Chimeric Antigen Receptor (CAR) Cell Patients Admitted to the ICU: The CAR-ICU Initiative Experience

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Introduction

To report characteristics and outcomes of CAR patients admitted to the ICU in centers participating in the CAR-ICU initiative.

Methods

Multicenter historical cohort study of adults receiving CART who were admitted to the ICU with treatment-related toxicities between November 2017 and May 2019 in 7 US centers. Demographic data and clinical data specific to ICU management were reported with descriptive characteristics and Fisher's exact or Chi-square test were used to identify variables associated with mortality.

Results

111 patients required ICU admission for CAR-related toxicities during the study period. Patients were mostly male (n=73,66%), median age 59(18-86), with lymphoma (n=110,99%) and had received a median of 4(3-5) lines of prior therapy. Most patients were treated with axicabtagene ciloleucel (n=105,95%). Cytokine release syndrome (CRS) was observed in 85(77%) patients and immune effector cell-associated neurotoxicity syndrome (ICANS) in 92(83%) patients; 66(60%) patients experienced both toxicities during ICU stay. Median SOFA score on ICU admission was 4(1-21) and max SOFA score was 5(1-23). During ICU admission, 11% of patients required mechanical ventilation (MV), 18% vasopressors (VP) and 3% dialysis. Median time from CAR infusion to ICU admission was 5(0-74) days and ICU length of stay was 4(1-22) days. Treatments consisted of corticosteroids (87%), tocilizumab (83%), anakinra (8%) and siltuximab (8%). ICU mortality was 9% and attributed to sepsis (2.7%), disease progression (2.7%), CRS (1.8%) and ICANS (1.8%). Experiencing concurrent CRS and ICANS did not increase the risk for mortality when compared to experiencing either toxicity alone. Variables associated with increased ICU mortality included multiple ICU admissions, higher cumulative corticosteroid dosing, MV and VP. Median overall survival was 8.6 (6.2-15.2) months with median follow-up time 12.2 (0.9-26.1) months.

Conclusion

Our data is the first to report a multicenter experience in the management of critically ill CAR patients. While concurrent CRS and ICANS don't appear to increase ICU mortality risk, interventions used to treat toxicities including VP, MV and corticosteroids may be associated with increased ICU mortality. Further analysis is needed to understand if a causative effect exists.

EFFECTS OF SMOFLIPID® VS. INTRALIPID® ON LIVER ENZYME CHANGES IN PATIENTS WITH CHRONIC LIVER DISEASE

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Introduction

Intravenous lipid emulsions (ILE) play an integral role in parenteral nutrition (PN) by providing a balanced source of calories and essential fatty acids. Existing literature has shown that composition of ILE may have immunomodulatory effects which can negatively impact liver function. Combination lipids, such as Smoflipid®, contain less soybean oil and include other oils which are less pro-inflammatory and have shown to have a more favorable impact on liver enzymes when compared to soy-based ILE in patients with intact hepatic function. The purpose of this study was to compare the median change in liver enzymes (AST and ALT) in patients with chronic liver disease who received PN with Smoflipid® vs. Intralipid® from initiation of ILE out to day seven.

Methods

This was a retrospective, single-center, cohort study of patients with chronic liver disease who received ILE therapy in conjunction with PN. A bivariate analysis was performed to evaluate the primary endpoint of median change in ALT and AST from start of ILE out to day seven. Secondary endpoints included change in total bilirubin, newly diagnosed infections out to 14 days post initiation of ILE therapy, change in MELD-Na scores during the study timeframe, and length of stay.

Results

Ninety-nine patients with chronic liver disease met inclusion criteria and received ILE therapy while on PN. Of these, 54 received Smoflipid® and 45 received Intralipid®. The median (interquartile range) MELD-Na score at initiation of ILE therapy was 29.3 (17.7 – 35.9) vs. 21.7 (15.4 – 34.9); p= 0.44 in the Smoflipid® and Intralipid® arms, respectively. There was no statistical median difference in AST [12 units/L (-16 – 38) vs. 6 units/L (-7 – 25); p= 0.87] or ALT [5 units/L (-2 – 17) vs. 2 units/L (-7 – 16); p= 0.40] from start of ILE therapy out to day seven. There were no significant differences in any secondary endpoints.

Conclusion

In patients with chronic liver disease who received PN therapy with Smoflipid® vs. Intralipid®, there was no statistical or clinical difference in the change in liver enzymes from the start of ILE therapy out to day seven. Further, long-term studies are needed to elucidate the impact of prolonged ILE therapy on liver enzymes in chronic liver disease.

Progressive EKG changes in children at risk for sudden unexpected death in epilepsy

Yi-Chen Lai, MD, See Wai Chan, MD

Introduction:
Sudden unexpected death (SUDEP) is a significant cause of mortality in epilepsy. Lack of seizure control and history of status epilepticus (SE) are known risk factors. Although cardiac pathology may contribute to SUDEP, temporal evolution of the cardiac changes is unknown. Here we sought to investigate whether cardiac alterations develop over time in children with epilepsy who may be at risk for SUDEP.

Methods:
Children admitted to the pediatric intensive care unit for seizures or SE were prospectively identified over 3 years. They were included if there was at least 1 EKG study in the electronic medical record and no pre-existing cardiac conditions. The primary outcomes were the presence of QRS axis deviation, altered PR, QRS and QTc intervals, ST segment and T wave changes, or arrhythmias. We performed Student t test for continuous variables; Fisher exact or $\chi 2$ for categorical variables; and logistic regression analysis to identify factors associated with EKG alterations.

Results:
244 children met the study criteria. 88 children had no history of epilepsy (control, 216 EKGs), 156 children had epilepsy (503 EKGs). Compared with controls, the epilepsy group was more likely to have abnormal EKG (1.4 [1.02-1.94], OR [95% CI], $p < 0.05$) and had more arrhythmias (PVC: 0.47% vs. 1.64%, junctional: 0% vs. 1.02%, heart block: 0% vs. 0.41%, control vs. epilepsy, $p < 0.05$). Within the epilepsy group, abnormal EKG studies occurred at an older age as compared with normal EKGs (66.6 ± 4.0 vs. 97.4 ± 5.0 months, normal vs. abnormal EKG, $p < 0.01$). In the control group no differences in age were observed (56.1 ± 5.8 vs. 54.2 ± 6.4 months, normal vs. abnormal EKG). Logistic regression revealed that age was independently associated with abnormal EKG only in the epilepsy group ($p < 0.01$).

Conclusions:
Our findings suggest that altered cardiac EP and arrhythmias may develop over time in this vulnerable epileptic cohort. Therefore, cardiac surveillance in a select group of children with epilepsy may be warranted.

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Aminoglycoside pharmacokinetics in critically-ill patients undergoing renal replacement therapy

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Introduction:
Changes to aminoglycoside (AG) pharmacokinetics during critical illness may affect attainment of pharmacokinetic targets. Use of continuous renal replacement therapies (CRRT) complicates attainment due to variable and poorly understood extracorporeal drug clearance.

Methods:
Adult patients who received a first dose of amikacin or tobramycin during CRRT between 2/1/2012 and 2/28/2017 were retrospectively evaluated. Patients were allocated to different study arms per their receipt of SLED, CVVHD, or CVVH. Two post-distributional serum levels were required for pharmacokinetic calculations. Patients were excluded if fewer than 2 serum AG levels were collected, if previous AG dose given within 7 days, if already enrolled or if pregnant. The aim of this study was to characterize first-dose AG clearance and Vd during CRRT.

Results:
A total of 80 patients were allocated to the SLED (49 subjects), CVVHD (19 subjects) and CVVH arms (12 subjects). Fifty-one patients received a median amikacin dose of 14.2 mg/kg per actual body weight (ABW) and achieved a median peak level of 27.3 mg/L. Twenty-nine patients received a median tobramycin dose of 6.4 mg/kg ABW and achieved a median peak level of 10.5 mg/L. The median clearance was 76.6 mL/min and was similar between study arms (P=0.94). The median volume of distribution was 0.55 L/kg and was similar between study arms (P=0.38). Attainment of target peak:MIC ratio of at least 10 occurred in 33% in the total study population and 41% in the subset of 37 positive cultures. No significant correlation was found between AG clearance and CRRT blood flow or pre-filter fluid rate for the 3 arms. A significant correlation between AG clearance and dialysate rate was observed in the CVVHD arm (P<0.001) but not in the SLED (P=0.85) or CVVH (P=0.19) arms.

Conclusion:
Critically ill patients undergoing CRRT have a reduced clearance, expanded volume of distribution and prolonged half-life that was not significantly different between CRRT modalities. Current dosing regimens led to low peak concentrations and poor attainment of pharmacokinetic targets.

Temperature and Perfusion Strategy During Cardiopulmonary Bypass (CPB) in Neonates and Infants

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Introduction:
Temperature and perfusion during cardiopulmonary bypass (CPB) are two modifiable variables which could potentially impact neurologic outcome in neonates and infants after surgery for congenital heart defect (CHD). We conducted an international survey to determine variability in practice of temperature and perfusion strategies during CPB at various children's hospitals.

Methods:
We performed an anonymous, cross-sectional, cohort, internet-based survey involving pediatric cardiac surgical teams of America, Europe, Asia and Australia. The list of survey participants was developed using congenital heart surgery network. The content and phraseology of survey questions were developed in an iterative manner using modified Delphi method. Pediatric and cardiac intensivists, pediatric cardiac surgeons and perfusionists assessed the content and construct validity of the survey items. Pilot testing of the survey was performed for readability, clarity and functionality prior to finalization and distribution. The final survey was developed based on the response from these reviews.

Results:
Out of 1960 pediatric cardiac surgical team members to whom the survey was emailed, 284 (14.4%) responded. Of the 284 respondents, 280 (98.5%) were pediatric surgeons and 4 (1.4%) were perfusionists. Of the 153 respondents who answered all the questions, the proportion of practitioners from free-standing children's versus university versus community hospital were 31%, 54% and 14%, respectively; from America, Europe, Asia and Australia were 32%, 46%, 19% and 3%, respectively. CPB flow in cc/kg versus cc/sq meter cardiac index was used by 47% versus 53%. The goal mean arterial pressure on CPB used was 30-50 mm Hg by majority (78%). When using selective antegrade cerebral perfusion (SACP), 44% used cc/kg flow strategy whereas 20% used % base flow, 16% titrated to NIRS, 10% titrated to MAP and remaining had inconsistent approach. Mild, moderate, deep and profound hypothermia was used by 6%, 26%, 59% and 9% for Norwood stage 1, respectively. For ASD repair, 94% used mild; whereas for TAPVR and aortic arch repairs, 75% and 88% used moderate-to-deep hypothermia. Rectal probe was used by majority as temperature monitoring site. Arterial to nasopharyngeal cooling and rewarming gradients of 4-10°C were used by 71% of respondents.

Conclusions:
There is variability in practice of temperature and perfusion strategies during CPB in children. More work is needed to study the outcome differences following these strategies.

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Evaluation of Neuromuscular Blockade Reversal on Postoperative Outcomes in Cardiovascular Surgery

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Background:
Residual neuromuscular blockade can be associated with respiratory complications, prolonged intensive care unit stays, skeletal muscle weakness, and poor recovery. Neostigmine is a reversal agent used to eliminate residual blockade, however, conflicting data exists on its association with respiratory complications, postoperative nausea/vomiting, and cardiac effects.

Methods:
A single center, retrospective chart review was conducted from January 2015 to April 2016. The study included adult patients who received a cardiovascular procedure and a non-depolarizing neuromuscular blocking agent. The primary endpoint was the duration of postoperative mechanical ventilation- defined as the time from end of procedure to time of initial extubation. Pre-specified secondary outcomes included incidence of postoperative atelectasis, incidence of postoperative pneumonia, need for non-invasive positive pressure ventilation after extubation, need for reintubation during hospital stay, discharge disposition, PaO2/FiO2 ratio, total antiemetic doses used up to postoperative day three, hospital length of stay, ICU length of stay, and readmission to ICU during hospitalization.

Results:
Study cohort included in the analysis consisted of 175 patients (neostigmine users n=95; non-users n=80). A difference in duration of mechanical ventilation was noted among neostigmine user and non-user groups (5.23 [IQR 3.93 to 9.33] vs 7.36 [IQR 5.18 to 23], p=0.03). In addition, more neostigmine users met the early extubation benchmark of less than six hours compared to non-users (55 vs. 34 patients, p=0.04). Controlling for all covariates, neostigmine was associated with a 34% (20.4 minute; p=0.007, 95% CI 0.49 to 0.89) reduction in duration of mechanical ventilation. No significant differences were found in regards to secondary endpoints.

Conclusions:
Neostigmine use decreased the duration of post-operative mechanical ventilation in cardiovascular surgery patients. More neostigmine users also met The Society of Thoracic Surgeons' early extubation benchmark less than 6 hours. Neostigmine use was also not found to be associated with increased risk of respiratory complications, postoperative nausea/vomiting, and did not impact length of stay.

Low Dose 4-Factor Prothrombin Complex Concentrate in Reversal of Xa Inhibitors in a Neuro ICU

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There is no FDA-approved reversal agent for Xa inhibitors, however 4-factor prothrombin complex concentrate (4PCC) is used off-label. A dose of 50 units/kg is commonly cited in the literature. This study evaluated the effectiveness and outcomes of 4PCC 35 units/kg in Neuro ICU patients requiring reversal of Xa inhibitors.

This IRB approved, single center, retrospective cohort study evaluated patients admitted May 2013 – February 2016 to the NSICU of a level-1 trauma center. Patients were ≥ 18 yr, received a Xa inhibitor near time of admission, had a major hemorrhagic event, and received 4PCC ~ 35 units/kg per institution protocol. Pregnant and incarcerated patients were excluded. The primary outcome was assessed using computed tomography (CT) to evaluate bleeding progression. Hemostasis was defined as a stable radiographic image performed after administration of 4PCC. Data collection included: patient demographics, admission APACHE and GCS scores, hemorrhage type, 4PCC dose, ICU and hospital LOS, disposition, and adverse events.

A total of 38 patients were included: The mean (SD) age was 72.9 (13.9) yrs and 53% were male. Twenty patients presented with a TBI, 10 with a SAH, and 8 with an ICH. Median (IQR) admission APACHE II score was 17 (IQR: 13-25) and GCS was 14.5 (IQR: 11-15). Twenty-nine patients were on rivaroxaban and 9 patients were on apixaban primarily for atrial fibrillation (73.7%). The median (IQR) 4PCC dose was 32.8 (IQR: 27.9-35.1) units/kg. Repeat CT showed no progression of the bleed in 33 (86.8%) patients. Three of the 5 patients without cessation of bleeding received a 2nd dose, all with cessation of bleeding. Median (IQR) ICU LOS was 2.1 (1.5-6.1) and hospital LOS was 9 (3.8-15.2) days. Two died; 1 due to infection and 1 due to family withdrawal of care. Fourteen (36.8%) were discharged to a SNF/Rehab, 13 (34.2%) to home, 5 to hospice, and 4 to LTAC.

Use of 4PCC 35 units/kg was associated with cessation of bleeding, clinically and radiologically, in 86.8% of patients taking Xa inhibitors. Prospective randomized studies are needed.

Defibrillation Skills of Pediatric Acute Care Providers: Are They Faster with Paddles or Pads?

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Introduction/Hypothesis

For every minute delay in defibrillation, survival from ventricular fibrillation cardiac arrest (VFCA) decrease 7% to 10%. There is lack of sufficient data on time taken by pediatric providers to apply shock using defibrillator paddles versus pads. We hypothesized that the time-to-shock by pediatric providers in VFCA is significantly longer with use of paddles as compared to pads.

Methods

We conducted a prospective observational study of video evaluation of hands-on defibrillation skills of pediatric providers in a simulated VFCA in our children's hospital. Each provider was asked to use pads to provide 2 J/kg shock to an infant manikin in VFCA. Following this, the same provider was asked to use paddles to provide 2 J/kg shock for the same scenario. The time-to-shock was defined a priori as time between switching on the defibrillator to the actual delivery of the shock. Videos were evaluated by 2 independent reviewers and disagreements resolved by a moderator. The data was analyzed using student t-test with significant p-value <0.05.

Results

Total of 51 (44 nurses, 7 non-nurse) pediatric providers were evaluated for time-to-shock using LifePak 20e ("study defibrillator"). Of these, 49% (25/51) had <5 yr of experience and 59% (30/51) were PICU providers. All the providers were PALS trained and the last PALS certification was median 288 days prior to VFCA scenario. The number of providers who had used either the study defibrillator or different defibrillator or both in real and/or mock resuscitation was 44 (86%), 7 (13%) and 15 (29%), respectively. The median time to apply paddles was 48.5 sec and to apply pads was 42.5 sec. The median time-to-shock with paddles was 97 sec (IQR: 60-122.5 sec), whereas the median time-to-shock with pads was 77.5 seconds (IQR: 59-105 sec) There was no significant difference for time-to-shock between use of paddles versus pads ($p>0.05$).

Conclusions

The time-to-shock (from defibrillator switch-on to shock delivery) by pediatric providers in VFCA using defibrillator paddles is not significantly different from that using defibrillator pads.

Duration of mechanical ventilation with non-benzodiazepine vs. benzodiazepine-based sedation

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Introduction

Current guidelines recommend analgosedation before sedation in mechanically ventilated adult intensive care unit (ICU) patients. If sedation goals are not met, non-benzodiazepines (NBZ) are recommended over benzodiazepines (BZ) for additional therapy. To our knowledge, there are no studies that compare patients who received combination sedative therapies, including analgosedation with either BZ or NBZ. This study aims to determine if there is a difference in duration of mechanical ventilation (MV) in patients who received NBZ (analgesic +/- propofol or dexmedetomidine) vs. BZ based sedation (BZ +/- analgesics +/- propofol or dexmedetomidine).

Methods

IRB approved retrospective observational study of patients admitted to the medical ICU of a tertiary care hospital between July 2012 and August 2015. Patients had to be treated with either NBZ or BZ based sedation and require MV for greater than 24 hrs. The primary endpoint is duration of MV and secondary endpoints are prevalence of delirium, and ICU and hospital length of stay (LOS).

Results

A total of 402 patients were included; 160 in BZ and 242 in NBZ group. There were no differences in baseline characteristics between BZ and NBZ including; age (median [IQR] 58 yr [48-68] vs. 62 [52-74] or APACHE II score 25 [21-32] vs. 26 [21-30]. Most common primary diagnoses were respiratory failure, shock and pneumonia. MV duration was BZ; (70.5 hrs [45.2-132] vs. NBZ; 55 [36.6-88.4] $p<0.01$). Prevalence of delirium was 65.8% in BZ vs. 50.2% in NBZ, $p<0.01$. ICU and hospital LOS was longer in BZ group (4.8 d [3-8] vs. 3.7 [2.6-6] $p<0.01$) and 10.3 d [5.6-16.2] vs. 7.5 [5-12.7] $p<0.01$). Subgroup analysis compared BZ group to the NBZ group excluding patients who only received analgesics, showed prolonged MV (70.5 hrs [45.2-132] vs. 49.4 [31.4-87.2] $p<0.01$), ICU LOS (4.8 d [3-8] vs. 3.7 [2.5-6.2] $p= 0.04$) and hospital LOS (10.3 d [5.6-16.2] vs. 6.8 [5-11.5] $p<0.01$).

Conclusion

Analgosedation and NBZ based sedation regimens rather than BZ based sedation in critically ill, MV adults may reduce duration of MV, incidence of delirium, ICU and hospital LOS.

Evaluating Outcomes of Poractant alfa (Curosurf) vs. Calfactant (Infasurf) in Neonates

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Introduction:

Pulmonary surfactant works to reduce surface tension that can lead to lung collapse, decreased compliance and respiratory distress syndrome (RDS). There is quite a bit of literature available indicating the benefits of surfactants. However, there is little data comparing poractant alfa and calfactant specifically. Memorial University Medical Center (MUMC) has used both products in recent years. The purpose of this research was to retrospectively evaluate safety and efficacy outcomes of using poractant alfa as compared to calfactant for the treatment of RDS in neonates.

Methods:

The hospital's electronic medical record was reviewed to identify neonates weighing 500-2000g, born before 34 weeks' gestation receiving one or more doses of either calfactant or poractant alfa within 48 hours of birth at MUMC for the treatment of RDS developing within 15 hours of life. Data was collected to assess baseline characteristics, outcome measures, and Apgar severity score.

Results:

94 patients met inclusion criteria. The use of calfactant was associated with more days on the ventilator compared to poractant alfa (9.9 vs 8.8 95% CI -5.2256-3.1256, p= 0.6187). Calfactant was also associated with a longer hospital length of stay (66 vs 57 95% CI -23.1426 to 5.7426 p=0.2346). There were two deaths in the calfactant group and three in the poractant alfa group (4.3% vs 6.4%, p=1.0000). The percent of patients requiring redosing was 40.4% in the calfactant group and 25.5% in the poractant alfa group (p=0.1877). The average cost per patient of calfactant was $534, while for poractant alfa it was $729. After adjusting the cost for the more frequent redosing required by calfactant, the total cost of poractant alfa was $7,538 more than calfactant.

Conclusion:

This analysis demonstrated that calfactant was associated with more days on ventilator, increased length of hospital stay, and more frequent redosing as compared to poractant alfa. However, there was a trend toward increased mortality associated with poractant alfa and it is an intrinsically more expensive product.

2015 SCCM Abstract

Title

Post-operative Acute Kidney Injury among Patients Admitted from the Emergency Room for Major Surgery

Authors

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This study describes the association of post-operative acute kidney injury (AKI) with mortality and length of stay among patients who were admitted from the emergency room (ER) and underwent major surgery.

Patients admitted from the ER to a quaternary teaching hospital in 2012-2013 with a major surgery as the principal procedure (AHRQ procedure class 3 or 4) within 1 day of admission were included. Patients <18 years, undergoing nephrectomy, and with preexisting AKI or stage 5 chronic kidney disease (CKD) prior to the principal procedure were excluded. AKI was defined as an increase in SCr by >=0.3 mg/dL or >=50% over a 72-hour interval, and AKI severity was staged per Kidney Disease Improving Global Disease Outcomes guidelines.

Among 11,975 adults admitted from the ER, 1,090 (9%) required major surgery within 24 hours and were included. Patients were 50% male, 60% white, and 44% aged ≥65. Post-operative AKI was detected in 16% (n=178). Of AKI cases, 81% (n=144) were stage 1, 13% (n=23) were stage 2, and 6% (n=11) were stage 3. In-hospital death occurred in 2.2% (n=24). The average length of stay was 5.8 days (SD 5.9). Baseline CKD (per ICD-9 codes) was present in 6% (n=65) and was associated with AKI (54% CKD vs. 14% no CKD, P<0.001). In-hospital death occurred in 7% (12 of 178) of patients with AKI and 1% (12 of 912) of patients without AKI (Unadjusted RR=5.1, 95%CI 2.4 to 11.2). Incidence of in-hospital mortality increased with AKI severity (1% no AKI, 5% stage 1, 9% stage 2, and 27% stage 3; P<0.001). Post-operative AKI was associated with 5.6 days of increased length of stay (10.5 days AKI vs. 4.9 days no AKI, P<0.001). Urgent interventions with the most cases of AKI were hip fracture/dislocation (19%, 19 of 98), PTCA (15%, 22 of 145), and cholecystectomy (13%, 16 of 123).

Post-operative AKI occurred in 16% of patients admitted from the ER and undergoing major surgery. AKI was associated with a 5-day increase in length of stay and a 5-fold increase in mortality. Modifiable risk factors of AKI should be identified and reduced to prevent AKI in this population.

QT interval adaptation to heart rate is impaired in pediatric epilepsy following status epilepticus

Submission No:

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Type:

Abstract

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Introduction:

QT interval adaptation to heart rate (QT dynamics) represents a fundamental electrophysiological observation. Impaired QT dynamics have been observed in cardiac disorders with propensity for ventricular arrhythmias, possibly reflecting an increased arrhythmic risk. Here we sought to investigate whether status epilepticus (SE) could alter QT dynamics and to identify potential contributing factors in children.

Methods:

We retrospectively reviewed Texas Children's Hospital emergency center (EC) visits with primary diagnosis of SE from 1/1/2011 to 12/31/2013. 12-lead EKG were included if: 1) obtained within 24 h of EC visit, 2) no cardiac medications, 3) no history of heart disease or ion channel defects. Children with SE were categorized as epileptic (E, n=14) or non-epileptic (NE, n=16). Age, gender and ethnicity-matched control children (C, n=30) met the inclusion criteria and had no seizure history. Ten QT and RR intervals per EKG were manually measured from Lead II. QT dynamics were assessed by the QT/RR relationship using linear regression analysis. Comparisons of clinical factors between epileptic and non-epileptic groups were performed using Student t test or Fisher exact test. Values are expressed as mean±SEM.

Results:

Of the 435 children presenting with SE, 30 met inclusion criteria. Compared with control, SE groups had weaker linear QT/RR relationship (C: $r^2 = 0.83$, NE: $r^2 = 0.66$, E: $r^2 = 0.61$). The epileptic group also had a flatten slope (C: 0.29±0.01, NE: 0.28±0.02, E: 0.17±0.01, $p<0.0001$). Between epileptic and non-epileptic groups, we observed no differences in clinical factors except age (NE: 25.9±8.9 mo, E: 90.8±19.0 mo, $p<0.01$), SaO_2 (NE: 99.7±0.2%, E: 97.1±0.9% $p<0.01$), and chronic anti-epileptic drugs (AED) use at presentation to EC.

Conclusions:

We found that children with epilepsy exhibited impaired QT dynamics following SE, possibly mediated by age, SaO2 and chronic AED use. Decreased QT adaptation to heart rate may be a predisposing factor to arrhythmias. Studies are ongoing to further examine the contribution of epilepsy-related factors to the observed changes in QT dynamics.

General Classification:

Clinical Research

Patient Type:

Pediatric

Categories:

Neuroscience

Keywords:

cardiac

electrophysiology

status epilepticus

Title: RCT of Chlorhexidine vs. Soap & Water Bathing for Prevention of Hospital-Acquired Infections in SICU

Background/introduction:
Preventing four of the five most common hospital-acquired infections (HAIs) (surgical site [SSI], bloodstream [BSI], catheter-associated urinary tract [CAUTI], and ventilator-associated pneumonia [VAP]) is a national priority. Compared to soap and water (S&W) daily bathing, 2% chlorhexidine gluconate (CHG) bathing every 48 hours for up to 28 days was hypothesized to decrease the hazard ratio (HR) of acquiring these four HAIs (primary BSI, CAUTI, VAP, or incisional SSI) in surgical intensive care unit (SICU) patients.

Materials and Methods:
This single-center, pragmatic, randomized, controlled trial compared the HR for acquiring four HAIs between two bathing strategies: CHG vs. S&W. Patients and clinicians were aware of treatment group assignment; investigators who enrolled patients or determined outcomes were blinded. Adults admitted to the SICU from 07/2012 through 05/2013 with an anticipated SICU stay ≥48 hours were included. Patients with Braden scores <9, pregnancy, CHG allergy, or skin irritation were excluded. A multiple endpoint survival model with stratified Cox regression (two-sided alpha of 0.05) was used for primary analysis. This study was IRB approved with a waiver of informed consent, registered (#NCT01640925), and internally funded.

Results:
Although 350 were randomized, only 325 subjects were analyzed (164 S&W vs. 161 CHG) as 24 were excluded due to prior enrollment and 1 subject withdrew consent. Subjects were 57% male, 59% white, aged 60±16 years, and had significant comorbidities (APACHE II scores 26±9, 38% with liver failure, and 50% with kidney failure). Subjects acquired 53 HAIs: 2 BSIs (2 vs. 0), 21 CAUTIs (14 vs. 7), 9 SSIs (6 vs. 3), and 21 VAPs (13 vs. 8) for S&W vs. CHG, respectively. Compared to S&W bathing, CHG bathing decreased the hazard of acquiring four HAIs (HR=0.555, 95% CI 0.309-0.998, P=0.049). For S&W vs. CHG, incidence rates per 1000 days at risk were 2 vs. 0 for BSI, 22 vs. 12 for CAUTI, 40 vs. 26 for VAP, and 12 vs. 6 for SSI, respectively.

Conclusion:
Compared with S&W, CHG bathing every other day decreased the hazard of acquiring these four HAIs by 44% in the SICU.

Effect of Delirium Motoric Subtypes on ICD-9 Documentation of Delirium in the Intensive Care Unit

Introduction: Studies have attempted to quantify delirium prevalence using International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) administrative codes. We hypothesized that surgical intensive care unit (ICU) patients with hyperactive or mixed delirium (HYPER/MIX) versus hypoactive delirium (HYPO) would be more likely to receive ICD-9-CM documentation for delirium. The objective of this study was to compare the proportions of patients with HYPER/MIX versus HYPO that received delirium ICD-9-CM documentation.

Methods: This retrospective cohort study was conducted at a 24-bed surgical ICU from 06/01/2012 to 05/31/2013. Adult patients with less than 24 hours surgical ICU care, admission to another ICU during the hospital stay, or not screened with the Confusion Assessment Method for the ICU (CAM-ICU) were excluded. Delirium was assessed twice daily and was defined as one or more positive CAM-ICU ratings during surgical ICU care. Delirious patients were categorized into three motoric subtypes using corresponding Richmond Agitation Sedation Scores (RASS), where all RASS of 1 to 4 was HYPER, all RASS -3 to 0 was HYPO, and the presence of RASS that were both 1 to 4 and -3 to 0 was MIX. We identified 26 unique ICD-9-CM codes used in previous studies; documentation of delirium was defined as having ≥1 of these 26 codes that was not present on admission. Proportions were compared with the Chi-squared test.

Results: Of included patients, 40% (423/1055) were diagnosed with delirium (253 as HYPER/MIX and 170 as HYPO) using the CAM-ICU and 17% (183/1055) had an ICD-9-CM code for delirium. The sensitivity, specificity, positive and negative predictive values, and diagnostic accuracy of ICD-9-CM codes for delirium were 36%, 95%, 83%, 69% and 71%, respectively. Patients with HYPER/MIX were 50% more likely to receive ICD-9-CM documentation compared with HYPO (42% [95% CI 35%-48%; 105/253] HYPER/MIX versus 27% [95% CI 21%-34%; 46/170] HYPO, relative risk = 1.5 [1.1-2.2], P=0.002).

Conclusions: Administrative ICD-9-CM codes had a poor sensitivity for documenting delirium in surgical ICU patients. Patients with HYPER/MIX were 50% more likely to receive an ICD-9-CM code for delirium compared with HYPO. Oversampling HYPER/MIX may bias studies that use ICD-9-CM codes to quantify delirium incidence.

Evaluating the Feasibility and Effectiveness of a Delirium Prevention Bundle

Poster No:
439

Hypothesis:
H0 A delirium prevention bundle will prevent or reduce delirium in ICU patients. H1 Certain bundle components contribute significantly to reduce or prevent delirium.

Abstract Type:
Abstract

Presentation Formats:
Oral or Poster

Authors:
Petra Grami[1], Claudia , DiSabatino Smith[2]

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Introduction:
Early identification and modification are key strategies for preventing and decreasing delirium duration. Delirium costs an estimated $38 to $152 billion per year per health care systems. Delirium development is associated with negative outcomes in ICU patients, often manifesting as prolonged ICU and hospital lengths of stay (LOS), loss of adaptive function, development of post-ICU cognitive impairment, and increased mortality in ICU population. Many patient environment and iatrogenic factors that contribute to the development of delirium in acute and critically ill patients are modifiable. The overall purpose of the study was to evaluate the effectiveness of a delirium prevention bundle in reducing the incidence and duration of delirium in adult ICU patients.

Methods:
This cohort intervention study was conducted in two medical-surgical ICUs at a large tertiary care hospital in the Texas Medical Center in Houston, Texas. Data Collection involved the use of three instruments: Richmond Agitation Sedation Scale (RASS); Confusion Assessment Method-ICU (CAM-ICU); and a researcher-generated data collection tool.

Results:
Data collected January 2012 through August 2012 resulted in a heterogeneous sample in both the control and intervention units. Sample size was 782 patients with over 23,430 observations. Data was analyzed for patients who had <30 days of observation. Delirium incidence was 43% in all 15 ICUs, which coincides with the national rate. Patients requiring mechanical ventilation or restraint demonstrated statistically significant odds of developing at least one day of delirium ($p<0.0001$). Patients who stayed in the ICU >3 days demonstrated statistically significant odds of developing at least one day of delirium ($p<0.001$). Patients with >3 lines, tubes or drains were more likely to develop delirium ($p=0.017$). Patients who experienced significant events or complications (i.e.. active bleeding requiring blood replacement, hemodynamic instability, cardiac arrest, new episode of documented sepsis, etc…) were more likely to develop delirium (OR = 3.86, $p<0.001$). The odds of developing delirium increased by 2.5% ($p=0.13$) for every day in the control unit, while the odds decreased by 4.8% ($p=0.08$) per day for every day in the intervention unit. The overall effect of implementing the bundle reduced the odds of delirium by 7.1% ($p=0.02$). Early and progressive mobilization significantly decreased the odds of developing delirium by 37% (OR = 0.37, $p=0.004$), while a small sample size of those on the sedation protocol failed to demonstrate a significant finding.

Conclusions:
It is feasible for staff nurses to effectively use the CAM-ICU at the bedside to assess patients for delirium. Use of a delirium prevention bundle in the ICU setting is an effective and feasible method to decrease the incidence of delirium in ICU patients. Hospitals should consider implementing a core model of delirium prevention care that combines evidence-based strategies with nursing interventions that are integrated into routine ICU care.

Abstract Categories:

Clinical Medicine – Neurology (Monitoring)
Keywords:
Delirium
ICU
Nursing

EVALUATION OF VENOUS THROMBOEMBOLISM PROPHYLAXIS IN PEDIATRIC TRAUMA PATIENTS. Lauren N. Hernandez[1,2,3], A. Crystal Franco-Martinez[1,2,3], Stephanie Younts[1,2,3], Darrel W. Hughes,[1,2,3] Anh Dinh[4], and Lillian Liao[5]. [1]Department of Pharmacy, University Health System, San Antonio, TX; [2]Pharmacotherapy Division, College of Pharmacy, The University of Texas at Austin; [3]Pharmacotherapy Education & Research Center & [4]Department of Pediatrics, Division of Critical Care & [5]Department of Surgery, Division of Trauma & Emergency Surgery, The University of Texas Health Science Center at San Antonio.

Introduction: Although venous thromboembolism (VTE) risk factors for pediatric trauma patients have been identified in recent literature, overall low occurrence rates have resulted in minimal guidance on risk assessments and prophylaxis regimens.

Hypothesis: To determine the appropriateness of VTE prophylaxis in the pediatric trauma population at a level two trauma center.

Method: A single center retrospective chart review of patients 17 years of age and younger admitted to the Pediatric Trauma Service between July 1, 2008 and December 1, 2011 was conducted. A VTE risk assessment was developed and retrospectively applied to each patient to determine appropriateness of VTE prophylaxis.

Results: Eight hundred four patients met initial inclusion criteria. Of these, 200 were evaluated with the VTE risk assessment and included for review. The median age was 11 years (IQR 5-16). One hundred twenty-five patients (62%) received appropriate prophylaxis. Reasons for inappropriate prophylaxis were a lack of sequential compression device (SCD) orders in 55 patients (73%), lack of pharmacologic prophylaxis orders in 14 patients (19%), and pharmacologic prophylaxis orders when not indicated by the risk assessment in six patients (8%). Pharmacologic prophylaxis was prescribed in 28% of patients. VTE occurred in four patients. Risk factors for VTE were an elevated Injury Severity score (p=0.03), lower Glasgow Coma Scale score (p=0.03), and the presence of central venous lines (p=0.004). Median ICU length of stay for patients with and without a VTE was nine (IQR 7-45) vs two days (IQR 0-4), respectively (p=0.006). Median hospital length of stay was 25 (IQR 14-51) vs six days (IQR 4-11), respectively (p=0.008). One bleeding event occurred (0.5%) in a patient receiving treatment dose anticoagulation. There was one death unrelated to VTE events.

Conclusion: Though VTE prophylaxis is commonly administered to pediatric patients at this trauma center, adherence (62%) has room for improvement according to the study VTE risk assessment and recommendations. A standard VTE risk assessment and protocol may be beneficial in this population to ensure consistent prophylaxis.

More than 2 years experience winners:

Melissa McLenon, University of Texas M.D. Anderson Cancer Center, Gregory Botz
M.D. Anderson Cancer Center

Title: Reducing Blood Draws in Critically Ill Patients

Introduction: To successfully implement a quality improvement initiative aimed at reducing the frequency of blood draw events among critically ill oncological patients in a 54 bed medical/surgical Intensive Care Unit (ICU) through the enhancement of nursing autonomy and the implementation of structured communication techniques among the ICU team.

Hypothesis: There will be a reduction in the frequency of blood draw events per 24 hours, per critically ill patient, after the implementation of communication training and enhanced autonomy among members of the ICU team.

Methods: A multidisciplinary team collected 4 weeks of baseline data on the frequency and volume of blood draw events on each patient in a 10 bed medical pod in a 54 bed medical/surgical ICU. The data was then collected for an additional 3 months post implementation of the quality improvement initiative. Quality tools and methods utilized included brainstorming sessions, development of affinity and Ishikawa diagrams, and a process chart. Run charts were generated to reflect the data over time.

Results: Baseline data showed a wide practice variation among providers. At baseline, the number of blood draw events ranged from 2-14 per patient per 24 hours, with an average of 3.99. Post implementation, the range decreased to 0-12 and the average number of blood draw events decreased to 2.97 per patient per 24 hours. At baseline, the blood volume collected with each blood draw event ranged from 6-250 cc per patient per 24 hours, with an average of 46.79 cc. Post implementation, the range decreased to 0-165 cc, with an average of 36.84 cc per patient per 24 hours. Overall, there was a 25% reduction in the number of blood draw events and a 21% reduction in the volume of blood drawn with each blood draw.
Conclusions: Studies have shown that excessive blood draws in the ICU results in increased mortality, LOS, and need for blood transfusions. Our team identified that our patients were experiencing frequent blood draws and redundant laboratory testing, mostly related to a lack of communication among the ICU multidisciplinary team. Our interventions to reduce the frequency and volume of blood draws per critically ill patient per day were successful.

Less than 2 years experience winners:

Amaris Fuentes, Joselin Joseph, Husaina Hassanali, Joshua Swan
The Methodist Hospital

Title: Comparison of Calculated versus Urine Measured Creatinine Clearance in the Critically Ill

The Cockcroft-Gault equation (CG) has been validated for estimation of creatinine clearance (CrCl) in patients with stable renal function. Nonetheless, it is used in the intensive care unit (ICU) where acute kidney injury (AKI) is common.

Compared to measured CrCl from 24-hour urine collection (24-CrCl), the CG-CrCl overestimates renal function in patients with AKI.

A retrospective analysis of consecutive admissions to five ICUs at a tertiary care, referral center was conducted between 2006 and 2012. Patients with a 24-CrCl, daily serum creatinine and recorded daily urine output were included. AKI was defined using AKI Network (AKIN) and RIFLE classifications, and was assessed on ICU days prior to urine collection. Continuous variables were analyzed with the Wilcoxon Rank Sum test and the Mann-Whitney U test. The independent samples Kruskal-Wallis test was used to analyze the effect of AKI severity on the discrepancy between 24-CrCl and CG-CrCl.

Included patients (n=291) had a median age of 61 years and were 64% male, 47% white, and 48% admitted to coronary care unit. CG-CrCl overestimated 24-CrCl by a median 9.3 ml/min (61.3 [IQR 38.8 to 90.4] vs. 52 [IQR 27 to 85], $P < 0.001$). Per AKIN criteria, 165 (57%) patients had AKI as either stage 1 (n=50, 17%), stage 2 (n=60, 21%), or stage 3 (n=55, 19%). The CG-CrCl overestimated 24-CrCl in patients with AKI per AKIN criteria, which increased with severity (ml/min; stage 0=3.8 [IQR -11.1 to 24.7], stage 1=3.0 [IQR 2.5 to 12.8], stage 2=6.4 [IQR -4.2 to 25.6], and stage 3=12.7 [IQR 0.5 to 28.8], P=0.037). Per RIFLE criteria, 147 (51%) patients had AKI classified as either Risk (n=29, 10%), Injury (n=65, 22%), or Failure (n=53, 18%). The CG-CrCl overestimated 24-CrCl in patients with AKI per RIFLE criteria, which increased with severity (ml/min, normal=3.0 [IQR -10.7 to 20.3], Risk=5.9 [IQR -7.4 to 15.2], Injury=6.2 [IQR-3.4 to 25.5], Failure=14.5 [IQR 0.8 to 33.3], P=0.023).

The CG-CrCl overestimates 24-CrCl in patients with AKI, especially AKIN stage 3 and RIFLE Failure classification patients. Use of CG estimations should be used with caution in these patient populations.

Alan Fields Award Winner: Practioner with more than 2 years experience

The Implementation and Evaluation of an Early Mobilization Program for Critically Ill Adult Oncology Patients

Authors:
Mary Lou Warren, RN, CNS-CC; Egbert Pravinkumar, MD, FRCP; Shari Frankel, PT, MBA, ATC; Stacy Ryan, PT, DPT, APC; Vi Nguyen, MOT, OTR, RRT; Becky Garcia, RN, BSN; Mini Thomas, RN, CCN; Laura Withers, MBA, RRT; Quan Nguyen, RRT; Ninotchka Brydges, MSN, ACNP-BC

Institution:
University of Texas MD Anderson Cancer Center, Houston, Texas

Background:

In the summer of 2010, the intensive care unit (ICU) Clinical Practice Committee at the University of Texas MD Anderson Cancer Center was charged with developing and implementing an early mobilization program (EMP) for critically ill cancer patients in the ICU. The driving forces included the perception and observation of primary admitting services and the ICU service of infrequent mobilization of critically ill patients in the ICU. Additionally, early mobilization in critically ill patients was emerging as a potential prevention strategy for several complications associated with critical illness including reduced disability and dependence in survivors. Much of the critical care literature on EMP is focused on patients requiring mechanical ventilation. However, both ventilated and non-ventilated critically ill patients equally benefit from early exercise programs (Burtin et al, 2009). In patients requiring mechanical ventilation, EMP have been found to be safe and are associated with decreased intensive care unit (ICU) and hospital length of stay and improved functional status at hospital discharge (Bailey et al, 2007; Hopkins, Spuhler, & Thomsen, 2007; Morris et al., 2008; Schweickert et al, 2009). In addition, a decrease in mechanical ventilation days and need for tracheostomy has also been described (Hopkins, Spuhler, & Thomsen, 2007).

A multidisciplinary team including participants from ICU faculty, nursing, respiratory care, and rehabilitation services was formed to develop and implement an EMP specific for critically ill cancer patients in the ICU. The primary aim was to increase the average number of mobilization activities provided by a multidisciplinary team per patient per day by 40% after an eight week pilot.

Methods/Materials:

A quality improvement methodology employing the Plan, Do, Study, Act (PDSA) cycle was utilized to pilot the EMP.

A meeting with the leaders from the rehabilitation and ICU services was held to gain support and evaluate the availability of designated rehabilitation staff for the ICU. After establishing rehabilitation resources, a multidisciplinary team consisting of nurses, physical therapists, occupational therapists, physicians, respiratory therapists, and nursing assistants developed a 5-level mobilization program in the ICU based on published evidence. The mobilization activities were structured into five levels based on the patient's functional status and level of sedation.

Prior to implementation, baseline information was collected on type and rate of mobilization activities for one week on consecutive patients admitted to 16 of the 54 ICU beds (8 medical beds and 8 surgical beds). Concurrently, an education program on the benefits of early mobilization, proper techniques in mobilizing patients, as well as the components of the mobilization protocol was provided to the licensed and unlicensed nursing staff. Nursing knowledge and perception of early mobilization was also assessed pre and post implementation of the education program.

The program was then implemented on consecutive patients admitted to the pilot area where the baseline information was obtained. During the pilot period, the type and rate of mobilization activities were collected at two weeks, four weeks, and eight weeks after implementation.

Additionally, the team met every two to four weeks to discuss barriers to implementation. Based on the feedback, revisions to the program were made and re-education to staff was provided. Encouragement and acknowledgement of staff participation was provided as well.

The study was approved by the institutional Quality Improvement Assessment Board.

Results:

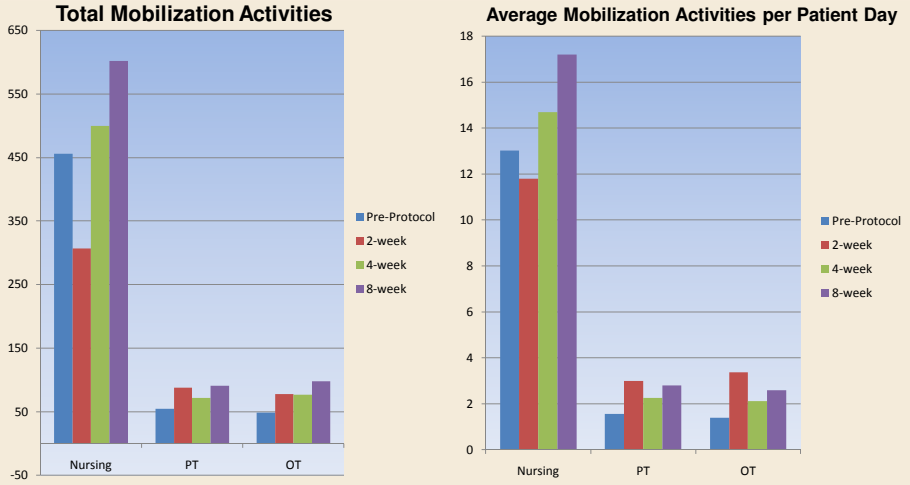
Following eight weeks of the EMP, the average number of total mobilization activities per patient day increased by 47%. Mobilization activities carried out by bed-side nursing staff increased by 31%. Mobilization activities carried out by physical therapists and occupational therapists increased by 86% and 78%, respectively. Additionally a trend towards decreased average length of stay and

Alan Fields Award Winner: Practioner with more than 2 years experience

average time on invasive mechanical ventilation for all medical and surgical patients were also noted.

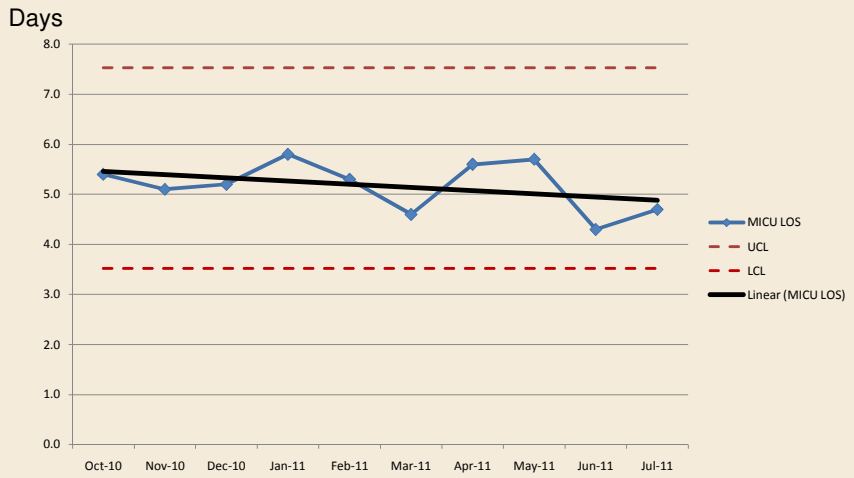
Data Summary

(8 weeks pilot phase for pods C & D)



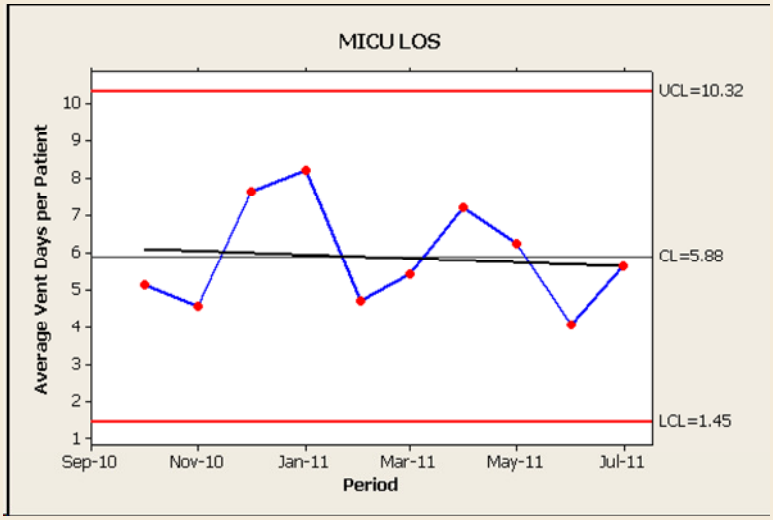
Activities included: ROM, positioning, bed in chair position, splinting, dangle at the edge of bed, out of bed, ADL, and ambulation.

MICU Average Length of Stay

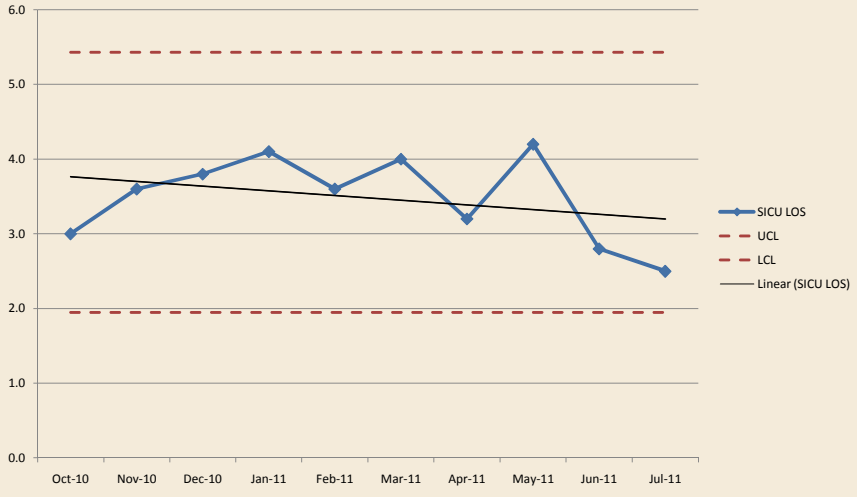


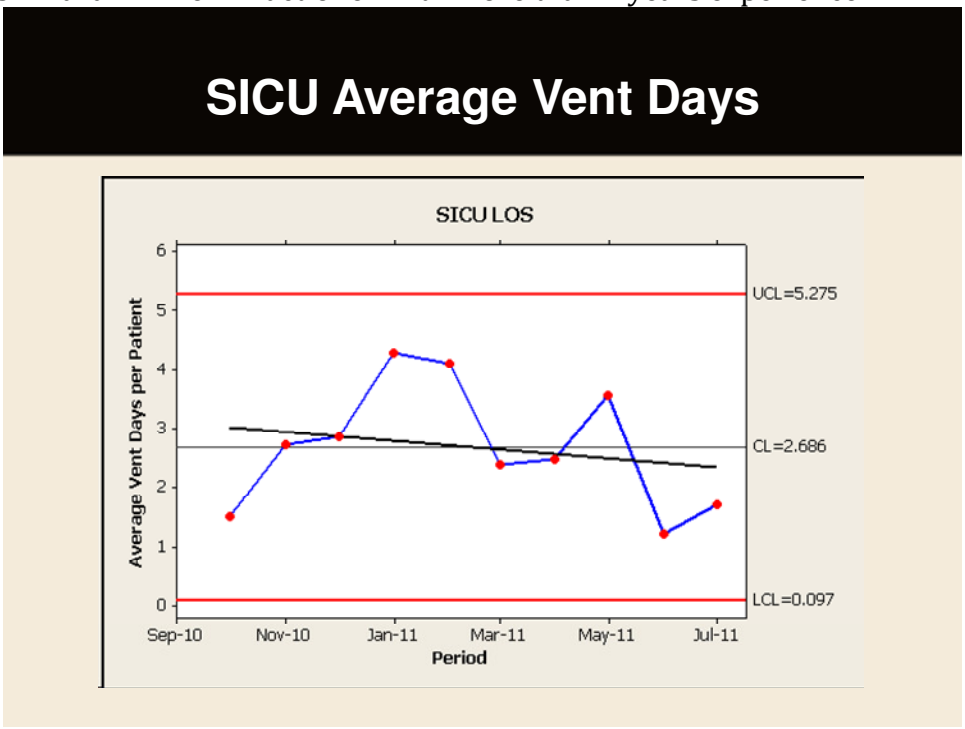
Alan Fields Award Winner: Practioner with more than 2 years experience

MICU Average Vent Days



SICU Average Length of Stay





Based on the successful results of the pilot EMP, the decision was made to expand the EMP to all ICU beds. During this time, a full-time physiotherapist and a full-time occupational therapist were appointed to the ICU when previously only one part-time physiotherapist was available.

Nursing feedback following the pilot program indicated the need for a simplified EMP. In practice, the initial 5-level standard EMP was noted to lack clear differentiation of levels and proved cumbersome to the nursing staff. In order to encourage, facilitate, and sustain mobilization activities by bed-side nursing staff, a simplified 3-level EMP was developed. The 3-levels of mobilization activity included: total assist, maximum to moderate assist, and moderate assist to supervision.

Additionally, visual aids were developed to assist the nurse, the patient, and their family in identifying the assigned mobility level for the patient. The simplification of the EMP has led to its implementation from 16 ICU beds to the entire 54 ICU beds. Data on nursing specific mobilization activities after implementation of the 3-level protocol are currently being evaluated.

Conclusions:

The implementation of a multidisciplinary EMP in critically ill patients led to an increase in the number of mobilization activities per patient day. The use of a

patient centered, interdisciplinary team approach and a quality improvement process ensured success and sustainability of the program. The next steps of the EMP include the development of a compliance monitor to evaluate if the 3-level program is being implemented as outlined. Additionally, periodic evaluation of the average number of mobilization activities per patient will be conducted. ICU LOS and ventilator days will also be monitored. Another goal of the initiative includes a research study to evaluate the impact of the EMP on patient outcomes including ICU and hospital LOS, quality of life, and activities of independent living. These next steps continue to support the institutional goals of Institutional Metrics and Improvement Plans, and Employee Engagement.

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Outcomes associated with a screening and treatment pathway for occult hypoperfusion following cardiac surgery

Authors:
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Introduction:

Routinely monitored parameters such as blood pressure (BP) and heart rate may not reliably detect perfusion abnormalities. However, central venous oxygen saturation (ScvO2) and lactate (LA) levels can detect occult hypoperfusion (OH) and identify patients who may be at risk for complications. The purpose of this study was to assess the impact of an OH treatment pathway (OHTP) on morbidity and length of stay (LOS) post on-pump coronary bypass and valve surgery.

Hypothesis:

An OHTP guided by ScvO2 and LA can reduce morbidity and LOS.

Methods:

Prospective cohort observational study following the implementation of an OHTP, defined by ScvO2 < 70% and LA ≥ 18mg/dL with systolic BP ≥ 90mmHg upon ICU admission. Initial treatment included volume resuscitation and/or blood transfusion, followed by additional interventions when ScvO2 remained < 70%. Repeat LA was obtained 18hr postoperatively. Primary outcomes were ICU/hospital (H) LOS and complications.

Results:

Among 390 cases evaluated, 53 OH cases were identified and treated according to the OHTP. The 53 cases were compared with 21 OH cases prior to implementation of the pathway. Furthermore, 33 cases achieving the repeat LA goal (< 18mg/dL) were compared with 18 cases not achieving the LA goal.

Comparing pre-implementation (n=21) vs post-implementation (n=53): ICU LOS was 117hr vs 64hr (p=0.27); HLOS was 16 days vs 11 days (p=0.049); ICU readmission rate was 28.6% vs 7.7% (p=0.03); length of mechanical

ventilation (LMV) was 64hr vs 44hr (p=0.67); complication rate was 47.6% vs 26.4% (p=0.10).
Comparing achieving LA goal (n=33) vs not achieving LA goal 18hr postoperatively (n=14): ICU LOS was 50hr vs 105hr (p=0.06); HLOS was 10 days vs 14 days (p=0.17); ICU readmission rate was 9.1% vs 7.1% (p=1.0); LMV was 18hr vs 117hr (p=0.17); Complication rate was 15.2% vs 50.0% (p=0.02).

Conclusions:
Implementation of an OHTP was associated with significantly shorter HLOS and lower ICU readmission rates, as well as a trend toward shorter ICU LOS and lower complication rate. Among patients managed by the OHTP, achieving the LA goal 18hr postoperatively was associated with a significantly lower complication rate, and a trend toward shorter ICU LOS/HLOS and LMV.