.6 + 2 d (NH); median was 4 vs 2 d. Hospital mortality was 50% for H and 39% for NH. Pre-HFOV and hr 1, 12, 24, and 48 values (mean +SD) for OI, PaCO2 and HFOV frequency (Hz) were: (please see attached table) CONCLUSION: 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 HFOV patients.

Sponsored Research - None

			H1N1					non-H1N1		
	Pre	1	12	24	48	Pre	1	12	24	48
OI-All pts	54±12	47±14	40±11	40±10	31±12	53±19	54±26	36±20	32±18	27±16
OI-Alive	54±13	43±16	36±12	38±11	27±7	53±20	54±30	28±13	26±15	25±15
OI-Died	54±10	51±12	43±11	42±10	36±15	54±18	54±21	48±23	44±19	38±18
PCO2-All	58±19	61±16	63±19	65±15	63±18	56±21	56±23	58±20	58±20	60±17
PCO2-Alive	57±16	54±16	63±23	62±16	68±18	61±23	63±24	57±16	59±17	61±16
PCO2-Died	58±15	67±13	63±17	67±14	57±18	48±17	46±20	59±26	57±26	58±22
Hz-All Pts	-	6.1±0.9	5.8±1	6.2±1.4	6.4±1.9	-	5.6±0.9	6.0±1.6	5.9±1.7	5.8±1.1
Hz-Alive	-	6.1±0.7	5.7±1	6.0±1.4	6.8±2.1	-	5.7±0.9	6.4±1.7	6.2±2	5.9±1.1
Hz-Died	-	6.1±1.1	5.8±1.1	6.4±1.5	6.1±1.6	-	5.5±0.8	5.3±1.1	5.5±1.2	5.6±1.5

904519

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

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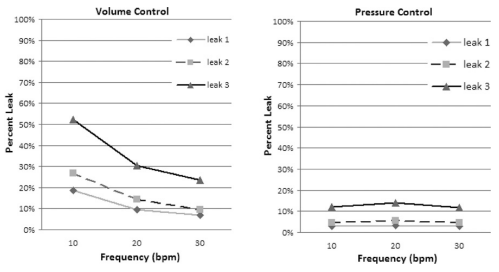
BACKGROUND: Leaks occur during ventilation and may cause a reduction in minute ventilation. Leaks may arise through a chest tube (CT) to treat a bronchopleural fistula. There are few data available to determine what affect mode of ventilation has on leaked volume. At least one study, of infant ventilation, suggests that pressure control ventilation (PC) is more efficient in maintaining minute ventilation than volume control ventilation (VC) in systems with endotracheal tube leaks (Respir Care 1996;41(8):728-735). The purpose of this study was to compare PC and VC using an adult model of ARDS in the presence of simulated CT leaks. We hypothesized that like the previous study, PC would be more favorable than VC. **METHODS:** We used an Ingmar ASL 5000 lung simulator (with Leak Module) set with a compliance = 35 mL/cm H_2O, resistance = 3 cm H_2O/L/s. A linear resistor (6 cm H_2O/L/s) was attached to represent airway resistance above the leak. A 7.0 mm id endotracheal tube was connected between the resistor and the ventilator. The ventilator was a CareFusion Avea set to deliver conventional PC or VC at frequencies of 10, 20, and 30 breaths/min (bpm); baseline tidal volume ≈ 500 mL (with no leak). Flow (in VC) or inspiratory time (in PC) was adjusted with frequency to keep I:E ≈ 1:2. Mean and standard deviations (for 10 breaths) for expiratory tidal volumes (V) were calculated using the ASL Post Analysis feature. For each frequency, percent leak = 100% × ($V_{no\ leak} - V_{leak}$) ÷ $V_{no\ leak}$. The study was conducted 3 times and mean values were compared one way ANOVA, with $P < 0.05$ considered significant. **RESULTS:** The data for percent leak are shown in the Figure. Percent leak for VC ranged from 2 to 7 times larger than PC. Leak decreased as frequency increased ($P < 0.036$) for VC ($P = 0.017$), but not PC. **CONCLUSIONS:** This bench study confirms the previous study of neonatal endotracheal tube leaks that pressure control preserves minute ventilation by decreasing percent leak better than volume control in the presence of simulated adult chest tube leaks. Furthermore, for volume control, increasing the frequency reduces the percent leak.

Sponsored Research - None



920239

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

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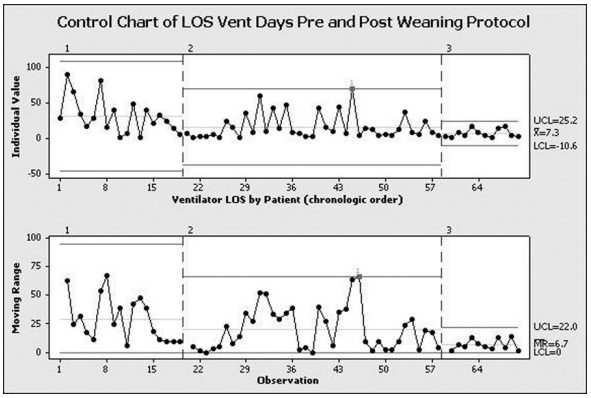
Background: Extensive evidence demonstrates the effectiveness of use of therapist driven weaning protocols at acute care hospitals for decreasing patient's LOS on mechanical ventilation. Our long term acute care institution implemented the use of a therapist driven mechanical ventilation weaning protocol 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-hospice, excluded DNR, etc.) Results are as follows: Total Mean vent days for period 1 is 31.8 (n=19); period 2 is 16.56 days (n=39); period 3 is 7.33 days (n=12) p=.002. Period 1 was the time prior to use of the protocol; Period 2 was the implementation and adjusment phase of the protocol and Period 3 is the steady state phase of the project. Conclusion: Implementation of a weaning protocol is effective in a long term acute care setting as evidenced by the statistically signficant decrease in LOS for patients at our long term acute care facility.

Sponsored Research - None



920740

NON INVASIVE ASSISTED RAPID SHALLOW BREATHING INDEX FOR PREDICTION OF FAILURE IN NON INVASIVE VENTILATION.

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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 signficance likely due to sample size.

Sponsored Research - None

921093

RAPID EXPANSION OF AN ECMO PROGRAM: A NOVEL, SIMPLIFIED VENOVENOUS SYSTEM FOR ADULT PATIENTS.

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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 an 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 new 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 requirement 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, which allowed for a doubling in 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 healthcare crisis.

Sponsored Research - None

918739

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

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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 though 10 with normal being a high value (8-10). Spirometry is a screening tool for respiratory health where exhaled volume and flow are measures and IPI 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: Sixty-five patients (34 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 effective 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

918952

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 safely and effectively used in assessing the response to the vasodilator, 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. METHOD: Idiopathic PAH patients were enrolled for the vasodilator test. Hemodynamic measurements were recorded by cardiac catheterization at baseline breathing room air and after breathing iNO. 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 patients' 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 decrease of mean pulmonary artery pressure (mPAP) ≥10 mmHg to reach an 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 35 ± 13 years. Two of 7 patients (28.6%) were positive response to iNO, and 5 patients were non-response (71.4%). Two patients were positive responder at 40ppm and 5 patients were non-responder even at 80ppm NO inhalation (Table). All of 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.

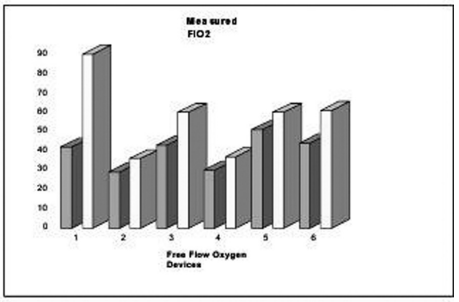
919076

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

Kathleen Deakins, 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 a cupped hand. 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 FiO2 range of 80-100% for non-resuscitation situations for infants compared to our current methodology. Methods: FiO2 was measured proximal to the mouth of a resuscitation mannequin by attaching a calibrated Maxtec 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 (Salter Medical, Arvin, CA #1114), (3) infant aerosol mask(Salter #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 (Mercury Medical, Clearwater FLA). Five measurements (per position and device) were recorded as the mannequin was positioned on a flat plane with the head at a 45degree angle(facing midline) and head turned linear toward the free flow device positioned horizontally at 2 and 5 cm distances. FiO2 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 FiO2 at a 45 degree angle(purple) and turned linear toward the free flow device (yellow). Combining both positions and distances, the mean FiO2 of a self inflating bag measured 24 + 2% (Control), while the device that generated the highest mean FiO2 (#1 large bore tubing with adapter and oxygen tubing) of devices assessed measured 90 + 14%: closest to the target values. Conclusion: Optimal FiO2 should be delivered by a standard oxygen delivery device instead of a self-inflating bag. In certain non-resuscitation situations, free flow oxygen can be provided by a simple large bore tubing setup to achieve a temporary and higher concentration FiO2 if a flow-inflating resuscitation bag is not available.

Sponsored Research - None



920371

VARIABILITY AMONGST T-PIECE RESUSCITATION CIRCUITS: ARE ALL CIRCUITS CREATED EQUAL?

Kathleen Deakins, 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 aren't typically interchanged with one another or tested on other resuscitator types. Frequently the devices are set-up prior to patient used by ancillary support staff. The purpose of this study was to determine if variability in PIP and PEEP existed when interchanging proprietary circuits with other resuscitators. Methods Four samples of each brand of t-piece circuits were attached to an Infant Star test lung (compliance 2mL/cmH20), the GE Panda Infant Resuscitator (GE Healthcare, Finland), Neopuff (Fisher and Paykel Auckland NZ) and NeoPIP (Neoforce Group Ivyland, PA) and tested at suggested inspiratory flows of 8LPM, 10LPM and 15LPM 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) 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 caregivers prior to clinical use.

Sponsored Research - None

T-piece Circuit Pressures (recorded in cm H2O)

T-piece Resuscitator	Circuit	PIP	PEEP
GE	Neopuff	48 +/-0.5	15+/-7.4
	Neopeep	49 +/-0	13+/-7.3
	GE	46+/-0.6	5+/-1.0
Neopuff	Neopuff	67.3+/8.1	10.6+/5.7
	Neopeep	72+/-0.5	8.7+/-4.6
	GE	54.9+/14.3	5.5+/-3.1
NeoPIP	Neopuff	95.3+/-4.6	15.3+/-8.3
	Neopeep	98+/-4.2	11.5+/-6.2
	GE	86+/-5.4	7.1+/-3.8

919812

MEASUREMENT OF PEEP ON MANUAL VENTILATION SYSTEMS.

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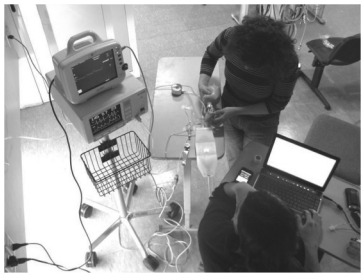
Introduction:Manual ventilatory support (MVS) is done by all members of the health care team in Critical Care Units. The ability of these devices to generate and maintain PEEP is still an open question Methods: We measured 3 devices: Adult self inflate bag (ASIB) (Hudson RCI. Durham. NC); Adult self inflatable bag and PEEP valve, (ASIBP) (Hudson RCI. Durham.NC); and Flow inflated bag, FIB (Vital Signa.Totowa,NJ). All connected 10 lpm O2 and a manometer (DHD Wampsville,NY) to give feedback to the operator. MIP, PEEP and RR were recorded and analyzed with a proximal pressure/flow sensor Varflex Bicore CP 100 blinded. Shape of the curve was was measured with a pressure monitor GE Dash 3000, blinded. 3 independent, well-trained RT's were asked to generate MVS with MIP 30 cmH20 and keep PEEP of 0,5,10,15&20 cmH2O stepwise with an initial RR of 15 bpm, then 30 bpm for 1 minute for each PEEP. Adult test lung was ventilated (Siemens-Elema AB,Solna,Sweden) compliance 20 mL/cmH20, resistance 12 cmH20. We recorded PEEP, shape of curve, MIP & RR. Shape was classified: Deacelerant, if PEEP not maintained; OK, if PEEP maintained and keep plateau; and Keeping, PEEP remains without plateau Results: ASIB with 15 bpm generated a MIP of 30,87(±2,08) cmH2O and 23,6(±1,27) bpm. With 30 bpm, MIP 30,53(±3,04) cmH20 and 31,93(±5,89) bpm. PEEP generated were 1,88(±0,47) it was OK; 3,68(±0.02); 5,08(±0,459); 7,83(±0,14) and 9,73(±0,71) cmH20, deacelerant. With ASIBP, 15 bpm was 13,67(±1,87) bpm, MIP 31,07(0,67) cmH20. RR 30 bpm, 24,13(±1,93) bpm and MIP 31,67(±1,61) cmH20. PEEP obtained were 1,65(±0,4), OK; 4.03(± 0,66), deacelerant; 9,65(±1,49), OK; 13,3(±0,94) and 18,17(±1,04), deacelerant. With FIB, 15 bpm, RR was 20,27(±3,83) bpm, MIP 29,27(2,02) cmH20. RR of 30 bpm, RR 29,53(±2,47) bpm, MIP 30,2(±3,48) cmH20. PEEP was 1,35(±0,21); 4,03(±0,19); 9,8(±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. ASIBP 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 has the risk of increase RR and the handling requires a longer training. Use of ASIBP or FIB are reliable to maintain PEEP. Clinical studies are need

Sponsored Research - None



920998

ETCO2 MONITORING IN THE POST-OPERATIVE SURGICAL PATIENT.

Cory 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. 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 monitors 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% Mean age = 66.50 Mean screening tool score = 3.22 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 (episodes > 10 minutes apart from one another) Total opioid reversal agents (Narcan) used = 0 Total Critical Care Assessment Team interventions = 0 Conclusions: 28% of patients scored using the pre-screening tool met criteria for developing respiratory depression post-operatively. 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 96mmHg 16 to 24 hours post-operatively on one patient was noted.

Sponsored Research - None

Pre-Operative Screening Tool

Score the patient based on the scale below. A score of "5 or higher" indicates a "positive" screen. (These patients are high-risk for Respiratory Depression/Obstructive Sleep Apnea)

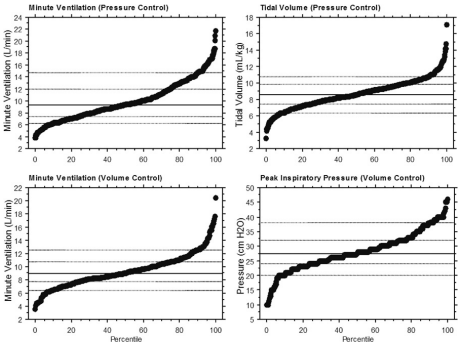
908748

REFERENCE DATA FOR DETERMINING VENTILATOR ALARM LIMITS.

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

BACKGROUND: Few studies are available regarding ventilator alarm settings and no rational approach to developing intelligent alarms has been described. A review of the literature revealed one study that reports 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 (MV), 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. Pressure support was not included. Measured MV was recorded for all modes. Peak inspiratory pressure (PIP) was recorded for VC. Tidal volume was recorded for PC. Patients intubated for less than one day were excluded. **RESULTS:** Data sets for 1,243 ventilator checks were recorded, 882 in pressure control and 361 in volume control. Data are expressed as (mean, ± standard deviation). PIP was 28 ± 7 cm H_2O. TV was 8.6 ± 2.2 mL/kg and mean TV was the same for VC. MV (L/min) was overall 9.6 ± 3.0: for PC 9.7 ± 3.2: for VC 9.3 ± 2.5. The Figure shows percentile plots with horizontal lines at 10th, 25th, 50th, 75th, and 90th percentiles. **CONCLUSIONS:** The main finding of this study is that actual values for minute ventilation, peak inspiratory pressure and tidal volume are highly variable, with significant portions at extreme values. It also suggested that surveillance of TV used in both PC and VC may be warranted. Current textbooks recommend fixed values for some alarm limits (e.g., ± 10 cm H2O for PIP) and fixed proportions for others (e.g. ± 25% for MV and TV). However our data would suggest that these limits may reduce safety for some extreme values while increasing nuisance events for other values. An alternative approach might be to reference the alarm limits to the current value of the parameter such that extreme values have tighter limits. Further research is needed to identify optimization algorithms (i.e., minimize both harmful and nuisance events) for intelligent targeting schemes to automatically set alarms during mechanical ventilation.

Sponsored Research - None



920783

USE OF CAPNOGRAPHY TO ASSURE AIRWAY PATENCY DURING INHALED VASODILATOR DELIVERY WITH NITRIC OXIDE FOR VASOREACTIVITY TESTING IN THE CARDIAC CATHERIZATION LAB.

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Background: Cardiovascular labs (CVL) perform Vasoreactivity (VR) tests with inhaled nitric oxide (NO) and not IV nifetipine. IV pumps monitor vasodilator flow disruption. No routine method has assured airway patency for NO delivery to the lower airways required to elicit a response. With moderate sedation, hypoventilation, partial airway obstruction and apneas occur as patients breathe abnormally. This occurs by observation evidence and oximetry. With abnormal breathing, airway patency is uncertain; a VR response may not be verified, wasting expensive NO. Methods: EtCO2 monitoring via nasal interface sidestream device was used to alert for abnormal breathing conditions. RT used alarm events to improve airway status and breathing with verbal or tactile stimulation. Low RR was set to 7. Low and high EtCO2 was set to 30 and 50mmHg. Delivery of 40 ppm NO for 5 minutes occurred when ordered. Supplemental 02 flowrates needed were supplied via separate nasal cannula. Average sedation dose for comfort was 60 mg for fentanyl and 3 mg for midazolam. Results: RT used capnography to monitor 17 patients for VR testing in the CVL. NO delivery was supplied to those who had increased mean PA and qualifying wedge pressures. NO delivery assurance was monitored by RT observing normal and abnormal capnography waveforms. Limit violations for RR and EtCO2 alerted RT to stimulate drowsy patients to increase breathing efforts. If patients given 40 ppm NO for 5 minutes did not produce a 10 torr decrease in mean PA pressure, they were often given 80 ppm NO for 5 minutes. Capnograms were observed with EtCO2 and RR values compared to their baseline values. All cases exhibited abnormal capnograms during testing. The average RR drop was 9 bpm or 48%. The average EtCO2 drop was 6 mmHg or 19% and increases averaged 10%. Hypoventilation, bradypnea, partial obstructions, or apneas were abnormal breathing patterns observed or recorded in all cases. Alarm conditions permitted RT the ability to predict partial obstructions degrading to apneas from complete obstructions, allowing RT stimulation of the patient to improve breathing effort. Conclusion: The team knows capnography is more accurate and faster in hypoventilation recognition than oximetry. Capnography can assure breathing variance for airway patency with inhaled NO. Capnography in the CVL is the facility standard method for assurance of airway patency before and after delivery of inhaled NO during VR testing.
Sponsored Research - None

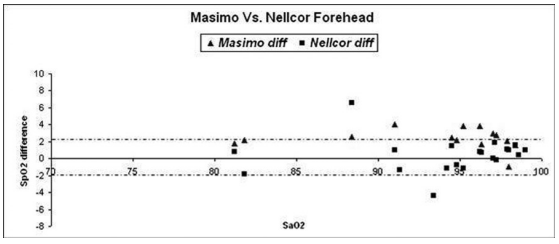
Vasoreactivity Testing with Sedation - EtCO2 and RR data

920386

PULSE OXIMETRY EVALUATION IN HYPOPERFUSED ICU PATIENTS.

Edgar Delgado, Mark Cohen-Melamed, Ray Tuttle; Respiratory Care, UPMC Presbyterian Shadyside, Pittsburgh, PA

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. Leading oximeters (Masimo Radical 7 and Nellcor OxiMax N-600), were evaluated in our ICU's to determine their response in hypoperfused patients. Method: Pt criteria established as mean arterial pressure < 60 mmHg and/or inability to capture a signal or unreliable signal from our standard pulse oximetry technology (Phillips, Inc). 20 patients were evaluated with capillary refill >3 Sec. Digit sensors were placed as per manufacturer recommendations. Finger 'jackets' utilized to prevent crosstalk. Initial forehead sensor placement rotated between manufacturers from patient to patient to eliminate bias and a minimum of 5 min was allowed for signal stabilization. ABG sample was then drawn with co-oximetry analysis as per the standard of care to evaluate oxygenation and correlation with pulse oximeters. Simultaneously, as the ABG was drawn, readings from pulse oximeters were recorded by a separate therapist to ensure accuracy. Immediately after acquisition of the ABG, the forehead sensor was switched to the other manufacturer and then signals were recorded. Results: In 20 patients where standard technology was unable to pick up a signal, the newer technology with forehead monitoring capability was able to reliably obtain SpO2 readings on 80% of the patients with the Nellcor vs. 25% with Masimo (within + 2 SaO2 points)(See Bland-Altman plot). As per Masimo recommendation, SpO2 readings with PI (perfusion index) of < 0.25 are unreliable/questionable, therefore, they were excluded. In comparison, Nellcor results were 20% more accurate than Masimo. Conclusion: Newer digit technology was superior to present technology, but not as accurate as forehead sensing technology. Forehead technology is clearly superior to present technology. Nellcor OxiMax Forehead was more accurate than Masimo Radical 7 Forehead. Nellcor results had more points closer to the gold standard (ABG) as compare to Masimo. Clinical implication: Maximum sensitivity needed to pick up a signal in our pts. During the evaluation as we swapped forehead sensors between manufacturers, we noted that the Masimo continued to display readings when the sensor was off the patient laying on the sheet or pillow.
Sponsored Research - None



920915

BREATH-BY-BREATH UPDATE OF PULMONARY DEAD SPACE FRACTION MEASUREMENT.

Lara Brewer, Matthias Görges, Joseph Orr; Bioengineering, University of Utah, Salt Lake City, UT

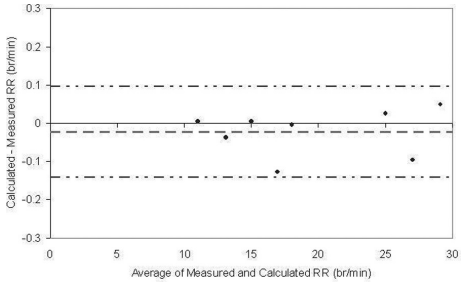
Background: The ratio of physiologic dead space (Vd) to tidal volume (Vt), Vd/Vt, has been identified as a pulmonary-specific predictor of mortality for patients with early Acute Respiratory Distress Syndrome. Vd/Vt is calculated using the Bohr-Enghoff equation: $Vd/Vt = (PaCO_2-PeCO_2)/PaCO_2$, where $PaCO_2$ is arterial partial pressure of CO_2 and $PeCO_2$ is the mixed expired CO_2. The two components of Vd are airway dead space (Vdaw) and alveolar dead space (Vdalv). When Vt is altered, the measured Vd/Vt changes the ratio of airway dead space to Vt, which alters $PeCO_2$. However, it is not likely the fraction of unperfused alveoli, termed alveolar dead space fraction (Vdalv/Vtalv), changes when tidal volume is adjusted. It may be possible to update Vd/Vt and Vdalv calculations based on each newly measured Vt as long as lung perfusion status has not changed significantly. The first aim of this study was to compare the changes measured in Vd/Vt and Vdalv/Vtalv subsequent to a change in Vt. The second aim was to test whether Vd/Vt could be accurately updated with each Vt. Methods: Five swine (30-33.8 kg) were ventilated with FiO_2 of > 0.5, Vt of 12 mL/kg, and I:E time ratio of 1:2; RR was adjusted to maintain $etCO_2$ of 35-40 mmHg. An arterial cannula provided continuous BP and periodic ABG draws. The NM3 volumetric capnometry monitor (Philips Respironics, Wallingford, CT) recorded $PeCO_2$, Vdalv, Vtalv, and Vd/Vt. Two Vt settings were used. Each time the Vt was altered, RR was adjusted to maintain the original alveolar minute ventilation. Stabilization was allowed for at least an hour, followed by ABG draw. Breath-by-breath updates to Vd/Vt were calculated as: $Vd/Vt = (Vdalv_{old} + Vdaw)/Vt$, where $Vdalv_{old} = (Vdalv/Vtalv)_{old} * Vtalv_{current}$. $Vdalv/Vtalv_{old}$ was calculated using original $PaCO_2$. Results: Subsequent to Vt reduction, ABG-based Vd/Vt increased by 0.1 ± 0.1 (n=9). Vdalv/Vtalv increased slightly by 0.008 ± 0.037. Linear regression analysis of the breath-by-breath Vd/Vt and the ABG-based Vd/Vt after the Vt reduction gave r^2 of 0.88. The difference between the two measurements was 0.003 ± 0.028 (0.48% ± 5.46%). Conclusions: As expected, a change in Vt led to observed changes in Vd/Vt but not to significant changes in Vdalv/Vtalv. This is because without gross disturbances in pulmonary perfusion, the main determinant of the changes in Vd/Vt is Vt. Updating the displayed Vd/Vt based on current Vt and Vdaw may be preferable to fixing the value until the next ABG draw.
Sponsored Research - Philips-Respironics

903695

PATIENT-SPECIFIC CALCULATION OF INITIAL RESPIRATORY RATE SETTING.

Lara Brewer, Joseph Orr; 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 (7.3-7.45) while avoiding $PaCO_2$ lower than 25 mmHg. It should be possible to estimate an initial RR that is close to the ventilation requirements of the patient without needing to wait for several arterial blood gas (ABG) panels to be run. Such an estimate would be based on inputs of set Vt, directly measured CO_2 excretion (VCO_2), modeled estimate of metabolic VCO_2, pulmonary dead space fraction(Vd/Vt), airway dead space, current $PaCO_2$ from ABG, and desired $PaCO_2$. The inputs would be analyzed to calculate the RR required for delivery of sufficient alveolar minute volume to support excretion of the metabolically produced CO_2 and to reach the target $PaCO_2$. Methods: A simple set of equations was developed to take inputs related to a patient's metabolism, $PaCO_2$, Vd/Vt, and recommended Vt and from those parameters, calculate a suggested RR. In an assessment of the equations in mechanically ventilated swine, the subject-specific, measured input parameters were used to calculate the RR needed to eliminate the measured VCO_2 at the given tidal volume during a period of stabilization. The calculated RR was compared to the monitored RR. After a change in Vt was made and 60 minutes had been allowed for stabilization, a second ABG was sampled and the RR was again calculated. Calculated and monitored RR were compared for each measurement pair. Results: The RR calculation was in good agreement with the monitored rate. The calculated RR differed from the monitored rate by mean SD of -0.02 ± 0.06 br/min (-0.12 ± 0.3%) and r^2 was 0.99 (n=8). Conclusions: Accurate selection of initial RR based on patient-specific ventilation, metabolism and pulmonary dead space parameters appears possible. When small tidal volumes are selected, a large percentage of the Vt is lost to airway deadspace, such that minute ventilation must be increased compared to large Vt ventilation in order to maintain the same effective alveolar ventilation. Future work should be done *in vivo* to compare the calculated RR with the RR empirically found from multiple ABG samples during ARDSnet ventilation adjustment. The model could also be expanded for cases where large pulmonary shunt is present. An interesting approach for future research would be to target a specific pH in addition to or instead of the target $PaCO_2$.
Sponsored Research - Philips-Respironics



903698

INTEGRATED PULMONARY INDEX STABILITY IN HEALTHY ADULTS UNDER CHANGING CONDITIONS.

Jonathan B. Waugh[1], David L. Vines[2], Donna D. Gardner[3], Richard B. Wettstein[3]; [1]Clinical and Diagnostic Sciences, University of Alabama at Birmingham, Birmingham, AL; [2]Department of Respiratory Care, Rush University, Chicago, IL; [3]Department 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 (SpO_2), heart rate (HR), end-tidal CO_2 ($EtCO_2$), 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. $EtCO_2$ 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 $EtCO_2$ 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 $EtCO_2$, RR, and SpO_2 were associated with increases in IPI. A standard deviation (SD) increase in $EtCO_2$ 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 SpO_2 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 $EtCO_2$, RR, and SpO_2. 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

Statistic	Gas Mixture [Air vs. Heliox]	Delivered Flow Rate [0 vs. 15 L/min]	Mouth Position [Open vs. Closed]
Difference Estimate	-0.010	0.088	-0.062
Standard Error	0.121	0.124	0.109
p-value	0.938	0.482	0.573

909919

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 questions was used in the statistical analysis. Four major strategies used by both RN and RT leaders emerged from the survey and interviews. Conclusions: From the research results it was concluded, that the best leadership practices in interdisciplinary communication between Registered Nurses and Respiratory Therapists are to: Provide Opportunities for Direct Interaction, Provide Training and Education,Set Clear Expectations,and Create and Support a Healthy Work Environment.

Sponsored Research - None

Survey Responses by Profession

903587

DEVELOPMENT AND IMPLEMENTATION OF AN ELECTRONIC MEDICAL RECORD CHART AUDIT PROCESS.

Russell E. Graham, Michael Bernstein, Roberta Melton, Adrianne 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 to ensure compliance (RC.01.04.01, RC.02.01.01, PC.01.02.10, PC.01.03.01, and PC.02.03.04). Traditional audits usually involve the use of a hand written 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 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 within the 10 evaluated areas. A threshold of 85% was assigned to all evaluated areas, with 5 of 10 (50%) of the scored areas below 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 7/10 (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

910069

RAPID RESPONSE REVISITED – A CONTINUED SUCCESS STORY?

Russell E. Graham, Bob Herrington, Adam Mullaly, 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) presented 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 it in 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 makeup varies 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

Sponsored Research - None

Cumlative Rapid Response Data, by Year

Year	2005	2006	2007	2008	2009
RRT Calls (n)		480	998	1041	1124
Transfer to HLC (%)		66%	60%	60%	62%
Floor Codes	90	56	51	57	43

910411

"THE RELATIONSHIP OF EMPLOYEE PRODUCTIVITY TO BILLING UNITS IN A RESPIRATORY CARE DEPARTMENT OF AN ONCOLOGICAL ACADEMIC CENTER"

Clarence Finch, Hollie Lampton, 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 one of 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 ($p > .010$). 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 ($p > .050$) between productivity, 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 needed to find prediction factors for ICU and night shift employees.

Sponsored Research - None

921022

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

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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 affectively using their respiratory education. At least 70% of the therapists with protocols believe that they were 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. Conclusions: 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

888140

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

906792

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

Linda Birnbaum, Valerie Olson, Andrew McDonough, Raju Parasher; 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 healthcare 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 the 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. Given the small sample size and geographical location, extrapolation of the results should be exercised with caution.

Sponsored Research - None

908215

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 participants. RESULTS: The following activities took place: RCPs 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 show support for 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 develop a relationship 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 field of respiratory therapy. 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

920396

USING HME'S TO REDUCE THE COST OF MECHANICALLY VENTILATION.

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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.2 Our institution had used ventilators 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.2 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 3,100 days of mechanical ventilation. The program was started on January 1st, 2009, with a cost savings goal of $14,000. The actual cost saving for the total year was evaluated in January 2010. While mechanically ventilated volume was a significant above budget for 2009, 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 system is cost effective. As with any cost saving proposal or change in therapy procedure it is very important to monitor outcomes. Although, we did not meet our goal, we did have a significant cost savings and maintain quality of care.

Sponsored Research - None

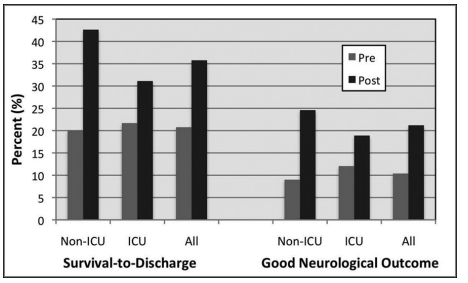
916003

RAPID RESPONSE:ARE WE MAKING A DIFFERENCE.

Suzan Herzig, Eugene De Guzman, Daniel Davis; Respiratory Care, UCSD Medical Center, San Diego, CA

BACKGROUND: In 2004, the Institute for Healthcare Improvement (IHI) initiated a patient safety plan called the "100,000 Lives Campaign. This plan included the implementation of a "Rapid Response Team"(RRT):The intention was to ensure positive patient outcomes by fostering collaboration between nurses, respiratory therapists and physicians in the care of patients through assessment, communication, immediate interventions, and support. UCSD started with a "front loaded" rapid response program focusing on detection rather than response. Charge nurses as well as critical care nurses are trained. This pilot program transitioned into a permanent team in 2007 and staff is trained regularly on rapid response concepts. We sought to evaluate and report patient outcomes of implementing a RRT. METHOD: Data was extracted from the medical centers Electronic Quality Variance Report (EQVR) system in which the circumstances and outcomes of all code blues and rapid responses are captured. We compared the number of code blue events and outcomes prior to having a RRT program in place in contrast to post program implementation. RESULTS: Chief complaint categories, in order of occurrences, were Respiratory, Cardiovascular, Altered LOC, Other, Fall, and lastly Intuition. Before the initiation of the RRT, the number of non-ICU arrest related deaths was 2.14 per 1000 patients discharged. In 2009 the number fell to O.34.The number of ICU arrest related deaths pre RRT changed slightly from 1.47 per 1000 patients discharged to 1.5. Baseline Cardiopulmonary arrests in non-ICU patients were 2.7 and in the ICU were 1.0 per 1000 patients discharged. Results in 2009 respectively were 0.8 and 2. For non ICU and ICU patients combined, patient survival to discharge was initially 21% and increased to 36% post RRT implementation. Post cardiac arrest survival to discharge with good neurological outcomes improved from 11% to 22%. CONCLUSIONS: With this comprehensive evidence, we can conclude that Rapid Response teams provide timely interventions resulting in fewer transitions to cardiac arrest in non ICU settings and improved clinical outcomes and survival to discharge. Respiratory Care Practitioners serve a valued role in such teams and contribute to improved outcomes.

Sponsored Research - None



916761

CHANGING AEROSOLIZED ANTIBIOTIC ADMINISTRATION TIMES REDUCES PATIENTS STAY.

Richard P. Bennett; Respiratory Care, Cleveland Clinic Foundation, Cleveland, OH

Madhu Sasidhar, M.D., Richard P. Bennett, B.S., R.R.T., Russ Crooks, R.R.T. - Respiratory Care Services Pulmonary and Critical Care Medicine, Cleveland Clinic Foundation, Cleveland, Ohio Background: To provide more hands on time for lead dayshift Respiratory Therapist to wean patients off mechanical ventilation. Our goal in changing administration times of aerosolized antibiotics was to reduce a time consuming task and start daily patient weaning earlier. Methods: We selected 20 patients; 10 patients immediately prior to change and 10 patients directly after change in administration times. All patients selected were post op bilateral lung transplant patients on at least 1 aerosolized antibiotic (Amphoterican B, Colistin, or Tobramycin) BID. All patients were yet to be weaned off mechanical ventilation. Results: Patients, in the prior to change group, recieved their aerosolized antibiotics between 0730 to 0800 hours. These patients averaged 53 days in the RESCU unit before discharge. The patients, in the after change group, recieved their aerosolized antibiotics between 0400 to 0430 hours. These patients averaged 26 days before discharge from the RESCU unit. Conclusion: Earlier start in weaning patients off mechanical ventilation by reducing time consuming tasks cut patient length of stay by 50%. Overall results have increased both patient and practitioner satisfaction. Earlier treatment times along with earlier start to wean times reduced overall costs to both patient and hospital.

Sponsored Research - None

920933

IMPLEMENTING A CLINICAL SERVICE IMPROVEMENT TEAM TO ENSURE BEST PRACTICE.

Garner G. Faulkner, Richard Ford, Jan Phillips-Clar, Deneen LeBlanc, Susan Herzig, Donald Pearman, Elsie Collado-Koman, Marcia Teal; Respiratory Care, UC San Diego Health System, San Diego, CA

BACKGROUND: In order to maintain a high functioning team, provide exceptional care, and adopt best practices through rapid cycle performance improvement processes, we often face many challenges. These challenges are often inclusive of coordinating the efforts of many, communicating what needs to be done, and overcoming the natural resistance to change. To aide in changing current practice and ensuring the entire team is engaged and well coordinated, we developed a Clinical Service Improvement Team (CSI). METHOD: We recognized key stakeholders responsible for the implementation or change of current clinical practice. These key stakeholders were inclusive of leadership responsible for policy/protocol development, education/training, front line supervisors, information system documentation, and those accountable for regulatory compliance and budget. A weekly meeting was scheduled in coordination with our Medical Directors meeting. An on line mechanism, accessible to all stakeholders, was developed in order to identify issues, capture discussion, identify action steps, target timelines, assign responsibility, and track status. RESULTS: The group has met weekly and the structured mechanism to capture ideas and implement change has enabled us to respond rapidly and ensure all concerns are considered. Discussion and action steps are also deferred for additional review by the Medical Director, another department/hospital committee, or our Partner in Leaders group which is a shared governance team within the department. Over 100 changes have been addressed in the first six month period. Examples include: implementing a method to address bagging our patients on Bleomycin therapy, implementing RT training for A-line draws, begin process to implement the use of point-of-care ABG analysis, adjust policy on APRV to meet current practices, and formalize an action plan to address equipment failure reporting. CONCLUSION: The creation of the CSI team has aided in the communication between our key stakeholders and effectively improved our clinical practice at UC San Diego. The existence of the team ensures that those factors that can sabotage, change or create resistance to change are minimized.

Sponsored Research - None

921175

COMPARISON OF METHODS FOR MEDICATION STORAGE AND TRANSPORT BY RESPIRATORY THERAPISTS IN AN 800 BED MEDICAL CENTER.

Daniel J. Grady, John H. Riggs, Terrence F. Smith, Gregory Campbell, Harvey Mitchell, Jordan Erickson, Jody Miller; Respiratory Care, Mission Health System, Asheville, NC

Background: The US Pharmacopeia and pharmaceutical manufacturers publish temperature storage ranges for inhaled medications. Regulatory requirements have prohibited Respiratory Therapists from carrying medications in their lab coat pocket or fanny packs due to excessive temperatures which may cause drug breakdown. **Hypothesis**: We hypothesize that there is no significant difference in temperature between the transported medications and medication stored in automated machines. **Setting**: This study was performed in an 800 bed, acute care hospital system. **Methods**: The temperature was measured in a total of 62 samples (n= 62) of unit-dose, normal saline medications. The mean temperature was compared in 2 groups: Group 1: saline stored in automated Pyxis machines was compared with; Group 2: saline medications transported by Respiratory Therapists. A total of 31 (n=31) saline samples were measured for temperature in each group. Method of transport by Respiratory Therapists included scrub pocket, lab coat pocket, and fanny pack. **Results:** No statistically significant difference in temperature exists between medication stored in automated Pyxis machines and medication transported by Respiratory Therapists (mean difference in temperature was less than one degree Centigrade and equals –0.8 degrees, two-sample t test (P-value = 0.388). Both the Respiratory Therapist method of transport and the automated storage machines were similar in performance for keeping saline within recommended medication temperature storage ranges. **Major Conclusions**: Because of the high cost associated with the inefficient process of obtaining medications; one at a time, from an automated storage machine in between patient visits; very significant cost reductions can be achieved by changing the process for medication retrieval. Instead of retrieving medications, one at a time, from a storage machine; our study indicates that multiple medications may be retrieved and transported without a significant difference in temperature of the medication. In the Mission Health System alone, this change in practice for medication retrieval will result in a 20% improvement in productivity for this procedure and cost savings of approximately $158,000 annually.

Sponsored Research - None

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

Storage Method	N	Mean Temp (F)	Standard Deviation
Pyxis Machine	31	76.4	3.06
Therapist	31	77.2	3.64

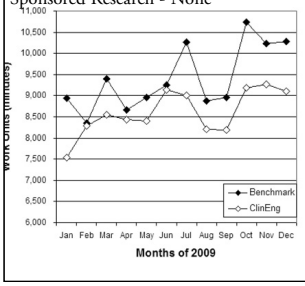
836320

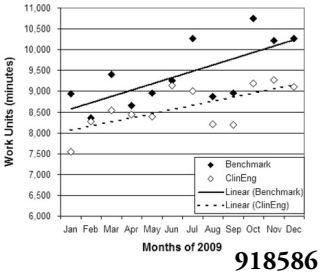
EVALUATION OF AARC BENCHMARKING METRIC VALIDITY.

Douglas Orens, Robert L. Chatburn; 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 at 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 calcul

Sponsored Research - None





918586

IMPROVING RESPONSE TIME FOR RESPIRATORY CARE DISASTER PREPARDNESS PLAN.

Jenifer 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. Methods: We determined that over 70% of our staff had text enabled cell phone plans. 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 been responsive to this form of communication. Conclusion: Developing 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 employees the day off. The few remaining staff not on cell phone text programs require traditional calling.

Sponsored Research - None

918970

IMPLEMENTATION OF A PATIENT DRIVEN PROTOCOL IN THE ERA OF COMPUTERIZED PHYSICIAN ORDER ENTRY (CPOE).

Dana Stauffer, James Rudegeair; 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)=.672, p=0.5172). 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

919877

THE VALUE OF A CAPITATED PULSE OXIMETRY PROGRAM.

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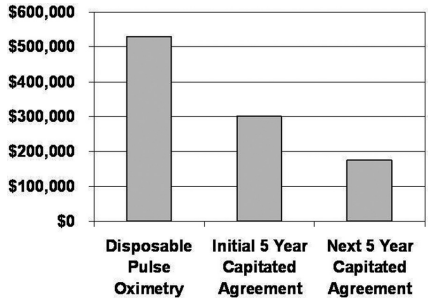
BACKGROUND: Disposable patient use items can cause a financial burden on healthcare systems, especially if costs increase due to increased volume of patients or increased disposal of an item multiple times for the same patient. We sought a cost containment program for pulse oximetry in our hospitals. 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 I trauma center, level III NICU teaching hospital and 241 bed community hospital. After clinical and financial evaluations, the multidisciplinary group choose a capitated, reusable pulse oximetry program (Dixtal 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 sensors 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 years cost saving will be an additional $1,774,830. See chart for annual costs. CONCLUSION: We demonstrate that a large 2 hospital system can provide pulse oximetry with a capitated program yielding large cost savings, fixed yearly costs and reduced items being disposed in the garbage.

Sponsored Research - None

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



920094

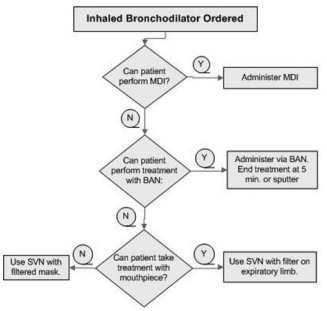
DECREASING RCP EXPOSURE TO POTENCIALLY HARMFUL AEROSOL PARTICLES.

Susan Rinaldo-Gallo, Ricky 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 medicated 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 41.0%. 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. There were too many variables such as H1H1 exposure outside of work and culturing employees was not feasible. 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

BD Decision Tree



903282

RESTRUCTURE OF HIRING PROCESS TO INCREASE RETENTION RATES.

Carol Mihailuk, Jan E. Phillips-clar, Elsie Collado-Koman; Respirtory 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. METHOD: 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's 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 applicant 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 and 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 restructure 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 TRACHESTOMY TUBE-ACQUIRED POST INTUBATION TRACHEO-ESOPHAGEAL FISTULA.

Shao Yu Li, Jen-Yu Hung, Jong Rung Tsai; 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 release the cuff pressure, significant air drainage from the nasogastric tube was found. Low inhalation 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 to bypass the T-E fistula. 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

ECMO: A NOVEL TREATMENT FOR TRACHEAL DEHISCENCE AFTER SLIDE TRACHEOPLASTY.

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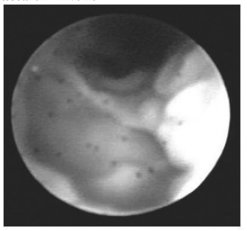
Introduction: Long segment congenital tracheal stenosis is characterized by complete tracheal rings. Surgical intervention is required during infancy to optimize outcomes. Complications from surgery can include mucus plugging, airway trauma, dehiscence at the surgical site, and death. Case Summary A 5 week with long segment congenital tracheal stenosis (LSCTS) underwent a slide tracheoplasty. She failed extubation on post op day (POD) 2, she was reintubated. A 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 healing. She was reintubated and placed on low ventilator settings. On POD 14, she was transitioned to HFOV, decannulated 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 LSCTS options include tracheal autograft, tracheal resection, or slide tracheoplasty. Surgeons "leak test" the tracheal anastomosis at 35cm H2O. During manual ventilation, there may have been periods when ventilation pressures that exceeded 35 cm H2O. Tracheal dehiscence is rare and life threatening. Options were limited for this patient, and ECMO allowed her trachea to heal. Routine use of ECMO in tracheal surgery has been described. ECMO facilitated airway healing. We went a step further and extubated her once she was on ECMO. Isolated reports exist of pediatric and adult patients being extubated on ECMO. Our report is the first where such a strategy was utilized following slide tracheoplasty. Our lung recruitment strategy involved the use of conventional mechanical ventilator followed by HFOV. After the patient was decannulated we continued using a conservative ventilation strategy, keeping her on HFOV for 5 days before transitioning to conventional ventilation.

Sponsored Research - None



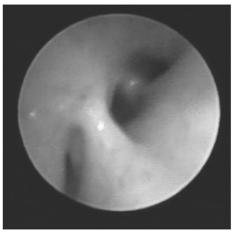


Figure on Left: Tracheal Wall Erosion on POD 5
Figure on Right: Complete Airway Healing on POD 27

884941

TRACHEAL AGENESIS.

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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" Floyyd's". Our patient belongs to type II. The prognosis is not much different, it depends on airway achievement and maintain. Case Summary: A 32 day-old new born male was transferred to KMU. When he was born, there was no meconium stain; however, poor activity, cyanosis, and delay of initial crying were noted. Ambulatory bagging was given, an endotracheal tube was inserted, and chest compression was performed due to bradycardia (<60). Under these circumstances, the infant 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 crackles. 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 Ampictin/Gentamicin or ETT with ventilator support. In the end, we used NG insertion. With a bronchoscope, we found that the tracheal atresia with T-E fistula was impressed; therefore, NPO with TPN. We confirmed the tracheal agenesis by 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

A CASE STUDY: USE OF HIGH FLOW NASAL AND VIBRATING MESH NEBULIZER DURING ASTHMA EXACERBATION ON A PREGNANT WOMAN.

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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 demonsrated3,4. 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 aerataion with expiratory 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 (Aeroneb 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 incease 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

920208

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

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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. Summary: A 43 year-old male presented to the emergency department in severe respiratory distress with stridor, sternal and intercostals retractions. He had extensive swelling to the face, throat and tongue. Patient was taken emergently to a surgical suite where multiple attempt to both nasally and orally intubate failed. Patient suffered cardiorespiratory arrest and an emergent tracheostomy was performed to which patient responded to in addition to cardiac medications. He then underwent dental extractions and drainage of an abscess of 100 mL of pus. Post-operatively, patient developed hypoxia with P/F ratio of 71 and chest radiograph revealed extensive airspace opacification consistent with pulmonary edema. Patient was diagnosed with acute lung injury secondary to NPPE. Patient was treated with mechanical ventilation and high level PEEP was titrated to maintain adequate oxygenation. Serial chest radiograph showed clearing of infiltrates within 48 hours of insult. Patient was weaned and liberated from mechanical ventilation on post-op day six. Discussion: NPPE has a low prevalence (<0.1%) and is typically seen in post-extubation laryngospasm, but other mechanical obstructions include hanging, laryngeal tumor, biting of endotracheal tube, croup and epiglottis. The primary mechanism postulated is that excessive negative inspiratory pressure leads to increased venous return to the right side of the heart with a concomitant increase in hydrostatic pulmonary capillary pressure. This combination favors the shift of fluid into the alveolar space. Treatment includes relief of the airway obstruction, oxygen therapy and in severe cases, mechanical ventilation and high levels of PEEP.

Sponsored Research - None

832117

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

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Introduction: The prevalence of acquired Pulmonary Alveolar Proteinosis (PAP) has been estimated to be 0.37 per 100,000 persons. Excessive thick granular phospholipoproteinaceous 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 transbronchial 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 degassed 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 pulmonogist utilized 24 liters (L) of normal saline with a return of 23.9L. The left lung lavage was completed the following week. 28L were instilled with a return of 29.4L. 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.

Sponsored Research - None

919738

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

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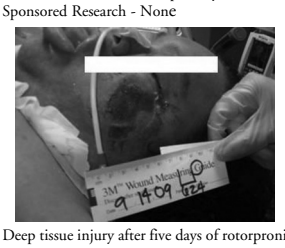
Background: While performing QI of Respiratory Care device related issues in UMCB-ICU, we encountered problems such as, redness, breakdown, and pressure ulcers due to airway devices. Interventional care steps began with RT Skin Champions and WOCN to develop best practice for skin preparation processes addressing the issues of skin breakdown, redness, and pressure ulcers relating to all RT devices. Further work was done regarding rotoprone 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 rotoprone 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 UMCB 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 #5, 9-14-09, a deep tissue 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 rotoprone patients following the initial case study patient. Analysis results shared 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 of Hospitals. Wound Assessment /Care site built to include Respiratory Care as a Discipline Managing Wound Assessment and Wound Care. Documentation on the computer site will be multidisciplinary to include Nursing, Physical Therapy, Occupational Therapy, Wound Ostomy Continence Nurse and Respiratory Care.

Sponsored Research - None



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

877860

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

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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 care at our institution. Her SpO2 was in the 60's and CXR showed severe bilateral pneumonia. She received oxygen via .50 Venti-mask 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 inotropic support. She developed persistent bilateral pneumothoraces and was diagnosed with BPF. She remained on ventilatory support for 25 days, and was successfully extubated. Autoimmune vasculitis 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.

Sponsored Research - None

889508

EX-VIVO LUNG PERFUSION AND VENTILATION.

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Introduction: Eighty percent of lungs donated for transplantation are rejected using UNOS criteria. Lungs from marginal donors have been successfully used for transplantation for at least a decade and the concept is gradually gaining acceptance. Closed circuit perfusion of the lung mimics in-vivo conditions. The ventilated lung is perfused with a 15% deoxygenated suspension of red cells in solution. From perfusion circuitry monitors, critical parameters of gas exchange, pulmonary vascular resistance and other variables under normothermic conditions can be measured. A six hour protocol of ventilation and perfusion strategies is performed to resuscitate otherwise discarded lungs for human lung transplantation. Case Summary: Double lungs (donor) from a 71 inch male with COPD were harvested and prepared for transport using the New England Organ Bank (NEOB)protocol. Upon arrival to our institution, they were placed on a sterile field; a "left atrium" was fashioned. Both the left atrium and pulmonary artery were cannulated. The lungs were "de-aired" using retrograde perfusion initially. An 8.5 endotracheal tube was placed and clamped. Once a temperature of 32 degrees Celsius was reached in the perfusion circuit, ventilation of the lungs began using a PB 840. Tidal volumes of 6-8ml/kg, 5cmH2O PEEP, Frequency 7, FiO2 of .21 were protocolized settings. Recruitment maneuvers using 20cmH2O of PEEP for 15 seconds were performed – keeping PAP's < 25mmHg, every hour. The FiO2 was increased ten minutes post recruitment (oxygen challenge), with venous and arterial blood gases drawn for evaluation. For edema prevention, goal LA pressures were 3-5mmHg and PA pressures were 10-15 mmHg. There were lung biopsies performed during the case (1hr, 4hr and 6hrs during perfusion). Peak inspiratory pressure suddenly increased, and suctioning via sterile Ballard was performed around the 4, 4.5, and 5 hour marks, thick yellow secretions were obtained. Discussion: Per MD evaluation, lung function was improved post protocol. The highest PaO2 was obtained at the end of the study. Compliance improved post recruitment (66L/cmH2O-113L/cmH2O). All criteria involved suggested an improvement in lung function.
Sponsored Research - None

Table

Age	< 55
Blood type	ABO blood group compatibility
Chest Radiograph (CXR)	Clear
Oxygenation	PaO2 > 300 mmHg on FiO2 1.0 and PEEP > 5 cmH2O
Smoking Hx	< 20 pack-year smoking history
Chest trauma	Absence of trauma
Sepsis	No aspiration or sepsis
Infection	Gram stain shows sputum free of bacteria, fungus, and significant WBC's

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919717

HIGH FREQUENCY OSCILLATORY VENTILATION RESCUE REFRACTORY HYPOXEMIA IN A PATIENT WITH TRANSFUSION-RELATED ACUTE LUNG INJURY.

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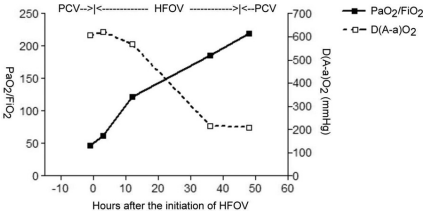
Introduction : Transfusion-related acute lung injury (TRALI) is a rare but life-threatening complication of blood transfusions. Treatment of TRALI is mainly supportive, which includes mechanical ventilation. High frequency oscillatory ventilation (HFOV) is an alternative mechanical ventilation mode for adult patients with acute respiratory distress syndrome (ARDS). We report a case of TRALI who had refractory hypoxemia with conventional mechanical ventilation successfully treated by HFOV. Case Summary : A 32 year-old woman with diabetes mellitus, hypertension and chronic renal insufficiency was admitted due to hematemesis. Because of anemia (hemoglobin: 7.5 g/dL), two units of packed red blood cells (RBC) were transfused without adverse reaction. After six days, another 2 units of packed RBC was transfused to correct anemia (hemoglobin: 7.8 g/dL). Thirty minutes after completion of transfusion, she experienced sweating and severe respiratory distress with hypoxemia. Artery blood gas revealed pH 7.32, PaCO2 36 mm Hg and PaO2 65 mm Hg on simple mask 45% O2. The respiratory distress and hypoxemia did not respond to intravenous furosemide and she was intubated for mechanical ventilation. The chest X-ray revealed bilateral infiltration with acute pulmonary edema. Due to persistent refractory hypoxemia (PaO2 66 mm Hg) after PCV support with FiO2 1.0 and 18 cm H2O PEEP for 12 hours, the ventilator was changed to HFOV (3100B, Sensormedics, Yorba Linda, CA). The initial setting rate was 3.5 Hz. with a mean airway pressure set at 30 cm H2O. The oxygenation improved with HFOV. The PaO2/FiO2 ratio and alveolar-arterial oxygen difference before and after HFOV were shown in Figure 1. Mechanical ventilation was changed to conventional PCV after 2 days of HFOV. She was successfully extubated after 2 weeks of conventional mechanical ventilation. Discussions : Management of TRALI is largely supportive, with more then 70% of patients with TRALI requiring mechanical ventilation. HFOV is characterized by settings of high mean airway pressures with the rapid delivery of small tidal volumes of gas, which improves oxygenation and has been used as a rescue mode of ventilation in severe ARDS. The hypoxemia was effectively corrected by changing to HFOV. In TRALI patients with severe hypoxemia refractory to conventional mechanical ventilation, HFOV is a potential rescue modality to improve oxygenation. Sponsored Research-None



The PaO2/FiO2 ratio and alveolar-arterial oxygen difference (D(A-a)O2) before and after the initiation of high-frequency oscillatory ventilation (HFOV).

905489

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.

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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 (IHCAs) 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 exception of hypothermia. 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 St. Dominic 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 fisher'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 pea were also compared before and after HP-CPR. RESULTS: there were 157 IHCAS in the historical control period. From 2006 to 2010, there were 524 patients treated with HP-CPR with at least 1 IHCA. 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=.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 19/27 (70%) historically. during the control period, the SHD:TP (expressed as %) for patients with VF/VT, as, and pea was 6.8, 7.2, 11.9 with HP-CPR respectively vs 5.1, 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. Survival 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 NEURALLY ADJUSTED VENTILATORY ASSIST TO TREAT A LARGE PULMONARY AIR LEAK: A CASE REPORT.

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Background: Any air leak in the patient-ventilator circuit may cause problems with ventilator triggering. In contrast to traditional pneumatic triggering, neurally adjusted ventilatory assist (NAVA) uses the electrical activity of the diaphragm (edi) to trigger and cycle a patient breath. Case: A 26 year old male with HIV/AIDS was admitted to the ICU with respiratory failure secondary to pneumocystis jirovecii pneumonia. The patient's course was complicated by bilateral pneumothoraces resulting in large air leaks. The air leaks caused false triggering of the ventilator that could be prevented only by making the trigger sensitivity so low that the patient was not able to trigger the ventilator at all. In order to tolerate the settings, the patient required large amounts of sedation (fentanyl at 1800 mcg/hr and midazolam at 20 mg/hr). These difficulties prompted us to proceed with a trial of NAVA utilizing a 16fr Edi catheter. With a NAVA level of 0.6 cm H2O/mv, the patient had an Edi Peak of 15, a respiratory rate of 6-10 breaths/min, and an inspired Vt of 600-650 ml. The exhaled Vt averaged only about 200 ml, which was well less than half the inspired Vt. On these settings, no false triggering was noted, and the patient tolerated a significant decrease in sedation. After 24 hours the patient was weaned to a t-piece CPAP at 7.5 cmH2O. Over the ensuing days, the patient alternated between CPAP and NAVA, with continued weaning of the patient's sedation. Over the following week the air leak subsided and the patient was able to remain on the CPAP valve continuously without an increase in Edi. Discussion: NAVA is a novel mode of ventilation that has the potential to enhance patient synchrony and comfort and reduce the need for sedation. However, there are no randomized, controlled trials of NAVA, and the literature consists of physiological studies involving small numbers of patients. Our experience with the patient presented here suggests that NAVA can be used effectively and safely to mechanically ventilate patients with large air leaks who are unable to be managed with conventional pneumatic triggering. We also found that Edi monitoring during the transition from the ventilator to CPAP and then to a trach collar provided valuable information. The Edi signal allowed the team to estimate the work of breathing and identify impending respiratory failure before there were indications from other physiologic signs.
Sponsored Research - None

918891

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

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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 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 such that the patient was no longer being over-supported via false triggering of the Servo I and also determine settings needed for the patient to tolerate the LTV 1200.

Sponsored Research - None

906231

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

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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 7.23/ PaCO2 169/ PaO2 86/HCO3 68.4. NIV was started with an IPAP 15cmH2O and EPAP 8cm H2O. A follow up blood gas revealed 7.25/146/85. After 36 hours on NIV with the same settings the PaCO2 remained high (145mm) and the patient again presented with a decreased level of consciousness an increased WOB. Heliox was then added to power the ventilator with a total FiO2 0.3. A repeat blood gas revealed 7.38/94/60/58 and the patient's mental status improved along with his WOB. Treatment was continued and twelve hours later a repeat ABG revealed 7.41/73/72/48. The patient was weaned off the NIV and Heliox. Six days later worsened hypercapneia 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 hypercapneia 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.

Sponsored Research - None

918901

THE VALUE OF THE SHIFT/TEAM LEADER IN FACILITATING HOME CARE DISCHARGES.

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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 care 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 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 continuity, coordination and insured the needed equipment is available to the patient. The Shift/Team Leader is best at facilitating this because of their understanding 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, Chassidy 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 (home) or in the medical equipment supplier's office (office). Potential advantages of office instruction include a larger selection of interfaces, an environment free of home distractions, and more therapist face-to-face time. 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 & 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 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

Environment	Number	Re-instruct	Re-fitting	Average AHI	Average Age	Average CPAP	Daily Use
Home	54	6 (11%)	9 (17%)	26.1	58.9	10.9	5.7 hours
Office	47	2 (4%)	6 (13%)	25.3	59.4	10.8	6.2 hours

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

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 home care 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 his home in Virginia. The usual process for out-of-state ventilator patient acceptance 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. AtHome Medical, a partner member of the MED Group's National Respiratory Network, contacted us on 04/15/09 and we agreed respiratory therapists from AtHome Medical and Roberts Home Medical would work together to facilitate a safe and quality transfer for this patient to his home. AtHome Medical respiratory 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. On 5/7/09 the patient arrived home by air 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 transition.

Sponsored Research - None

899134

USE OF HEATED HUMIDIFIED HIGH FLOW NASAL CANNULA FOR AN INFANT AT HOME: A CASE STUDY.

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Introduction: Oxygen therapy via heated, humidified, high-flow nasal cannula (HHHFNC) 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. Discharge orders included 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 hospital 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 extension tubing proximal to the humidifier. A Fisher & Paykel MR850 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 patient's insurance company. The system was set up in the hospital for 48 hours for patient acclimation prior to her discharge on 05/29/09 on 4.5 L/min FIO2 0.30 HHHFNC @ 32∞ C. The patient has received regular monthly respiratory therapist visits with no hospital admissions. She has been weaned to nocturnal HHHFNC and oxygen via standard nasal cannula while awake, is now on oral feeds and is making 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

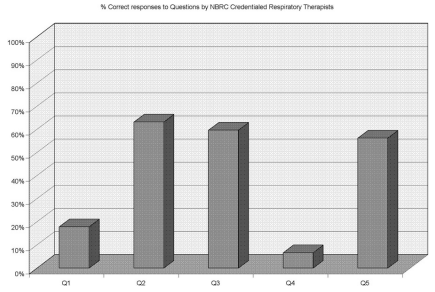
879636

ASSESSMENT OF RESPIRATORY THERAPISTS' KNOWLEDGE OF CURRENT 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 "seamless". This study was designed to quantify respiratory therapists' (RT) knowledge level of the technology used to provide long-term oxygen therapy (LTOT). Method: A multiple choice survey including five (5) knowledge questions was prepared and AARC members were asked to participate via the AARC weekly e-mail newsletter. Information required to correctly answer the questions is available in numerous texts and journal articles and in a review of LTOT published in the August 2009 issue of Respiratory Care. 1. Oxygen concentrators used for low flow oxygen applications and delivering oxygen concentrations of (80%; 85%; 90%; 95%) or greater are considered therapeutically equivalent to 100% oxygen. 2. A numerical setting on a particular oxygen conserving device (OCD) (is; is not) equivalent to the numerical setting on an oxygen flow meter. 3. The effect of an increased respiratory rate for a patient receiving continuous flow oxygen via nasal cannula at 2 L/min is (FIO2 remains the same; FIO2 increases; FIO2 decreases). 4. Pulse-dose-only portable oxygen concentrators (POCs) weighing from 5 to 10 pounds produce (0.5 to 1 L/min; 1 to 2 L/min; 1 to 3 L/min; 1 to 5 L/min) of therapeutic oxygen. 5. A numerical setting of 2 on a particular model of oxygen conserving device (OCD) will deliver a bolus of oxygen that is (equal to; larger than; smaller than; either larger or smaller than) a setting of 2 on a model from a different manufacturer. Results: 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%; Q4: 7%; Q5: 56%. Conclusions: NBRC credentialed RTs do not have the knowledge required to safely and adequately manage patients utilizing currently available LTOT equipment. The response to Q3 indicates a lack of RTs' understanding of low-flow oxygen systems. Because the majority of patients requiring respiratory therapy reside in their homes, RT education programs should increase their emphasis on LTOT and equipment.

Sponsored Research - None



901731

COPD: TRANSITION OF CARE AND REHOSPITALIZATION RATES.

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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 requires 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 predicted/historical readmission rate of 22.8% for these patients in this area. 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.

Sponsored Research - None

920950

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 and third party bench evaluation indicated it delivers a fixed pulse volume of 43 mL per breath at a setting of 2; higher than many commercially available OCDs. The purpose of this study was to evaluate clinical response and the device setting variability when compared to continuous flow oxygen (CFO) delivery to home based 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 CFO setting at rest and exertion, 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 equivalent 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 CFO 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. Conclusions: Prior published research and our own empirical data suggest >95% of stable LTOT users clinically tolerate OCDs. We hypothesize 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 or randomization of the evaluation order (CFO first) may have fatigued some patients and altered their tolerance of the OCD. This study reenforces the prior published research and expert recommendations for assessment and titration of the specific OCD for each patient at rest and with exertion.

Sponsored Research - Invacare Corporation

Activity	Number	OCD = CFO	OCD > CFO	OCD < CFO
Rest	31	23 (74%)	4 (13%)	4 (13%)
Exertion	32	16 (50%)	15 (47%)	1 (3%)

901743

VALIDATION OF LITER FLOW RATES ON AN OXYGEN CYLINDER SYSTEM WITH BUILT IN REGULATOR.

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Background: Respiratory Therapists (RTs) use oxygen cylinder systems (OCS) with built in regulators on a daily basis. RTs rarely question the accuracy of flows being delivered. We decided to validate the actual flow rates being delivered by the OCS, and hypothesized that actual flow rates would be within +/- 10% of the set flow rate on the regulator. Methods: A bench study was undertaken to validate the flow rates of the OCS used in our institution. The study design compared actual flow rates to pre-set flow rates at 1, 5, 10, and 15 LPM on five different D-size cylinders. This design was tested at tank pressures of 2000, 1000, and 600 psig on aluminum oxygen cylinders. Measurements of respiratory flow were acquired and averaged over a 30 second period using the MP-100 computerized data acquisition system. Flow was measured utilizing a 0-35 LPM calibrated PNT. Flow of 100% oxygen was calibrated using a TLO-15 calibrated flowmeter. The flow accuracy was verified with a calibrated syringe. All output signals were routed via an analog channel box into the MP-100 data acquisition unit converting them into digital signals that were processed with a computer. Signals were obtained at a rate of 1000 samples per second. Room temperature and barometric pressure remained constant over the testing period (23.3∞ C, 753 mmHg). Results: The averaged flow rates of the five cylinders at various cylinder pressures were within a range of +/-10%. As cylinder pressures decreased, the observed flow rates also decreased, but did not exceed set flows beyond the hypothesized +/- 10% range. The manufacturer validates regulators on an annual basis. The process includes placing the flow rate on 10 LPM, and accepting if flow > 7 LPM (30% variance), then placing the flow rate on 15 LPM and accepting 11 LPM (26% variance), and then back to 10 LPM to ensure repeatability. Conclusion: In this bench study, the D-sized OCS delivered flow rates within a +/- 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.

Sponsored Research - None

Equipment Used in Experimental Design

Unit	Manufacturer	Location
Biopac MP-100 System (MP-100)	Biopac Systems, Inc.	Santa Barbara, CA
Pneumotachograph (PNT)	Hans Rudolph, Inc.	Shawnee, KS
Model TLO-15 (TLO-15)	Timeter Group	Lancaster, PA
Calibrated Syringe (CS)	Hans Rudolph, Inc.	Shawnee, KS

898427

EVALUATION OF BRONCHIAL PRESSURES DURING ADULT HIGH FLOW NASAL CANNULA.

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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's right main stem (Laedral, Wappingers Fall, 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 cardiopulmonary monitor (Philips Electronics, Andover, MA). The intubation manikin was first open 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 closed. The elevated airway pressure is relatively low and may have the potential to vary depending on flow rate used and resistance of the upper airway.

Sponsored Research - None

Bronchial End Expiratory Pressure in Spontaneously Breathing Lung Model during HFNC

	No Flow	HFNC 40 LPM	HFNC 50 LPM	HFNC 60 LPM	HFNC 70 LPM
Pressure (cmH2O + SD) measured with Mouth Open	0.3 ± 0.4	0 ± 0	0±0	0 ± 0	0.1 ± 0.3
Pressure (cmH2O + SD) measured with Mouth Closed	0.1 ± 0.2	0.7 ± 0.4 a	1.0 ± 0.7 a,b	1.5 ± 0.5 a,b,c	1.4 ± 0.4 a,b,c

a. Significantly greater than No Flow ($p<0.05$)
b. Significantly greater than HFNC 40LPM ($p<0.05$)
c. Significantly greater than HFNC 50 LPM ($p<0.05$)

921015

EFFECT OF SIGNAL LOSS ON RESPIRATORY RATE RECORDING WITH A CLINICAL OXYGEN DOSE RECORDER.

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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 contribute to inaccurate RR calculations. **METHODS:** Adult patients who had been referred by a physician to a pulmonary rehabilitation program were recruited. A sampling cannula was used to connect patient to the CODR, and either a continuous or pulse-dose administration of oxygen, in accordance with manufacturer recommendations. A dual lumen cannula was used for those receiving oxygen by continuous flow and single lumen cannula for patients receiving oxygen by pulse-dose. Data were recorded over the course of 15 visits. Descriptive statistics were used to report mean values RR and signal loss. Clipped (without zero values) and unclipped RR data for each delivery system, continuous and pulse dose, were compared with Students T-test. Statistical significance was established at $p \leq 0.05$. **RESULTS:** CODR data were collected from four patients at a sampling rate of 20 milliseconds. Two of the patients received oxygen by pulse dose, and two by continuous flow. A total of 65,528 data points were collected by the CODR for the total cohort, 37,300 of which were from those receiving oxygen by pulse-dose. The percent signal loss for patients receiving oxygen therapy by continuous flow was 6.2%, and twice the rate of data collected from the pulse dose group. A value of zero was recorded for each signal loss. Upon review of aggregate data it was noted that a high value for the RR, between 40 and 100, was recorded immediately prior to every signal loss. Mean values for the unclipped data were lower for both the pulse dose 33.2, ±SD 16.0, and the continuous flow 25.1, ± SD 14.1 compared to clipped pulse dose 34.2, ± SD 15.1 and continuous flow 26.8, ± SD 12.9. Comparison of clipped and unclipped data for each type of oxygen delivery system was statistically significant, $p < 0.001$. **CONCLUSIONS:** Care should be taken to review RR data and determine signal loss occurrence. The inclusion of signal loss values, recorded as no detectable breath, may provide erroneously lower respiratory rates. Clinicians should evaluate the effect loss signal has on data prior to clinical decision making.

Sponsored Research - None

904301

COMPARATIVE EVALUATION OF PULSED DOSE OXYGEN CONSERVING DEVICES.

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BACKGROUND: Pulsed dose oxygen conserving devices (PDOCD) are frequently prescribed with oxygen therapy for home care patients. Many different designs are available but little information exists regarding their performance. The purpose of this study was to evaluate 10 currently marketed PDOCDs. **METHODS:** Devices evaluated were Inovo - Bonzai, Lotus, Evolution; Cramer Decker - Solo2; DeVilbiss - BP1000; Invacare - 10C100P; Precision – EasyPulse5; Salter - O2XPRESS; Responsive Respiratory - Respond; Drive – Oxypulse. Pulse characteristics were measured with the Oxygen Conserver Test System (Hans Rudolph, Inc.). Oxygen delivery during simulated breathing was measured with a model nose, nasal cannula and ASL 5000 lung simulator (Ingmar Medical Inc., Pittsburgh, PA). The lung model was a sinusoidal flow pump; inspiratory rise was 5%, hold 0%, release 25%, frequency 15 to 30 breaths/minute, tidal volume = 500 mL. Median values were compared with Kruskal-Wallis One Way Analysis of Variance on Ranks with P values < 0.05 considered significant. **RESULTS:** Pulse flow results fell into two groups, those with low flows (≤ 3 L/min), long pulses (0.5 – 1.25 s) and those with high flows (≤ 20 L/min), short pulses (0.2 – 0.5 s). There was considerable variability in pulse time and volume among devices. Pulse volume increased as the PDOCD setting increased for all devices. The Bonsai triggered at the smallest pressure drop (-0.03 cm H_2O); the Respondo2 required the highest pressure drop to trigger (-1.12 cm H_2O), $P < 0.001$. Pulse delay was shortest for the Bonsai (28 ms) and longest for the Oxypulse (131 ms), $P < 0.001$. Data for oxygen delivery at setting #2 are shown in Figure. The Solo2 had the highest pulse volumes but also the second longest pulse time, so its oxygen delivery was among the lowest. The PD1000 had the best oxygen delivery overall, which might be explained by its combination of relatively high pulse volume, short pulse time and short pulse delay. None of the PDOCDs could duplicate constant flow at 2 L/min at frequency of 15 breaths/min. **CONCLUSIONS:** Considerable performance variation exists among pulsed dose oxygen conserving devices. Setting numbers have no consistent relation to constant flow and therefore cannot be used as equivalents for constant flow oxygen prescriptions. This study highlights the importance of titrating each device to the specific oxygen saturation specified by the physician for the patient at rest, exercise and sleep.

Sponsored Research - Study was funded by all the device vendors mentioned in the abstract.

920774

PULMONARY REHABILITATION DESIGNS A PLAN TO STEP UP IN TIMES OF DISASTER, THE PULMONARY REHABILITATION, RESPIRATORY CARE SURGE 2010 DISASTER PLAN.

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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 strategies to augment critical care staffing within 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. METHODS: The Pulmonary Rehabilitation team members developed an action plan for times of crisis (Surge) within the Respiratory Care Department. The surge plan will assess the current PR staff capabilities, limitations, and training needs. Pulmonary Rehabilitation cross training provides an opportunity to work per diem in the Respiratory Care Department, ability to increase skill set and job security. RESULTS: Pulmonary Rehabilitation therapists were trained to work in acute floor care within the Respiratory Care Department. Immediate and ongoing training for Pulmonary Rehabilitation staff in how to clean, stock and process equipment in the Respiratory Care department was carried out. A Surge Equipment Manual was developed that included photos of each hospital area with a list of the respiratory equipment required for the specific patient care area. Training in patient driven protocols, Omnicell use, and CliniVision documentation for floor therapy was provided and all team members were successfully checked off. 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

904457

PATIENT REFERRAL TRACKING OUTCOMES IN A PULMONARY REHABILITATION PROGRAM.

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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 were received 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 at 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

912772

ART AS A THERAPUTIC OUTLET IN THE PULMONARY REHABILITATION SETTING.

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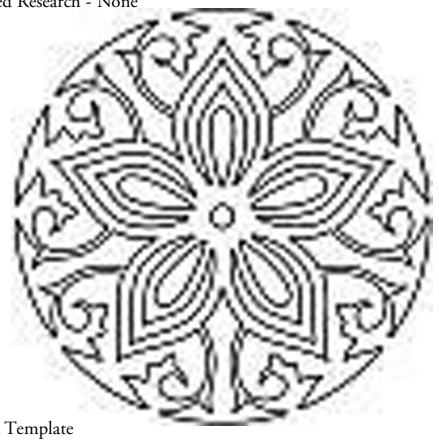
BACKGROUND: Art diversion in the Pulmonary Rehabilitation setting was started twelve years ago to offer a creative means of coping with end-stage lung disease. METHODS: A Respiratory Care Practitioner enlisted patients individually and through support groups. Patients and hospital personnel then started 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 exhibits, logging 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



Mandala Template

919556

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

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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 are lacking. We describe a case with SDB related to chronic opioid usage where ASV shown 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 parasomnias or abnormal leg 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 ataxic 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: Ataxic 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. Oxygen 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

905306

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

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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: 52 stable 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 3 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 ΔSpO2, %DLco, 6MWD walk load, 6MWD, %DLco/VA, and MRC dyspnea scale. In a multiple regression analysis, a subgroup of two variables had the association ΔSpO2 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%, ≦88% group 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 severity for patients. Moreover it was necessary to evaluate not only the SpO2 measurement value but also ΔSpO2 during the pulmonary rehabilitation. SpO2 88% is the cutoff value for SpO2 during walk and is a reference value in the home oxygen therapy in Japan. SpO2 88% were also identified discontinuance criteria of exercise in pulmonary rehabilitation. FEV1.0% was not correlated with the SpO2 recovery time and SpO2 lowest value. However %DLco was a high correlation with the SpO2 recovery time, ΔSpO2 and SpO2 lowest value.

Sponsored Research - None

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.

920380

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 (range 26–79). Care-givers assissted 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

920948

HANDS ON SIMULATION EXPERIENCE VS. OBSERVATION: A KNOWLEDGE OUTCOMES ANALYSIS.

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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, $p < 0.001$). At approximately 2 months (mean 64.3 days), subjects were tested again. The hands on group had a mean of 84.8 and the observation group had a mean of 60.0 ($p < 0.0001$). The rate of knowledge degradation over the two month interval for the hands on group was also 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

920997

NBRC SECURE SELF ASSESSMENT TESTS: 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=22) > CoARC cut. Senior students on the 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, to promote career protection and for patient safety. Further study is warranted with more wRRT SAE examinees and to study use of the Clinical Simulation SAE.

Sponsored Research - None

921057

SURVEY OF STUDENTS UTILIZATION OF VIDEO TAPED CLASSROOM LECTURES.

Ijaz Ahmed, Rachael Lee, Jon Nilsestuen; Department of Respiratory Care, The University of Texas Medical Branch, Galveston, TX

Background: The Respiratory Therapy Program at the University of Texas Medical Branch, Galveston, TX has been providing their students with video recordings of their 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 within 48 hours. We surveyed five lecture based classes taken by the fifteen 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 further 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 to complete their notes; 54% (n=27) to review prior to an exam; and 20% (n= 10) watched the 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) disagreed 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

905825

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

Cynthia C. White, Abby Motz, Tonie Perez, Carmen Williams, Tracey Neff, Susan Allgeier; Cincinatti Childrens Hospital Medical Center, Cincinatti, 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 at CCHMC for forming a clinical question, searching and critically appraising the literature, synthesizing the literature, 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 their resources are. 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 improved understanding of the EBM process through education and 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

882526

A CAMPUS COMMUNITY'S ATTITUDES AND BEHAVIORS REGARDING TOBACCO USAGE.

Christy Kane, Elizabeth Fitzgerald, Helen Grace Ryan, Alice Kimble; Bellarmine University, Louisville, KY

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 was 36% or 989 participants. The majority of respondents were female undergraduate students. Only 3.7% of survey participants smoke more than 10 cigarettes each day. 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

900164

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 (α=.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 (84.8%), full-time (80.6%), and an average age of 37.7 years (SD=10.0). Respondents were predominantly RRTs (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 development opportunities in the last year (70.8%). RTs described EBP as meaningful (62.4%), valuable (69.6%), important (70.9%), and useful (72.6%). RTs averaged 1.22 hours/week reading professional literature and reported discussing evidence for clinical practice with fellow therapists (53.0%). In addition, over 80% identified that department policies/procedures were based upon evidence. Finally, respondents indicated 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 and 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

901774

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 Hospital. The purpose of the team is to improve patient care/outcomes, improve therapist morale, 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 a test, 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 safety and time savings 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

904087

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

Abby Motz, 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 (RRTs) 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 most respiratory therapy programs. The Point-of-Care (POC) scholar program was designed to prepare the healthcare team at our institution on the importance of understanding and participating in EBP. 2009 marked the first year in which RRTs were permitted to participate in this program. 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 RRTs salaries were paid for by the institution's Center of Professional Excellence. The RRTs developed separate PICO questions, literature searches and appraisals, evidence summaries, and practice changes. Two RRTs, upon application review, were selected to partake in the POC program. Scheduled program updates were given by the RRTs 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 RRTs 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 RRTs shared valuable knowledge gained and could be EPB mentors, and practicing EBP skills were important for RRTs to learn. Conclusion: As a direct result of this program, both RRTs developed research projects and one RRT 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 RRTs will continue to educate and mentor fellow RRTs on the EBP process.

Sponsored Research - None

Evaluation of RRTs in the POC program

904144

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 emerge and make their mark on the profession. Education is a key component to any good leader and advancing the respiratory care profession. However, currently half of the RT workforce is functioning at an Associate Degree level or lower. Other medical professions require a minimum of a Bachelors degree to obtain employment. RRTs must prepare themselves educationally to compete in today's healthcare arena and to advance the profession. There are many educational platforms that allow today's RRTs the ability to further their education. Our institution cultivates an environment for continuing education that also provides tuition reimbursement programs for undergraduate and graduate degrees. Currently, the Respiratory Care Division at our institution employs 195 therapists, 4% hold a Master's Degree and 28% hold a Bachelor's Degree. Method: Anonymous surveys were conducted and distributed to all Bachelor and Master Degree RRT holders at our institution; one for each degree holder. Results: In completing the survey, Bachelor Degree holders were 73% compliant and Master Degree holders were 86% compliant (See Table 1). Survey results indicated that the majority of Bachelor and Master Degree holders held degrees outside of respiratory care. 56% of the Bachelor Degree holders indicated they plan on pursuing a Masters Degree and 67% of the Master Degree holders indicated they plan on continuing education to further career advancement. Tuition reimbursement monies influenced 50%-69% of both groups in advancing their education level. 80% of the Masters Degree holders obtained a new position in leadership upon degree completion. Conclusion: Based on survey results, more RRTs are showing interest in continuing their education to obtain higher degrees. Tuition reimbursement does appear to play a role in this decision in addition to organizational support. At our institution, RRTs are positioning 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 study was to determine whether diverse linguistic origin has an effect on writing style that might affect a student's ability to express oneself in reflective writing. Linguistic Inquiry and Word Count (LIWC) is text analysis software that was initiated in 2001 by JW Pennebaker. This instrument categorizes words into linguistic dimensions to provide quantitative analysis of individual writing. Methods: Sixteen senior respiratory care students at our program individually chronicled their shared experience 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/projections/usinterimproj/ 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(4):405-413.

Sponsored Research - None

Table 1 Mean Occurrences/100 Words

Linguistic variables	EFLB (n= 5)	NEFLB (n=11)
Self ref*	5.86	7.78
Social	10.99	12.22
Cognitive	3.95	4.52
Big words	15.17	4.60
Positive	2.53	2.52
Negative	0.34	0.45

* Self reference variable (e.g. I, me, mine) (p=0.03)

920280

SURVEY OF EXISSTING CONDITIONS OF TEH 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 respiratory care team, which 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 teams. METHOD: The subjects of this survey were nurses, physical therapists, clinical engineers and physicians in Japan. We randomly selected subjects for this survey in Japanese respiratory care related journals. We surveyed 370 individuals at 39 hospitals who were members of the respiratory care team, and 427 individuals at 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 (69.7%) 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", "ability of the individual" (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 team 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. Prior to discharge, Respiratory Therapists (RT) shared participation in training home caregivers of mechanically ventilated and patients with tracheostomy tubes to assure a safe transition to home. 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. Method: Staff was tested for familiarity and use of current patient family education tools. A Likert scale survey was distributed via Survey Monkey to RTs who perform tracheostomy home caregiver training. 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-distributed to assess use of the new manual. 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 question assessing use of 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 discharge planning process has significantly increased. Use of 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 interdisciplinary 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' role. 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 data with significance set at $p<0.05$. 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 (see table): interdisciplinary education, understanding 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 strengthen communication skills during pre-professional training. Additional research is needed to assess the benefits of these collaborative efforts and the translation to collaboration in the patient care setting.

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 deliver quality education. . This study sought to determine the prevalence of asthma education delivered by those holding the AE-C and the variety of practice patterns. Methodology: We used an internet-based survey provider to distribute a 24 question survey to all the contacts in the Association of Asthma Educators (AAE) database (N=1,730). 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 (49%) had the AE-C. In total, of the 177 (78% of the surveys) providing asthma education, 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 medical literature lacks standards for the development of health coach training programs. We evaluated a four-day training program for OSU Health Coaches that included equal parts didactic instruction about nine health risk assessment areas and hands on 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 ($p = 0.03$). Confidence levels with MI at 90 days did not differ from post-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.

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Abstract Title: Therapists' Experiences as Clinical Preceptors Background: The education of respiratory therapy students encompasses classroom, laboratory, and clinical experiences. 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 utilized Likert-scale 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 experiences 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 personnel responsible for division of workloads and preceptor assignments must ensure preceptors are given workloads that allow adequate teaching time for purposeful, thorough student precepting. As a result, preceptors will experience greater job satisfaction and students will receive consistently higher quality clinical experiences.

Sponsored Research - None

919785

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

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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 paper is 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 workers for lung disease. Otherwise, spirometry has shown to be effective in both monitoring 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 useful in both detecting and diagnosing lung disease and impairment in at risk populations. Based on the current literature, it is reasonable to conclude screening spirometry serves effective 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 conditions.

Sponsored Research - None

841833

AN ABG PROCEDURE COMPLICATIONS ANALYSIS.

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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 order to provide care for 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 take any appropriate action. In this study we wanted to retrospectively evaluate 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 documented (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 (sweating, 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 our data, complications caused by the ABG sampling procedure are documented infrequently. Hematoma formation is the most common complication noted. Patients in the 61-80 year old range are the mostly likely to have procedure complications. RCPs are very successful at obtaining arterial blood samples with minimal complications. *Robert Kacmarek, Steven Dimas, Craig W. Mack. The essentials of Respiratory Care – Fourth Edition. Elsevier Mosby, 2005.

Sponsored Research - None

919144

SCREENING OF OBSTRUCTIVE SLEEP APNEA IN AWAKE SUBJECTS.

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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 frequencies of the oscillatory modes yielded 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 frequency histogram both yielded a sensitivity of 76.2% (for 95% specificity). The data was mostly composed of severe OSA patients (12), however it also included 4 patients with mild OSA and 4 patients with moderate OSA. Efficiency of detection was not dependent on disease severity. No significant correlations were found between age, sex and the best correlated indexes. Conclusions: Although further studies will be needed to test the reproducibility of these results, the proposed measures seem to provide a fast method to screen OSA patients, in awake period, thus reducing the costs and the waiting time for diagnosis. The physiological mechanisms that underlie the differences 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

906004

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

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Background: Robert E. Hyatt and his colleague defined a nonspecific pattern (NSP) of pulmonary function test results as a reduced FEV1 and FVC, a normal FEV1/FVC, and a normal total lung capacity (TLC). They encountered the NSP in 9.5% of their subjects. Fifty percent of the subjects were obese and sixty-eight percent had airway hypersensitivity or chronic lung disease. Stanescu suggested the NSP be called the small airways obstruction syndrome. We performed a similar study among Japanese patients showing decreased body mass index, compared to those in the original study. Methods: We undertook a retrospective analysis of subjects studied in our pulmonary function laboratory between Jun 2009 and May 2010. Selection criteria for the NSP were that subjects be more than 20 years old with an FEV1 and FVC below the lower limit of normal, and the FEV1/FVC and TLC above the lower limit of normal. And then, these subjects had received a bronchodilator challenge. A positive bronchodilator response was an increase in FEV1 and/or FVC of at least 12% or of at least 200mL. A TLC was examined in the gas dilution method. Results: From 399 test results, the NSP was found in 25 subjects (6.3%). We classified the NSP subjects into five groups. Group A consisted of airway hyperresponsiveness, defined as a clinical diagnosis of asthma and/or positive bronchodilator response (n=3). Group B consisted of airway disease without AHR, i.e. COPD (n=2), bronchiectasis (n=2), diffuse panbronchiolitis (n=2) and undifferentiated connective tissue disease with bronchiolitis (n=2). Group C were obese subjects without airway disease (n=4). Group D were other diagnosis, i.e. nontuberculous mycobacteriosis (n=3), idiopathic pulmonary fibrosis (n=2), nonspecific interstitial pneumonia (n=2) and so on. In the NSP subjects (normal FEV1/FVC, reduced FEV1 and FVC, normal TLC), the value of V50/V25 were higher than other subjects with normal FEV1/FVC, reduced FEV1 and FVC, reduced TLC ($p=0.0147$). Conclusion: We found the NSP subjects in Japanese population at a little lower rate than in the original study. One of the probable underlying cause of the pattern might be small airway disease. So, even in Japan, when the subjects showed normal FEV1/FVC with reduced FEV1 and FVC, we shouldn't automatically rule out airway obstruction, and shouldn't rule in pulmonary restriction.

Sponsored Research - None

905083

IMPACT OF A THERAPIST-DRIVEN PROTOCOL INCLUDING INCENTIVE SPIROMETRY AND HIGH-FREQUENCY CHEST-WALL OSCILLATION ON INCIDENCE OF POST-OPERATIVE PNEUMONIA.

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Background: Pneumonia is common in post surgical patients. Reported mortality rates for pneumonia range from 20% to more than 45%. In our hospital, pneumonia rates 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 therapy. Major surgery and other high risks patients unable to meet IS target progressed to treatment with HFCWO BID for 48 hours, and then re-evaluated. Retrospective review of infection control records compared incidence of pneumonia in the facility from 2005 to 2009. A preliminary cost savings calculation compared cost of care for two post-surgical patients that developed pneumonia to cost of care for patients with identical diagnoses that did not develop pneumonia. Results: Pneumonia rates decreased following implementation of the IS/HFCWO protocol. The number of post surgical patients admitted to our units and the corresponding pneumonia rates for each year is shown below. A preliminary estimate of cost saving was $288,000 following implementation of the therapist IS/HFCWO protocol. Conclusions: Reduction in post-operative pneumonia occurred after implementing a therapist-driven protocol for all post-operative patients. Our results 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

Year	# of Post-Operative Patients	Patients Receiving IS*	Patients Receiving HFCWO	Pneumonia Rate
2006	1197	1146	0	2.9
2007	1083	1188	230	0.8**
2008	933	1044	205	0
2009	897	828	125	0

* Includes non-post-operative patients.
**Protocol implementation 2/07.

906812

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

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Background: Cardiopulmonary exercise testing (CPET) involves monitoring numerous physiologic parameters, including blood pressure, for safety and 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 a critical measurement and can suggest a plethora of abnormalities depending on its response, yet it is subject to error. The Tango B/P system was designed to measure B/P during exercise testing by integrating a microphone into the cuff and capturing the R wave signal from the EGC system to further clarify the signal and minimize noise which can cause errors. The system also allows the user to listen to the Korotkoff sounds to manually determine the B/P along with displaying the automated B/P. The comparison of B/P measured non-invasively versus directly is not well characterized during CPET. In a single study, Rasmussen and colleagues reported that the mean systolic pressure difference (direct minus indirect) was +29 mmHg and the mean diastolic difference was +12.3 mmHg during exercise testing. Hypothesis: The Tango system accurately measures B/P automatically when compared to the manual method during exercise. The B/P measured non-invasively via the Tango versus the B/P measured with an arterial line has the same relationship of direct to indirect as in previously published data. Method: 14 subjects for whom a CPET with an arterial line was ordered as a clinical test were used in the comparison. In these subjects an arterial line is placed and B/P measured according to standard laboratory procedures. On the opposite arm as the catheter the non-invasive B/P system was placed according to the manufacture's recommendations. B/P was recorded using both systems at rest and maximal exercise. Data were analyzed using Student t-test for comparability. Results: Table 1 Conclusion: During maximal CPET there is no significant difference between the B/P measured automatically and using the manual auditory method with the Tango system. The relationship of direct versus indirect measurement of B/P during exercise is consistent with previously published data for systolic pressure but demonstrates a dissimilar correlation in diastolic pressure with no substantial difference between the measurements. However the sample size is limited and would need further study to characterize this relationship.

Sponsored Research - None

920301

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

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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 exists 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 Body 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 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%; 5% 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

Regression Equations derived from 112 healthy Saudi adults from the Eastern Province of Saudi Arabia (aged 18–22 years)

Ht, Height in m; R2, coefficient of determination; RSD is the standard deviation of the residuals (residuals = observed - predicted) and the value of 1.64 * RSD corresponds to the prediction value at the lower fifth percentile. The lower limit of normal for each parameter can be calculated by subtracting 1.64 * RSD from the predicted mean

919931

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

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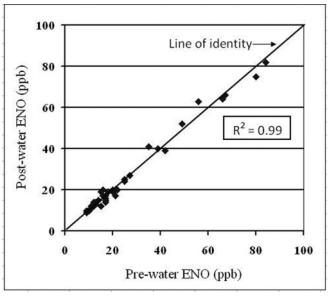
Introduction: Exhaled nitric oxide (ENO) is a biomarker of airway inflammation. ENO is measured by having the subject inhale maximally and then exhale their breath through a mouthpiece into the ENO analyzer at a specific flow rate. The American Thoracic Society (ATS) and European Respiratory Society (ERS) have published testing guidelines1. They recommend 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 their outcome. However in clinical practice it has been our experience in the laboratory that the consumption of water prior to testing has little or no effect on the measurement. Hypothesis: The consumption of water has no effect on the exhaled nitric oxide measurement. Methods: 40 subjects (age 25-78; M/F 10/30)) for whom ENO was ordered as a clinical test were studied in the comparison. Subjects were tested using the Apieron 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 R2 0.99 with a $p<0.99$. Conclusion: There was no statistical or clinical difference between the measured exhaled nitric oxide values results before or 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 the Online and Offline 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



920257

DOES EXHALATION TIME OF THE FORCED VITAL CAPACITY MANEUVER SIGNIFICANTLY AFFECT MEAN ESTIMATES OF PULMONARY FUNCTION SCREENING PARAMETERS?

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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% p<0.0001, ppFeV1 p=0.03, and ppFVC p<0.0001). The FeV1% was lowest for exhalation times > three seconds (MEAN: all=81.8%, >6 sec=85.2%, >3 sec=77.6%, and < 3 sec=89.5%). Mean ppFeV1 was lowest for maneuvers less than three seconds (MEAN: all= 78.1%, > 6 sec= 77.3%, > 3 sec=81.2%, and < 3 sec=65.4%), and significant differences were seen between the > 3sec and < 3 sec groups (α=0.05). Mean ppFVC was also lowest for exhalation times < three seconds when compared to all other s (MEAN: all=78.0%, >6 sec=80.5%, >3 sec=78.6, 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

921282

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

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BACKGROUND: The ATS/ERS Task Force Paper 5: "Interpretative Strategies for lung function tests" provides a simplified algorithm showing a pathway where if $FEV_1/VC \geq$ LLN, then if Vital Capacity is also ≥ LLN, a restrictive lung defect is excluded. The algorithm statement is "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 age range selected was that used in the ERS reference set studies. Measured parameters were compared to reference values using Standardised Residuals (SR). Search criteria were '$FEV_1/VC \geq$ LLN and VC ≥ LLN and TLC < LLN'. Output parameters were FEV_1, VC, FEV_1/VC, TLC, TLCO, VA. For each parameter, reference value was output with the standardised residual. Demographic parameters output 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, TLCO 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 32 males (28 had □TLCO/VA) and 28 females (10 had □ TLCO/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=31) may feature more prominently. **CONCLUSIONS:** There are a number of patients with normal FEV_1/VC ratio and normal VC where a restrictive defect is identifiable only by measuring TLC. Neither reduced TLCO 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

889260

A SAFER METHOD OF PERFORMING APNEA TESTS USING CARBOGEN AND CAPNOGRAPHY FOR PATIENTS ON APRV.

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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 de-recruitment of the lungs and cause additional adverse side effects. 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 carbogen has been approved for apnea testing in our facility. Using carbogen alleviates 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 – 7.20/0.006. 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 carbogen tank (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 carbogen apnea test provides less chance of pulmonary or cardiac side effects, predictable end point test compared to the standard apnea test, and a safer environment for the patient.

Sponsored Research - None

ABG AND VENTILATOR SETTINGS

	pH	PaCO2	PaO2	SPO2	HCO3	ETCO2	HR	BP	MODE Phigh Plow	SETTINGS Tigh Tlow VT
Baseline	7.38	47	136	97%	27	36	90	125/72	APRV 28 0	5 0.55 @ 700 ml
Pre-Apnea	7.42	42	461	100%	27	30	94	125/72	APRV 28 0	4.2 0.55 @ 700 ml
Post-Apnea	7.17	82	461	98%	29	67	90	134/67	APRV 28 0	30 0.55 @ 750 ml

870354

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

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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 arterialized human blood using an extracorporeal circuit at 37oC with 12% O2 and 5% CO2. We tested Radiometer Safe Pico Self-fill, Smiths 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 22oC or 7-8oC 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 CST 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 values was 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 variable times and temperatures

PO2	0 Min	15 Min	30 Min
Roche Microsampler	74.7(3.4)	74.0(5.3)	76.7(8.3)
Portex	77.5(3.9)	78.0(3.3)	87.4(3.6)
PICO	76.2(0.7)	81.0(6.0)	86.1(6.1)
Portex with CST		81.8(7.9)	82.9(2.1)

920953

CLEAN MY R.I.D.E.(REDUCE INHHALATION OF DIESEL EXHAUST: PHASE TWO.

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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

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

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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 acid induced vocal cord edema. It was later 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, resuscitation efforts in the spontaneously breathing patient in respiratory distress 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

903356

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.

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Background: MD's and RT's learn clinical competency with airway placement and proficiency with advanced techniques for emergencies since failure to place a required airway can be fatal. These clinicians train for airway placement differently yet perform similarly. Hospitals get airway devices and equipment, but no shared standard training exists for MD's and RT's. Performance Improvement (PI) 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 with good results. Training stations with manikins featured items used in code carts and difficult airway drawers. RT instructors reviewed NRP, PALS, and ACLS guidelines and hospital policies to offer hands on educational opportunity to participants. Infant, pediatric and adult ET tube insertion was taught with manual and videolaryngoscopes. ET tube insertion through an LMA was taught. Difficult airway items included disposable optical laryngoscopes, emergency cricothyrotomy, retrograde intubation, tube exchangers, intubating stylettes, and percutaneous tracheotomy. Laryngectomy and tracheotomy tube replacement was presented with cuff management. Participants practiced intubating by fiberoptic bronchoscopy. Results: There were scheduled times for MD's, RT's and a general session. Attendees included internists, pulmonologists, pediatricians, anesthesiologists, and emergency and family practice doctors. AW evaluations were positive. Results for departmental PI of airway placement by RT in 2 attempts or less did improve after the second AW. 2007 PI showed RT success at 88.6% in 2 attempts or less. 2009 RT PI showed 4% improvements to 92.6%. Attempts per airway placed remained at 1.4 for RT and 1.7 for MD's while bringing more hospital beds online in this time. RT intubators increased between 2007 and 2009 from 34 to 42. RT Proficiency OR Intubation Program was improved and the hospital acquired new equipment in 2008 and 2009. Conclusion: AW for RT and MD's offer a standard approach to learning new products and devices. Participants worked to build teamwork and satisfaction and the number of RT intubators increased. AW may be a component for improving airway placement PI along with acquiring new equipment and improvements to the RT Proficiency OR Intubation Program. The AW promotes RT instructors as airway specialists who help doctors and peers improve airway placements.

Sponsored Research - None

Established Airways Data for RT and MDs; Attempts/Airway Placed

920382

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

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Background: Following observations from two case studies we propose an interventional algorithm using HHFT Optiflow nasal canula in Acute Respiratory Failure. Method: Clinical decisions are focussed 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. For further desciption of decision making, refer to the algorithm. Results: Case 1: Two days after upper abdominal surgery, a 45 years old man develops a Type I Acute Respiratory Failure; on FiO2 0.8 with a PaO2/FiO2 of 200 mmHg. Arm 1 of the algorithm is solicited with instauration of HHFT Optiflow 40 L/min during 30 minutes. After 30 minutes on FiO2 0.75, ABG reveals PaO2/FiO2 of 231 mmHg (15.5% increase). Flow is increased at 60 L/min for 30 minutes and after 30 minutes at 60 L/min on FiO2 0.45, PaO2/FiO2 is 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 consults 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 solicited with instauration of HHFT Optiflow at 40 L/min during 30 minutes. After 30 minutes on FiO2 0.28, ABG reveals a PaO2/FiO2of 329 mmHg, pH 7.37, PaCO2 59 mmHg (PaCO2 decrease ≥ 10%). Optiflow is maintained unchanged for another 30 minutes; ABG values unchanged and RR decreased from 35 to 24/min; therapy is continued. Conclusions: We believe the Optiflow has a niche in the therapy of ARF. As Non Invasive Ventilation often precedes Invasive Ventilation support, we are tempted to think that Optiflow therapy could fit as first line treatment before instituting Non Invasive Ventilation. Further investigation is needed to valide this algorithm.

Sponsored Research - None

Arm 1: If PaO2/FiO2 >200 mmHg, institute 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 after 30 min, PaO2/FiO2 increases by <15%, consider NIV; if PaO2/FiO2 increases by >15%, increase Optiflow 50–60 L/min for 30 min then attribute 'Success/Failure'.
Arm 2: If pH >7.32, institute Optiflow 30–40 L/min for 30 min thereafter if PaCO2 decreases by >10%, keep Optiflow unchanged for 30 min then attribute 'Success/Failure'. If after 30 min, PaCO2 decreases by <5%, consider NIV; if PaCO2 decreases by >5%, increase Optiflow 50 – 60 L/min for 30 min then attribute 'Success/Failure'(see algorithm).

904141

REDUCTION OF ORAL PRESSURE ULCERS FOLLOWING IMPLEMENTATION OF THE HOLLISTER ANCHORFAST ET TUBE SECURING DEVICE™ AND THE B&B MEDICAL UNIVERAL BITE BLOCK™

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BACKGROUND: Prevention of hospital acquired pressure ulcers (HAPU) is an important element of patient care, effecting 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 at our institution, a level 1 trauma and burn center, 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. METHOD: 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 for the ten months prior to introduction of the AnchorFast (Pre-A) was compared to the same data collected for the ten months after the AnchorFast (Post-A) had been established as the standard securing device. RESULTS: In the Pre-A group, 3039 patients were initiated 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, 3010 patient were initiated 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 decreased following introduction of the AnchorFast and Universal Bite Block in our institution.

Sponsored Research - None

901441

TRACHEAL TRAUMA FROM AN AIRWAY EXCHANGE CATHETER.

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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 PC02 87 P02 30 HC03 49 BE 17. Initial treatment included non-invasive ventilation and supplemental 02. 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 tracheotomy 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 catheter composition. The rigidity of the AEC keeps it from being compressed while in the airway but this predisposes the patient to injury or 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

TRACHEOSTOMY DAYS POST LIBERATION FROM PROLONGED MECHANICAL VENTILATION: A RETROSPECTIVE REVIEW.

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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 (TDPV). 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 (TDPV). Results: 58 patients were studied. Demographic data revealed: 35 male, 23 female, with a mean age (+/- SD) of 45 +/- 16 years. Forty three patients came from the surgical ICU, 15 from the medical ICU. Mean (+/- SD) MVTT = 9.6 +/-5.6, MVPT = 8.6 +/-7.2, MVD = 19 +/- 8.7, and TDPV = 12.9 +/- 6.9. Conclusion: The development of standard reporting values may prove useful to evaluate current practice and realize practice variations. The routine monitoring of TDPV may serve as a particularly useful benchmark for monitoring and providing support for standardizing tracheostomy management.

Sponsored Research - None

918485

PERFORMANCE OF THE VEST® AIRWAY CLEARANCE SYSTEM WITH TWO SUBJECTS SIMULTANEOUSLY: A PILOT STUDY.

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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 limited to one oscillator per household, patients have connected two vests 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: Two mannequins, same manufacturer and model, were fitted with appropriate sized vests. Pressure and frequency were set on 5 and 13 respectively. Multiple trials of 10 runs lasting 5 minutes per run were performed on the individual mannequins (controls). Multiple trials were then conducted on two mannequins simultaneously (study setup) with vests connected in series via a hose from the oscillator to one vest, a hose connecting the vests, and a hose from the second vest back to the oscillator. Pressure generated on the surface of each mannequin was measured via an intra-esophageal balloon placed between the mannequin and each vest. Position of the mannequins relative to the two oscillator ports was tested as were hose configurations. After 5 minutes of oscillation for each run, esophageal balloon peak pressure and trough pressure measurements were recorded for each oscillatory cycle during one second (13 cycles). The mean change between the peak pressure and trough pressure for 13 cycles was calculated. The means of the study setups were compared to means in the controls using a two-sample t-test. RESULTS: The mean pressure was significantly lower ($p < 0.0001$) in the study setup, with vests connected in series, than in the controls regardless of mannequin position or hose configuration. CONCLUSION: In this study, the use of "The Vest®" HFCWO with two vests simultaneously, connected in series, resulted in a decrease in performance compared to use with a single vest, as measured by the difference in peak and trough pressures at the surface of the mannequin. While simultaneous treatment of CF siblings may save time, doing so may decrease efficacy. Therefore, further investigation of oscillator performance by using increased pressure settings to compensate for pressure drop, using parallel circuitry, testing similar devices made by other manufacturers, and demonstrating the clinical significance of decreased pressure is warranted.

Sponsored Research - None

921046

NON-BRONCHOSCOPIC BRONCHIAL ALVEOLAR LAVAGE – A SAFE AND USEFUL PROCEDURE AS A DIAGNOSTIC AND PREVENTATIVE TOOL AGAINST VENTILATOR-ASSOCIATED PNEUMONIA.

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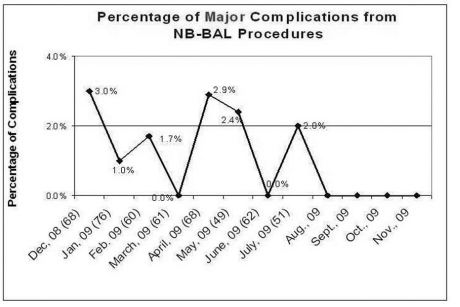
BACKGROUND Accurate diagnosis of Ventilator-associated Pneumonia (VAP) is critical for optimal treatment. Endotracheal aspirates (ETA) often give false positive VAP diagnoses. Bronchoalveolar Lavage (BAL) is a more accurate diagnostic tool. Fiberoptic bronchoscopy is the most accurate technique for BAL but is expensive and requires a physician-led team. Non-bronchoscopic (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 (RRT, RCP) were trained to perform NB-BAL using the BALcath (Ballard Medical Products). Training is 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 following complications of NB-BAL was performed: hypoxemia, arrhythmias, hypo- or hypertension, bronchial hemorrhage, coughing, and pneumothorax. 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



(the number in parentheses relate to the total number of NB-BAL procedures done each month)

919773

BENCH STUDY OF THE SONARMED AIRWAY MONITORING SYSTEM'S ABILTY TO DETECT ARTIFICIAL AIRWAY DISPLACEMENT.

Joel M. Brown, 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 assure airway 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 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 a simulated human airway. Methods: The SonarMed AMS(SonarMed Inc, Indianapolis IN) was calibrated and connected to 3 different ETTs (8.0, 7.0, and 6.5) using the proper airway adapter. Each ETT was marked in 0.5cm increments. The ETTs 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 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. Results: The 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 ET 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 movement 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.

Sponsored Research - None

920234

BENCH STUDY OF A NEW AIRWAY MONTIORING SYSTEM TO DETECT PARTIAL ENDOTRACHEAL TUBE OBSTRUCTIONS.

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BACKGROUND: Identifying partially occluded endotracheal tubes (ETT) is a key factor to patient safety in the ICU. Current methods for identifying partial ETT obstructions may not be sensitive enough to notify caregivers that action is necessary to maintain a patent airway. Normal airway resistance (Raw) is expected to be < 15 cmH2O/L/s[1] as monitored on a ventilator with a plateau pressure. A new airway monitoring system (SonarMed Inc, Indianapolis IN) may be able to quickly and accurately identify partial ETT obstructions. This device is a handheld monitor that uses an audio waveform echo algorithm (also known as acoustic reflectometry), and can give continuous measurements during conventional mechanical ventilation. We wanted to compare the SonarMed Airway Monitoring System (AMS) with Raw measurements typically used to identify partial ETT obstructions. METHODS: We performed a bench study using a ventilator (Drager Evita 4, Lubeck Germany), ETT and training test lung model for all readings. We created partial ETT obstructions with 1 minute epoxy. ETTs (size 7.0 and 8.0) had partial obstructions created in 3 different positions. Obstruction positions: near 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 ventilator and the % obstruction reading on the AMS. After bench testing, we cross-sectioned each ETT obstruction and took a digital image. Then we superimposed the enlarged image of the partially obstructed lumen over a square counting grid, to calculate actual % obstruction. RESULTS: See table for the data. The AMS accurately displayed the position of the obstruction in each different ETT. CONCLUSIONS: The AMS identified every partial ETT obstruction. Raw measurement would only identify the 2 largest of the 6 partial ETT obstructions (Raw > 15 cmH2O/L/s). Raw measurements trended in the direction of the severity of the obstructions, but the threshold of normal Raw may fail to show partial obstructions that may have clinical significance. The new Airway Monitoring System could be a useful adjunct for patient safety in monitoring patient's endotracheal tubes. REFERENCES: 1) Respiratory Care, January 2002, vol 47, Evidence-Based Guidelines for Weaning and Discontinuing Ventilatory Support

Sponsored Research - None

920352

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

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BACKGROUND: Conventional chest physical therapy (CPT) has become the standard to which all other bronchial hygiene techniques are compared. The objective of this investigation was to compare the clinical outcomes of hospitalized patients treated with The Vest® Airway Clearance System (the Vest®) vs. CPT. METHODS: Hospitalized patients with a CPT order were randomized to receive therapy consisting of the Vest® or conventional CPT. The Vest® facilitates removal of secretions from the lungs utilizing an air pulse generator and an inflatable vest to create high frequency chest wall oscillation (HFCWO). The primary outcome measure was the number of hospital free days. Hospital free days are defined as the number of days free from hospitalization during the study enrollment period [30 days]. A patient satisfaction rating, as measured by using a comfort scale, was a secondary outcome measure. RESULTS: 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 differences in their baseline characteristics at the time of entry into the study. No significant difference exists in the number of hospital free days between 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 (69.0%) versus in CPT patients 84 (67.7%) p = 0.832. Lobar atelectasis resolved in Vest® patients 42 (37.2%) versus in CPT patients 48 (38.7%) p = 0.807. Significant difference exists 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. CONCLUSIONS: The analysis of clinical outcomes shows no statistical difference 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.

Sponsored Research - Hill-Rom

907957

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

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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 pressure) and dynamic (PPV and CPAP) conditions. METHOD: A stand was built to hold four simulated tracheas (clear vinyl tubes, L =25 cm, ID = 2.5 cm) and four different 8.0 mm ID ETTs: three High Volume-Low Pressure (HVLP) barrel-shaped cuffs (Rusch, Mallinckrodt Hi-Lo, and Hi-Lo Evac) and one tapered cuff (Mallinckrodt TaperGuard Evac). ETTs were connected to a manifold that allowed delivery of either no pressure below the cuff, PPV below the cuff (PIP 30 cmH2O, PEEP 5 cm H2O) or CPAP 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; MOV + 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 seals. 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 effective in removing most fluid from above the cuff but cuff of the Hi-LoEvac still allowed some leakage. CONCLUSION: In this bench study, MOV + PPV resulted in no cuff leakage into the artificial trachea regardless of cuff type because of positive pressure below the cuff. The tapered cuff, as designed, developed no cuff folds and was effective in preventing leaking when MOV was used. HVLP 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 slightly) in the simulated trachea; future studies should consider the effect of ETT movement.

Sponsored Research - None

Range of Fluid Leakage Past Endotracheal Tube In 5 Minutes

Tube	Cuff 25 + No PP	MOV + No PP	MOV + PIP 30 PEEP 5	MOV + CPAP 5
Rusch	10 ml	None	None	None
Hi-Lo	10 ml	2-6.4 ml	None	0-1.6 ml
Hi-Lo Evac	6.4-10 ml	0.2-1.61 ml	None	0-1.4 ml
TaperGaurd Evac	10 ml	None	None	None

912713

PATIENT SAFETY INITIATIVE: USING STANDARDIZED TRACH SUPPLY KITS AT THE BEDSIDE.

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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 percent 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 four week period. Trach patients' 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 spare trach, 57% had suction catheters, 37% had a 10 ml syringe, and 64% had a manual resuscitator bag. Post trial 100% of patients had a trach kit and manual resuscitator bag. $6720 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

900361

EFFECTS OF MUCUS CLEARANCE ON THE DIFFERENCES OF RHEOLOGICAL PROPERTY AND DRIVING PRESSURE DURING HIGH FREQUENCY CHEST WALL OSCILLATION (SMARTVESTTM).

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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 stimulants (MS) were prepared using thickener 1, 2, 3 and 4% (Toromi Perfect TM, Nisshin Oillio Company) and the pressure controls of SmartVestTM (Electomed Inc.) were driven 20, 30 and 40. MS rheological studied were measured using Rheometer MARS (Thermo Scientific HAAKE).They were quiet breathing 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 Borg scale on each driving pressure, also measured clearance velocity of each MS. Data analysis was performed using software SPSS Statistics 17.0. Results: The higher setting pressure controls droved, the more PEFR and PEmax increased ($p<0.05$). The lower viscoelasticity of MS had, the faster clearance velocity moved in table 1 ($p<0.05$). There was the negative correlative relationship between viscoelasticity of MS and clearance velocity(6.813Hz: r=-0.49~-0.73, $p<0.0001$) (10Hz: r=-0.42~-0.64,$p<0.0001$),(stress dependency: r=-047~-0.75,$p<0.001$). When the driving pressure increased, the 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 tolerable on each driving pressure, had nothing in effort breathing using modified Borg scale (from very weak to weak). Conclusions The lower viscoelasticity of MS had, the faster clearance velocity moved during HFCWO. However, the clearance velocity did not increase in the higher viscoelasticity of MS in spite of higher driving pressures.

Sponsored Research - None

919322

THE EFFECTS OF NON-INVASIVE POSITIVE PRESSURE THERAPY (CPAP OR BIPAP) INTERFACES ON SKIN INTEGRITY.

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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 projects. Anecdotal reports have arisen over concerns 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 (2.86%) 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 hemodynamic 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 nocturnal 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

920812

EVALUATION OF ENDOTRACHEAL TUBE CUFF LEAKAGE IN A HUMAN CADAVER MODEL.

Tim Op't Holt, Zachary Trost; 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 trachea 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 vertically-oriented, preserved cadaver trachea (I.D. 20mm) and cuffs were inflated to 15, 20, 25, and 30 cmH2O. Colored water (5 mL) was added to the top of each cuff and leakage was measured by a graduated cylinder at 1, 5, and 30 minutes. Trials were repeated once more. ANOVA was used to analyze the differences in leak volume among the tubes, with α=.05. In a second experiment, the tubes were coated with radiographic contrast, the trachea was intubated, and the cuffs were pressurized to 25 cm H2O. CT scans were done on the intubated trachea to determine the formation of microchannels within each cuff. Results: Both the Microcuff and HiLo allowed very little leakage while the LoPro and CF tracheal tubes showed significantly more leakage ($p<0.05$) among all pressures and times. CT scans revealed that the Microcuff was the only tube without microchannel formation. Conclusion: Both the Microcuff and HiLo cuffs had negligible leakage at cuff pressure ranges lower than the recommended range of 20-30 cmH2O. These tubes may be better than others in helping to prevent aspiration of oral secretions, which supports out 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.

919190

EVALUATION OF 3 TYPES OF ENDOTRACHEAL TUBES WITH SUBGLOTTIC SUCTION CAPABILITIES.

John Davies, Mike Becker, Stephanie Keeting, Neil R. MacIntyre; Duke Medical Center, 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 elevation of 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 whose outlet is situated above the cuff. Hypothesis: This bench study was designed to evaluate and compare the suction effectiveness of the commercially available ETT's 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 Neptune 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 20 mmHg was applied to the suction port on the ETT's and timing began with a stopwatch. Timing stopped when an audible "gurgle" sound was heard (indicating that the fluid was completely removed). Results were compared using ANOVA and t tests with the Bonferroni correction for $p < 0.05$. Results: The suction time to "gurgle" with water was the same for all brands of ETT's. Means, standard deviations and significance are displayed in the table below. Conclusion: There are differences in rate of clearance of liquids with different properties using these systems.

Sponsored Research - This study was supported by an unrestricted educational grant(travel to the Congress only) from Teleflex Medical. However, the study was done independantly from any Teleflex employees and took place in Duke Medical Center.

* 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

921084

DECREASING TRACHEOSTOMY INNER CANNULA CHANGE FREQUENCY FOR PATIENTS RECEIVING MECHANICAL VENTILATION

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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 those patient to all 448 mechanically ventilated patients with a tracheostomy in 2009.We were able to show a mean decrease in ventilator length of stay of 0.996 days in both Medical Critical Care (MCC) as well as Surgical Critical Care (SCC). Additionally overall VAP numbers were also decreased between 2008 and 2009 by 18.4%. 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.

949409

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

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Background Endotracheal tube(ET) 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 ET. There is no research which would substantiate a timeframe to reposition a tube. We compared three interval frequencies (12, 24, 36 hrs.) of ET 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 ET 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 shows a 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 a strong correlation between ulcers and prolonged repositioning times (r =.941). Conclusions Our results indicate that ET 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

907965

IN-HOUSE TRAINING & COMPETENCY PROGRAMS: MEETING EDUCATIONAL DEMANDS AND SAVING COSTS TOGETHER.

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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 credit costs ten dollars on average (Tom Lamphere, 2009). $13,400 can be estimated in total cost of continuing education. TRHMC's Respiratory Care Services department created a committee to develop in-house continuing education in an effort to reduce costs and fulfill the requirements placed upon them. A lesson plan was created per job descriptions to encompass all areas of care provided by the department. Ten credits were available to all inpatient therapists (five extra credits for NICU RTs) on various topics at the 2009 seminar. Results: The total cost of the in-house education program 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 take into account the assumption that the amount of money paid out for time off and overtime to attend traditional seminars are 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 responsibilities) of the Joint Commission were fulfilled. All credits were AARC approved. Conclusion: This study demonstrated that an in-house educational/competency 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

793864

MERGING INFORMATICS AND RESPIRATORY TO IMPROVE RESEARCH AND PATIENT CARE OUTCOMES.

Kenneth Miller, Diane Horoski, Robert Leshko, 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 given that 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 Informational System Specialist (CISS). Our goal was to have a designated departmental individual (the AA) who had the ability to transform the information from the documentation database into usable reports. The CISS would assess which data parameters 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 reports desired for our daily ventilator rounds, QA/PI requirements, development of a departmental 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) Conclusion: These positions have allowed our department to offer invaluable information on how clinical interventions affect outcomes and how to improve those outcomes with increased efficiency. Although these positions may not be feasible for every Respiratory Care department, they maybe something that needs further investigation by some Directors. The ability of departmental 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

Process	Pre	Post
Ventilator Rds	2 hours	10 minutes
Q/A Data Collection/Compiling	1-2 weeks	3 hours
Reintubation/Self Extubation Data	2-3 weeks	1.5 hours
VAPS Compliance/Month	1-2 hours/day	2 hours/Month

848234

UTILIZATION OF ELECTRONIC DOCUMENTATION TO ASSESS PATIENT OUTCOMES.

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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 (ICU EMR) that would 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 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, 3296 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 (9.8%). 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 (17.6%) required reintubation. Of the 4020 episodes of mechanical ventilation, 162 (4.0%) required re-intubation within 24 hours and 146 (3.6%) required re-intubated after 24 hours. Conclusion: We implemented an ICU EMR that accepts data both electronically and manually 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

854253

IMPROVING EMPLOYEE OPINION THROUGH A PARTNERSHIP WITH LEADERSHIP.

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Background: It is vital the Respiratory Care workforce is engaged and 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 participation in decision making. Through this program we aimed to improve staffs perception of the workplace and leadership. Method: A hospital-wide employee opinion survey was conducted in July 2008 in which engagement and communication were identified as needing improvement. Based on many principles of the Nursing Magnet Program, we created PL. The program requires each member of RC leadership select no less than one staff member as a partner with the objective they communicate important issues, exchange ideas, and involve the partner in decision making. The PL group, consisting of RC leaders and their partners, attend quarterly meetings in which staff recommendations are submitted in advance via the PL website. At the PL meeting recommendations are introduced by the author, discussed, and a decision made to implement, disapprove, or defer. In all decisions the staff partner has an equal vote as their associate leader. One year after implementing the PL program RC staff was re-surveyed and results 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 yielded improved results. Conclusion: Through this program we created a structure that is open to all staff and creates a formal mechanism to get ideas introduced and allows them equal status in making decisions. The program has helped improve employee opinion and staff support of change.

Sponsored Research - None

Employee Opinion Scores

Leadership Area of Focus	% Favorable in 2008	% Favorable in 2009
Recognizes Performance	52.2	69.6
Provides Coaching	61.1	63.0
Recognizes My Ideas	61.1	65.2
Encourages Me	56.7	60.2
Listens to Me	66.7	72.1

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. Methods: A set of desirable characteristics for scheduling software was developed and a team formed to evaluated features, capabilities and costs. A software provider was selected and the system configured to meet the unique needs of the department and correlate with the hospital's timekeeping system. 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 and leadership satisfaction and improved communication between sites. Conclusions: Schedule Anywhere adds transparency for all users and enables employees to view their schedules from any PC. Leadership has the ability to view activity at either site at any time. Timekeeping has been simplified and errors are now minimal. 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 canceled below their appointed percentage.

Sponsored Research - None

900809

THE VALUE OF UTILIZING FILESHARING 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 experience. Throughout the workday there are several documents for reference and training that needed to be made available to leaders 24/7. Providing these resources through a printed "supervisors" manual proved to be difficult to always access, keep current, and represented a significant expense. We elected to explore loading and organizing files on a separate computer hard drive (Q-Drive) and establishing File sharing processes and rules to access this information. Methods: A 700 GB partition was established on a designated Medical Center drive and access established for all members of the 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 to 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 included on the Q-Drive. Supervisors demonstrated they could easily navigate the organization of the shared folders and access resource documents whenever needed. The drive files also were set up for live meeting minutes and action plans and additional uses evolving each day. Documents are current and being constantly updated and made available. If an individual is absent or leaves the position all together, work can continue as others can access the files and continue where the work last stopped. Conclusions: Distance between sites and hours worked can no longer be an obstacle for accessing current information or acquiring tools needed to complete the job. The Q-Drive has allowed the work of our entire management team to come together as one. By implementing this process, we have improved the overall managerial function of the department.

Sponsored Research - None

918635

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 in Orlando had staffed Respiratory Therapists following a unit or floor-specific model. In some cases, there would be a Respiratory Therapist covering one floor alone.In recent times, as resources have become more scrutinized and service demand has increased due to the expansion of the physical plant in the opening of a new 15 story patient care tower, we were compelled to revise our service and staffing 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/DPI 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 divesting ourselves of 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. Assignment volumes change throughout the shift and if the lead or charge therapist is kept abreast of the dynamics, workloads can be adjusted appropriately. Results: Initially, there were concerns from the team that the ability to respond to STAT 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 ddition, with zone assignments we are seeing a higher level of teamwork than in the past where everyone worked in silos. Conclusion: While Zone Staffing is a new concept for us, we believe it is the model that will allow us to meet the demands of a large urban tertiary center in the face of declining resources and increasing clinical demand. Our patients are receiving more accurate assessments of their needs and in many cases bypassing a trip to a Critical Care Unit.

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 system called (EPIC ASAP corporation) EPIC ASAP for charting. While the flow from one charting system to another for the staff was relatively an easy one, capturing charges from EPIC ASAP has shown to be more difficult. All 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 go live date (11/11/2009) to obtain all patients who received continuous therapy in the emergency department. A 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. RESULTS: Charge capture significantly rose from 29% percent between November 2009 to April 2010 to averaging 80% charge capture from April 2010 to June 2010. There are still 20% of charges unaccounted for due to improper documentation procedures. CONCLUSION: While this data collection is still new for the billing team, it has significantly increased our charge capture dollars. Further improvement is expected through chart audits and staff education to enable charge capture.

Sponsored Research - None

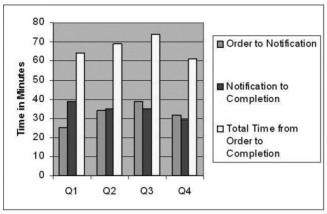
920885

IMPROVING UPON PRE-EXISTING HOME OXYGEN DISCHARGE PROCESSES, WHILE SIMULTANEOUSLY EXPLORING ALTERNATE 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 hypoxemia. Home oxygen discharges were traditionally allocated to the pulmonary 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 time was no longer workable under current practices. Objective: To identify and improve upon the pre-existing home discharge processes, while simultaneously exploring alternate methods of education in order to sustain and improve upon the 90 minute discharge goal. Method: The equipment technicians have extensive experience in the use of medical gases, and in particular oxygen, so it was proposed that they take on the responsibility of basic home oxygen discharges starting in October of 2008. The relative flexibility in the technicians' work flow gave them the ability to address and complete the discharges in a timely manner and was consistent with the standard of practices used by durable medical companies in the state of Colorado. Results: All data was collected in two separate fields and then combined to produce an overall average discharge time. The first 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 taken monthly and compounded quarterly in order to produce the following results: 1) Quarter one yielded an average of 24.86 minutes for field one, 39.16 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 31.63 minutes for field one, 28.9 minutes for field two, resulting in an overall time of 60.6 minutes. Conclusion: With the utilization of the technicians in order to expedite home oxygen discharges, 2009 yielded a yearly average of 66.57 minutes per discharge, which was 23.43 minutes below our target time of 90 minutes.

Sponsored Research - None



866960

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

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

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 via electronic mail to ATS physicians. Approximately 7300 ATS members 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, $p \leq .05$) was used to detect differences between comparisons. Data were expressed in frequencies and percentages. RESULTS: Physician's responded that higher RCP and nurse professional credential yields greater practice competency; however, physicians' perception of Nursing as compared to Respiratory Care Practitioners is different and more favorable ($p < .05$). Additionally, physician's responded that higher academic degree in both professions yields 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. Noteworthy, physicians made the same distinction between baccalaureate 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

887509

STRATEGIES TO ENHANCE RESPIRATORY THERAPISTS' PROFESSIONAL SATISFACTION: CLEVELAND CLINIC EXPERIENCE.

Ed Hoisington, Robert L. Chatburn, James K. Stoller; Respiratory Institute, Cleveland Clinic, Cleveland, OH

BACKGROUND: To ascertain most-wanted improvements in respiratory therapy (RT) processes, The Cleveland Clinic Respiratory Therapy departments held a series of structured meetings facilitated by the Process Improvement (PI) department (Respir Care. 2009;54(11):1568). We describe one measure undertaken from these meetings – conducting a staff survey to assess ways of optimizing RTs' professional satisfaction. **METHODS:** The Cleveland Clinic issues a 12-item annual Gallup (Gallup Organization, Omaha, NE) survey yearly to assess institution-wide employee engagement. As a follow-up to this survey, we polled RT staff regarding general satisfaction (Q3 and Q4-2009) and again in Q1-2010 and Q2-2010 (see Table) with a focus on satisfaction with specific types of RT equipment. In the 2009 general survey, RTs were asked to rank which of the 12 survey items were most important to them and first was "Having the necessary equipment to do my job." The Q1-2010 and Q2-2010 surveys were developed to identify the specific types of equipment most in need of improvement, e.g., ICU ventilators, transport ventilators, and CPAP machines. Response ratings were: no problem, need better equipment, need more equipment, equipment too hard to find, need more supplies, or supplies too hard to find. **RESULTS:** In the baseline Q3-2009 general satisfaction survey, 50% of RT respondents felt they had the materials and equipment necessary for their job (see Table). By the Q4-2009 survey, scores had risen, with 67% of respondents reporting satisfaction, possibly reflecting a concurrent announcement to purchase new ventilators. Later, in Q1-2010, RT supervisors implemented an "equipment shortage card" on which RTs indicated where and when they could not find specific equipment. Supervisors committed to seeking equipment and prepared an "equipment bulletin," which located some hard-to-find items. Thereafter, the demand for the equipment has only rarely exceeded the supply and satisfaction has risen in all categories on the Q2-2010 survey. **CONCLUSIONS:** Focused attention on specific opportunities to enhance RTs' professional satisfaction can identify actionable solutions to longstanding and widespread challenges. Specifically, in the case of locating equipment, using focused on-line surveys to poll RTs and having a leadership commitment to harvest solutions from the staff and to implement good ideas can produce favorable results.

Sponsored Research - None

920285

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

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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 the current EHR the hospital used another proprietary electronic MAR. The 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 previous barcode compliance 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 scanning compliance < 90%. After implementation in July of 2009, that 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 by rounding in 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 about their role in medication safety. Communicating expectations and holding individual RCPs accountable for barcode compliance as part of medication safety are essential for success. Removal of barriers, providing adequate equipment, dialogue 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%

920848

15 YEAR EXPERIENCE ON REDUCTION OF VENTILATOR ASSOCIATED PNEUMONIA (VAP) – ONE INSTITUTION'S EXPERIENCE.

Joy K. Hargett, John Sabo; Respiratory Care, St. Luke's Episcopal Hospital, Houston, TX

Background: In 1997, a multidisciplinary team consisting of infection control practitioners, respiratory therapists, nurses, pulmonary and infectious disease physicians was established to address increasing VAP rates. Method: We developed a screening tool that identified pneumonia risk patients and an intervention protocol. This tool evaluated patients who were mechanically ventilated for greater than 24 hours and did not have an infectious disease physician or pulmonologist. The protocol included (1) obtain sputum sample (2) obtain chest x-ray if not done within last 24 hours, (3) order complete blood count if not done in last 24 hours, (4) institute closed suction catheter, (5) twice daily chlorhexidine mouth care (6) daily replacement of SVN on ventilator patients (7) repeat orders every 48 hours until patient was extubated, trached, a positive sputum culture obtained or pulmonary/infectious disease physician consult occurred. Attending physicians were notified if the sputum gram stain was positive or if certain organisms were identified and physicians received guidelines for empiric therapy. This was piloted in our 41-bed cardiovascular ICU and then expanded to all ICU's. Since the inception of the project continued performance improvement has occurred. Evaluation of the project from 1996-2006 or the "10 year report card" showed an 86% reduction in the VAP rate house wide. Since then, we have instituted a number of practices that we feel have led to a continued reduction in VAP rates. These practices include (1) institution of "water free" heated wire circuits on all ventilators patients, (2) continued replacement of inline nebulizers daily (3) use of the closed suction catheter on all ventilator patients and (4) changing the ventilator circuit prn. In 2009, we introduced a revised order set on ventilator care, including spontaneous awakening and breathing trials, and sedation management. All staff (respiratory care and nursing) was educated on this new tool. In 2010, we changed the products utilized for oral care. Results: Since 2006 the VAP rate continued to decrease another 33% or 91% from the 1997 baseline. Conclusion: Continued decline in the VAP rate has been seen and in some months, no VAP's are reported. We currently focus on maintaining/improving this quality level by continually monitoring our VAP rate. As VAP's do occasionally occur, we review individual cases in order to determine if certain causation factors can be identified.

Sponsored Research - None

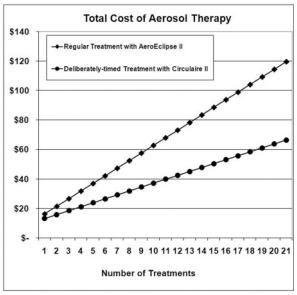
920917

FINANCIAL IMPACT SPREADSHEET FOR COMPARING TOTAL COST OF AEROSOL DRUG DELIVERY SYSTEMS.

Michael McPeck; Respiratory Care, Long Beach Memorial Medical Center, Long Beach, CA

BACKGROUND: To comply with cost reduction goals, I sought to better control costs of providing aerosol drug therapy. Total cost to hospitals for aerosol therapy by RTs includes 3 cost components: supplies, drugs and labor. Supplies may range from <$1 for simple "tee" nebulizers to >$5 for a breath-actuated device. Drug costs range from 10-16 cents (albuterol) to >$70/dose for Tobi. Labor costs vary widely but are easily determined in most hospitals. My goal was to account for many different combinations of supply, drug and labor costs and to graphically present comparison data between two or more scenarios in an intuitive and visually-compelling manner. METHODS: I obtained current hospital cost data from appropriate sources with respect to our average departmental labor cost (including benefits), acquisition cost of different nebulizer systems from our purchasing group and aerosol drug costs from our pharmacy. Using MS Office Excel 2007 I developed a spreadsheet with user input fields for variables to be tested, lookup tables for known constants (cost of different nebulizers, cost of different drugs), and formulas to calculate cumulative cost of treatments over time under differing scenarios. Multiple scenarios reflecting current practice and potential practice changes were devised and input for testing. RESULTS. The spreadsheet rendered a compelling visual comparison of the cumulative cost difference between different treatment scenarios and permitted me to confirm the selection of a conserver-type nebulizer system (Circulaire II) over a breath-actuated system (BAN) on the basis of labor time cost-avoidance. Similarly, I was able to demonstrate that the labor component of aerosol therapy is the greatest component of total cost for many scenarios in which device cost varies widely by as much as 5 or 6-fold. Further, I determined that certain costly drugs (eg, Tobi & Pulmozyme) skew the total cumulative cost so greatly that compensation by labor cost modification is virtually impossible. However, this analysis demonstrated that significant time savings can be identified for other purposes, such as improving patient compliance in patients with multidrug aerosol therapy. CONCLUSION: Graphical spreadsheet analysis enhances cost comparison between different therapy scenarios, enhances our recognition of understanding of the differences, and exposes subtleties that may otherwise go unnoticed, thereby assisting with cost reduction endeavors.

Sponsored Research - None



921203

RESPIRATORY CARE AS A MICROSYSTEM: APPROACH TO ORGANISATIONAL VERBAL ORDER REDUCTION.

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BACKGROUND: Organizational improvement relies upon local implementation of PDSA cycle tests. To spread change and engage respiratory therapists (RTs) in improvement processes, a designated quality improvement RT and analytics RT participated in multidisciplinary team to reduce verbal orders. METHODS: Automated data in the form of PYXIS 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 PYXIS 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 use accounted for no 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 resource utilization for data collection. Alignment with organizational improvement plans can be applied to RT departments which practice by care area rather than geography like nursing and medical staff. Minor adjustments to implementation can be translated to our discipline. This model of local application to the RT discipline as a microsystem can be applied to other elements of CPOE or web based event reporting databases to save resources and apply rapid cycle improvement.

Sponsored Research - None

921125

EFFECT OF INCENTIVES ON REGISTERED RESPIRATORY THERAPIST CREDENTIAL ACHIEVEMENT.

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BACKGROUND: RRT credentialing exams are one way to assess the high-level critical thinking skills and knowledge that increase potential for exceptional care. Achievement of the RRT is typically preferred by employers eager to staff an expert team. Many respiratory therapists, however, settle for an entry-level CRT credential and forgo the RRT. It is uncertain what incentives motivate some to complete the registry process. In light of this, the research question considered was "What effect do incentives have on obtaining the RRT credential?" METHOD: Respiratory therapists employed at six of the larger Oklahoma City, Oklahoma metropolitan hospitals were recruited onsite during evening shift change. Convenience sampling was used as potential participants were limited to those on duty on the prescheduled date. A 30 item author-generated survey questionnaire was designed based on related scholarly literature to collect demographic, credential, and incentive information. Colleagues piloted the tool prior to use. SPSS was used for descriptive statistical analysis. RESULTS: Subjects (N = 71) included 58 RRTs and 13 CRTs. A significant number of RRTs (91%) were recipients of pay incentives (M = $3.15 per hr) for obtaining the RRT credential and 43% reported this to be the key incentive followed by personal pride/achievement (33%) and professionalism (14%). Personal pride/achievement was the top reason 31% of CRTs are considering the RRT followed by pay and marketability with an equal value of 23% each. CRTs were more likely offered a pay increase after RRT obtainment or none at all. A prepayment (6 or 12 months) of RRT credential pay was the most cited incentive given to registered therapists and resulted in 85% achievement within 12 months. Those limited to pay after receiving the RRT were less apt (46%) to do so within 12 months. CONCLUSION: Pay is of obvious importance as salary incentives, especially in the form of prepayment of RRT credential pay, are logical contributors to the number of therapists obtaining the RRT. Personal pride/achievement, however, should not be overlooked. Importance of the accomplishment should continue to be expressed and successful candidates recognized. Additional data collection to obtain a larger pool of CRT subjects and input from therapists in rural areas would be beneficial for further analysis.

Sponsored Research - None

917375

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

John Sabo, Joy K. Hargett, 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 treated 3,314 ventilator patients with an average total cost of $61,127. A 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 standardization of care, interventions between disciplines, variability in skill levels, communication and discharge process. Actions items to address 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 two categories. The Ventilator Product Line included DRG's, 541, 542, 565, 566, and 575. The second category was comprised of the remaining DRG's of patients requiring mechanical ventilation. Due to the complexity of the patient population, we focused primarily the VMI on the Ventilator Product Line DRG's. The measurement matrix included Length of Stay (LOS), ICU LOS, Progressive Care Unit (PCU) LOS, Length of Ventilation (LOV), Total Cost/Case, and Case Mix Index(CMI). Conclusion: Comparing 2008 and 2009 data after the institution of the VMI program, there were decreases in LOS, ICU LOS, PCU LOS, LOV, and Total Cost with an increase in CMI in the Ventilator Product Line DRG's. We also saw decreases in the total ventilator population, PCU LOS and LOV in the remaining DRG patients. Currently the next phase of the initiative will focus on enhancing communication to the physicians via electronic means for all 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 records reporting the progress of the weaning process.

Sponsored Research - None

920772

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

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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 hospitalized COPD patients while maintaining/improving quality. An integral part of the APU is the Respiratory Clinical Specialist (RCS). Method: The RCS is an advanced RRT position whose duties include facilitating care of the COPD patient with physician rounding, patient/caregiver teaching, defining appropriate care/discharge needs, and case managing those patients with frequent readmissions. In this "traffic cop" role, the RCS helps insure established patient care activities are occurring on a daily basis in the care of COPD patients. One activity is the 60-second walk, a procedure designed to give a real-life view of how patients tolerate mobilization in limited spaces, such as the home. COPD patients who may be admitted to the ICU care are seen by the RCS in order to facilitate transfer to the APU. The RCS will assist facilitate discharge issues between the patient, physician and durable medical equipment company and provide telephone follow up after discharge. The RCS role has recently expanded into the Respiratory Care Department's inpatient sleep assessment program by helping identify high risk or diagnosed obstructive sleep apnea patients and facilitating orders for care. Results: An analysis compared FY2008 vs. FY2009 COPD (DRG 88) patient discharges. The result from FY2008 to FY2009 was a 9% decrease in LOS, a 7% decrease in total cost/case with an increase in CMI of 3%. Further analysis compared patients without an ICU/PCU admission who were admitted/discharged from the APU. The APU COPD patient population compared to non APU COPD realized a 2% decrease in LOS, a 9% decrease in cost/case with same CMI. Creating an "Alternative Care Level" for COPD patients resulted in a 23% decreased in COPD ICU admissions. COPD discharge from the APU after an ICU admission had a 32% shorter LOS with 27% less total cost/case than a COPD discharged from other areas. Conclusions: This initiative contributed improvements in average net margin/case of COPD patients from FY2008 vs. FY2009 of 32%. The RCS program has helped hardwire care, establishing the position as integral part of COPD management at our institution.

Sponsored Research - None

920854

USING WORKRATE TO ESTABLISH RESPIRATORY CARE ASSIGNMENTS.

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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 despite presumed achievable average work load assignments (Respir Care 2009;54(11):1552). 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 Root Cause Analysis to generate ideas 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 all the other modalities. We surveyed the clinical staff to determine willingness 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% (15/24) 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

NONINVASIVE VENTILATION WITHIN AN ACADEMIC MEDICAL CENTER: A UTILIZATION REVIEW.

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Background: The growing use of noninvasive ventilation (NIV) requires routine evaluation of departmental as well as hospital policies, procedures and equipment. An equipment utilization review may provide valuable information for departmental resource allocation. We provide a retrospective review to evaluate NIV usage in our adult intermediate and intensive care settings. Method: Using our electronic charting systems, we randomly selected 16 dates over a 3 month period and analyzed data on 126 patients that required NIV. Recorded data included: diagnosis, location of use, mode, settings, and patient-owned vs. hospital owned equipment. Patients from our Emergency Department and Post Anesthesia Care Unit were excluded from analysis. Results: Of the 126 patients reviewed, ninety-two patients (73%) were diagnosed with obstructive sleep apnea (OSA), eighteen patients (14%) presented with acute respiratory failure (ARF), and sixteen patients (13%) were diagnosed with chronic hypoventilation syndrome (CHS). Ninety-nine patients (79%) were treated in an intermediate care area while twenty-seven patients (21%) were treated in an intensive care unit. Eighty-six patients (68%) were treated with continuous positive airway pressure (CPAP) while forty patients (32%) were treated with bi-level positive airway pressure. Forty-three (34%) were patient-owned noninvasive ventilators while eighty-three (66%) were hospital-owned devices. Mean FiO2 was 32%; bi-level was 43% while CPAP was less than 28%. Conclusions: 64% of patients in our institution receiving NIV therapy required CPAP with a mean FiO2 < 27% for treatment of OSA. In considering resource allocation, supportive data on institutional use as well as monitoring requirements would prove beneficial. Lower tier NIV devices may provide an effective alternative over newer-generation multi-mode ventilators for the delivery of CPAP or diagnoses requiring minimal support. Personnel responsible for making equipment purchasing decisions may benefit by reviewing their institutions NIV utilization before purchasing noninvasive ventilators.

Sponsored Research - None

917901

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

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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 the approach. ***Method:*** The ventilators are set with the following settings; HFJV: Rate 420, PIP 20, PEEP 5 cmH_2O, temperature cartridge at 38 C and the circuit at 40 C. Bird VIP: PEEP 5 cmH_2O, Flow 8 LPM, no rate, temperature chamber at 35 C and the circuit at 37 C. The approach is to side stream the endotracheal tube (ETT) 2 cm distal to the Bunnell Life Port with tees that are the same inner diameter (ID) as the ETT. The tee is connected to the ETT that has been attached to the neonatal lung model. An Aerogen Aeroneb Pro Solo with Pediatric Tee adaptor is adapted to connect as aside stream to the ETT tee. A gas source is connected to distal end of the Aerogen tee adaptor. The 3 ETT sizes chosen coincided with the Life Port sizes. To measure the aerosol deposition a pre weighed disposable paper filter was placed between the end of the ETT and before the lung model. The filters were weighed again once the aerosolized Albuterol (3 ml unit dose) was complete. Controls were performed to determine background humidity (see table 2). ***Results:*** Gas flows used for testing: No Flow, 0.25 LPM, and 0.5 LPM. The ventilators were allowed to reach a steady state. Flow testing: The pressures within the lung model were recorded. Flow was then added at the ETT 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 depositions were recorded (see tables 3, 4, and 5 results). ***Conclusions:*** Aerosolized medication using a side steam of the ETT is possible. 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. The 0.5 LPM appears to be the best option, though the pressure changes in the lung model may be construed as an impairment of ventilation. Further testing should be completed. Animal testing that include; arterial blood gasses pre and post aerosolized albuterol using the method as described to determine ventilator effects, and aerosolized radionuclides may provide definitive data on aerosol deposition and distribution.

Sponsored Research - None

906251

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.

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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; Length of 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 along with RSV, bronchiolitis, or pneumonia; Pts who required continuous aerosol therapy Demographic information available on accompanying tables. **Misty Neb:** All medications diluted to a minimum of 3ml. **BAN:** Albuterol was mixed at a 1:1 ratio with NS. Ex: 0.5 albuterol was mixed with 0.5 NS. If Albuterol was combined with ipratroprium or budesonide, there was no difference in dilution between Misty and BAN. i.e. no NS added. Misty neb was nebulized until consistent sputter (8-12 minutes). BAN was nebulized to sputter or 5 minutes whichever came first (as per manufacturer instructions). Flow rates for both nebulizers were identical (6-8 lpm); no blow-by treatments were given in either group. **Results: Breath Actuated Nebulizer:** Number of Nebulizer Treatments: 5.8 Hours on Oxygen: 3.43 Length of Stay (LOS): 29.96 hours **Misty Nebulizer** Number of Nebulizer Treatments: 7.04 Hours on Oxygen: 7.5 Length of 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 populations and additional medications.

Sponsored Research - None

920188

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

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Effects on Mortality Rates Utilizing Aerosolized Epoprostenol and Inhaled Nitric Oxide (INO) For the Treatment of Hypoxemic Patients. Malloy R, Glynn B, McClintic C, Pezzano T, Weibel S. BACKGROUND: Both aerosolized Epoprostenol and Inhaled Nitric Oxide (INO) are used to treat hypoxemic patients (ARDS and /or Pulmonary Hypertension). Neither is FDA approved for this use though it is the standard of care in many critical care units. At 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 conducted and INO therapy for non-cardiac patients with refractory hypoxemia 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 pao2/fio2 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 (n=22). 73% of the patients expired prior to discharge with a 27% survival rate when treated with aerosolized Epoprostenol (n= 30). Chi square $p < .05$ (n=52). The median pao2/fio2 ratio was 71 for the INO group and 82 for the Epoprostenol group. CONCLUSION: The comparison showed a clinically significant reduction in mortality rates with patients treated with aerosolized Epoprostenol in lieu of 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 $8000.00 per patient versus $1,600.00 for the Epoprostenol population resulting in an 80% reduction in costs. Further investigative studies are required to validate the clinical findings.

Sponsored Research - None

890223

AEROSOL PAUSE TIMES ASSOCIATED WITH VIBRATING MESH NEBULIZER.

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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 with some pauses between aerosol. The pause varies based 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 575 BodyGuard) with a dedicated infusion set was used to deliver solution (nss) 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 4 ml were 226±34, 111±15, and 54±8 seconds. Mean pause times for experiment group at 1ml, 2ml and 4 ml were 276±75, 179±103, and 50±16 seconds. CONCLUSIONS: The term "continuous aerosol" can be confusing when associated with this new paradigm in inhaled 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 both groups were significantly less than 6 minutes, 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.

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Over the last 15 years, administration of Inhaled epoprostenol sodium has been reported, 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, independent 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 to achieve desired lung dose based on the efficiency of aerosol delivery system used. Methods: To better understand the relationship of nebulizer output 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 reach target 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, formulation 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

	3%	14%	28%
80 kg	37.3	8.0	4.6
15 kg	3.5	1.5	.75

Table shows infusion rates with a 30 mcg/ml formulation of epoprostenol sodium (1.5 mg in 50 cc sterile diluent) 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 DURING MECHANICAL VENTILATION.

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Background: Constant output nebulizer wastes aerosols during expiration phase. Furthermore, with it placed in the mechanical ventilator circuit, the waste aerosolized particles maybe capture by the bacterial filter on the expiratory 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 aerosol particles 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 within 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 descending ramp pattern. The inhaled agents with constant output nebulizer were administered every 45 minutes. Each pressure drop was measured at 5, 15 and 30 minute after 15 minutes of nebulization. Pressure drop was measured against an air flow at 100 L/min by a flow analyzer (PF 300, imtmedical, Europe, Switzerland) before and after each test. The end point was 45 doses through nebulizer or when the filter was obstructed measured by the ventilator. The pressure drop after steam autoclaving was also measured. Median values were compared with Kruskal-Wallis, Mann-Whitney U, and Wilcoxon Signed Rank test; $p<0.05$ considered significant. Results: The pressure drop of all 7 of the filters were increased after inhalation (9.95 ± 12.67 and 2.7 ± 0.58 cmH2O, respectively; $p<0.001$). However, only 10% Acetylcysteine yielded a significant difference in the pressure drop before and after test ($p<0.05$). It was also observed that after steam autoclaving, the pressure drop of all 7 of the filters were decreased, but could not return to the recommended safe value (<4 cmH2O at 100L/min), as the filter was already been obstructed by the particles ($p<0.05$). Conclusion: 10% Acetylcysteine aerosol particles increase the resistance of the bacterial filter during mechanical ventilation. The bacterial filter on exhaled limb should be replaced 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 VENTILATOR AND STAND ALONE VAPORIZER.

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Introduction: Administering inhaled Isoflurane to the status asthmaticus patient in an ICU is difficult because an anesthesia ventilator 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. To attempt 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. Methods: We evaluated the Drager 19.1 series Isoflurane vaporizer, obtained a Datex Ohmeda 5250 RGM anesthesia monitor, developed a gas savaging 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 ventilator 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 benefit 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 BRONCHODILATORS ADMINISTERED.

Susan Rinaldo-Gallo, Janice J. Thalman; 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 determine the effect of LABA use on SABA volume delivered to inpatients 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 volume and type of Beta Agonists delivered on 3 medicine units (100 beds total) where retrospectively examined from 2005 – 2009. Therapist's documentation and billing records from the departmental information system was used for analysis. 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 Guide to Aerosol Delivery Devices for RT," Arzu, 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/DPI. 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 1320.6 hours. The cost savings in therapist pay was $33,015 (not including benefits). The cost increase for medication was $1,128. Conclusions: 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

Quanity 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
% SABA	91.3%	89.7%	88.7%	85.2%	85.2%
LABA Total	3,069	3,810	3,677	4,603	4,568
% LABA	8.7%	10.3%	11.3%	14.8%	14.8%
Grand Total	35,256	36,954	32,411	31,164	30,927

909103

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 volume has been observed after many hours of use. Methods: We tested 3 different SPAG-2 units, which were all set up according to manufacturers recommendations. Each was < 2 years old and filled with 100 mL sterile H2O. Units were run at regulator pressure = 26 psi, nebulizer flow = 8 L/m and drying air flow = 6 L/m.. 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 verified nebulizer function by noting that all three units produced approximately one-half inch diameter spray patterns on the wall of the flask. Results: Data are displayed in the table below. Mean output for all epochs and devices was 6.6 mL + 4.8 mL per hour. This yielded a coefficient of variation of 74%.Conclusion/Discussion: According to the manufacturers specifications, SPAG-2 should have an output range of 12.5 to 15.0 mL/hr. Our tests showed high variability in the output within and between units and that none of the units came close to performing according to the manufacturers claims. A limitation of this study is that we did not actually use a solution of Ribavirin dissolved in sterile water, owing the very high cost of the drug (list price $4963 per 6 g vial. However, our findings confirmed many reports from clinicians that the SPAG-2 has large and varying residual volumes at the end of nebulizations periods when using Ribavirin solution. This poor performance could lead to low and or inconsistent drug delivery and may have a negative impact on outcomes of patients who need the drug and certainly could contribute to frequent observations that the drug did not seem to work. Assuming our current customary dosing schedule of a single 6 g dose diluted into 100 mL of sterile H2O, given for 2 hours, TID, and further assuming an actual nebulization rate of 6.6 mL/hr and a cost of $49.63/mL, we may be wasting about 60 mL of the drug per day or about $2978. Further study may be needed to find better methods of delivering this drug.

Sponsored Research - None

Nebulizer Output in mL

Unit	Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Mean	SD	CV
1	10	8	9	3	19	9.8	5.8	59%
2	9	2	13	3	3	6	4.8	80%
3	6	3	2	6	3	4	1.9	48%

920412

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 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 (Ciruss). 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 inhaled aerosol peaked (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 confirmed 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.

Sponsored Research - None

887665

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

Scott T. Dwyer, Stairhime 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 (Aeroneb 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 4.08% (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.

Sponsored Research - Nebulizer provided by Aerogen Ltd.

921137

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

Ariel Berlinski[1,2], Janet B. Hayden[1,2]; [1]Pediatrics, UAMS COM, Little Rock, AR; [2]Pediatric Aerosol Research Laboratory at ACHRI, 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 Notes. 2008;(1):27-30]. This methodology increases testing time for serial testing procedures. We hypothesize that after an initial prolonged cooling time, experiments could be repeated after shorter re-cooling times without sacrificing accuracy. Methods: 3 units of continuous output (HUDSON RCI UP-DRAFT II® Optineb Nebulizer, Teleflex Medical, Research Triangle Park, NC) (HUDSON) and breath enhanced (PARI LC Plus, PARI Respiratory Equipment Inc., Midlothian, 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 (P%1-3) were compared with 3 different protocols. Initial cooling of the NGI (90 minutes for all protocols) was followed by 2 measurements with re-cooling 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 CITDAS 3 software (Copley Scientific, Nottingham, UK). Data were compared using ANOVA for repeated measures. A $p < 0.05$ was considered statistically significant. Results: MMAD, GSD, P%<5, and P%1-3 for first measurements of all protocols (n=9) were: 3.47 ± 0.21 μm, 2.31 ± 0.07, 67.3 ± 2.6%. and 40 ± 2.3% (PARI) 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: -3.9 to +2.1% (PARI) and -4.1 to +2.9% (HUDSON) for MMAD; -5.6 to +2.6% (PARI) and -4.9 to +1.9% (HUDSON) for GSD; 0 to +4.6% (PARI) and -3.7% to +5.7% (HUDSON) for P%<5; and -2.4 to +5.2% (PARI) and -1.8 to +4.9% (HUDSON) for P%1-3. 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.

Sponsored Research - None

890196

THE INFLUENCE OF PEDIATRIC AEROSOL MASK TYPES AND NEBULIZERS ON BRONCHODILATOR DELIVERY IN VITRO.

Wen-Qie Liu[1,2], Hui-Ling Lin[1], Xin-Qiang Wang[1], Kai-Ying Liu[1,2]; [1]Department of Respiratory Care, Chang Gung University, Tao-Yuan, Taiwan; [2]Respiratory Therapy, Chang Gung Memorial Hospital, Tao-Yuan, Taiwan

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 influence of 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 (Galemed, 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 150 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 (Galemed) 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 shows the median % (range) of total dose inhaled and dead volume. The Fish mask was more efficient than standard mask with CONs ($p<0.05$) but not the BEN. The Neb-2 delivered more drug than other CONs or BE, with either mask ($p <0.05$). . Conclusion: Mask and nebulizer selection can increase inhaled dose-up to two fold in this model of simulated pediatric ventilation.

Sponsored Research - None

903569

INFLUENCE OF PEDIATRIC MASKS WITH A BREATH ACTUATED NEBULIZER ON AEROSOL DELIVERY.

Kai-Ying Liu[1,2], Hui-Ling Lin[1], Wen-Qie Liu[1,2], Xin-Qiang Wang[1]; [1]Department of Respiratory Care, Chang Gung University, Tao-Yuan, Taiwan; [2]Respiraotry Therpay, Chang Gung Memorial Hospital, Tao-Yuan, Taiwan

Background: Breath actuated nebulizers (BAN) can increase inhaled mass in adults. Although manufacturer suggests that the (BAN) can be used for children with inspiratory flow rate higher than 15 L/min delivery efficiency with mask has not been reported. Objective: The purpose of this study is to demonstrate the influence of different pediatric aerosol masks used with a BAN during patient triggered, manually triggered and continuous aerosol output. Methods: A spontaneous pediatric lung model (ALS5000, IngMar Medical) with tidal volume 150 mL, inspiratory time 0.8 second, inspiratory flow rate 20 L/min, and respiratory rate 25 breath/min was attached to collecting filter and face form. The BAN (AeroEelipse, Monaghan Medical Inc) was tested with a standard pediatric aerosol mask (Galemed Cop), the "Bubble of Fish" aerosol mask (Pari Inc) and the valved aerosol mask for the BAN (Monaghan Medical Inc). The BAN was manually actuated (MA) during inspiration and continuous output (CON) with standard and Fish masks. The BAN breath actuated (BA) with the valved mask fit tightly on the model face. A unit-dose of 5.0 mg salbutamol (GSK Corp.) in 4 mL diluent was nebulized with 8 L/m of gas at 50-pisg (n=5). Inhaled drug was eluted from the filter and analyzed with a spectrophotometer (Hitachi Crop) at 276 nm. Mann-Whitney U test was used for statistical analysis, and $p< 0.05$ was used for statistical significance. Results: The figure illustrates the median % drug mass of unit-dose drug inhaled on the filter. With Breath actuation and valved mask, the BAN delivered up to 2 fold more drug than MA. CON delivered > 10 fold more inhaled drug than BA ($p<0.01$). Conclusion: In this model of nebulization with a BAN to a spontaneously breathing pediatric patient, continuous output delivered more drug than either breath or manual actuation.

Sponsored Research - None

903557

IN VITRO INHALED AEROSOL COMPARISON OF A CONSERVER NEBULIZER (CIRCULAIRE II) VS. A BREATH-ACTUATED NEBULIZER.

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BACKGROUND: Two different aerosol drug delivery systems claim to enhance Inhaled Aerosol (IA) and shorten 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 phase, which would otherwise be wasted, and delivers it on the subsequent inhalation. Conversely, the Monaghan Medical AeroEclipse II Breath-Actuated Nebulizer (BAN) powers the nebulizer jet during inspiration only, to reduce waste during exhalation. Our department was already using the BAN 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 TTs? 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 (f/VT/I-time%): 15/500/50%, 15/500/30%, 30/250/50%, and 30/250/30%. The devices were run on wall air at 50 psig & 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 at 4 and 8 mins by 2.5 (mass of albuterol in mg in Initial Charge). RESULTS: The IA, shown graphically, depicts the mass of IA against TT for 4 breathing patterns. The mean (±SD) IA for the CIRC at 4 mins was 0.66 (±0.09) mg compared to 0.55 (±0.14) mg for the BAN at 8 mins. SUMMARY: CIRC out-performed BAN inasmuch as equivalent IA was delivered in roughly half the time (4 vs 8 mins). CONCLUSION: For equivalent IA delivery, TT with the Circulaire II is significantly shorter than the BAN and, coupled with a favorable supply cost differential, meets our requirements for an aerosol drug delivery system for deliberately shortened routine therapy.

Sponsored Research - As mentioned above, I have a consulting relationship with Westmed for public speaking. For this study, I appraoched Westmed to fund a product preference study for our hospital. Westmed rented the aerosol lab and paid for the materials on my behalf but did not direct either me or the study and its methodology or influence the results in any way. They allowed me to be completely independent.

916733

EFFICACY, SAFETY, AND PATIENT AND RESPIRATORY THERAPIST SATISFACTION WITH A BREATH 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®), may be superior to conventional nebulizers due to reduced drug waste and treatment. The aim of the study was to compare the BAN to standard nebulizer 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 lower with the BAN (4.1 vs. 9.9 min $p=<0.001$). 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. Pre 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

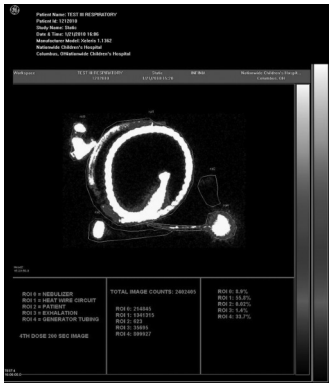
886800

EVALUATION OF SYSTEMIC CIRCUIT PARTICLE DEPOSITION USING THE AEROGEN MICROPUMP AEROSOL GENERATOR WITH A VARIABLE FLOW NCPAP SYSTEM.

Kimberly Farney[1], Brandon Kuehne[1], Laurie Gibson[2]; [1]NICU, Nationwide Childrens Hospital, Columbus, OH; [2]Department of Nuclear Medicine, Natinwide Children's Hospital, Columbus, OH

Background Much debate has taken place regarding the efficacy of aerosolized medications given through nasal CPAP systems. The Aerogen micropump aerosol generator has traditionally been an acceptable method of aerosolized medication delivery in the hospital setting. However, little is known about how much drug is actually delivered to the patient when used inline with a variable flow nasal CPAP system. Methods We created a system that employed a test lung placed in a plastic jar. The jar was subjected to negative pressure by means of time/valve mechanism connected to a suction system. Simulated inspiration effort was measured by use of a heated wire anemometer. The flow signal was then integrated with an Avea ventilator. We used 3 ml of TC99mTC DTDA as our aerosol. The Aerogen was placed inline with a Cardinal Infant Flow Generator system connect to a CPAP driver. All nebulizer sessions were done over 15 minutes. The Aerogen was placed either proximally and distally in the circuit and patient effort was simulated at a 0.4L minute volume. All circuits were then placed under a GE Infinia Hawkeye Gamma Camera. Results Data was analyzed from 15 sessions. The Aerogen was placed at the heater,and the average medication delivery was 0.32%±.36(n=6). When the Aerogen was placed 18 inches from the prongs the average medication delivery was 21.41% ±11.49(n=9). Single factor analysis of variation (ANOVA) yielded a P= 0.0007 between the two placements. Conclusion This study suggests that the placement of the Aerogen, is associated with greater aerosolized medication delivery when the Aerogen is placed closer to the patient . As a result of this study a change of practice will occur regarding location of inline nebulizer placement.

Sponsored Research - None



904400

AEROSOL LUNG DEPOSITION USING A VIBRATING MESH NEBULIZER DURING HIGH FREQUENCY OSCILLATORY VENTILATION IN AN ADULT LUNG MODEL OF ARDS.

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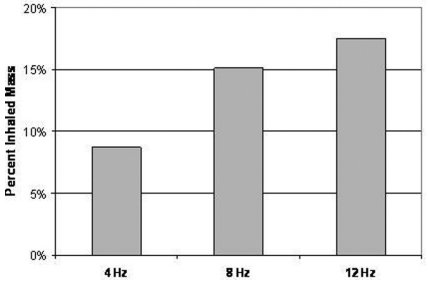
Background: Lung deposition of aerosolized medication during high frequency oscillatory ventilation (HFOV) in adults has not been thoroughly quantified. We measured simulated lung deposition in an adult lung model during HFOV using a vibrating mesh nebulizer (VMN). Method: A VMN (Aeroneb Solo, Aerogen) was placed between the 3100B (Viasys) ventilator "Y" and a Ballard Trach Care double swivel elbow inline suction catheter. The suction catheter was connected to a 7.5mm endotracheal tube inserted into a bifurcated trachea model and the cuff was inflated. Bacteria filters were positioned at the distal ends of each bronchial lumen and connected via a "Y" adapter to a single compartment of a test lung (TTL, Michigan) set at a compliance of 20 mL/cm H20. The ventilator was set to amplitude of 90 cm H2O, mean airway pressure of 34 cm H2O, 33% inspiratory time, with bias flow of 40 L/min. The VMN was filled with a 3 mL (2.5 mg) dose of albuterol and nebulized continuously until empty. A total of 3 runs each were performed at frequencies of 4 Hz, 8 Hz, and 12 Hz. Albuterol was eluted from the filters and analyzed with UV spectrophotmetry (276 nm) and reported as percent of total dose. Results: The percent of albuterol delivered distal to the mainstem bronchi in a bifurcated trachea model was 8.7 ± 0.78 % at 4 Hz, 15.1 ± 6.9 % at 8 Hz, and 17.5 ± 3.1 % at 12 Hz. There was a trend of increasing inhaled mass with frequency. The average deposition across all frequencies tested was 13.8%. Conclusion: During HFOV in an adult lung model of ARDS, simulated lung deposition of drug aerosolized with the VMN is consistent with the range of dose efficiency reported with conventional ventilation (Ari et al, Resp Care July 2010). During HFOV, drug delivery appears to increase with higher frequencies. Further investigation of lung deposition, penetration, and clinical response to aerosol medication delivery during HFOV in adult patients with ARDS is warranted.

Sponsored Research - Jim Fink has a consulting relationship with Aeroogen



918781

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 at home 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 with 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 taken 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, poor 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

801477

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

Megan Hayden, Rachel Lenshyn, Kevin Tucker, Joel Brayfield, Aaron E. Light; Respiratory Therapy, Ozarks Technical Community College, Springfield, MO

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 manikin (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 flowrates. 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 manikin 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 manikin'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 links of tusks. 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

920353

SECONDHAND AEROSOL EXPOSURE DURING MECHANICAL VENTILATION WITH AND WITHOUT EXPIRATORY FILTERS: AN IN-VITRO STUDY.

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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 pacer 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 pacer (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 pacer. 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 Respironics BiPAP Vision, the Respironics V60 and the Hamilton C2 during conditions of sequenced system leak. Each ventilator evaluated in this study was exposed to a protocol that incorporated increasing and decreasing system leaks, during which time breath type delivery (i.e., triggered, missed, and auto-triggered) was recorded. For each leak condition, Repeated Measured Analysis of Variance (SPSS 17 for Windows) was used to compare within and between ventilator differences among leak conditions for each breath type delivered. Results: The C2 ventilator delivered fewer triggered breaths than either the Vision or the V60 at a leak condition of 50 L/min ($p < 0.05$). No differences ($p > 0.05$) were identified in the number of missed breaths delivered. At conditions of higher leak (i.e., 25 L/min and 50 L/min), there were a greater number of auto-triggered breaths delivered by the C2 ($p < 0.05$) as compared to either the Vision or the V60. Conclusion: Taken together, missed breaths and auto-triggered breaths interfere with patient-ventilator interaction, and any increase in the delivery of auto-triggered or missed breaths result in a decrease in patient-ventilator synchrony. In our study, the presence of system leaks resulted in more lung model-ventilator dyssynchrony by the C2 ventilator when compared to either the Respironics BiPAP Vision or the Respironics V60. This study is limited by its bench design and should be repeated in a clinical setting.

Sponsored Research - Philips/Respironics

920691

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®

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 Respironics BiPAP Vision, the Respironics V60 and the Hamilton C2 during conditions of sequenced system leak. 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 Measured 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 leak (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 Vision 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 model created to mimic 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 continuous dyssynchrony and a failed NPPV trial. This study is limited by its bench design and should be repeated in a clinical setting.

Sponsored Research - Grant support from Philips/Respironics

920670

BENCH STUDY: EVALUATION OF END-EXPIRATORY PRESSURE VENTILATING NEONATES WITH MODERATE TO SEVERE LEAKS USING THE VIASYS AVEA AND MAQUET SERVO-I.

Joshua Dillon, Jody Lester; Respiratory Care, Boise State University, Boise, ID

BACKGROUND: Leaks are not uncommon when ventilating neonatal patients due to cuff-less endotracheal tubes. The purpose of this study was to evaluate the effect of various percentages of leaks on end-expiratory pressure (PEEP). METHOD: We performed all required pre-use tests and then connected each ventilator to the IngMar NeoLung with a 3.5 ETT. Calibrated pressure and flow sensors were put in the inspiratory and expiratory limbs of the ventilator circuit and settings were selected to simulate ventilation of a 1250 gram neonate (Vt target of 5 ml/kg). Sensitivity was set to avoid auto-triggering. Avea settings: PC mode, RR 30, Ti 0.3, Ti Rise 5, PEEP 5, Inspiratory pressure 7 (above PEEP), tube compensation off and a hot wire flow sensor was used. Servo-i settings: PC mode, RR 30, Ti 0.3, Ti Rise 0.15, PEEP 5, and Inspiratory pressure of 4 (above PEEP). Using these settings, we created 0, 25, 50, and 75 percent leaks and collected data (every 30 ms) for at least two minutes; leaks were created by adjusting a stopcock valve on the NeoLung. The Avea was tested with leak compensation on and off, and with bias flow set at 1 and 3 LPM. RESULTS: Even with large leaks, measured PEEP did not drop below set PEEP for all tests on the Avea regardless of whether leak compensation was turned on or off. The Avea consistently delivered measured PEEP at levels slightly higher than set PEEP (5.01-5.26cmH2O). The Avea required a higher PIP (12 cmH2O) than the Servo-i (9 cmH2O) to deliver a similar target Vt in PC mode. For all tests on the Servo-i, measured PEEP values in both the inspiratory and expiratory limbs were slightly less than set PEEP (4.86-4.91cmH2O); this difference was greatest at the 75 percent leak. When comparing the PEEP measurements in the inspiratory versus the expiratory limbs, the Servo-i had measurements within 0.01 cmH2O of each other; measurements for the Avea were 0.17- 0.2 cmH2O higher in the inspiratory limb (these differences were less when bias flow was set at 1). CONCLUSIONS: With leaks up to 75 percent, the Avea ventilator was able to deliver measured PEEP levels at or above set PEEP even with leak compensation off. Measured PEEP values for the Servo-i were slightly below set PEEP with the largest difference at 75 percent leak. More research is needed to determine if the results of this study are clinically significant and whether similar results would be found using different modes and pediatric or adult settings.

Sponsored Research - None

920982

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 as well as 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 69 valve surgery patients,893 coronary artery bypass graft (CABG) patients, 16 Stanford A Aneurysm Patients, 6 aortic dissection patients and 16 off pump CABG patients. Out of the 1000 patients in CTICU that required post surgical ventilatory support, 773 patients were weaned and extubated within three hours. 215 patients were outliers and 12 patients were re-intubated within 24 hours. EXTUBATION HALTING CRITERIA/OUTLIERS: Mediastinal Hemorrhage 200cc/hour Ramsay Sedation scale 4 Metabolic or respiratory acidosis Postoperative cardiogenic shock Extubation time was defined as the time between 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 for extubation. We had total of 12 re-intubations in total over 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), intrapulmonary percussive ventilation (IPV), super high flow therapy (SHFT) and Heliox modalities post extubation in patients with multiple co-morbidities. This significantly reduced our reintubation numbers. The overall re-intubation rate was 1.2% The utilization of the rapid shallow breathing index as the sole criteria for weaning has lead to significantly lower mean extubation times in cardiac surgery patients. No increased rates of re-intubation were observed. CLINICAL IMPLICATIONS: 1) Successful integration of respiratory therapy protocols into the cardiac surgery program. 2) Patient and family satisfaction with early extubation times. 3) Reduced length of stay in the cardiothoracic intensive care unit. 4) Integration of the respiratory therapy department's weaning expertise with cardiac surgery perioperative protocols.

Sponsored Research - None

919214

CO2 REBREATHING DURING SIMULATED NON INVASIVE VENTILATION: COMPARISON OF THE DRAGER CARINA AND RESPIRONICS VISION.

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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 limb circuit that lacks a true exhalation valve may cause RCO2 because a portion of the exhaled volume moves down the circuit limb 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 also be affected by respiratory rate (RR). We tested the effects of RR on RCO2 using two single limb NIV devices. Method: A Michigan Instruments Test Lung with the two chambers locked 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 Vt of 600 mL, RR of 20, 25, 30, and 35, I:E ratio of 1:1, and inspiratory flow rate of 100 L/min. CO2 bleed-in to 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 Respironics Vision using two exhalation port types, Plateau Exhalation Valve (VPEV) 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 DC1V, and 64 ± 24%, 34% to 91% 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 device related and needs to be recognized.

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

921227

ELECTRICAL IMPEDANCE TOMOGRAPHY CONFIRMS IMPROVEMENT OF LUNG AERATION AND VENTILATION IN SPONTANEOUSLY BREATHING PIGS DURING HFOV.

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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 for evaluation of lung characteristics. **Results:** Comparison of end expiratory lung volume (EELV) 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 predominantly preserved in the dependent lung regions. A significant shift in ventilation toward the dependent lung regions 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 PaCO2 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 were published. RESULTS: Multiple regression analysis of the formula showed a significant relationship between predicted PaCO2 and post test PaCO2, r =.83, r2 = .68 p <.089. Eight studies that either used the practice guidelines or variations of the apnea test, and reported on complications were found. Comparisons from carbogen vs. 1995 guidelines, respectively showed 12 % vs. 14% incidence of hypotension, and <1% vs. 7% incidence of hypoxemia, were our major findings. We had no incidence of asystole or arrhythmia, which were reported in the literature. CONCLUSION: Carbogen administration is a safe alternative to the current apnea test guideline and allows for patients to be tested in the presence of severe lung injury.

Sponsored Research - None

787994

A COMPUTERIZED RESPIRATORY THERAPY DRIVEN PROTOCOL IMPROVES VENTILATOR ORDER RECONCILIATION.

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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 This c-TDP improved ventilator order reconciliation. This protocol may reduce the error rate associated with the ventilator order reconciliation while potentially improving communication within the multi-disciplinary team.

Sponsored Research - None z

880470

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

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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. Frequently, 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-Expiratory 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 Avea, 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; EEP 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 EEP was measured when using the Servo-i. The highest EEP varied depending upon the compliance level and the ventilator. Conclusion: When using an electronic lung simulator at three different levels of compliance, the EEP 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 EEP, and the associated clinical significance.

Sponsored Research - None

918534

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

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Background: Tube Compensation (TC) is an option on some mechanical ventilators used to compensate for the imposed Work of Breathing (WOBi) of 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 by the ETT) or under-compensate (causing increased WOB because of the ETT). If the machine over-compensates, 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, or by the ventilator itself during a simulated SBT. Methods: The Hans Rudolph HR 1101 Electronic Lung Simulator was interfaced using size 7.0, 7.5, 8.0 and 8.5 ETTs, to the Viasys Avea, 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/L/sec, Compliance 60 ml/cmH2O, rate 20/minute, slope 1, 20% inhale, target volume 3000 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, with 5 cmH2O CPAP, pressure support off, and apnea override 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 with the Drager (at 80 and 100%) 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 of 20. The 17% increase in tidal volume was equal to 79 ml per breath; at a rate of 20, the minute ventilation would increase 1.58 L. Conclusion: When using a lung simulator, this study 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

Measured Tidal Volume with Tube Compensation Off and On during a Simulated Spontaneous Breathing Trial using an Electronic Lung Simulator, Amplitude 20

913959

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

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Background: The Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database report is an important benchmark program for large volume cardiovascular centers. A key indicator is the percentage of 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%. Method: 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 to1) increase awareness of 24 hour window, 2) improve communications between caregivers and 3) increase interventions before 24 hours. Specific interventions established included education of the 24 hour window to all caregivers especially 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 leadership to physicians that had contributed to prolonged ventilation cases. 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. In a 6 month period in excess of 252 patients were included with < 9% prolonged ventilation. Conclusion: A Multi-Professional approach utilizing increased awareness, incorporation of visual aids, effective communication, and coordination of sedation management and spontaneous breathing trials, can reduce the percentage of prolonged ventilation in CAB patients.

Sponsored Research - None

919580

A SCREENING TOOL USED TO ASSIST IN IDENTIFYING VAP IN A LARGE VENTILATOR POPULATION.

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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. During the data collection period 2 patients were confirmed with a diagnosis of VAP (VAP rate < 1/1000 vent days). 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

920288

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

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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, 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 blender then connecting it to a test lung. Participants were given a single sheet of written instructions with ventilator settings. .They could also use any instructions printed on the ventilator by the manufacturer. I timed each staff member from the time they started to assemble the circuit and blender 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

921042

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

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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 techniques using a simulation. METHODS: We implemented a mathematical model of pressure control ventilation (J Appl Physiol 1989; 67(3):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[Suppl.]:S228–40); 2) Titrate Tlow to target VT 4-6 cc/kg (http://ccmtutorials.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 expiratory resistance (RE) of 15 cmH2O/L/s, and three sets of static compliance (C) 15, 30 and 60 mL/cm H2O, values which have been previously published for ARDS patients. For methods 1 and 2 we set the Plow at 0 cm H20, 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, a PEFR between 50-75% was only achieved with a C of 30 and 60 mL/cmH20 with a Tlow of 0.2-0.3 s and 0.3-0.6 s respectively. These settings generated significant aPEEP and a broad range of VT (Table 1). For method 2, Tlow ranged between 0.4-6 s for a C of 15 mL/cmH2O with minimal aPEEP, but only single Tlow values of 0.3 s 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 15, 30 and 60 mL/cm H2O, Plow values ranged between 0-4, 12-14, 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

921035

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

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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), VS, 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 Ventrak 1550 Respiratory Mechanics Monitoring System (Novametrix Medical Systems, Inc., Wallingford, CT) as follows: TPiWOB= WOB(B+A) – WOBB, where WOBB was first measured on lung B using tidal volumes of 200, 400, 600, and 800 mL with peak flows of 40, 60, 80, and 100 L/min via a sine wave. WOB(B+A) was then measured at these settings using lung B to drive lung A with normal compliance (0.05 L/cm H2O) and resistance (2.7 cm H2O/L/sec), decreased compliance (0.02 L/cm H20), and increased resistance (17.6 cm H2O/L/sec). Lung A received assistance from either VC with a fixed inspiratory flow 60 L/min and VT of 600 mL, PSV of 10, 15 or 20 cm H2O, VS at a target VT of 600 mL or PAV at 50% or 80% using a PB 840 (Covidien-Puritan Bennett, Boulder, CO) . TPiWOB was converted from joules to joules per liter (J/L) based on the delivered tidal volume to lung A. An ANOVA with a post hoc follow up test (Newman-Keuls) was used to determine significant differences. RESULTS: See Table. CONCLUSIONS: As expected TPiWOB decreased as PSV increased from 10 to 20 cm H2O. PSV at 20 cm H2O provided the lowest TPiWOB. Although the difference did not reach statisical significance, PAV 80% resulted in a lower TPiWOB compared to VS in this model.
Sponsored Research - None

a.significantly less than VC;
b.significantly less than PSV+10;
c.significantly less than VS;
d.significantly less than PAV 50%; e.significantly less than PAV 80%;
($p<0.05$)

921165

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

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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%. 4. 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.

Sponsored Research - None

920878

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

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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 morbid 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

920312

ASSESSING BARRIERS OF INTERPROFESSIONAL CARE FOR COPD IN CINCINNATI.

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Background: Chronic Obstructive Pulmonary Disease (COPD) is the fourth leading cause of death in the United States and affects more than 24 million people. Appropriate management is imperative to control symptoms. Most COPD patients receive their care from primary care providers(PCP). Spirometry is recommended to assess presence and severity of disease, yet many diagnosed with COPD have never had spirometry testing. There is significant underutilization of pulmonary rehabilitation, smoking cessation counseling and referrals to pulmonologists. Methods: Focus groups including 40 healthcare providers, 24 COPD patients and 8 caregivers were convened. The interviews had a pre-determined set of topics and were recorded. Separate focus groups were recruited and conducted from family practitioners, general internists, nurse practitioners, nurses, respiratory therapists, emergency rooms physicians, pharmacists, COPD patients and their caregivers. Each group was directed by a trained facilitator. Facilitation questions were developed by Dr. Kues, reviewed by core investigators and customized for each group. Results: Each discipline had differing perceptions of each level of care. Many were unaware of the value of an outside discipline and chose not to refer due to this ignorance. Gaps in care delivery were identified in key areas of real impact to the patient including smoking cessation counseling and pulmonary rehabilitation. Beliefs ranged from "smoking cessation is not sustainable" to "I think pulmonary rehabilitation is an end-stage treatment." There is poor communication among all healthcare providers. Spirometry is underutilized to confirm COPD. Conclusions: PCPs are not sure how to access such therapy as smoking cessation counseling and pulmonary rehabilitation. Many providers don't want to stigmatize the patients by labeling them with COPD and opt for diagnoses of asthma or bronchitis. There is great room for improvement using a collaborative method of not only patient care but educating other disciplines about what each brings to the table. Clinical pharmacists are uniquely positioned to monitor patients who are filling prescriptions for chronic respiratory conditions and can assess compliance, adherence and knowledge gaps.
Sponsored Research - Educational Grants from:

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903602

PROTEIN KINASE ACTIVITY AND EXPRESSION OF ITS ISOENZYMES DURING THE ONSET OF ASTHMA.

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Protein Kinase C (PKC) plays a pivotal role in airway inflammation in asthma. However, changes in PKC activity and expression at the initiation of airway inflammation need to be studied in relation with airway hyper-reactivity. In this study, we have used the male guinea pig were sensitized with ovalbumin. Airway inflammation was checked by intradermal test and airway functions (after ovalbumin challenge) assessed at 30 min on day 0, 9 and 14. Blood and lung specimens were obtained for lymphocytes, airway smooth muscles (ASM) and histopathological examination. PKC activity and its expression were determined in ASM and lymphocytes. Day 9 was the day of initiation of airway inflammation. In OVA sensitized group PKC activity and its expression (PKCα and PKCε) increased both in ASM and lymphocytes on day 9 at 30 min which remained almost unchanged up to day 14.Histological examination of the lung revealed mild peribronchial chronic lymphocytic inflammation on day 9 at 30 minutes. On day 14, moderate infiltration of lymphocytes and eosinophils was seen at 30 minutes which progressively increased during late hours. The results of this study suggest that PKC signal transduction pathway participates in the regulation of the activation of lymphocytes and ASM and its activation leads to the initiation of airway inflammation in animal model, which are the characteristic features of asthma.
Sponsored Research - None

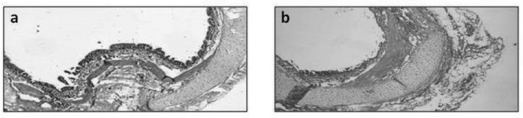

Fig. 2.

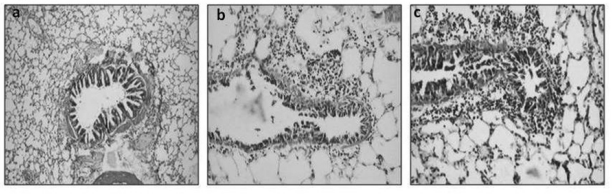

Fig. 3.

890390

INCREASES IN AIRWAY EOSINOPHILIA AND A TH1 CYTOKINE DURING THE CHRONIC ASYMPTOMATIC PHASE IN PATIENTS WITH ASTHMA.

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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: Nine nonatopic asthma (NAA) patients, 19 atopic 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 ($P<0.0001$); 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 levels of IL-4, IL-5, and IL-13 among the four groups. In contrast, the IFN-γ levels were higher in NAA ($P<0.001$) and AA($P<0.0001$) patients compared to AC and NC. Interestingly, the GM-CSF levels were higher in AA ($P<0.01$) patients compared to AC or NC. NAA ($P<0.01$) patients showed higher eotaxin levels compared to AA, AC, and NC; NAA and AA patients showed higher RANTES levels compared to NC ($P<0.05$). In NAA, AA, and AC 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($r=0.541$ and $p<0.0001$, $r=0.453$ and $p<0.01$), eotaxin ($r=0.640$ and $p<0.0001$, $r=0.514$ and $p<0.001$), 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

879004

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

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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 demographic characteristics that influence recipient of tiotropium plus 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 2005 to 2008 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 <55 (N=137), age 55-64 (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 monotherapy (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/very 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 to include 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.

906533

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

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BACKGROUND: About 50% of patients diagnosed with acute chest syndome (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 the 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 decreased 0.46 from the initial pilot data. CONCLUSIONS: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.

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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 reach a 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 (RDS) > 5 were tracked for the first four hours or 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 to a goal of 80%. PED staffing was increased to have two therapists per shift to cover a 35 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 addressed. Progress was communicated through multiple streams such as daily pre-shift huddles, 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: Improving 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

900524

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. METHODS: 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 mean 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 a common comorbidity, which is associated with high incidence of ACS. 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 into adulthood.

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.

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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 inhalers with valved holding chambers (MDI-VHC) are effective modalities for 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 (UMHC) 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.—) 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 patient age range was 2-18 years with a median age of 6 years and 60% were male. Eighty one percent of patients were treated with MDI-VHC's only, 8% were treated with nebulizers only and 11% were treated with both modalities. Inpatient admission rates were 1.3% for those treated solely 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 average Emergency Department length of stay was 186 minutes for the 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 72-hour return rate was 2.1% for those treated solely with MDI-VHC's, 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

PARENTAL KNOWLEDGE, ATTITUDE AND PRACTICES REGARDING CHILDHOOD BRONCHIAL ASTHMA.

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Objectives: To assess the parental knowledge, attitude and practices employed regarding childhood bronchial asthma Material and Methods: Parents of 250 patients 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 1-8 years. Whereas 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 that will help to control the acute exacerbation of asthma and prevent its complications 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 56% parents. There was no delay in seeking treatment during an acute exacerbation (55% within 6 hours, 36% within 24 hours and rest within 36 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

Sponsored Research - None

919357

A NEEDS ASSESSMENT FOR DEVELOPING SCHOOL ASTHMA MANAGEMENT PROGRAMS IN THE EAST CENTRAL HEALTH DISTRICT OF GEORGIA.

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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 7 out of 13 (53.8%) of the counties. 41 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 implement changes in the public health district.

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

920338

EVALUATION OF BRIEF IN-PATIENT TOBACCO DEPENDENCE INTERVENTION TRAINING.

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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 assistance, 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: Participants (n=4) were all RRT with an average of 15.63 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, but rarely discussing options with patients. Following training, there was a statistically significant difference in knowledge of tobacco treatment (p= .007), knowledge of pharmacotherapy (p=.002), belief that interventions are effective (p= .004), confidence discussing how to quit (p=.000), and confidence discussing pharmacotherapy options (p=.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.

Sponsored Research - None

921153

EFFECTIVENESS OF A CHRONIC CARE MANAGEMENT PROGRAM IN A MEDIAID POPULATION WITH ASTHMA AND COPD.

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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 treatment of 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 care 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 nurses. 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 continuous months. Results-Members with COPD 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 respiratory disease 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

916132

EASE OF USE WITH THREE DIFFERENT METERED DOSE INHALER SPACER DEVICES.

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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. **METHODS:** Adult patients enrolled in 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 MediSpacer 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 and actuated the MediSpacer and the AeroChamber in the least amount of 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 time of 35.9 seconds (±SD 29.4). All patients preferred traditional spacer designs, specifically the MediSpacer and AeroChamber, 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.

Waleed Alzahrani, Robert Harwood, James Fink, Lynda Goodfellow, 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. Since actuation of pMDI with inspiration is not feasible with HFOV, we investigated the impact of actuation timing only during CMV. METHOD: CMV (Respironics Esprit) and HFOV (Sensor Medics 3100B) ventilators with passover humidifiers and heated circuits were connected by 8 mm ID ETT and filter (Respirgard II, Vital Signs) to a test lung (TTL) with compliance settings of 20 and 40 ml/cm H2O in order to simulate a non compliant lung. Settings for CMV (Vt 6 ml/kg, I:E 1:1, PEEP 20 cm H2O, and RR 25/min), and HFOV (RR 5 Hz, IT 33%, ∅P 80 cm H2O and mPaw 35 cm H2O) were used, with similar mPaw on CMV and HFOV. Parameters were selected based on ARDSnet protective lung strategy (Fessler and Hess, Repiratory Care 2007) Eight actuations of albuterol from pMDI (ProAir HFA, Teva Medical) with double nozzle small volume actuator (Mini Spacer, Thayer Medical) placed between the "Y" adapter and ETT at >15 sec intervals for each condition (n=3). During CMV, pMDI actuations were synchronized (SYNC) with the start of inspiration at >15 s, and nonsynchronized (NONSYNC) with actuations at 15 s intervals. Drug was eluted from the filter and analyzed by spectrophotometry (276 nm). Paired and independent t- tests were performed at the significance level of 0.05. RESULTS: The table shows the percent (mean±SD) of emitted dose inhaled with p values between levels of compliance. In all cases, aerosol delivery was greater with HFOV than CMV ($p<0.05$). Synchronizing pMDI actuations with the beginning of inspiration increased aerosol deposition significantly at 20 and 40 cmH2O ($p=0.011$ and $p=0.02$, respectively). Lung compliance and aerosol delivery are directly related. Increasing lung compliance to 40 ml/cmH2O improved aerosol delivery during CMV and HFOV ($p<0.05$). CONCLUSION: Albuterol deposition with pMDI was more than two fold greater with HFOV than CMV in this in-vitro lung model. Changing lung compliance has almost 2 fold impact on aerosol delivery during both modes of ventilation. Synchronizing pMDI actuations during CMV improved aerosol delivery up to 4 fold.

Sponsored Research - None

886509

EFFECTS OF HEAT AND MOISTURE EXCHANGERS DESIGNED TO ALLOW AEROSOL DELIVERY ON AEROSOL DEPOSITION IN SIMULATED MECHANICALLY VENTILATED ADULTS.

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BACKGROUND: Heat and moisture exchangers (HME) reduce aerosol deposition. Mechanisms to bypass the HME during aerosol delivery (HME-AD) have been introduced without supporting research evaluating their effectiveness. The purpose of this study was to determine the effect of HME-ADs on aerosol deposition in simulated mechanically ventilated adults. METHOD: A ventilator (Respironics Esprit, Respironics Inc.) delivered adult parameters (Vt 450 mL, frequency 20/min, PIF 50 L/min, PEEP 5 cmH2O and I:E ratio 1:2) through an HME-AD and 8.0 mm ETT to a heated humidifier simulating exhaled humidity (37 C and 100% RH) and test lung. The types of HME-ADs used in this study include: (1) Circuvent (Smiths-Medical, Keene, NH) with a standard HME, (2) Gibeck Humid-Flo HME (Hudson RCI, Arlington Heights, IL), and (3) Airlife BHME (Carefusion, San Diego, CA). Four separate doses 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 (n=3). Drug was eluted from a filter distal to ETT and analyzed by spectrophotometry (276 nm) Student t-tests and ANOVA were performed at the significance level of 0.05 ($p<0.05$). RESULTS: The table shows % of total albuterol dose inhaled (mean ±SD). In the aerosol configuration, all devices delivered less aerosol compared to the control, Circuvent and Humid-Flo were significantly different than the control ($p=.004$ and $p=.002$, respectively). Aerosol delivery in the HME configuration was higher than anticipated with 93.8% of aerosol for the Humidflo, ($p=.078$), 76.8% for the Airlife and 33.9% for the Circuvent ($p=.002$ and $p=.005$, 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 Ari[1], Susan Roark[2], Lucrecia Lobo[2], Robert Harwood[1], Meryl Sheard[1], James B. Fink[1]; [1]Georgia State University, Atlanta, GA; [2]Emory University, Children Healthcare of Atlanta, Atlanta, GA

BACKGROUND: With the proliferation of systems for administration of oxygen via high flow nasal 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 using a sinusoidal pump attached through an absolute filter to a SAINT infant upper airway model was developed to simulate spontaneously breathing newborns (RR 50, Vt 8ml, and I:E ratio 1:2). Two HFNC systems (RT 329 Continuous Flow Circuit, Fisher Paykel and Conchatherm, Hudson) were operated at 35 – 40 degree C, at oxygen flows of 3 and 6 LPM, with manufacturer's infant and pediatric nasal cannulas. A vibrating mesh nebulizer (Aeroneb Solo, Aerogen Inc., Ireland) was placed on the inlet (dry side) of the humidifier to nebulize albuterol sulfate (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 $p=0.038$, respectively). Drug deposition trended higher at 3 lpm than 6 lpm, for both systems but was only significant with the Hudson ($p=0.009$). CONCLUSIONS: The size of nasal cannula, type of humidifier and amount of flow rate used during aerosol therapy impact aerosol delivery. Reducing flow rate and using pediatric nasal cannula with larger bore tubing/prongs increased aerosol delivery in this simulated neonatal lung model.

Sponsored Research - None

880277

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

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Background: Aerosol delivery during mechanical ventilation depends on several factors. We use 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 II® Opti-neb Nebulizer, Teleflex Medical, Research Triangle Park, NC) (JET), ultrasonic (Maquet Ultrasonic nebulizer, model N06302595E400E, Solna, Sweeden) (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/3.5mL 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 cuffed ETT followed by a lung model with a deposition filter interposed between them. VT was adjusted when jet nebulizer was tested. 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 &@V than @Y & @30 ($p < 0.01$). ULTRA had higher output @H than @Y & @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 @V. 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

890703

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

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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 ICUs for pulmonary hypertension, right heart failure and hypoxemia. We suspected that our INO 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 ($p < 0.05$). No 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 PEEP, 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 - None

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

919109

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.

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BACKGROUND: Interest in delivery of medical aerosols with high flow nasal cannula (HFNC) has been described; however, the impact of helium-oxygen (heliox) mixture on aerosol delivery to newborns is not known. Previous models 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 at low and high flow rates used with infant HFNC in a model of spontaneously breathing newborns. METHOD: 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 newborn (RR 50, Vt 8ml, and 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 model's trachea 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 6 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 cannulas.

Sponsored Research - None

Heliox		Oxygen	
3 lpm	6 lpm	3 lpm	6 lpm
4.5±0.64%	6.91±0.54%	5.69±0.77%	4.78±1.13%

883806

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

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BACKGROUND: There is little data on effects of artificial airways and their interfaces on aerosol delivery. The purpose of this study was to compare aerosol delivery between tracheostomy and endotracheal (ETT) tube using different interfaces such as tracheostomy mask, t-piece and ambu bag. METHOD: A teaching manikin was intubated with ETT (Mallinckrodt) 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/3mL) was nebulized with a jet nebulizer (eValueMed, Trianim) 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). Deposition was lower with tracheostomy collar 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 tube and ETT. It is unclear how the shift from active lung simulator to passive test lung impacted deposition. CONCLUSION: Efficiency of aerosol deposition is impacted by type of artificial airway and interface used. Aerosol therapy through ETT was less efficient than tracheostomy, across interface devices. Aerosol delivery from a jet nebulizer via ambu bag was most efficient using this bench model. 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 artificial airways.

Sponsored Research - None

	Tracheostomy Collar	t-piece	Ambu Bag
Tracheostomy Tube	6.92±0.81	13.79±2.59	45.75±1.8
ETT		9.05±0.70	27.23±8.98

886161

PEDIATRIC RESPIRATORY THERAPISTS' PERFORMANCE AS A RAPID RESPONSE TEAM FIRST RESPONDER FOR AN INFANT IN RESPIRATORY DISTRESS-A VIDEO REVIEW.

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Background: All Pediatric Respiratory Therapists (RTs) are required to respond to pediatric rapid response team (PRRT) calls throughout the Johns Hopkins Hospital's Childrens 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. Methods: 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 using 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 time goals for PPV and one (5%) met the time goal for visible chest rise. However, 13/19(68%) provided 2 adjunctive airway maneuvers and obtained visible chest rise. The most common interventions when initial PPV was unsuccessful were repositioning the airway, 15/19 (79%) and oral airway insertion, 10/19 (53%). Only 4/19 (21%) utilized the key maneuver of two person PPV. Times to key performance measures are found in Table 1. Conclusion: This study revealed concerning deficits in fundamental airway skills of our pediatric RTs that may place critically ill children at risk of suboptimal management and threaten their clinical outcomes. Adjustments will be made to subsequent training days to focus on quicker assessment of respiratory distress, meeting time goals for PPV, and a systematic algorithm for adjunctive airway maneuvers including rapid application of two person PPV.

Sponsored Research - None

919668

RESPIRATORY THERAPIST ROLE IN MOUTH CARE AS AN EFFORT TO COMBAT VENTILATOR ASSOCIATED RESPIRATORY INFECTIONS.

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Background: Healthcare providers have become increasingly conscious that patients are at risk of developing Ventilator Associated 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 bead 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 providing 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 73.3% of respondents. Conclusion: RTs at our institution report feeling competent in performing mouth care. Greater compliance is needed with raising the head-of-the-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, insuring mechanically ventilated patients receive frequent mouth care, and expansion of skills for RTs.

Sponsored Research - None

919801

NASAL CPAP FOR INITIAL STABILIZATION IN VERY LOW BIRTH WEIGHT INFANTS.

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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 turn this could lead to a shorter length of stay and reduce the morbidity and mortality associated with premature birth, potentially enhancing an infant's quality of life. Purpose/Aim: By December, 2010, all inborn infants meeting established criteria who are between 750-1250 grams and less than 32 weeks, 6 days gestation will only be intubated for surfactant administration. To give infants the best chance at remaining off mechanical ventilation, the following protocols will be initiated: Initiating nasal CPAP PEEP of +6 & increasing to +8 if needed Initiating caffeine therapy immediately after birth Using chin straps to maintain CPAP Inserting a ventilation orogastric tube (6.5 French) Accepting liberalized PC02s Following surfactant administration guidelines. 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, Apgars 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

Sponsored Research - None

883100

AIR TRANSPORT WITH INHALED NITRIC OXIDE IN CHILE.

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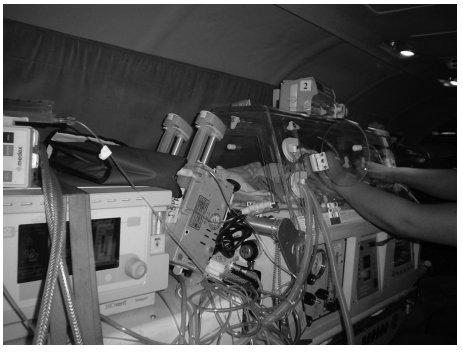
Introduction The inhaled nitric oxide (iNO) system in Chile works in several hospitals and clinics in Santiago (10 centers) and Concepción (2 centers, 500 Kms from Santiago). The services of installation, control, transport, weaning and retirement are provided by only one Respiratory Care team, due to limitations 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, with on-label and off-label use: 1. Patient with iNO (CV or HFOV) and must be transported to ECMO center 2. Patient without iNO (CV or HFOV) and can get clinical benefits of iNO with stability for transport 3. Patient in HFOV and can be supported with CV and iNO for stability in transport Objetive Show our expertise since 2008 to now in Chile of air transport with iNO Materials and methods We make and save all the clinical records of the patients transported with iNO. We transport all patients using the iNOVent (Datex-Ohmeda Inc. Madison, Wi) with two D cylinder or one 88 iNOMax cylinder, with a mechanical ventilator BioMed MVP-10 (BioMed Devices. Guilford, CT) and neonatal circuit. Results We transported 11 patients with iNO from several places of Chile, Concepción 54%(6), Puerto Montt 18,18% (2), La Serena, Valdivia and Antofagasta, each with 9,09% (1). All were neonatal patients, age 16(±27) days, with different pathologies, like persistent pulmonary hypertension (36,4%), meconium aspirative syndrome (9,1%), Congenital Diaphagmatic Hernia (27,2%), pneumonia (27,35%) and respiratory distress syndrome (27,3%). We completed a total of 29,7 flight hours, with a mean of 2,7(±0,74) flight hours. We went in Jet aircraft in 54,5%, and in Turbo aircraft in 45,5%, both compensated cabine. The patients were transported to ECMO center in 81,82% of cases, and to iNO center in 18,18%. 54,55% of patients used ECMO, 45,45% used iNO+HFOV, 9,09% used only HFOV, and 9,09% only used CMV. Only one patient die after 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 regardless to realize this 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 leak or other failure.

Sponsored Research - None



920993

QUALITY IMPROVEMENT PROJECT: TOLERABILITY AND EFFICACY OF THREE DEVISES USED FOR EARLY LUNG RECRUITMENT.

Daniel D. Woodhead, Vicki L. Baer, Diane K. Lambert, Robert D. Christensen; McKay-Dee, Ogden, UT

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 (NC), 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 30 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) FiO2 >30%. Early lung recruitment was performed for 90 min according to protocol, on eligible patients, using one of the three test devises. Assignment to a devise was pre-determined. Study data were collected prospectively by a NICU respiratory therapist or nurse. Tolerability was judged using a scoring system of back-arching and arm-stiffing. Efficacy was judged by whether NICU admission and intubation were averted, and by whether the patient required "rescue" by changing from the failed original devise 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 groups were not statistically different. Tolerability scores were lowest (best) 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) (P<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 8/18(44%) of those with the NC. A similar trend was seen in intubation rate among those admitted to the NICU (PF 0%, F&P 86%, NC 50%). In an attempt to avert NICU admission, 17 were switched from the original devise to another devise. Those who failed the original devise were; PF (0/17, 0%), F&P (7/23, 30%, P<0.01 vs. PF), NC (10/18, 56% P=0.000 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 averting NICU admission.

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

891808

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

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Background: Recently, studies (1) have suggested that high frequency percussive ventilation through endotracheal tubes placed in the nasopharyngeal area of premature 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 in more 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 Phasitron and Hudson Nasal CPAP Prongs (Sizes 0-5) and endotracheal tubes(ET) 2.5 mm and 3.0 mm were attached to a SmartLung Infant test lung. The lung was set at a compliance of 1 ml/mbar and resistance at 5 mbar/L/s and then placed in the Vitaltrends Technology Neonatal Vt 1000 Plethysmograph. The Neonatal Plethysmograph was calibrated and the Bronchotron set at 30psi and oscillatory CPAP and pulsatile flow rate were set to achieve various mean airway pressures to investigate the effect on tidal volume (Vt) and minute ventilation (VE). The rate on the Bronchotron 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 breaths (VtH). Ventilator frequency (279-282) was kept constant while operational pressure (30-32 psi) and the oscillatory CPAP controller were adjusted to achieve targeted mean airway pressures (MAP) of 6, 8, 10 and 12 cmH2O. At these various settings the Vt and VE were determined at the various prong and ET-tube sizes. Operational pressure was only adjusted if the oscillatory CPAP control reached the maximum level and could not meet the targeted MAP. **Results:** We found that increasing the prong size and endotracheal tube diameter dramatically increased both the mean tidal volume and mean minute ventilation (see attached table). **Conclusion:** As expected the endotracheal tubes delivered the lowest minute ventilation at the test settings because of their small diameter and longer length. Also, tidal volume and minute ventilation increased with prong size diameter at each test setting (see attached table).

Sponsored Research - None

905855

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

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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, lethargic and fever for the past 6 days. Chest x-ray (CXR) showed hyperinflation, perihilar 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 mm0l/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 1/2 days of increasing PCV-IMV settings ending with PC-IMV 34 cmH20, rate of 38/min and PEEP of 14 cmH20, ABGs showed pH 7.27, PaC02 70, PaO2 82 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 per 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

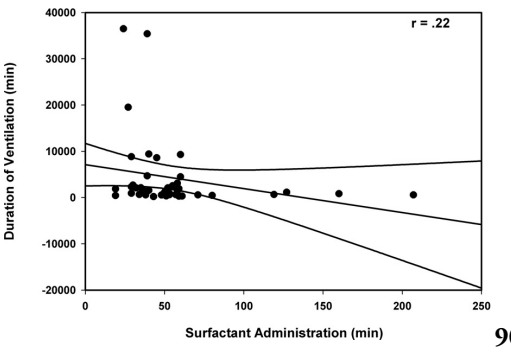
887246

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

Khin-Kyemon Aung[1,2], Daniel W. Sutton[1,2], Susan M. Brant[1,2], Firas Saker[1,2], Robert L. Chatburn[2], John Dickson[1,2]; [1]Hillcrest Hospital, Mayfield Heights, OH; [2]Cleveland 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); 23 were excluded due to death, transfer outside of the Cleveland Clinic Health System, or incomplete records. Very early surfactant administration (SA) was defined as surfactant delay ≤45 min and early SA was administration >45 min. Duration of ventilation (DV) was defined as the time (min) from intubation to extubation. Linear correlation and a paired t-test were used to evaluate the association between 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 205-69,161 min. The figure shows the relationship between SA and DV. The low r value indicates no correlation. A subset of the data (gestational age 29-31 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

COMPARISON OF NEONATE TIDAL VOLUMES IN TIME CYCLED PRESSURE LIMITED OR VOLUME TARGETED VENTILATION DURING THE FIRST 48 HOURS OF LIFE.

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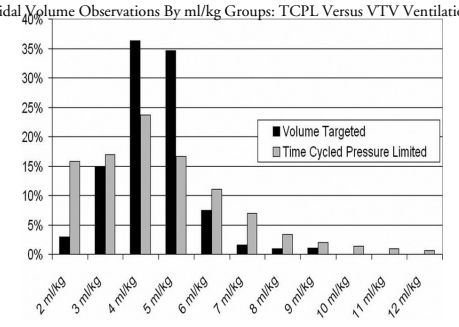
BACKGROUND: Conventional time cycled pressure limited ventilation as well as volume targeted ventilation has been used in our 60 Bed Level III NICU. Experts have proposed an optimal tidal volume range of 4 to 6 ml/kg for neonates, but there is limited published data for optimal tidal volume. Interest in volume targeted ventilation has increased in recent years. We wanted to compare 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), birth weight and mortality. Tidal volume in ml/kg was calculated for tidal volumes in the first 48 hours of life using birth weight and converted to whole numbers for charting purposes. RESULTS: Four hundred seventy patients were identified as receiving TCPL 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. Neonates that were < 1500 grams birth weight comprised 52% of the TCPL group and 56% of the VTV group. See chart for tidal volume observations by ventilation mode. Tidal volumes were 4 to 6 ml/kg 51% of the time for the TCPL group and 79% of the time for the VTV group. 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 and 1.6 tidal volume adjustments per VTV patient ordered. Mean MAP was 7.8±1.6 and 7.7±1.9 cmH2O for TCPL and VTV. Mean PIP was 17.4±3.2 and 16.6±6.6 cmH2O for TCPL and VTV. Mortality was 6.5% and 5.0% for TCPL and VTV(p=0.55). CONCLUSIONS: In our NICU: 1) TCPL ventilation was used six times more frequently than VTV ventilation in the first 48 hours of life. 2) Both TCPL and VTV ventilation were used in similar proportions on neonates < 1500 gram birth weight. 3) VTV ventilation was maintained at 4 to 6 ml/kg in a larger percent of observations (~80%) than TCPL ventilation (~50%). 4) Less ventilation adjustments were ordered in the VTV group. 5) MAP and PIP were similar for both groups. Larger, randomized, controlled studies are required to determine if the tidal volume control, offered by VTV, will yield positive long term outcomes in neonates.

Sponsored Research - None

Percent of Tidal Volume Observations By ml/kg Groups: TCPL Versus VTV Ventilation



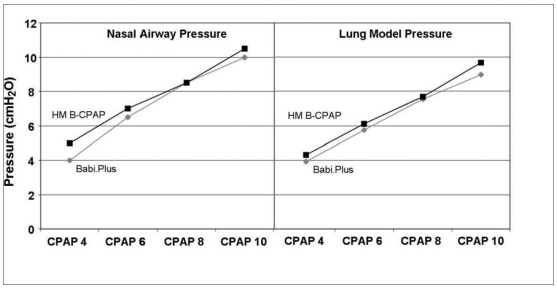
909909

AIRWAY (PAW) AND LUNG MODEL (PLUNG) PRESSURE STABILITY IN TWO NASAL BUBBLE CONTINUOUS POSITIVE AIRWAY PRESSURE (B-CPAP) SYSTEMS .

Dave N. Crotwell, Rob DiBlasi; Respiratory Care, Seattle Children's Hospital and Research Institute, Seattle, WA

BACKGROUND: B-CPAP is a non-invasive respiratory support strategy that is widely used in spontaneously breathing premature infants. We designed a descriptive study to compare differences between the set and measured pressures using two different systems during B-CPAP. 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 spontaneously breathing test lung (ASL 5000, Ingmar Medical; settings: RR 50 and Tidal Volume 5 mL). The nasal airway model was affixed with nasal prongs (Argyle Small, Sherwood Medical) and attached to the following B-CPAP systems: 1) Babi.plus (A Plus Medical); and 2) Homemade B-CPAP (HM B-CPAP). The Babi.Plus controls B-CPAP with an adjustable labeled dial that regulates depth of the distal bubbler. The HM B-CPAP device controls pressure by manually adjusting the depth of the distal tubing and confirming the depth with a measuring tape (6cm=6cmH2O). Bias flow in each system was set at 6 L/min. Nasal airway (PAW; Criterion 40, Respironics) and lung model (PLUNG;ASL 5000) pressures were measured simultaneously while varying the B-CPAP settings between 4-10 cmH2O. RESULTS: (Figure below). CONCLUSION/DISCUSSION: These data suggest that both B-CPAP systems provided similar pressure stabilization, as noted by the respective PAW and PLUNG measurements. However, in most cases, the PLUNG pressures correlated with the set B-CPAP level better than did PAW. Although we did not use the same pressure measurement device, per location, we suspect that the observed pressure drop across the anatomic infant nasal airway is related to attenuation of the airway pressure oscillations created by gas bubbling during B-CPAP. We feel that the recently FDA approved, Babi.plus system may provide a safe and effective alternative to the off-label HM B-CPAP systems that have been used over the last 40 years.

Sponsored Research - None



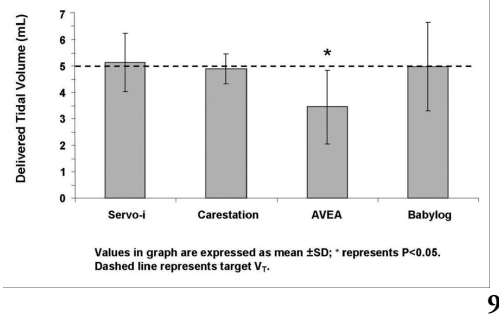
921044

TIDAL VOLUME PRECISION OF NEONATAL VOLUME-TARGETED, SPONTANEOUS MODES IN AN ACTIVE AND PASSIVE INFANT LUNG MODEL.

Dave N. Crotwell, Rob DiBlasi; Respiratory Care, Seattle Children's Hospital and Research Institute, Seattle, WA

BACKGROUND:Volume-targeted spontaneous modes are used in premature infants to provide a consistent tidal volume (VT). We evaluated 4 neonatal ventilator's ability to maintain target VT with changes in condition and respiratory effort. We hypothesized that there would be no difference in the delivered VT between ventilator brands while varying mechanics and respiratory effort in a premature infant lung model. METHODS:4 neonatal ventilators were tested using volume-targeted spontaneous modes, including:1) GE Carestation(PSV-VG); Marquet Servo-i(PRVC-Auto Mode); Drager Babylog8000 plus(PSVG); Carefusion Avea(Machine Volume-Flow Cycle). A standard infant disposable patient circuit and humidifier was attached to each ventilator and a circuit test was performed.The ventilators were set at VT=5 mL, BU RR 40 b/min, PEEP 5 cmH2O, and FIO2 0.21. Gases were humidified at 37∞C before testing. When available, the ventilator was set to limit volume delivery at 125-130% of the set VT. The Ingmar ASL 5000 was configured using a customized breath sequence (n=265) of erratic, spontaneous and apneic breathing patterns with ongoing changes in mechanics and breathing effort. Each ventilator was attached to the ASL 5000 with a 2.5mm ID ET tube. Breath to breath VT delivery was measured using ASL software version 3.0 for the entire breath sequence. Data were compared using ANOVA with SNK for post-hoc analyses. 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; Figure). The CV for each ventilator tested was: Servo-I 22%, Carestation 12%, AVEA 40%, and BabyLog 8000 plus 33%. CONCLUSION/DISCUSSION:It appears that neonatal ventilators servo-control pressure to maintain small VT within an acceptable clinical range when exposed to breathing patterns that are commonly experienced by premature infants. The AVEA ventilator had a tendancy deliver a lower VT than targeted initially. The Avea targets an uncorrected volume measured at the ventilator gas outlet, not at the proximal flow sensor. The Carestation ventilator had the best VT precision as noted by the lowest CV value. While these data may be important for ventilating premature infants, we only tested one of each specified ventilator brand. Additional testing using more ventilators is needed before any inferences can be made about the performance of these modes in premature infants.

Sponsored Research - None



920391

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

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Introduction. Substantial variation exists in current practice for the setup of high frequency oscillatory ventilation (HFOV) circuits based on clinician preference, departmental policies, and individual patient requirements. Clinicians may place an elbow suction catheter in-line, use a Y-adapter suction catheter, and/or add a flexible adapter to better position the circuit as the patient is turned or moved. Other providers prefer not to place any adapters in the circuit due to the belief that these alterations attenuate amplitude and may be detrimental to tidal volume delivery (V_T). Circuit variations have important clinical implications as the circuit must be opened for suctioning unless an in-line suction catheter is used. We hypothesize that inserting any adapter in-line affects delivered V_T. **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 3100A Oscillator (CareFusion), and a flexible circuit. V_T at the ETT was measured with a COS_2MO+ 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 cm H_2O, inspiratory time 33%, 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 cm H_2O and frequencies ranging from 4 to 10 Hz in increments of 2 Hz. The circuit was not humidified. Fifty V_T measurements were obtained at each combination of frequency, amplitude, and adapter. The effects of frequency, amplitude, and adapter on V_T were determined by paired t-tests. Statistical significance was defined as $p < 0.05$. **Results.** 400 measurements were obtained per circuit setup. Mean V_T was significantly higher with no adapter than with any of the in-line connectors (Table). Mean V_T differences between types of adapter were not significantly different. **Conclusion.** The addition of any connector to a HFOV circuit can decrease the delivered V_T 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 V_T are clinically significant or whether the loss of V_T outweighs the risk of opening the circuit for suctioning. However, these findings indicate that the potential impact on V_T must be considered when adaptors of any form are added to a HFOV circuit.

Sponsored Research - None

Tidal volume delivery for each circuit variation.

	No adaptor	Elbow adaptor	Y-adaptor	Flexible adaptor
Tidal Volume (ml)	13.6 ± 6.0	12.7 ± 6.0	12.3 ± 5.1	12.7 ± 5.6
p (vs. no adaptor)	--	0.034	0.0008	0.039

Data are displayed as mean (ml) ± standard deviation.

919433

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

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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 using: 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/s) sealed within a calibrated plethysomograph. 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 plethysomograph. Data were compared using ANOVA and Student-Newman Kuels 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 at bias flows > 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 approximated 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 PRESURE 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, respectively. 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.

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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 help save environmental resources.

Sponsored Research - None

918520

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 training is assigned as instructors. Students may be assigned to different preceptors each day and this creates challenges in tracking progress and communicating areas that the student/new employee may need improvement. We identified the need for improving communication among preceptors. We sought to create a system of continuity 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. 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 checkoff 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 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 much stronger evaluation of new employees and students. This also enhances their growth and success in the profession.

Sponsored Research - None

919700

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

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Background: Cincinnati Children's Hospital Medical Center is a 475 bed medical center with 12 clinical areas served by 198 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. Positions were 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 survey monkey, we distributed a questionnaire to our staff. The questionnaire asked staff to rate their satisfaction and level of 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 roll out of new education, and an 83% improvement in educational 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

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

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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 inorder to facilitate downsizing and decannulation of all tracheostomized patients. The therapists in the Cardiothoracic (CT) ICU team were chosen for this process. Patients with high acuities including those with lung transplant, heart Transplant and open heart surgery were involved in the process. Methods: Protocol for trach downsizing and decannulation procedure was developed. All Respiratory Therapists had three phases of training for the procedure, which included physician lecture, procedure demonstration using manikin and return demonstration with competency verification via manikin simulation technology. Staff were monitored for 3 procedures and then operated independently. Continuous monitoring of oxygen saturation via pulse oximetry, arterial blood pressure, heart rate, respiratory rate, breath sound and bleeding (tracheal aspirate) assessed the safety of the procedures. The therapists were responsible for monitoring the process and coordinating with the physician as per protocol to begin the downsizing and decannulation process. Data was collected and tabulated in Excel spread sheet by the lead therapist. Results: Respiratory therapists performed 333 trach change procedures and 131 decannulations on 299 patients. A total of seven (1.5%) adverse events were reported of a total of 464 combined changes and/or decannulations. In 5 (1.5%) cases Respiratory Therapists had trouble reinserting the smaller sized tube which required physician intervention. Furthermore, 2 (0.6%) cases required direct visualization utilizing a fiber optic bronchoscope due to anatomical deformity of trachea and granuloma formation. The average time from initial trach to decannulation was 35.5 + 29.7 days. Conclusions: Under order of physicians, Respiratory Therapists can perform downsizing and decannulation of Tracheostomized patients safely. Furthermore, Respiratory Therapists can act as the "gate keeper" for process of downsizing and decannulating tracheostomy patients.

Sponsored Research - None

920337

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

Tammy R. Byrd, 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 life-long 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 consistency 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 bronchiolitic 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 their job. 65% strongly agreed and 32% moderately agreed 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 the 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 professional realm.

Sponsored Research - None

920388

COTININE TESTING FOR TOBACCO ABUSE: INITIAL RIYADH EXPERIENCE.

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(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 two 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 exposure. (4) Conclusion: A cotinine + result provides a rapid assessment of tobacco abuse, an opportunity for student counseling and evidence for requiring further cotinine testing to ensure a smoke free lifestyle. Weakly negative results allowed for discussion of second-hand smoke exposure providing an opportunity for involving the family in smoking cessation. The advance notice serves as a kind encouragement for students who smoke to experience two weeks without tobacco — and maybe even kick the habit.

Sponsored Research - None

921048

UTILIZATION OF INTERDISCIPLINARY EDUCATION IN RESPIRATORY CARE PROGRAMS.

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Background: A greater emphasis on interdisciplinary education (IDE) of health professionals is needed to promote collaborative, cost-effective and patient-centered care. The purpose of this study was to examine the use of IDE in respiratory care (RC) educational programs across the United States (US) and to determine the attitudes of program directors (PDs) regarding IDE activities. Methods: A questionnaire addressing the practices of and perceived needs for IDE was developed and field tested. Two hundred two (202) PDs were invited to participate in the survey through electronic mail which included a link to the online questionnaire. Anonymity of responses was maintained, collected data were compiled into an Excel database and descriptive statistics were calculated. Results: Participants included 52 RC PDs (26% response rate) from across the US at a variety of institutions (65% from 2-year colleges; 22% from 4-year colleges or universities; and 10% from academic health centers). Associate degrees were offered at 81% of these programs and baccalaureate degrees at 33%. Thirteen percent (13%) of the programs offerred both associate and baccalaureate degrees. 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 believe it is or would be beneficial to 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 health 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 best 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. Acknowledgements: Margaret Harris,PhD; Rebecca Ludwig,PhD,RT;Terry Dubose,MS; Michael Anders,PhD,RRT; Becky Butler,MSSW,LCSW; and Sarah Jackson,MS,CGC.

Sponsored Research - None

920787

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 potentially even standards related to simulation-based education. The 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 calculator): 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% (33). Respondents said their current simulation activities take place 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 provided contact information. **CONCLUSIONS:** 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 centers are being used. These data should support the AARC's ongoing activities related to simulation in education and inform future initiatives.

Sponsored Research - None

887631

EVALUATION OF A COMPUTER SIMULATION FOR TEACHING MECHANICAL VENTILATION.

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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 assessment prior to commencement of the teaching module. Overall GPA, obtained from the student's academic transcript 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

890973

CRITICAL THINKING ABILITY IN BACCALAUREATE LEVEL RESPIRATORY CARE STUDENTS.

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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

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

Kenneth Miller, Linda Cornman, Uma Bhatt, Bryn Surgernor; 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 "manageable" workload. These 'veteran' staff were given minimal 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 technologic 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 were issues and concerns that arise during the orientation process, a review of adult learning principles from the Neglected Learner: 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 a have better vision of their roles and responsibilities.

Sponsored Research - None

831055

A STUDENT SURVEY OF ACCREDITED TWO YEAR RESPIRATORY CARE PROGRAMS.

Roger J. Smith, Mike Trevino, David Mussetter, 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.

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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 initiate critical strategies to improve patient care when provided the education and resources. A multidisciplinary approach to providing education helps to build trusted relationships between respiratory therapist and healthcare team members.

Sponsored Research - None

919560

A MODEL FOR TEACHING THE MECHANICS OF A CHEST DRAINAGE SYSTEM.

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Background: The traditional method of teaching the mechanics of chest drainage systems is to present a lecture via PowerPoint. In the experience of the author, this method by itself does not produce 100% mastery and leaves some students still having difficulty grasping the concept of a three-chambered chest drainage system. For this reason, we sought to produce a working model of a chest drainage system that would both add a laboratory component to the instruction and provide another venue by which students could enhance their comprehension of the topic. Method: The model was constructed out of common respiratory supplies and equipment. The lung and chest wall was made by inserting a 0.5 L manual ventilation bag (Ventlab, Mocksville, NC) into an empty 1000 ml plastic sterile water container (Cardinal Health, McGaw Park, IL). A 2 inch circular hole was cut in the bottom of the container and a latex glove was secured around the bottom to simulate the diaphragm. The chest drainage system was formed by using three 1000 ml plastic sterile water containers connected together with 3/16" suction tubing and filled to appropriate fluid levels. Common straws served as the water seal and as the suction control mechanism. Two additional holes were cut into the side of the lung and thorax container – one to facilitate placement of the chest tube (which was 3/16" suction tubing) and another to place an external pressure manometer. To determine if the model was able to enhance student learning, 18 second-year respiratory therapy students received the customary PowerPoint presentation followed by a twenty minute review of key principles using the model. They were then asked to respond to the following statement using a Likert scale format: "The model enhanced my comprehension of chest tubes and helped me discover aspects of the three-bottle system that I did not fully understand in the PowerPoint." Results: All eighteen students either strongly agreed or agreed (SA=13, A=5) that the model enhanced their understanding of chest drainage systems. Conclusion: Our model allows students to observe tidaling in the underwater seal, see pressure changes occur in the pleural space when the suction control straw is moved up or down, and watch the lung inflate when suction is applied to the pleural space, among other interactions. The model accurately, realistically, and inexpensively simulates a patient-chest drainage system and may improve students' comprehension of this topic.

Sponsored Research - None

919799

SMOKING CESSATION AT CARILION CLINIC.

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Background: Cigarette smoking is the most prevalent health risk behavior in the United States, with tobacco-related disease and disability accounting for $50 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 significantly 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 started 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.

Sponsored Research - None

919552

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

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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 this HMPC were very low at a national average of 52% with our average being 27% the first quarter and 54% in the next 7 quarters. We were tasked with the goal of obtaining an 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 at 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.

Sponsored Research - None

903538

PERFORMANCE OF A DISPOSABLE SINGLE PATIENT USE CONTINUOUS CUFF PRESSURE MONITORING SYSTEM, A BENCH TEST.

Matthew Davis, Maria Madden; Respiratory Care, UMMC/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 ETT. 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 ETTs 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 ETT. Thus the pressure easy is reliable for continuous cuff pressure monitoring. If the green circle is visible then the cuff pressure 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 MOV may be a novel idea and further research is needed to validate these findings.

Sponsored Research - None

887516

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 dates 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 ABG 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

918582

INITIAL EXPERIENCE WITH REGISTERED RESPIRATORY THERAPISTS PLACING ESOPHAGOGASTRIC TUBES IN ADULT MECHANICALLY VENTILATED PATIENTS.

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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 phrenic nerve action potentials that result in cyclic diaphragm 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 successive 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

902423

MODEL OF CO_2 PRODUCTION, STORAGE AND ELIMINATION AS AN AID TO UNDERSTANDING CO_2 TRANSIENTS.

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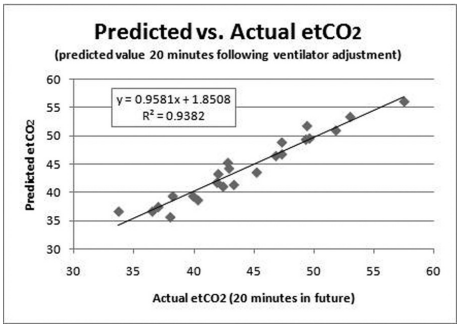
Introduction: CO_2 excretion (V_{CO2}) monitoring is useful as an indicator of effective ventilation, metabolic activity and pulmonary perfusion. Interpretation of a change in V_{CO2} subsequent to a change in alveolar ventilation can be difficult because measured V_{CO2} changes in a transient manner following ventilation adjustments. When ventilation changes occur, the metabolism remains stable while large amounts of stored CO_2 are transferred into or out of the body over an extended time. The transferred CO_2 is reflected in the transiently changing V_{CO2} and $PaCO_2$. To facilitate understanding of the V_{CO2} signal, we developed a computer algorithm that separates the measured V_{CO2} 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 CO_2 production, storage, distribution and elimination within the body. This computer model simulates the change in stored CO_2 volume and partial pressure as ventilation is changed. This computer model simulates the change in stored CO_2 volume and partial pressure as ventilation is changed. The computer model inputs are ventilation and V_{CO2} data collected during the 30 minutes immediately prior to the time of analysis. The model parameters are continuously optimized to minimize the difference between the actual and modeled V_{CO2}. Once optimized, the model is used to predict the future value of end-tidal CO_2 ($etCO_2$) and V_{CO2} following ventilation changes. A volumetric capnometer (NICO2, Philips-Respironics, Wallingford, CT) was used to monitor ventilation, $etCO_2$ and V_{CO2} in 5 mechanically ventilated piglets. Step changes in respiratory rate or minute ventilation were made periodically. Model predictions of $etCO_2$ and V_{CO2} were compared to actual data recorded 20 minutes after the prediction time. Results: The difference between actual and predicted $etCO_2$ was 0.0 ± 1.47 mm Hg (n=22). The difference between the predicted and actual V_{CO2} was 1.55 ± 4.72 mL/min. The squared correlation coefficient for $etCO_2$ was $r^2 = 0.94$ and for V_{CO2} was $r^2 = 0.89$. Conclusions: Isolating the metabolic portion of measured V_{CO2} from the total V_{CO2} monitored at the bedside allows prediction of future values of $PaCO_2$ following a ventilation change. Calculations such as percent of over- or under-ventilation and the ventilation rate needed to achieve a specific $PaCO_2$ value are made possible by estimation of metabolic V_{CO2}.

Sponsored Research - Philips



920315

EVALUATION OF ADEQUACY OF TIDAL VOLUMES USING A VOLUMETRIC CAPNOGRAPHY REFERENCE DATA SET.

Joseph Orr[1], Lara Brewer[1], Michael Jaffe[2]; [1]Anesthesiology, University of Utah, Salt Lake City, UT; [2]Philips-Respironics, Wallingford, CT

Introduction: Respiration rate (RR) is often used as a simplistic indicator of ventilation adequacy when the patient is exhibiting spontaneous ventilation effort. 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. Breaths 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_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-intubated 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 is smaller than serial dead volume in each of the patient types 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, non-intubated patients during sedation. Breaths were least likely to be of insufficient volume in anesthetized, intubated adult and pediatric patients at 0.6% and 0.44% respectively. Conclusions: Monitoring algorithms that report breath rate or calculated indices based on a simple breath rate while not indicating the presence of very small breaths may fail to indicate the possibility of hypoventilation.

Sponsored Research - Philips

919850

A NOVEL METHOD FOR INTEGRATING A LUNG ANALOG INTO A CADAVER FOR RELIABLE VOLUME MEASUREMENT DURING POSITIVE-PRESSURE MASK TESTING.

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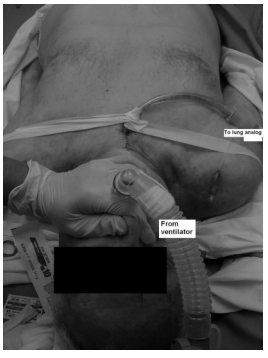
BACKGROUND: The cadaver model is frequently used to simulate live subjects. However, large, repetitive tidal volumes can alter or damage the lungs, thus altering performance characteristics. Lung analogs allow for reliable repetitive volume changes with little or no alteration in the system, but lack anatomical similarity to live subjects. We describe a novel integration of a lung analog into a cadaver to gain the advantages of both in positive-pressure mask testing. METHOD: To test two different types of positive pressure masks in the cadaver model while reliably measuring volumes delivered and leaked, the authors integrated a Michigan Instruments TTL, (Grand Rapids, MI) into a fresh, un-embalmed cadaver through the use of a retrograde tracheostomy technique. A tracheotomy was performed and a #8 endotracheal tube was placed with the distal tip directed cephalad toward the larynx. The tube was then sutured in place and the incision was closed tightly around the tube. The cuff was inflated and checked for leaks. The proximal end of the endotracheal tube was directed toward the lateral chest taped in place (See Figure 1). Tubing was attached to the 15 mm adapter and then to a vane-type spirometer. Another piece of tubing was used to attach the spirometer to the lung analog. Nineteen volunteers tested both an intra-oral and a conventional mask on the face of the cadaver. Tidal volumes of .5 L, 1.0 L, and 1.5 L were delivered to the masks by a ventilator set on volume control at a rate of twenty breaths per minute for two minutes. A total of at least 4,560 breaths were delivered to the integrated model. RESULTS: The masks were applied to the face of the cadaver by the volunteers with varying degrees of success, in keeping with what would be expected in the live subject. Volume delivered to the lung analog and volume leaked past the masks were easily and reliably observed. The cadaver was returned to the anatomy laboratory, minimally altered, to be used for future study. CONCLUSION: This novel approach provided the advantages of both the cadaver and the lung analog in positive-pressure mask testing. This approach may be valuable in testing other devices that are applied to the face or upper airway where volume measurement is important. Although not measured in this study, adapters could easily be placed in-line to measure pressure in this model. This technique might also prove suitable for use in the animal model.

Sponsored Research - NuMask Intraoral masks were supplied by NuMask, Inc. for use in the study mentioned in this abstract.

Figure 1.



921167

EFFECT OF HELIOX ON END-TIDAL CO_2 AND RESPIRATORY RATE MEASUREMENT IN HEALTHY ADULTS.

Donna D. Gardner[1], David L. Vines[2], Richard B. Wettstein[1], Jonathan B. Waugh[3]; [1]Department of Respiratory Care, University of Texas health science Center at San Antonio, San Antonio, TX; [2]Department of Respiratory Care, Rush University Medical Center, Chicago, IL; [3]Clinical and Diagnostic Sciences, University of Alabama at Birmingham, Birmingham, AL

Background: Capnography is a non-invasive method of monitoring ventilator status in the clinical setting. Therapeutic gases delivered by inhalation (O_2, N_2O, NO, He, anesthetics) may affect the accuracy of capnographic measurements (Colman Y. J Clin Monit 1999;15:403-9). Oridion Capnography Inc. (Needham, MA), claims to have a technology that is unaffected by heliox and anesthesia gases. Our goal was to determine if heliox gas delivered through a mask, and/or flow rate of inspired gas affect this technology's capnographic measurements of end-tidal CO_2 ($EtCO_2$) and respiratory rate (RR). Methods: We measured $EtCO_2$ and RR by capnography in 20 adult volunteers (15 female, ages 20-36 yrs.) with normal spirometry as they breathed heliox (gas mixture of 20% oxygen and 80% helium) via a non-rebreather mask compared to breathing room air (20.9% oxygen and 79.1% nitrogen) at rest. Participants were distracted by watching a video movie to help maintain a steady breathing pattern and were coached to keep their frequency between 10-20 bpm if needed. A six minute washout period occurred between each six minute level of testing. Results: A mixed models analysis revealed that the average $EtCO_2$ for all subjects and flow rates while breathing heliox, 36.9±4.5 mm Hg (mean±standard deviation), was not different ($p = 0.501$, alpha-level of 0.05) from the value while breathing room air, 36.0±4.5 mm Hg. Repeated measurements on each of the same subjects over 6 minute periods of breathing spontaneously (0 L/min), with 10 L/min flow rate, and with 15 L/min flow rate showed no difference in $EtCO_2$ related to flow (0 L/min vs. 10 L/min, $p = 0.759$; 0 L/min vs. 15 L/min, $p=0.642$; 10 L/min vs. 15 L/min, $p=0.865$; see table). Conclusions: Breathing heliox caused no difference in $EtCO_2$ and RR measurement using a Capnostream™ 20 capnography monitor during resting breathing in this group of young adults with normal spirometry. These same measurements were not affected by differing flow rates of heliox or ambient air compared to breathing with no mask. This has practice implications for both intubated and nonintubated patients receiving heliox in emergent and critical care settings.

Sponsored Research - Funded by Oridion Capnography Inc.

904424

EVALUATION OF SPUTUM PRODUCTION WITH THE USE OF THE FREQUENCER WITH THE ADULT CYSTIC FIBROSIS PATIENTS.

Theodore S. Vallejos, Sandra Kindel, Jan Phillips-Clar; Respiratory Care, University of California San Diego Medical Center, La Jolla, La Jolla, CA

Background: The use of secretion clearance and secretion clearance device selection protocols with the adult cystic fibrosis(CF) population provides the Respiratory Care Practitioner(RCP) and patient to select from multiple secretion clearance devices. Although, the multiple selections are available, chest physical therapy(CPT) via a percussor, remains to be one of the primary choices by the patient for effective sputum production. The device selection protocol suggests the vest and intrapulmonary percussive ventilation(IPV) to be one of the preferred or primary devices, with CPT via percussor or flutter being an alternative choice. In March of 2010, the Frequencer was added to the departments' inventory of secretion clearance devices. Since then, 12 CF patients have been initiated. Method: The Frequencer was introduced to the adult CF population as an alternative to their normal secretion clearance regime. Our respiratory care management information system(RCMIS) allows RCP's to select from a list to document the device and the measurement of sputum production. The sputum production list consists of none, scant, 1-4ml, 5-10ml, 11-15ml, and swallowed. The number of treatments given and the sputum production range selected were totaled from our RCMIS. Scant and none were counted to be unproductive. The documentation of 1-4ml, 5-10ml, 11-15ml, and swallowed were counted as productive. Results: Since March 2010, 12 CF patients have initiated the use of the device, with 84 treatments delivered. Document of sputum production was as follows: 19 none(23%), 2 Scant(2%), 17 1-4ml(20%), 23 5-10ml(27%), 3 11-15ml(4%), and 20 swallowed(24%). The majority of the treatments were productive (63; 75%). A fourth of the treatments were unproductive (21; 25%). Conclusions: With acceptable results of sputum production documented with the initial 12 CF patients, the Frequencer, can safely be considered to be one of the preferred or primary choices by the patient and RCP.

Sponsored Research - None

921222

BACTERIA GROWTH ON PORTABLE OXYGEN TANKS DURING HOSPITAL USE.

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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 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 patients' 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 tank, just below the regulator. After initial cultures were obtained, oxygen tanks were thoroughly cleaned using germicidal disposable cloths and then put into use. Prior to returning the oxygen tanks to their distributor they were re-cultured in the same manner to determine if they had become contaminated during hospital use. Results: Of the initial 30 cultures all grew mixed Bacillus bacteria, 4 grew mixed Staphylococci, 2 grew Zygomycota. After cleaning each tank and putting them into use, only 20 of the tanks were returned and recultured. Of those cultures 19 grew mixed Staphylococci, and 14 grew mixed Bacillus bacteria. Conclusion: Although certain strains of Bacillus are pathogenic, the mixed Bacillus found on the tested oxygen tanks was non-pathogenic and normally classified as a common environmental contaminant found in soil. The Staphylococci found on the tested tanks was classified as normal skin flora, unlike some of the more pathogenic forms. Zygomycota is a fungus that produces spores which are naturally occurring and are unharmful to healthy individuals. However, to the immunocompromised patient this fungus can be harmful. In conclusion, portable oxygen tanks do not appear to be a contributor to nosocomial infections. However, extra precautions (i.e. cleaning) should be taken when using portable oxygen tanks for the immunocompromised patient.

Sponsored Research - None

920330

ACCURACY 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 aucusculated 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 Rad87 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). Results One hundred eighty seven 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

811730

COMPARING BREATHING INTOLERANCE INDEX PRE- AND POST-DIAPHRAGMATIC MUSCLE FATIGUE IN HEALTHY ADULTS.

Dawn Marie Axness, Junko Morikawa, Chontel Ross, Dione Harrod, Lonny Ashworth; Boise State University, Boise, ID

Background: Breathing Intolerance Index (BIT Index) was proposed by Dr. Toshihiko Koga as an alternative to measuring the Tension Time Index of the diaphragm (TTIdi) to measure diaphragmatic fatigue. BIT Index is defined as Inspiratory Time/Total Time multiplied by Tidal Volume/Vital Capacity: (Ti/Ttot) x (Vt/VC). Dr. Koga previously found that subjects who used NPPV at night for OSA had a higher BIT Index when compared to healthy adults. Presently, there is no clinical scale for 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, and see if the BIT Index changes. Methods: Following IRB approval, four subjects' baseline Vt, VC, Ti, Ttot and MIP were measured using the METEOR Respiratory Mechanics Handheld Monitor. The baseline BIT Index was calculated for each subject. Next, each subject used an Inspiratory Muscle Trainer set at 40% of their MIP. Each subject's heart rate, respiratory rate and level of dyspnea (using the Modified Borg Scale) were monitored every three minutes. Each subject continued the use of the Inspiratory Muscle Trainer until a 10 (maximal) was reached on the Modified Borg Scale. At this point, the MIP was immediately re-measured and spirometry measurements were repeated to obtain new data points for the BIT 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 increased, the MIP decreased, while Vt and Vt/VC increased. For the two subjects whose BIT Index did not change or decreased, MIP increased, while Vt and Vt/VC decreased. Conclusions: The two subjects who had an increase in their BIT Index reached a 10 on the Modified Borg Scale in less than forty minutes. The subject whose BIT Index decreased used the inspiratory muscle trainer for seventy-seven minutes. The subject who had no change in BIT Index ended the testing period in a tripod position. Further studies are needed to evaluate alternate methods of inducing muscle fatigue and to evaluate the BIT Index for patients with muscle fatigue and/or muscle weakness.

Sponsored Research - None

Breathing Intolerance Index Before and After Inducing Muscle Fatigue

	Time to Fatigue (in Minutes)	BIT Index Pre-Fatigue	BIT Index Post-Fatigue
Subject 1	34	0.048	0.066
Subject 2	28	0.035	0.065
Subject 3	77	0.080	0.064
Subject 4	63	0.034	0.034

888645

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

Mark S. Siobal, Josephine C. Valdes; Anesthesia, SFGH/UCSF, 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 PeCO2 using ventilator measurements of VCO2 and VE, which is corrected for circuit compression volume. We calculated PeCO2 from the Drager XL Ventilator measurements and compared it to PeCO2 and VD/VT measurements from the Respironics NICO2 Monitor in intubated patients diagnosed with ALI/ARDS. Method: The ventilator flow sensor and mainstream CO2 sensor, and the NICO2 monitor combined CO2 / flow sensor were calibrated and attached between the ventilator circuit and the patient. Following stabilization, VCO2 and VE measurements from the ventilator were recorded and average over a 5 minute period. The averaged VCO2 and VE were used to calculate the fraction of exhaled CO2 (FeCO2) where FeCO2 = VCO2 / VE. PeCO2 was calculated by multiplying FeCO2 and the barometric pressure minus water vapor pressure (PeCO2 = FeCO2 (760 – 47). The PeCO2 calculated from ventilator measurements and the NICO2 monitor, and PaCO2 from the most recent ABG was used to determine VD/VT using the Enghoff modification of the Bohr equation: (VD/VT = (PaCO2-PeCO2) / PaCO2). The proximal and distal position of the ventilator CO2 sensor, and the NICO2 combined CO2 / flow sensor were then reversed and the measurements were repeated. A total of 31 measurements of PeCO2 and VD/VT in 9 patients were recorded and compared. 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 ($r = 0.95$, r squared = 0.90, $p < 0.0001$) and VD/VT ($r = 0.97$, r squared = 0.95, $p < 0.0001$) Conclusion: PeCO2 and VD/VT calculated directly from the Drager XL Ventilator measurements are in strong agreement with measurements from the NICO2 monitor.

Sponsored Research - None

908202

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

919730

EVALUATION OF DRÄGER APRV WITH AUTORELEASE – A MODEL STUDY.

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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 P_{high}) as a percent of peak expiratory flow (% PEF). This setting determines expiratory time (T_{low} 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 (V_T) and mean airway pressure (mPaw). **METHODS:** A passive patient with ARDS was modeled using an Ingmar ASL 5000 lung simulator. Simulator settings were: compliance = 30 mL/cmH_20, resistance = 10 cm H_20/L/s. Ventilator settings: mode = APRV AutoRelease, inspiratory pressure (P_{high}) = 30 cm H_20, expiratory pressure (P_{low}) = 0 cm H_20, frequency 10 breaths/min. % PEF settings were: 0, 10, 20, 30, 40, 50, 60, 70 and 80%. Mean values for EELP, V_T 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 V_T. The change in expiratory time was a small fraction 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 EELP for PEF% > 0. **CONCLUSION:** Appropriate use of the APRV requires careful consideration of the complex interactions of ventilation 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 V_T ranging from 345-510 mL and EELP from 15-20 cm H_20. Expiratory times from 0.27-0.84s (associated with the %PEF settings) resulted in V_T ranging from 348-846 mL and EELP from 3-20 cm H_20. 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 T_{low}.

Sponsored Research - Ventilator was loaned for period of study.

900130

LABORATORY EVALUATION OF THE SAVE SIMPLIFIED AUTOMATED RESUSCITATOR.

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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 determine 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 varied 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 lpm resulted in the SAVe failing to cycle. Measured FIO2 was comparable to reported FIO2 although it decreased with simulated spontaneous breathing through the device. Conclusions: The SAVe resuscitator is a limited function device. Tidal volume delivery is inconsistent with decreased lung compliance and/or increased resistance. The set respiratory rate and tidal volume are not guaranteed under these conditions. During spontaneous breathing, room air is supplied to the patient. Entrainment of oxygen at greater than the recommended flow rate may result in ventilator malfunction. The SAVe could potentially be used for ventilatory support of carefully selected military casualties to replace manual ventilation, but caregivers must be aware of the limitations.

Sponsored Research - None

906629

MECHANICAL VENTILATORS IN THE HOT ZONE: EFFECTS OF A CBRN FILTER ON PATIENT PROTECTION AND BATTERY LIFE.

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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. We evaluated the effect of a CBRN filter on battery duration and patient protection of four ventilators (CareFusion LTV-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 (AC) 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-asphyxiation valve of a failed device. Results: The range of battery life varied widely across different ventilator models (99.8 – 562.6 minutes). 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: LTV-0.4 min., Impact 754-3.6 min., Impact 731- 4.1 min., and HT 50-10.9 min. The peak negative pressure required to breathe though 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 below shows 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 under normal operating conditions, leaving the patient's airway exposed to the contaminated environment.

Sponsored Research - None

906613

BENCH EVALUATION OF SEVEN PORTABLE VENTILATORS.

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Introduction: Portable ventilators (PV) continue to decrease in physical size while 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 at both the 50 ml and 100 ml, and the HT 50 at the 100 ml settings exceeded the ASTM standards for tidal volume accuracy. Additionally, the HT 50 was unable to deliver a VT of 50 ml. Triggering response and battery duration varied widely among ventilators. Data below shows the negative pressure generated from baseline using an aggressive setting of 600 ml VT and inspiratory flow of 1.3 L/s and battery duration with each ventilator. Conclusions: Manufacturers continue to improve the performance of portable ventilators. Wide variability still exists between ventilator models with regard to battery life and triggering sensitivity. The majority of the ventilators we evaluated performed adequately in terms of VT delivery across a wide range of settings. The combination of high respiratory rate and low VT presented problems for two of the devices. Clinicians must be aware of ventilator limitations when choosing a device for their patient populations.

Sponsored Research - Funding for this study was provided by GE Healthcare

906560

OXYGEN CONSUMPTION AND BATTERY LIFE OF NEW TRANSPORT VENTILATORS.

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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 50% Oxygen and operate off of battery power were evaluated. **Methods**: During both the oxygen and battery life evaluations ventilators were set in volume control mode, tidal volume 500 ml, inspiratory time 1.0 second, rate 20/min, and PEEP 5 cmH2O. Battery life was evaluated on 3 separate occasions following at least a 16 hours recharge period. Battery life (TBattery) was determined from the onset of ventilation until the ventilator stopped functioning. Oxygen consumption was determined on 3 separate occasions after the ventilator was set based on manufacturer's recommendation to deliver an FIO2 of 0.5 as determine by an oxygen analyzer in the ventilator circuit. Time was determined from the onset of ventilation until the FIO2 decreased to 0.45 (T45) and FIO2 returned to 0.21 (T21) or the ventilator stopped functioning. **Results**: The table below lists the results. **Conclusion**: Battery life on all ventilators was acceptable for intra and inter hospital transfer but did differ greatly. Oxygen consumption was as expected on some ventilators but also varied considerably.

Sponsored Research - None

920749

TRANSPORT VENTILATOR PERFORMANCE DURING 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 muscle effort of 0.5% BCT, and return of pressure to baseline 22.7% BCT, maximum muscle effort (Pmus) 5 and 10 cmH2O. Three combinations of compliance (C) and resistance (R): C 60 mL/H2O/R10 cmH2O/L/sec (C60/R10); C60/R5; and C30/R10 were evaluated. PS was set 15cm H2O above PEEP levels of 5 and 15 cmH2O. Manufacturers default settings and optimal setting of trigger sensitivity, rise time and termination criteria were compared. The following variables are reported: Time to Trigger (TT): The time, in milliseconds, from start of the breath to ventilator triggering. Pressure to Trigger (PT): The magnitude of pressure difference, measured in cmH2O, between initial airway pressure at start of breath and the negative deflection in airway pressure needed to trigger. Time to Baseline (TB): The time, in milliseconds, from ventilator triggering to the point when airway pressure reestablishes and maintains baseline pressure (PEEP), Inspiratory T90 (T90). **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

920267

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

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BACKGROUND: With ongoing interest in ARDSnet and lung protective strategies, we formed a PI group to examine the management of our hypoxemic 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 hypoxemic 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 hypoxemic 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. 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 non-survivors (23.3±4.0, 26.0±4.8, p<0.002). There was not a significant difference in Vt between survivors and non-survivors (7.6±1.5, 7.7±1.6, p=0.13). CONCLUSION: Overall hospital mortality was comparable or more favorable than previously published outcomes of mechanical ventilator patients[1]. Patients in our SHRF population were 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, but increases in Vt were not 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 the Outcomes of Mechanical Ventilation.

Sponsored Research - None

Vt (ml/kg) and Plat versus mortality in severe hypoxemic respiratory failure patients

913044

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 in whom conventional ventilation (CV) strategies have been failed. The purpose of this study is to analyze the characteristic difference between survivors and nonsurviors in ARDS patients with HFOV. Method: 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 ≧ 65 mm Hg with FiO2 ^0.6 when PEEP > 10 cm H2O or plateau airway pressure ^ 35 cm H2O). The setting were FiO2 of 0.9 to 1, 5 Hz, inspiratory time of 33%, 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 ≧0.6. 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 35 and 60 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 survivors group had less baseline severity such as lung injury score, organ system failure 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 (32.77+/-16.69 vs 47.85+/-26.21 hours, p = 0.049). The duration of HFOV was significantly shorter in survivors than nonsurvivors (35.92+/-21.12 vs 64.95+/-47.13 hours, p = 0.045). Conclusion: High frequency oscillatory ventilation was effective for oxygenation failure in some selected ARDS patients. In this study, the initial less severe ARDS patients had better outcome. The survivors had the shorter 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

APACHE II:Acute Physiology and Chronic Health Evaluation II, LIS: lung injury score, OSF: organ system failure, SOFA: sepsis organ failure assessment, MOD: multiple organs dysfunction, OI: oxygenation index, MAP: mean airway pressure, CV: conventional ventilation

919077

DOES THE LTV 1200 MAINTAIN A SAFE OPERATING TEMPERATURE WHEN INCREASED RESISTIVE LOADS, (PEEP LEVELS UP TO 30 CMH20), ARE PLACED ON THE TURBINE?

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BACKGROUND: During the 2009-2010 Influenza Pandemic, the Dartmouth Hitchcock Advanced Response Team (DHART) transported several patients with 2009 H1N1 related ARDS. Several of these patients required PEEP greater than 20cmH2O, the maximum setting on the LTV 1200 ventilator. We tested the LTV 1200 to determine if it could be used safely with the addition of an external PEEP valve for patients requiring greater than 20 cmH2O of PEEP. A bench test was performed to see if PEEP could be increased by adding an adjustable PEEP exhalation valve, (CareFusion PN# 10824), and applying external PEEP to the internal PEEP of the LTV 1200. Using a Michigan Instruments TTL Test Lung, we found that PEEP settings up to 30 cmH2O could be achieved by adding internal PEEP (15 cmH2O) to the external PEEP valve, (15 cmH2O), while maintaining reasonable accuracy of delivered parameters, as measured by the TTL and LTV 1200 with low Cstat/high Raw test lung settings and ARDSNet patient settings. We noted increased heat radiating from the ventilator case during our test runs. The maximum operating External Surface Temperature, (measured on the ventilator case), is 50∞ C., according to the LTV 1200 Operator's Manual, (P/N 19802-001, Rev A, page A-7). METHOD: We set up the LTV 1200 in the above described manner and secured a temperature sensor centered on the ventilator case. We simultaneously measured the internal temperature. Normal ventilator operating parameters and lung mechanics were used as a baseline. ARDSNet compatible settings were tested with severely reduced compliance and increased Raw under increasing PEEP conditions. Temperature measurements were taken with a Fluke 52II Dual Channel Thermometer and readings taken after each condition was run for two hours and readings were stable. RESULTS: The maximum External Surface Temperature, as shown in Table 1, of the LTV 1200 was not exceeded during our test runs. CONCLUSIONS: We conclude that modifying the PEEP delivery system to be able to deliver up to 30 cmH2O of PEEP does not create an unsafe increase in operating temperature of the LTV 1200.

Sponsored Research - None

918599

NON-COMPLICANCE OF LIBERATION FROM MECHANICAL VENTILATION FOLLOWING A STANDARDIZED WEANING PROTOCOL: A RT/RN INTERVENTION.

Lisa Cracchiolo; Barnes Jewish Hospital, St. Louis, MO, MO

Authors: Lisa Cracchiolo, RRT, AE-C; Adam Sampson, MA, RRT; Carrie Sona, RN, MSN, CCRN, CCNS; Elizabeth Dykeman 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 proven challenging. A growing number of patients in our SICU, experience delays in 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, 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 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, secretions 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 ICU. This intervention 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

913011

LENGTH OF SPONTANEOUS BREATHING TRIALS PREDICTS SUCCESFUL 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 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 SBTs 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 VERSUS CIRCUIT BLEED-IN OF 80:20 HELIOX.

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BACKGROUND: We compared two methods of adding heliox into a Respironics 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, ITime=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 Respironics 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 Respironics Vision at both 10 LPM and 15 LPM consumed less heliox than when the Respironics 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 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, along with an inability to predict the magnitude of CO2 changes due to ventilator setting changes. Case Summary We describe a case of a 26 week gestation baby with bronchopulmonary displasia ventilated on high frequency oscillation with volume guarantee (VG) in our neonatal intensive care. The CO2 variance during the period of HFOV with no VG was 237.80, with a mean of 77.40. This was compared to a variance of 78.00 and a mean of 64.69 for the period when VG was active. The higher CO2 variance before VG was activated showed two episodes of hypercapnia, putting the patient at risk for PVL and IVH Discussion HFOV + VG allows for control of high frequency tidal volume independently of hertz and amplitude, allowing the return of autonomy of rate control to the hertz setting. Changes in hertz no longer cause an over-estimation or under-estimation in ventilating volume that would impact CO2 removal, resulting in serious long term consequences. This brings the ventilation strategy in high-frequency in line with conventional ventilation strategy and eliminates some of the 'guess work' out of the process. Using VG required a change in our high frequency oscillation protocol and strategy. Overall the team felt that they had better control over ventilation and were better able to mitigate the sequelae of hypocapnea and hypercapnea.

Sponsored Research - None

909149

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 750,000 additional 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 (Ingmar 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 50cmH2O with PEEP of 15cmH2O. Above 35cmH2O, 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 <0.3sec) 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 was 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

OXYGEN PLANNING FOR FIXED WING TRANSPORT WITH THE LTV 1200.

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Background: Oxygen planning for fixed wing transport includes 3 parts: preflight estimate of patient needs, patient contact actual oxygen needs, and in-flight monitoring of oxygen usage. 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 referral center. Goal: Develop a formula for preflight oxygen planning for 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 10 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 E 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

920212

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 a medical application was detailed in 1984 by Barber and Brown. Using a system of 16 electrodes, plus a reference, low alternating current is injected resulting voltages are measured in a rotating sequence and tomography images are reconstructed. We hypothesized that EIT would be able to demonstrate an increase in the Impedance Ratio (IR) with the change from supine to upright position. METHOD: For data analysis we used ANOVA for repeated measures which assessed differences across breaths and between positions using the IR between anterior and posterior.10 "healthy" subjects were instructed to tidal breathe. We recorded one minute of data for each subject and position, then averaged the means of 5 tidal breaths and calculated a ratio of anterior and posterior ventilation in both supine and standing positions. Table1 illustrates the mean IR for standing and supine positions. RESULTS: We anticipated a regional shift in ventilation from supine to standing position with a corresponding increase in the IR closer to1. Statistically this appeared not to be the case. For our calculations we utilized the tidal variation arbitrary units from the EIT device. Raw data analysis demonstrated the anticipated result for 7 of 10 subjects. We were unable to determine why 3 did not have the same result. Some of the possibilities for not obtaining predicted results could be related to defining, healthy volunteers, anthropometric measures, or other pathological conditions. CONCLUSION: Use of EIT bedside for images of increased ventilation is fairly well documented. In this case EIT was not able to reliably demonstrate the relative decrease in posterior ventilation with position change from supine to standing, using the tidal variation number.

Sponsored Research - None

891400

A MULTIDISCIPLINARY APPROACH TO DECREASE TRANSMISSION RATES OF MULTIPLY RESISTANT PSEUDOMONAS AERUGINOSA (MRPA) IN CYSTIC FRIBROSIS (CF) PATIENTS.

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Background: Chronic airway colonization with Pseudomonas aeruginosa has been associated with increased morbidity and mortality among CF patients. Between 2004 and 2009, 56% 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 "contact 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 instructed to wear masks when 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 dominate 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 HIGH-FREQUENCY INTRA-HOSPITAL TRANSPORT VENTILATOR.

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Background:<b/> **Primary Children's Medical Center (PCMC) is a 271-bed tertiary care facility located in Salt Lake City, Utah. Annually, PCMC has more than 1200 high-frequency ventilation patient days per year and uses more than 25,000 hours of inhaled Nitric Oxide(iNO). There is a periodic need to move these types of patients within the facility for care not readily available at the bedside. PCMC has acquired a Percussionaire Sinusoidal Bronchotron with Turbohead(Bronchotron) and we seek to test its compatibility with the Ikaria INOMax DS for use in intra-hospital transport.** *Methods:* **A Bronchotron is used with a Fisher Paykel RT 130 Infant ventilator circuit. The injector module from the calibrated INOMax DS was placed at the gas outlet 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 Smart Lung 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 10-33 cmH2O. A variety of ventilator settings and iNO 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 2x-3x greater than set dose in all testing conditions. We hypothesize that variability in percussive ventilation flow-i.e. "pulsating 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 equaled 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 added external flow caused the PAW to increase by 2 to 9 cmH_2O. The following table shows results of testing with and without external flow to 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 humidity. Recently a method to deliver heated humidity using the high frequency ventilator was devised. ***Method:*** The Perussionaire Bronchotron I with Turbohead Phasitron(Bronchotron) was used with size #0, size #5 Hudson Nasal CPAP prongs or a 3.5 endotracheal tube(ET) and was attached to a specimen cup used as a lung model with a fixed leak. The Philips NEO-POD T(NPT) was evaluated with an Airborne Neonatal Isolete(Isolete). The NPT was set @ 37∞ Celsius(C) and targets up to 100% relative humidity(RH). A noenatal ventilator curcuit was used. The percussion 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 38∞C were unchanged from measurements done at 37∞C so are not listed. The following measurements were with 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 Isolete temp set at 34∞C. An ARH of 92.2% and AT of 34.2∞C was measured with the NPT set at 37∞C and the Isolete set at 37∞C. The measurements with the 3.5 ET were as follows. Without the NPT the Isolete temp set at 34∞C an ARH of 31.9% and AT of 31.2∞C was measured. With the Isolete temp set at 37∞C an ARH of 33.5% and AT of 31.4∞C was measured. With the NPT set temp at 37∞C and the Isolete set temp at 34∞C an ARH of 96% and AT of 32.3∞C was measured . All measurements are shown in following table. ***Conclusion:*** 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 temp 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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Backround: Primary Childrens Medical Center (PCMC) has used nasal continuous positive airway pressure (NCPAP) with conventional ventilation and humidity for many years. It was determined that a method of consistent humidification was needed while delivering high frequency NCPAP (HFNCPAP). ***Method:*** The Percussionaire Sinusoidal Bronchotron with Turbohead phasitron (Bronchotron) and Hudson Nasal CPAP Prongs were attached to a specimen cup. The Fisher & Paykel MR850 (MR850) heater, the Hydrate OMNI Humidification System (OMNI) and the Percussionaire aerosol generator (PAG) were all evaluated. For testing purposes devices were set to 37∞C and to target 100% relative humidity except the PAG (non heated device). A FLUKE 971 was used to measure relative humidity and temperature within the specimen cup. The Bronchotron was set up with an infant ventilator circuit compatible with each device. Operational pressure was set at 30psi and oscillatory cpap and pulsatile flowrate were set at low, mid, and high settings (other settings were placed in the 12 o'clock position for the duration of testing). The humidifiers were allowed time to stabilize when placed on a new settings, then measurements were obtained from the specimen cup. Measurements were taken at time of stabilization (when humidifier indicated set temperature) and fifteen minutes post stabilization using size #0 and #5 Hudson cpap prongs. The range of NCPAP pressures were from 3 to 13cmH_2O. ***Results:*** We found that the MR850 and the OMNI were able to deliver adequate heat and humidity in all of the tested areas. The MR850 delivered an average of 97.3% relative humidity at 34.9∞C, but took approximately 15 minutes to stabilize. The OMNI delivered an average of 98.9% relative humidity at 33.9∞C and took less than 2 minutes to stabilize. The PAG was able to deliver an average of 71.2% relative humidity at room air temperature. Relative humidity in the room was measured at 28%. Visible humidity and rainout were also observed. All measurements are shown in the following table. ***Conclusion:*** At PCMC we currently utilize the MR850's so it would not be cost effective to change to a different device at this time given that both devices (MR850 and OMNI) operated very well in the testing environment provided. The OMNI may prove more cost effective over time due to reduced circuit costs. The PAG may be an alternative if power is not available, but would increase gas consumption.

Sponsored Research - None

887342

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 emergently 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 suctions 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 therapists' 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 outpatients 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 high frequency oscillatory effect on flow is clinically beneficial. Heated, 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 induced flow oscillations mechanically. Four new devices using a fluidic oscillator in conjunction with a High Flow Nasal Cannula were 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 nares and nasopharyngeal airway. A pressure sensor in the pharyngeal model captured continuous 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 rising flow. Device #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 Childrens 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 cmH_2O, and PEEP 8 cmH_2O 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 SXN 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 the DSM compared to 36-50% with the SSM. Test lung down times ranged from 51%-91% using DSM compared to 39-57%with the SSM. Reinflation times ranged 4-10%using the DSM and 4-13%with the SSM. The average deflation time was 16% for the DSM and 42% with the SSM. The average test lung down time was 76% for the DSM and 50% for the SSM. The average reinflation 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 longer 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 practice 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 proportion to 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 the NAVA mode of ventilation in comparison to Pressure Support Ventilation,(PSV),(Breatnac,2010,Bengtsson 2010). The purpose of this study was to determine whether PIP would decrease in NAVA in comparison to pneumatically triggered, (primarily SIMV) modes of ventilation,and trend the physiological effect on parameters that contribute to minute ventilation. Method: 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 i ventilator utilizing an electronic data card. Data was continuously collected by minute from 30-minutes prior, and 6 hours after swiching 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 outcome differences among baseline(30 minutes before), 30 minutes after and 6 hours after NAVA accounting for age, gender, weight, pre-NAVA mode of ventilation and NAVA level. Post-hoc multiple comparison adjustment was applied for significant effect. Results: Patients' ages ranged from three weeks to 15 years with a median of 1.25 years (IQR = 2.75). This sample was primarily male (66.7%) and their weight ranged from 3.6 to 77.2 kilograms (Median = 8.3, IQR = 8.7). PIP consistently and significantly decreased at both at 30 minutes and 6 hours after switching to NAVA ($p = .0091$). See Table 1 for effect for on tidal volume, minute ventilation, PH, and pCO2. Conclusion: This data supports the theory that improved breath cycle synchrony with the diaphragm may result in improved lung compliance. Data from our NAVA cohort revealed a consistent decrease in PIP after patients were switched to NAVA. All 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 DELOYMENT LOW RESOURCE MODEL FOR PEDIATRIC EXTRACORPOREAL MEMBRANE OXYGENATION (ECMO) TRANSPORT.

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Background Children with severe heart failure are often stabilized with ECMO until a definitive diagnosis is made or function recovers. In some cases, cardiac function does not improve requiring bridge to transplantation using a ventricular assist device (VAD). Access to centers specializing in long term mechanical support and transplantation, may require transport while on ECMO. We sought to describe our experience with ECMO transport in children requiring 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 as 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 (<34∞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 referral 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. Three patients (50%) were transported by fixed wing aircraft, 2 (33%) 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±33.8 (240-32) 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±4.7 (45-19) and duration of hospital stay was 32.6±4.6 (45-22). 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 model. Given the relatively quick response time, rate of low severity complications, and excellent outcomes, we feel our model of ECMO transport can be accomplished safely in children on ECMO to centers specializing in VAD support or transplantation. Additional study is needed to evaluate the rate of complications and outcome in a larger data set.

Sponsored Research - None

919332

PROCESS IMPROVEMENT IN THE NICU.

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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 occured. 22 environmental cultures were positive: 12 B. cerus, 5 B. thuringiensis, 5 Bacillus species. A multidisciplinary team was assembled to help isolate and control the spread of infection among the infants in the NICU. Bacillus is a gram positive, spore forming, aerorbic rod consistently found in soil and dust, transmitted by environmental contact. Bacillus Cereus can cause opportunistic infections in the immunocompromised premature hosts. B. cereus has been associated with serious invasive infections and neonatal demise in 1998 and 2001. 7 of our babies were extremely susceptible to the organism requiring antibiotic therapy and prolonged mechanical ventilation. Method: The team suggested several sources of possible contamination. Initially the common areas were the focal point for extreme cleaning. There was no appreciable reduction in positive cultures. Next, infants with positive cultures then had their direct contact respiratory equipment swabbed and re-cultured, again no significant findings. Finally, all of the Drager Babylog 8000 flow sensors and housings that were previously disinfected for re-use were cultured. Results: The inadequately cleaned housing and flow sensors were the culprits. Initially these vital ventilator parts were only cleaned in the nursery by RT staff. Flow sensors were soaked in 70% alcohol for 15 minutes, rinsed in sterile water for 10 minutes, air dried and finally placed in an open bin before being returned to service. By adding the step of sending the sensors to SP for steam sterilization and individual packaging, the growth and spread of B. cereus on the flow sensors was completely stopped by March of 2009. Conclusion: This case analysis strongly suggests that pre-soaking followed by steam sterilization of reused flow sensors will prevent contamination and the spread of B. cereus. Single patient use is always preferred but not always an option.

Sponsored Research - None

920775

IS THERE A METHOD FOR SIMPLFYING 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 discouraged the use of the oscillator and jet ventilators more common in the NICU setting. The Bronchotron (Percussionaire Corporation, Sandy, Utah) requires no electricity for actuation 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 waveforems 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 an 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 pressure fixed at 20 PSIG while varying pulse frequency and 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 describe 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 parameters without the luxury of a digital readout.

Sponsored Research - None

920501

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 patients receiving mechanical ventilation and aerosol delivery 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

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 re-emphasis. Saturations were maintained in the target parameter of 88-92% with alarm settings at $\pm$ 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

920261

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 (HeO_2) admixture. Our pediatric critical care transport team (PCCTT) has been using HeO_2 as an adjunct therapy for select children with upper airway obstruction from croup. We sought to describe our experience with HeO_2 on transport and hypothesized that transported children treated with HeO_2 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 (HeO_2 n=17, no HeO_2 n=18). Demographics were similar between groups except for a higher weight in the HeO_2 group [mean(SD)= HeO_2 19.9kg (13.6) vs no HeO_2 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 HeO_2 had a higher baseline croup score [mean(SD)= HeO_2 5.7(2.3) vs no HeO_2 2.9(2.0), p<0.001]. The improvement in croup scores over the first 60 minutes of transport was more rapid in the HeO_2-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)= HeO_2 20.2(11.1) vs no HeO_2 23.4(22.8), p=0.59] and hospital length of stay [mean hours(SD)= HeO_2 43.7(18.7) vs no HeO_2 44.5(33.6), p=0.64] were similar between groups. No HeO_2-treated children required intubation versus one intubation in the no HeO_2 group. **Conclusion:** HeO_2 use in treatment of critically ill children transported via a PCCTT provides a more rapid improvement of croup scores. HeO_2 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 HeO_2.

Sponsored Research - None

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