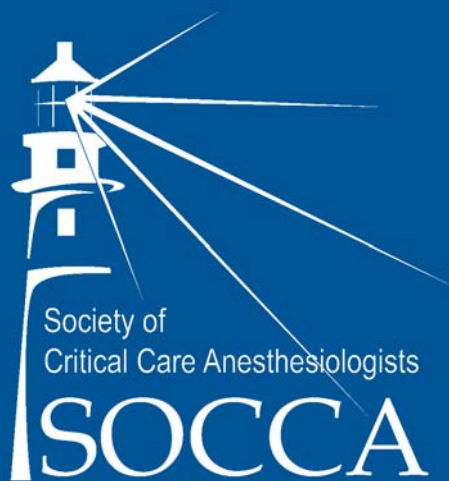


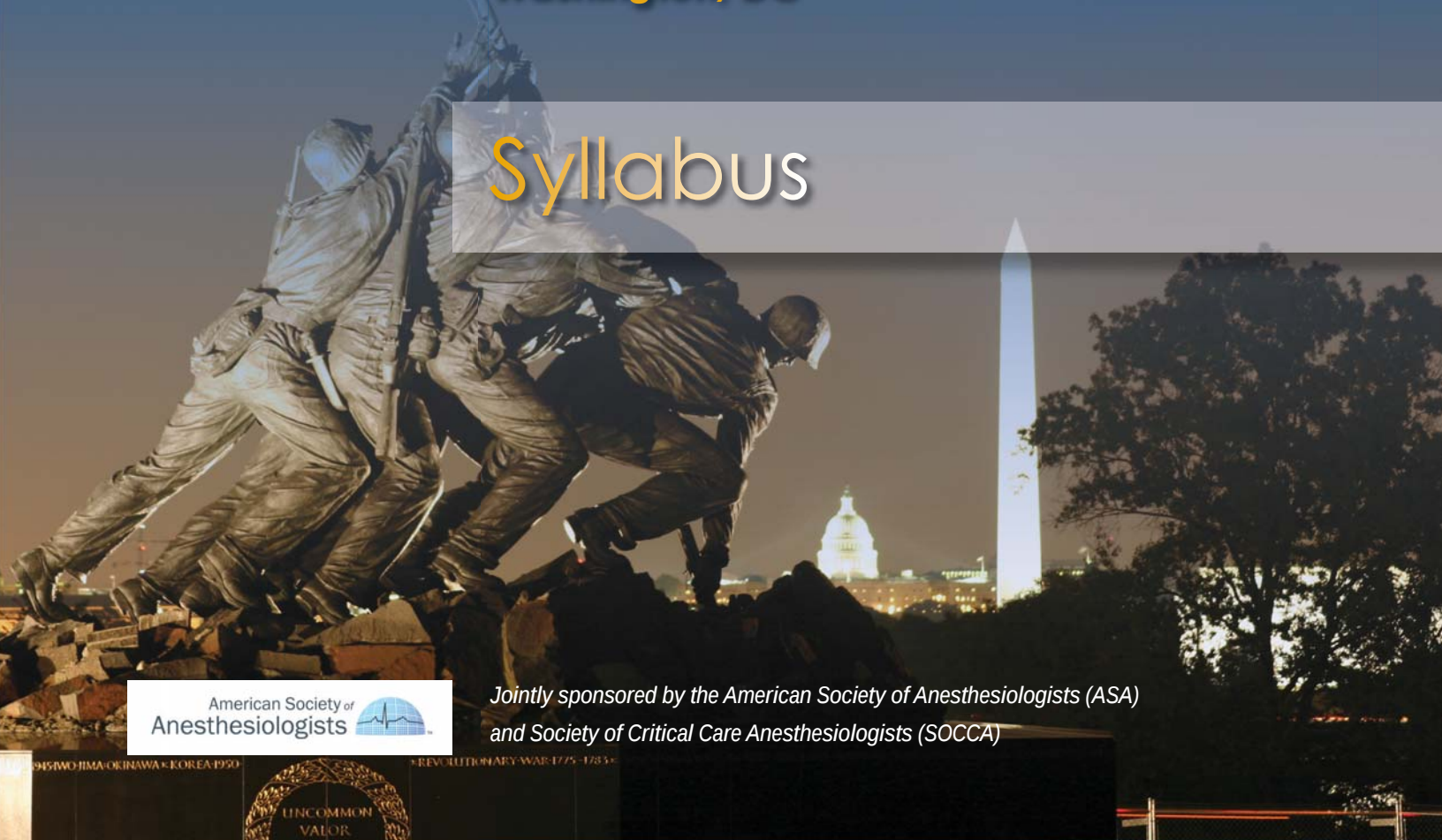


25th Annual Meeting and Critical Care Update

October 12, 2012

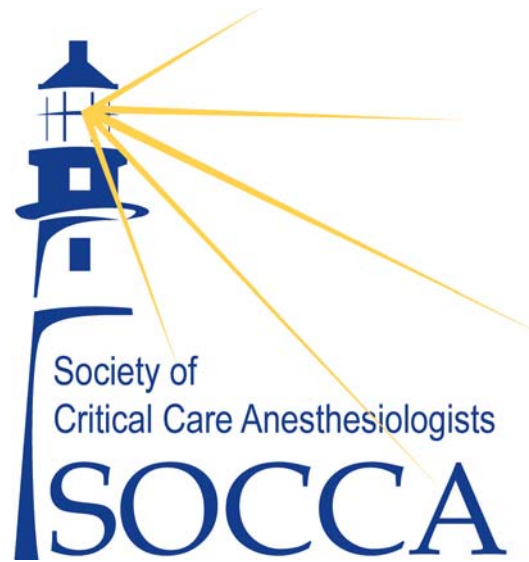
**Renaissance Washington DC Downtown Hotel
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Syllabus



American Society of
Anesthesiologists 

*Jointly sponsored by the American Society of Anesthesiologists (ASA)
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**Society of Critical Care Anesthesiologists
would like to thank the following exhibitors
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Program Information

Target Audience

The SOCCA 25th Annual Meeting and Critical Care Update is designed for anesthesiologists in the clinical and laboratory setting who desire to improve development of anesthesiology teaching methods by engaging in an inter-change of ideas as represented in this meeting.

Needs Assessment

Topics for this meeting were derived from 2011 meeting evaluations and previous annual meetings. Suggested topics were discussed and developed by educators who attended previous Annual and Board meetings and by other authorities in the field of Anesthesiology.

Accreditation Statement and Credit Designation

This activity has been planned and implemented in accordance with the Essential Areas and Policies of the Accreditation Council for Continuing Medical Education through the joint sponsorship of the American Society of Anesthesiologists and the Society of Critical Care Anesthesiologists. The American Society of Anesthesiologists is accredited by the ACCME to provide continuing medical education for physicians.

Participation in the SOCCA 25th Annual Meeting

Attendance shall be open to all health practitioners, provided that they have registered for the meeting. CME credit will only be offered to M.D.s, D.O.s or equivalent. A completed Physician Verification of Attendance form must be turned in to SOCCA at the conclusion of the meeting. The form will be available on-site.

Educational Format

CME activities include the following formats: plenary sessions, lectures, moderated poster discussions, and skill-set workshops

SOCCA Annual Meeting and Critical Care Update (Friday)

The American Society of Anesthesiologists designates this live activity for a maximum of 6.0 AMA PRA Category 1 Credit(s)[™]. Physicians should claim only credit commensurate with the extent of their participation in the activity.

Disclaimer

The information provided at this CME activity is for continuing education purposes only and is not meant to substitute for the independent medical/clinical judgment of a healthcare provider relative to diagnostic and treatment options of a specific patient's medical condition.

Faculty Disclosure

The American Society of Anesthesiologists and Society of Critical Care Anesthesiologists adhere to ACCME Essential Areas, Standards, and Policies regarding industry support of continuing medical education. Disclosures of faculty and commercial relationships will be made known at the activity. Speakers are required to openly disclose any limitations of data and/or any discussion of any off-label, experimental, or investigational uses of drugs or devices in their presentations.

Annual Meeting Learning Objectives

Upon completion of this learning activity participants should be able to:

- Discuss the role of early mobilization in improving outcomes for critically ill patients.
- Review strategies to enhance cost effectiveness in the delivery of critical care.
- Recognize the possible advantages and disadvantages of employing non-physician providers in the intensive care unit.
- Discuss current controversies in providing palliative care for patients in the intensive care unit.
- Review the practical legal aspects and process of a malpractice case related to the care of a critically ill patient.
- Discuss significant advances in the evolution of critical care practice over the past 25 years including mechanical ventilation, hemodynamic monitoring and staffing of intensive care units.

Resolution of Conflicts of Interest

In accordance with the ACCME Standards for Commercial Support of CME, the American Society of Anesthesiologists and the Society of Critical Care Anesthesiologists will implement mechanisms, prior to the planning and implementation of this CME activity, to identify and resolve conflicts of interest for all individuals in a position to control content of this CME activity.

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4, 8 - Hospira; 4 - Baxter;
4 - American Heart Association;
4 - NIH; 4, 7 - Cephalogics

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8 - Hawaii Medical Service As
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4 - Agency for Healthcare Res; 8 - Various hospitals and healthcare; 7 - Association for Professional

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Awards

Lifetime Achievement Award

Attendees of the SOCCA 25th Annual Meeting will honor Philip D. Lumb, M.B., B.S., MCCM as this year's Lifetime Achievement Award recipient. This award recognizes Dr. Lumb distinguished service and outstanding contributions to critical care medicine. Dr. Lumb's presentation is entitled *"Anesthesiology Critical Care - Back to the Future."*

Young Investigator Award

This award is presented annually to the individual whose research exemplifies the Society's mission to educate anesthesiologists in the care of critically ill patients and to foster the knowledge and practice of critical care medicine by anesthesiologists. The recipient of the Young Investigator Award will make an oral presentation of their work at the SOCCA Annual Meeting. SOCCA is proud to announce the 2012 Young Investigator Award recipient as Nicholas Burjek, M.D., Vanderbilt University Medical Center, for his paper entitled *"Early BIS and Sedative Requirements During Therapeutic Hypothermia Predict Neurologic Outcome at ICU Discharge"*

Meeting Schedule

Friday, October 12, 2012

- 6:30 a.m. - 5:00 p.m. Registration
- 7:30 - 8:00 a.m. Continental Breakfast - Exhibits Open
- 8:00 - 8:05 a.m. Welcome and Introduction
Ronald W. Pauldine, M.D., Carlee A. Clark, M.D.

SESSION I: Early Mobilization and Cost

- 8:05 - 8:35 a.m. Early Mobilization to Reduce Health Care Cost
Dale M. Needham, M.D., Ph.D.
- 8:40 - 9:10 a.m. Cost Effectiveness in Critical Care
Brian Cuthbertson, Ch.B., M.D., FRCA
- 9:15 - 9:45 a.m. Midlevel Practitioners in the ICU, at What Cost? - Pro vs. Con
Richard B. Silverman, M.D.; Walter A. Boyle III, M.D., FCCM
- 9:50 - 10:10 a.m. Break and Vendor Visits

SESSION II: Controversies in Palliative Care

- 10:10 - 10:15 a.m. Moderator and Introduction
Rebecca Aslakson, M.D.
- 10:15 - 10:35 a.m. Palliative Care. Should DNR Be The Default
David A. Chmielewski, M.D.
- 10:40 - 11:00 a.m. Terminal Sedation And General Anesthesia For Palliative Care
Allen Gustin, M.D.
- 11:00 - 11:15 a.m. Reaction Panel
Liza M. Weavind, M.D.; Ronald G. Pearl, M.D., Ph.D.
- 11:15 - 11:30 a.m. [Young Investigator Award and Abstract Presentation](#)
"Early BIS and Sedative Requirements During Therapeutic Hypothermia Predict Neurologic Outcome at ICU Discharge"
Nicholas Burjek, M.D.
- 11:30 - 11:35 a.m. Introduction of ASA President-Elect
Michael F. O'Connor, M.D., FCCM
- 11:35 a.m. - Noon ASA President-Elect Address
John M. Zerwas, M.D.
- Noon - 1:10 p.m. Lunch and SOCCA Business Meeting

Session III: Malpractice in the ICU

- 1:15 - 2:15 p.m. Defending Critical Care: Navigating Through a Malpractice Case
Moderator and Introduction
Neal H. Cohen, M.D., MPH, MS
Audience Response Legal Panel
Crystal S. Deese, Esq.; Catherine D. Bertram
- 2:20 - 2:35 p.m. SOCCA-FAER- Hospira Physician Scientist Award Lecture
"APOE to Sex Differences: The Circuitous Route of Science"
Michael (Luke) James, M.D.
- 2:35 - 2:50 p.m. Break and Vendor Visits
- 2:50 - 3:15 p.m. Moderated Poster Session
- 3:15 - 3:45 p.m. Lifetime Achievement Award Presentation
"Anesthesiology Critical Care - Back to the Future."
Philip D. Lumb, M.B., B.S., MCCM

Meeting Schedule

Session IV: SOCCA 25 Years Later. What's Changed?

3:50 - 4:00 p.m.	Moderator and Introduction Robert N. Sladen, M.B., Ch.B., FCCM
4:00 - 4:15 p.m.	Mechanical Ventilation John B. Downs, M.D., FCCP, FCCM, M.B.A.
4:20 - 4:35 p.m.	Hemodynamic Monitoring Myer H. Rosenthal, M.D.
4:40 - 4:55 p.m.	Critical Care Staffing Jeffrey S. Vender, M.D.
5:00 - 5:10 p.m.	Moderator and Audience Response
5:15 - 6:45 p.m.	Welcome Reception

SESSION I: Early Mobilization and Cost

Early Mobilization to Reduce Health Care Cost

Dale M. Needham, M.D., Ph.D.

Cost Effectiveness in Critical Care

Brian Cuthbertson, Ch.B., M.D., FRCA

Midlevel Practitioners in the ICU, at What Cost? - Pro vs. Con

Richard B. Silverman, M.D.; Walter A. Boyle III, M.D., FCCM

Early Mobilization to Reduce Health Care Cost

Dale M. Needham, M.D., Ph.D.

Critical illness contributes to long-term morbidities. Early initiation of physical rehabilitation in the ICU has been demonstrated to be safe, feasible, and beneficial. Early rehabilitation improves patient outcomes, including physical function (e.g. 6-minute walk distance) and health-related quality of life, while decreasing mechanical ventilation duration and length of stay. Moreover, a follow-up study has demonstrated a decrease in the combined endpoint of one-year hospital re-admission and mortality (Morris, 2011).

However, important steps are required to change ICU culture to introduce early physical rehabilitation as part of routine care. Over-sedation of ICU patients is often a barrier to early rehabilitation. Minimizing over-sedation can decrease delirium and allow patients to engage in early physical rehabilitation. Structured quality improvement projects have been successful in introducing early physical rehabilitation into routine practice while reducing length of stay (Needham, 2010).

Existing studies suggest, from the perspective of U.S. hospitals, that there may be net cost savings from implementing an early physical rehabilitation program due to decreased length of stay. Existing data have been used to create a financial model and associated sensitivity analyses to further evaluate the potential financial impact on hospitals (Lord, 2012). This Excel-based financial model and Users' Guide are available for free download at:

http://www.hopkinsmedicine.org/pulmonary/research/outcomes_after_critical_illness_surgery/oacis_programs_qi_projects.html

Selected References from the Presentation

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Cost Effectiveness in Critical Care

Brian Cuthbertson, Ch.B., M.D., FRCA

In modern health care health care costs and the opportunity costs of adopting a technology / drug are very high. New drugs and technologies require full evaluation before implementation into practice and this should include cost-effectiveness analysis. It can be difficult to convince doctors they should be interested in cost-effectiveness and it is not an exciting topic by any means. I propose that we have a moral, societal and ethical obligation to undertake and consider the results of cost-effectiveness analysis in our practices. I will discuss a number of existing studies where cost-effectiveness has changed our practice and indeed where it can change the result of a study altogether. I also discuss the missed opportunities in major “no-effect” studies that did not perform cost-effectiveness analysis and potentially missed a practice changing result because of this fact.

Midlevel Practitioners in the ICU, at What Cost? Pro vs. Con

Richard B. Silverman, M.D.; Walter A. Boyle III, M.D., FCCM

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SESSION II: Controversies in Palliative Care

Palliative Care. Should DNR Be The Default

David A. Chmielewski, M.D.

Terminal Sedation And General Anesthesia For Palliative Care

Allen Gustin, M.D.

Reaction Panel

Liza M. Weavind, M.D.; Ronald G. Pearl, M.D., Ph.D.

Palliative Care. Should DNR Be The Default

David A. Chmielewski, M.D.

- The history of CPR, the role of medical ethics, and the challenge of reconciling provider-surrogate non-agreement about code status
- How the “gentle influence” of default options can yield health care improvements
- How defaults regarding DNR can be integrated into institutional policies and/or bedside practice within ethical and legal bounds

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Terminal Sedation And General Anesthesia For Palliative Care

Allen Gustin, M.D.

Terminal sedation refers to the use of sedatives to relieve intractable patient suffering at the end of life.¹ Terminal sedation is also known by the following terms: palliative sedation, continuous deep sedation, and sedation for intractable suffering in the dying patient. Because of these multiple terms, it is difficult to determine the prevalence of terminal sedation within the United States (US) and other countries. Terminal sedation has gained more attention in the US over the last three decades as several US court cases have clarified the legality of palliation at the end of life.^{2,3} The use of terminal sedation has been uncommon in the US; but it is gaining more acceptance as more palliative care consultants participate in multidisciplinary care.

The goal of terminal sedation is to induce decreased or absent awareness in non-intubated patients when the degree of suffering is considered to be unacceptable. When opioid therapy is unhelpful or when opioid side effects are considered unacceptable, terminal sedation can be considered an option (only as a last resort). Though terminal sedation is most commonly used for patients with symptoms of intractable pain, patients with other conditions (e.g., intractable seizures, breathlessness, malaise, fatigue) are candidates for terminal sedation when the symptoms are considered unacceptable.⁴

The list of medications for use in terminal sedation is short. Propofol and barbiturates have negative connotations within the US public. Propofol has been associated with a high-profile case (M. Jackson) and barbiturates are associated with use in capital punishment. Negative press regarding terminal sedation and safety with sedation may have led to restrictive institutional policies on some medications in non-intubated patients. Benzodiazepines are considered the drug of choice for use in most terminal sedation protocols given the relative short duration of action and relatively few side effects. Continuous infusions of drugs tend to be more popular than bolus dosing. Variations of sedation endpoints exist when using terminal sedation (mild sedation with titration to desired effect versus deep sedation).⁵

Terminal sedation can be problematic for institutions unfamiliar with the procedure and the associated ethical issues. Palliative care physicians, anesthesiologists, critical care physicians, bioethicists, and legal personnel can be crucial to the success of terminal sedation protocols. Terminal sedation tends to be more ideal for non-critical care settings. However, when a patient is already present in the intensive care unit (ICU) and the prediction of death is less than a few days, then the ICU may be the best site for the initiation and completion of the terminal sedation protocol. Critical care physicians can serve as consultants for physicians unfamiliar with terminal sedation by acting as an information resource and by avoiding unneeded ICU transfers.

Critical care physicians are adept with the process of the “withdrawal” or “withholding” care to critically ill patients. Physician assisted suicide (PAS) is now legal in three US states (Oregon, Washington, and Montana). Euthanasia is not legal in any US state (but is legal in the Netherlands, Belgium, and Luxembourg). According to bioethicists, terminal sedation represents the median between the “withdrawal/withholding” of care and PAS/euthanasia.⁴ Terminal sedation differs from PAS and euthanasia with regards to intent and outcome. Terminal sedation has not been shown to hasten death.⁶ Beneficence, non-maleficence, patient autonomy, and double effect are all ethical principles that support the use of terminal sedation.⁷ The use of hydration and artificial nutrition during terminal sedation is considered an ethical dilemma that is hotly debated.

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Young Investigator Award

“Early BIS and Sedative Requirements During Therapeutic Hypothermia Predict Neurologic Outcome at ICU Discharge”

Nicholas Burjek, M.D.

Young Investigator Award

Early BIS and Sedative Requirements During Therapeutic Hypothermia Predict Neurologic Outcome at ICU Discharge

Nicholas Burjek, M.D.

Introduction: Therapeutic hypothermia (TH) following cardiac arrest improves neurologic outcomes and decreases mortality, but the incidence of neurologically intact survival remains low. Models that predict neurologic outcome using patient characteristics gathered immediately after resuscitation do not account for the early clinical trajectory of patients and have limited usefulness for predicting poor outcomes. We hypothesized that a low bispectral index (BIS) and low sedative requirements 12 hours after initiation of TH accurately predict poor neurologic function at ICU discharge.

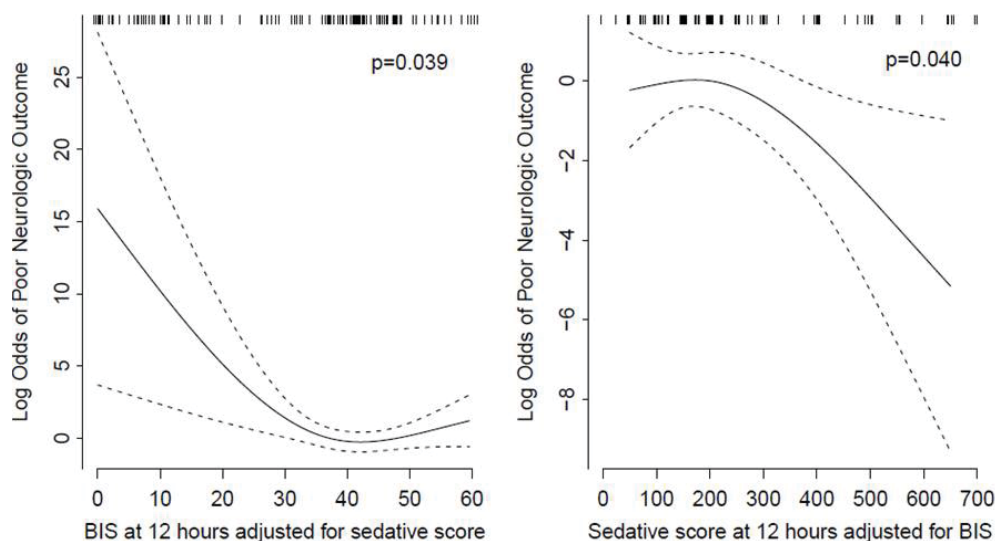
Methods: BIS, sedative exposure, and neurologic outcome were collected in 160 consecutive adult patients treated with TH at a single academic center from 2007-2011. TH was performed according to an institutional protocol that dictates paralysis, controlled ventilation, hourly BIS measurements, and midazolam and fentanyl sedation titrated to a BIS of 40-60. A combined sedative score equal to the sum of the hourly fentanyl dose and the midazolam dose multiplied by 50 was used (for example, a fentanyl dose of 100 μ g/h and midazolam 2mg/h is a sedative score of 200). Poor neurologic outcome was defined as a Cerebral Performance Category (CPC) score of 3, 4, or 5 at ICU discharge. Patient characteristics were compared between subjects with poor and favorable neurologic outcome, and logistic regression was used to measure the association between BIS or sedative exposure, independent of each other, and neurologic outcome.

Results: 142 of the 160 patients were treated according to the sedation protocol, survived to 12 hours, and were included in the analysis. The

median age was 59 years, 66% were male, and the median time to cardiopulmonary resuscitation was 10 minutes. Eighty-five (60.0%) patients were discharged from the ICU with a poor neurologic outcome, most of which (91.8%) died in the ICU. Patients with a poor outcome were less likely to present with VTach or VFib (50.0 vs. 85.5 %, $p < 0.001$), had longer time to return of spontaneous circulation (30.0 ± 19.8 vs. 14.3 ± 9.4 minutes, $p < 0.001$), and at 12 hours following ICU admission had a lower BIS (21.1 ± 18.0 vs. 45.6 ± 8.5 , $p < 0.001$), required less fentanyl (84 ± 63 vs. $171 \pm 114 \mu$ g/h, $p < 0.001$) and midazolam (1.79 ± 0.94 vs. 3.93 ± 2.41 mg/h, $p < 0.001$), had lower sedative scores (159 ± 103 vs. 361 ± 222 , $p < 0.001$), and had higher blood lactate levels (4.6 ± 3.5 vs. 2.4 ± 2.0 mmol/l, $p < 0.001$). After adjusting for sedative exposure or BIS, the odds of poor neurologic outcome remained significantly higher for patients with a lower BIS or lower sedative score, respectively (Figure). For example, a BIS of 30 compared to 40 was associated with 5.13 increased odds of poor neurologic outcome (95% CI 1.32-19.9), and a sedative score of 200 compared to 400 was associated with 4.80 increased odds of poor outcome (95% CI 1.41-16.30).

Conclusions: A low BIS and low sedative requirement 12 hours after initiation of TH following cardiac arrest predicts poor neurologic function at ICU discharge. Prognosis prediction models incorporating BIS and sedation requirements early in the ICU course may help inform decision-making regarding discharge planning, end of life discussions with families, and organ donation services.

Independent associations between BIS or Sedative Requirement at 12 hours of resuscitation and odds of Poor Neurologic Function at ICU discharge



Session III: Malpractice in the ICU

Defending Critical Care: Navigating Through a Malpractice Case

- Moderator and Introduction
Neal H. Cohen, M.D., MPH, MS
- Audience Response Legal Panel
Crystal S. Deese, Esq.; Catherine D. Bertram

Defending Critical Care: Navigating Through a Malpractice Case

Moderator and Introduction

Neal H. Cohen, M.D., MPH, MS

Audience Response Legal Panel

Crystal S. Deese, Esq.; Catherine D. Bertram

The session will utilize clinical case scenarios to assess professional liability issues and how to manage risk in the ICU. A panel of malpractice lawyers will discuss each case with respect to areas of malpractice risk, offer their expertise in assessing “standard of care” as well as provide guidance in defending clinical management decisions and developing strategies to address adverse outcomes of care. The audience will have the opportunity to participate in the discussion by providing feedback regarding assessment of standard of care, areas of professional liability risk, disclosure and informed consent.

Case 1 – Standard of Care

A patient was admitted to the ICU after complex spine procedure in prone position. At the time of admission the patient remained intubated for airway protection, but was breathing spontaneously with satisfactory gas exchange. Shortly thereafter, the patient’s airway was assessed. There was no visible evidence of airway edema and there was a large leak around the endotracheal tube when the cuff was deflated and positive pressure was applied to the lungs. The patient’s trachea was extubated. For the next 3 hours, the patient had minimal stridor, but denied dyspnea and maintained satisfactory gas exchange.

Later that evening the patient developed worsening stridor with audible, noisy respirations. Airway movement was minimal, although the patient initially maintained satisfactory oxygen saturation. In response to the respiratory distress, the respiratory therapist initiated BiPAP with no improvement. The ICU physician attempted emergent intubation using multiple different blades, including a MAC 4 and Miller 2 without success. No other equipment was available at the time of the attempted intubation, since the “difficult airway cart” was in use in another ICU. Despite attempts to optimize the patient’s position and airway, mask ventilation was no longer possible. The patient’s oxygen saturation was worsening, so the airway was secured by performing a cricothyroidotomy. Subsequently attempts to wean the patient from mechanical ventilation were difficult. Assessment documented severe tracheal stenosis. The patient required long-term tracheostomy and will require surgical intervention. A retrospective review of the anesthesia record indicated that the initial intubation had been difficult, but was accomplished successfully using a Glidescope for visualization of the airway.

- Was the management of this case within the standard of care?
- Did the provider have the skills needed to ensure standard of care was provided?
- What, if any alternative approaches should have been used to minimize the likelihood of complications?

- Should LMA have been placed immediately?
- What is the role of ASA difficult airway algorithm in clinical decisionmaking?
- How does the community standard apply in this case? Does it matter if the patient is receiving care in an academic versus community facility?
- Is there a role for independent clinical judgment of the physician, particularly if it differs from a practice guideline?
- How would the lack of review of anesthesia record or incomplete communication during the transition of care impact defense of case?
- Is there liability for the anesthesiologist related to communication about intraoperative management?
- What information should be provided to the patient or family regarding the patient’s care and subsequent course?

Case 2 – Managing a Complication of Care and its Medical-Legal Implications

A 54 year old homeless patient is receiving care in the ICU for management of sepsis and renal insufficiency. A femoral dialysis catheter was placed to provide access for CVVH. Immediately after initiation of the CVVH, the patient became hypotensive and developed marked abdominal distension. The patient was treated with fluids and required initiation of vasopressor therapy. Despite intensive management of the hypotension, the patient suffered a cardiopulmonary arrest. During the resuscitation the patient was noted to develop marked abdominal distention. Evaluation demonstrated that the catheter had been placed into the retroperitoneum. Although the patient was successfully resuscitated, she remains in a persistent vegetative state.

- What are the concerns regarding the clinical management of this patient?
- Was the patient’s care within the standard for this community?
- How should the patient be managed now?
 - What are the professional liability issues related to the patient’s current clinical condition and long term prospects for recovery?
 - What is the role for surrogate decisionmakers in this case?
 - What if the surrogates do not agree on the management strategy?

- Are there medical-legal implications related to the management decisions when the surrogate decisionmakers do not agree?
- Does it matter if there is a single surrogate with power of attorney?
- Are the medical legal implications different if the patient is 90 years of age, a venture capitalist?
- What is the impact of the patient's future earning potential?
 - What is the impact of loss of consortium for a significant other?
- What are the implications of state laws and tort reform on the legal management strategies?

SOCCA-FAER-Hospira Physician Scientist Award Lecture

APOE to Sex Differences: The Circuitous Route of Science
Michael (Luke) James, M.D.

SOCCA-FAER- Hospira Physician Scientist Award Lecture

APOE to Sex Differences: The Circuitous Route of Science

Michael (Luke) James, M.D.

Intracerebral hemorrhage (ICH), or hemorrhagic stroke, is a common and deadly form of cerebrovascular disease without proven therapy beyond supportive care. Treatment of patients with this disease is often complicated by the need to balance tight hemodynamic control with maintaining cerebral perfusion and requires a neurosurgical intensive care setting. It is also clear the certain genetic polymorphisms, such as apolipoprotein E (apoE), are associative with disease modification and outcome after injury. Multiple studies have shown associations between apoE genotype and outcome in chronic and acute neuroinflammatory states. An apoE-mimetic peptide has been developed in our lab as a targeted therapeutic approach to brain injury. Our study investigated the interactions between apoE genetic background, exogenous apoE-mimetic peptide administration, and sex in a murine model of ICH.

Lifetime Achievement Award

Anesthesiology Critical Care - Back to the Future
Philip D. Lumb, M.B., B.S., MCCM

Anesthesiology Critical Care - Back to the Future

[illegible]

Session IV: SOCCA 25 Years Later. What's Changed?

Moderator and Introduction

Robert N. Sladen, M.B., Ch.B., FCCM

Mechanical Ventilation

John B. Downs, M.D., FCCP, FCCM, M.B.A.

Hemodynamic Monitoring

Myer H. Rosenthal, M.D.

Critical Care Staffing

Jeffrey S. Vender, M.D.

Mechanical Ventilation

John B. Downs, M.D., FCCP, FCCM, M.B.A.

Mechanical Ventilation: 25 Years Later. What Has Changed?

Initially, I planned to discuss the history of interest in barotraumas, volutrauma and the evolution of ARDSNet. But it occurred to me that everyone listening would be intimately familiar with, at least, the concept of “protective” ventilatory strategy. Therefore, I decided to trace a personal evolution of ventilatory support strategy and highlight the distinct differences, as they occurred. Further, I will offer some personal observations and opinions as to the reasons behind the divergent evolutionary lines in mechanical ventilatory support. The talking points are represented by the following bibliography.

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Hemodynamic Monitoring

Myer H. Rosenthal, M.D.

Notes:_____

Critical Care Staffing

Jeffrey S. Vender, M.D.

- Critical Care (ASCCA/SOCCA) 25 years ago
- Existing Situation(s)
 - Variable – Structure, Process, Outcome, Cost
- Do Intensivists make a difference???
- Staffing Issues
 - Today/Projections
- Structure
 - Specialization vs. Economies of Scale
- Staffing Alternatives
 - Regionalization
 - ACNP; PA's
 - Hospitalists – The New Controversy
 - Telemedicine / Teleintensivist
- New Perspective on Resource Allocation/Capacity Demands

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13. Bauman, Chest 2012: 142: 5
14. Wilcox, Critical Care 2012; 16: R127

Poster Presentations

(Note: Bold name represents poster presenter)

- Poster 1 **Rapid Diagnosis And Treatment of Compartment Syndrome Following Renal Transplantation**
Joseph Schlesinger, M.D.; John Barwise, M.B., Ch.B.
Vanderbilt University Medical Center
- Poster 2 **Perceptions of The Terms “Palliative Care” And “Palliative Medicine” Amongst Surgical ICU Nurses, Surgeons, And Critical Care Anesthesiologists**
Kerry Shannon, M.P.H.¹; Rebecca A. Aslakson, M.D., M.Sci.¹; Jessica Peters, RN, M.S.N., ACNP-BC²; Selena An, M.A.³; Wutyi Aunt, B.A.³; Peter J. Pronovost, M.D., Ph.D.¹
The Johns Hopkins School of Medicine¹; Johns Hopkins Hospital²; The Johns Hopkins Bloomberg School of Public Health³
- Poster 3 **Mortality Prediction in Stroke And Non-Traumatic Intracranial Hemorrhage Patients Within The First 24-Hour of ICU Admission**
Alexander F. Bautista, M.D.¹; Rainer Lenhardt, M.D.¹; Michael F. Heine, M.D.¹; Edward Mascha, Ph.D.²; Ozan Akca, M.D.¹
University of Louisville¹; Cleveland Clinic²
- Poster 4 **Severity Assessment And Mortality Prediction in The Elderly Neurologically Compromised Patients Within The First 24-Hour of ICU Admission**
Bautista F. Alexander, M.D.¹; Rainer Lenhardt, M.D.¹; Cate Heine¹; Edward Mascha, Ph.D.²; Ozan Akca, M.D.¹
University of Louisville¹; Cleveland Clinic²
- Poster 5 **Impact of Video Laryngoscopy in a Large Tertiary Anesthesia Practice**
Lawrence R. Bellmore, M.D.; Daniel Diedrich, M.D.; Daniel Brown, M.D., Ph.D.; Laurence Torsher, M.D.; Subramanian Arun, M.B.B.S.
Mayo Clinic
- Poster 6 **Gastroesophageal Reflux Disease is Not Associated With Early Postoperative Acute Lung Injury in Patients Undergoing High-Risk Thoracic And Aortic Vascular Surgery: A Retrospective Cohort Evaluation**
Eric K. Cannon, M.D.; Daryl Kor, M.D.; Arun Subramanian, M.B.B.S.; Amandeep Singh, M.B.B.S.; Anas Alsara, M.B.B.S.
Mayo Clinic
- Poster 7 **Hemodynamic Relationship Between Pulse Pressure Variation And Fluid Balance**
Suzanne Kellman, M.D.¹; Aalok Kacha, M.D.¹; Jay Koyner, M.D.²; Michael O'Connor, M.D.¹
Department of Anesthesia and Critical Care¹, Department of Nephrology², The University of Chicago
- Poster 8 **Using SNOMED CT to Efficiently Identify Preoperative Patients Who Are at High Risk of Developing Postoperative Acute Lung Injury**
Rebecca C. Adair, M.D.; Jyotishman Pathak, Ph.D.; Daryl J. Kor, M.D.
Mayo Clinic
- Poster 9 **Compensating For Facemask Leaks During Noninvasive Ventilation (NIV) Improves Accuracy of Work of Breathing (WOB) Measurements**
Nawar Al-Rawas, M.D.¹; Michael J. Banner, Ph.D.¹; Neil R. Euliano, Ph.D.²; A. Daniel Martin, Ph.D.¹; Stephen Myers, Ph.D.²; Andrea Gabrielli, M.D.¹
University of Florida College of Medicine¹, Convergent Engineering², Gainesville, Florida
- Poster 10 **Fetal, But Not Adult Acetylcholine Receptors Are Upregulated Following Muscle Immobilization And Systemic Inflammation**
Stefan J. Schaller, M.D.¹; Christopher Kramer, M.D.¹; Alexander Kretschmer¹; Claire Delbridge, M.D.¹; Jeevendra A.J. Martyn, M.D.²; Heidrun Fink, M.D.¹
Klinik für Anästhesiologie der Universität München, Klinikum rechts der Isar, Germany¹; Department of Anesthesia, Critical Care and Pain Medicine, Shriners Hospital for Children, Massachusetts General Hospital, Harvard Medical School, Boston, Massachusetts
- Poster 11 **Postoperative Outcomes After Etomidate Induction in Cardiac Surgery**
Megan Graybill Anders, M.D.¹; Chad E. Wagner, M.D.¹; Julian S. Bick, M.D.¹; Rashid M. Ahmad, M.D.²; Xue Han, M.P.H.³; Mias Pretorius, M.B., Ch.B., MSCI
Department of Anesthesiology¹, Department of Cardiac Surgery², Department of Biostatistics³, Vanderbilt University School of Medicine

Poster Presentations

- Poster 12** **The Utilization of Critical Care Services Among Patients Undergoing Spine Fusion Surgery**
Ottokar Stundner, M.D.^{1,2}; Ya-Lin Chiu, M.S.^{3,4}; Xuming Sun, M.S.^{3,4}; Yan Ma, Ph.D.^{2,5}; Fleischut M. Peter, M.D.^{1,6}; Stavros G. Memtsoudis, M.D., Ph.D.^{1,2}
Department of Anesthesiology¹, Hospital for Special Surgery², Division of Biostatistics and Epidemiology³, Department of Public Health⁴, Research Department⁵, Weill Medical College of Cornell University, New York; NewYork-Presbyterian Hospital, New York
- Poster 13** **The Surgical Home: Decreased Mortality in Critically Ill Patients**
Mark W. Haney, M.D., M.S.; Gaston Cudemus, M.D.; Sonya Ehreshman, M.D.; Mariana Mogos, M.D.; Peter Roffey, M.D.; Duraiyah Thangathurai, M.D.
Keck School of Medicine, University of Southern California
- Poster 14** **Tracheal Stenosis And Obstruction Due to Plastic Bronchitis in a Post-Adrenalectomy Patient: Case Report**
Mark W. Haney, M.D., M.S.; Mariana Mogos, M.D.; Peter Roffey, M.D.; Duraiyah Thangathurai, M.D.
Keck School of Medicine, University of Southern California
- Poster 15** **Severe Post-Operative Obstructive Sleep Apnea And Its Successful Treatment With Modafanil: Case Report**
Mark W. Haney, M.D., M.S.; Mariana Mogos, M.D.; Peter Roffey, M.D.; Duraiyah Thangathurai, M.D.
Keck School of Medicine, University of Southern California
- Poster 16** **An Evaluation of The Association Between Intraoperative Events And Patient Responses And Development of Postoperative Acute Lung Injury in Patients Undergoing High-Risk Aortic Vascular And Thoracic Surgery: A Retrospective Cohort Study**
David R. Wetzel, M.D.; Arun Subramanian, M.B.B.S.; Oderich S. Gustavo, M.D.; Wigle A. Dennis, M.D., Ph.D.; Amandeep Singh, M.B.B.S.; Daryl J. Kor, M.D.
Mayo Clinic, Rochester, MN
- Poster 17** **Anaphylactoid Reaction During Treatment of Severe Hemorrhagic Shock**
Andrew J. Crabbe, M.D.; Amanda Gomes, M.D.; William S. Havron, M.D.; Gozde Demiralp, M.D.
Department of Anesthesia, University of Oklahoma Health Science Center
- Poster 18** **Tracheostomy After Cervical Spine Fusion Surgery Incidence, Risk Factors And Outcome**
Ottokar Stundner, M.D.^{1,2}; Licia Gaber, BA⁵; Ya-Lin Chiu, MS^{3,4}; Xuming Sun, MS^{3,4}; Madhu Mazuar, M.D., Ph.D., MS, MA^{3,4}; Stavros G. Memtsoudis, M.D., Ph.D.^{1,2}
Department of Anesthesiology¹, Hospital for Special Surgery², Division of Biostatistics and Epidemiology³, Department of Public Health⁴, Weill Medical College of Cornell University, New York; LKG Consulting, Plainsboro, NJ⁵
- Poster 19** **Eliminating Central Line-Associated Bloodstream Infections: A National Patient Safety Imperative**
Asad Latif, M.D., M.P.H.; Lisa H. Lubomski, Ph.D.; Kristina Weeks, M.H.S.; Bradford D. Winters, Ph.D., M.D.; Peter J. Pronovost, M.D., Ph.D.; Sean M. Berenholtz, M.D., M.H.S.
Johns Hopkins University School of Medicine
- Poster 20** **Perioperative Monitoring of Intracranial Pressure During Liver Transplantation Using Optic Nerve Sheath Diameter**
Vijay Krishnamoorthy, M.D.¹; Katharina Beckmann, M.D.²; Mark Mueller, M.D.²; Deepak Sharma, M.D.¹; David Schwartz, M.D.²
University of Washington¹; University of Illinois²
- Poster 21** **Nitroglycerin Infusion Preventing Transfusion-Related Acute Lung Injury**
Najmeh P. Sadoughi, M.D.; Mark W. Haney, M.D.; Gaston Cudemus, M.D.; Peter Roffey, M.D.; Mariana Mogos, M.D.; Duraiyah Thangathurai, M.D.
Keck School of Medicine of USC
- Poster 22** **Near-Fatal Angioedema Compromising The Airway in a Patient Following ACEI Substitution**
John Denny, M.D.; Harris Shaikh, M.D.; Sabrina Haque, M.D.; Andrew Burr, D.O.; Sharon Morgan, CRNA, MSN
Robert Wood Johnson Medical School
- Poster 23** **Comparison of Arterial and Non-Invasive Blood Pressure Measurements**
Mark Bendel, M.D.; Arun Subramanian, M.B.B.S.
Department of Anesthesiology, Mayo Clinic, Rochester, MN
- Poster 24** **Reliable Cardiac Output Monitoring by Innovative Pulse Contour Analysis During Hemodynamic Drug Infusions**
Ramakrishna Mukkamala, Ph.D.¹; Varun Agrawal, Ph.D.¹; Joseph K. Prinsen, B.S.²; Marc Zemel, S.M., M.B.A.¹; Nicholas B. Olivier, D.V.M., Ph.D.²
Retia Medical¹; Department of Small Animal Clinical Sciences, Michigan State University², East Lansing, Michigan

Poster Presentations

- Poster 25 Occult Thyrotoxicosis in The Trauma Intensive Care Unit: A Great Masquerader
Gozde Demiralp, M.D.¹; Christopher A. Godlewski, M.D.¹; Sean Nix, D.O.²; Jason Lees, M.D.²; Pamela Roberts, M.D.¹
Department of Anesthesiology¹, Department of Surgery², Oklahoma University Health Science Center
- Poster 26 Post Operative Atrial Fibrillation After Extra Pleural Pneumonectomy: Risk Factors And The Effect of Prophylactic Beta Blockade
Gyorgy Frendl, M.D., Ph.D.; James Hardy, M.B.B.S.; Xiaoxia Liu, M.S.; David Sugarbaker, M.D.
Brigham and Women's Hospital
- Poster 27 Incidence And Risk Factors For Emergence And PACU Delirium
Elizabeth B. Card, B.S.N., RN; Christopher Hughes, M.D.; Amy J. Graves, M.S.; Pratik Pandharipande, M.D., MSCI
Department of Anesthesiology, Vanderbilt University School of Medicine, Nashville, Tennessee
- Poster 28 Heparin Requirements For Full Anticoagulation Are Higher For Patients Treated With Dabigatran Than For Those on Coumadin
Thomas Edrich, M.D., Ph.D.¹; Gyorgy Frendl, M.D., Ph.D.²; Ioannis C. Paschalidis, Ph.D.³
Department of Anesthesia, Perioperative and Pain Medicine, Surgical ICU Translational Research Center, Brigham and Women's Hospital, and Harvard Medical School, Boston, MA¹; Department of Anesthesia, Perioperative and Pain Medicine, Brigham and Women's Hospital, Harvard Medical School²; Department of Electrical and Computer Engineering and Division of Systems Engineering, Boston University³
- Poster 29 Attending Physician Handoffs in The Intensive Care Unit
Meghan B. Lane-Fall, M.D.; Rebecca M. Speck, M.P.H.; Maureen McCunn, M.D., MIPP; Charles L. Bosk, Ph.D.
University of Pennsylvania
- Poster 30 Clinical Impact of Post Operative Atrial Fibrillation Following Extra Pleural Pneumonectomy
Gyorgy Frendl, M.D., Ph.D.; James Hardy, M.B.B.S.; Xiaoxia Liu, M.S.; David Sugarbaker, M.D.
Brigham and Women's Hospital
- Poster 31 Perioperative Risk Factors for Venous Thromboembolism in Patients With Malignant Pleural Mesothelioma: A Retrospective Analysis of Our Four Year Database
Gyorgy Frendl, M.D., Ph.D.; Sujatha Pentakota, M.D.; Xiaoxia Liu, M.S.; Cindy Gonzalez, B.S.; David Sugarbaker, M.D.
Brigham and Women's Hospital
- Poster 32 Postoperative Creatinine Increase Predicts Sustained Kidney Injury in Patients With Malignant Mesothelioma Undergoing Surgical Resection
Gyorgy Frendl, M.D., Ph.D.; Annette Mizuguchi, M.D.; Aya Mitani, M.P.H.; Sushrut Waikar, M.D.; Joseph Bonventre, M.D.; David Sugarbaker, M.D.
Brigham and Women's Hospital
- Poster 33 An Evaluation of The Efficiency of RxNorm in The Identification of Preoperative Risk Factors for Postoperative Acute Lung Injury
Jennifer Bartlotti Telesz, M.D.; Jyotishman Pathak, Ph.D.; Daryl Kor, M.D.
Mayo Clinic
- Poster 34 Routine Post-Procedural Chest Radiographs are Dispensable After Central Venous Catheter Placement Through Internal Jugular Vein
Dhamodaran Palaniappan, M.D.; Erich N. Marks, M.D.; Krishna Parekh, M.D.; Raghu Seethala, M.D.; Peter Hou, M.D.; Gyorgy Frendl, M.D.
Department of Anesthesiology, Perioperative and Pain Medicine, Brigham & Women's Hospital, Harvard Medical School
- Poster 35 Postoperative Delirium: A Literature Review of The Last Two Years
Matthew McDaniel, M.D.; Scott Brudney, M.B., Ch.B.
Duke University Medical Center
- Poster 36 [Young Investigator Award](#)
Early BIS And Sedative Requirements During Therapeutic Hypothermia Predict Neurologic Outcome at ICU Discharge
Nicholas E. Burjek, M.D.; Frederic T. Billings, M.D.; Ryan D. Hollenbeck, M.D.; John A. McPherson, M.D.; Li Wang, M.S.; Chad E. Wagner, M.D.
Vanderbilt University Medical Center

Poster Presentations

- Poster 37 Use of Dexmedetomidine in Acute Phencyclidine Toxicity
Matthew F. Spond, M.D.; Victor Mandoff, M.D.
Department of Anesthesiology, University of Arkansas for Medical Sciences, Little Rock, Arkansas
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Department of Anesthesiology and Critical Care, University of Miami-Ryder Trauma Center, Miami, Florida
- Poster 39 Serendipitous Discovery of a Partial Anomalous Pulmonary Venous Connection in The Surgical Intensive Care Unit
Ashish K. Khanna, M.D.; Ankit Maheshwari, M.D.; Marc Popovich, M.D.; Piyush Mathur, M.D.
Surgical ICU, Anesthesiology Institute, Cleveland Clinic Foundation
- Poster 40 Effect of Mitochondrial Dysfunction in The Development of Multi-Organ System Dysfunction Syndrome After LVAD Placement
Joseph S. Meltzer, M.D.; Mario Deng, M.D.; Galyna Bondar, Ph.D.; Martin Cadeiras, M.D.
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Rapid Diagnosis And Treatment of Compartment Syndrome Following Renal Transplantation

Joseph Schlesinger, M.D.; John Barwise, M.B., Ch.B.
Vanderbilt University Medical Center

A fifty-four year old Caucasian male patient was admitted to the surgical intensive care unit (SICU) status post a right-sided cadaveric renal transplant. He arrived intubated secondary to slow arousal in the operating room but was extubated within fifteen minutes after arrival. After extubation, he started to complain of vague lower limb pain. This pain escalated despite significant intravenous opiate and anxiolytic medication. On physical examination, the painful leg was ipsilateral to the renal transplant. The thigh was normal and the calf had what looked like muscle spasm that could be induced to relax with massage. However, the calf rapidly became swollen, tense and extremely painful to touch. The distal arterial pulses were palpable and the veins were more distended compared to the other lower limb and the ipsilateral thigh. The transplant surgical service was summoned to the bedside and diagnosed muscle spasm. Since the pain was not ameliorated with massage or medication intervention, a presumptive diagnosis of compartment syndrome was made¹. A Mirador Biomedical Compass Compartment Pressure device was used to ascertain the medial and lateral compartment pressures of 42 and 44 mm Hg, respectively. Secondary to the excruciating pain and the impending fasciotomy, the patient was induced with propofol and the trachea was intubated. The orthopedic surgical service was consulted and a bedside fasciotomy was performed with propofol total intravenous anesthesia. As the incision was made along the medial and lateral compartments, the muscle was observed to be dusky, but rapidly

expanded and regained a pink hue when the compartment pressure was relieved². Mechanical ventilation was quickly weaned and the patient's trachea was extubated. Analgesia was provided with a multimodal regimen that included: hydromorphone PCA, ketamine, ketorolac, and gabapentin. On post-operative day two, the incisions were closed with only residual incision site pain. Post-surgical compartment syndrome is a rare complication at a rate of 2.6:100,000 cases³. Failure to recognize this condition can lead to permanent physical dysfunction from skin to muscle to nerve and even amputation. In this case, the application of the Mirador Biomedical Compass Compartment Pressure device aided in a rapid diagnosis of compartment syndrome by the surgical intensive care unit team, dismissing the erroneous diagnosis of muscle spasm by the transplant surgical service, and leading to rapid consultation and bedside fasciotomy by the orthopedic surgical service.

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Perceptions of The Terms “Palliative Care” And “Palliative Medicine” Amongst Surgical ICU Nurses, Surgeons, And Critical Care Anesthesiologists

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Introduction: Approximately 20% of deaths of Medicare patients in the United States occur either in or shortly after admission to an intensive care unit (ICU) and multiple palliative care and palliative care-related interventions have been designed and tested with the ultimate goal of improving ICU-based palliative and end-of-life care. Despite the emergence of palliative medicine as a field, nurse and physician preconceptions regarding the terms “palliative care” and “palliative medicine” are unclear and may impact clinician utilization of palliative medicine philosophy and consultation of palliative medicine providers. Due to cultural issues, surgical ICU clinicians may have unique preconceptions concerning these terms.

Hypothesis: Surgical ICU nurses, surgeons, and critical care anesthesiologists have specific preconceptions concerning the terms “palliative medicine” and “palliative care.”

Methods: Recorded, semi-structured, in-depth interviews were conducted with fifteen surgical critical care nurses, anesthesiologists and/or surgeons who practice in or admit into two general surgical ICUs and/or one cardiac surgical ICU at a large, tertiary care, academic inner city hospital. Interviews were audiorecorded, transcribed, and de-identified. Data analysis was constant and iterative. Grounded theory was used to identify emergent themes and data acquisition and analysis was continued until informational redundancy was obtained.

Results: Informational redundancy was quickly reached with three key emergent themes identified. (1) Many interviewees felt that “palliative

care” and “palliative medicine” specifically referred only to end-of-life care and only benefitted patients who were actively dying or soon to die; consequently, “palliative medicine” was viewed as synonymous with end-of-life care and comfort care. (2) The interviewee acknowledged that other physicians thought palliative medicine to equate with end-of-life care but the interviewee him or herself viewed the topic more broadly – as relating to more holistic and patient and/or family-centered care. (3) Many interviewees expressed a strong desire to learn more about palliative care services available for patients. Other emerging themes included the belief that palliative services were not available in the ICU and/or whether palliative care teams were even appropriate for ICU patients. There were also debates about whether such care should be provided by a separate consultant team or by the primary ICU team.

Conclusion: Many surgical ICU clinicians – nurses, surgeons, and critical care anesthesiologists – have the preconception that palliative care and palliative medicine is solely for actively dying patients, however, there is general interest in learning more about palliative care and palliative medicine and how it could benefit patients. Such beliefs likely impact provider utilization of palliative care and palliative medicine philosophy and consultation.

Summary: Despite the emergence of palliative medicine and palliative care as medical fields, preconceptions regarding the terms “palliative care” and “palliative medicine” exist and likely impact clinician utilization of palliative medicine philosophy and consultation of palliative medicine

Mortality Prediction in Stroke And Non-Traumatic Intracranial Hemorrhage Patients Within The First 24-Hour of ICU Admission

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Background: Severe stroke and non-traumatic intracranial hemorrhages (ICH) are common causes of ICU admission. Although their mortality is high, there are no specific severity assessment and prognostic tools to assess status early, and apply preventive strategies to decrease mortality. Therefore, we aimed to establish a model using patients' co-existing diseases, physiologic and laboratory parameters obtained in the first 24-hour of admission to predict mortality in severe stroke and non-traumatic ICH patients in the ICU.

Methodology: After IRB approval, using our ICU database from 2005-2010, we retrospectively reviewed the electronic records of patients who were admitted to our neuroscience ICU with the diagnosis of stroke and ICH. Patients with advance directive (i.e. no life-prolonging measures of care) and who survived <48h were excluded. Severity of illness was assessed daily using APACHE III, GCS, and SOFA scores. Independent contributions of co-existing diseases, severity scores, and clinical and laboratory values obtained in the first 24 hours of ICU admission was assessed in a stepwise multivariable logistic regression model to predict in-hospital mortality (with significance criteria of $P < 0.05$ to enter the

model and $P < 0.10$ to stay). Area under the receiver operating characteristic curve (AUROC) was calculated to assess the ability of model to discriminate survivors from non-survivors, and the Hosmer-Lemeshow goodness of fit test was used for calibration of the model.

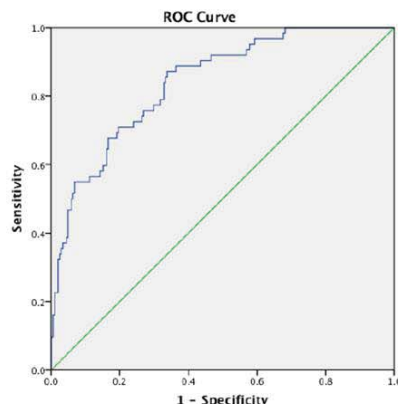
Results: There were 284 patients admitted with stroke and non-traumatic intracranial hemorrhage. Mean $\pm$ SD age was 77 ± 7 years. Overall mortality was 23%. Length of ICU stay was 13 ± 9 days. Independent risk factors for in-hospital mortality were age, GCS, presence of COPD, APACHE III score at admission, and SOFA scores' hemodynamics component (Table). Calibration of the model to the data was acceptable (Hosmer and Lemeshow goodness to fit P-value of 0.26). The model including the independent risk factors was able to predict in-hospital mortality very well, with AUROC of 0.840 (Figure).

Conclusion: In this retrospective study, age, GCS, baseline diagnosis of COPD, WBC, APACHE III score, and cardiovascular component of the SOFA score at admission provided useful information to predict mortality in severe stroke and non-traumatic ICH patients in the ICU.

Table

	B	p	RR	95% CI for RR
AGE	0.079	0.002	1.083	1.0-1.1
GCS	-0.280	<0.001	0.756	0.7-0.8
COPD	-1.919	0.047	0.147	0.0-0.9
WBC	0.030	0.043	1.030	1.0-1.1
APACHE III Score	0.037	0.002	1.038	1.0-1.1
SOFA Score-CVS Part	0.420	0.016	1.522	1.1-2.1

Figure 1.



Area Under the Curve
Test Result Variable(s): Predicted probability

Area	Std. Error ^a	Asymptotic Sig. ^b	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.840	.027	.000	.787	.894

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

Severity Assessment And Mortality Prediction in The Elderly Neurologically Compromised Patients Within The First 24-Hour of ICU Admission

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Background: In 2009, the elderly population, arbitrarily defined as age 65 years and older, reached at 39.6 million, comprising 12.9% of the U.S. population. As evidenced by this growing population, a vast majority of elderly patients are being admitted to ICU due to their critical status. Although current data suggests that age in itself plays as an independent risk factor for mortality in the ICU, factors such as co-morbidities, primary diagnosis, pre-morbid cognitive and functional status are regarded as contributing factors as well. [1, 2] [3] Severe stroke, hypertensive and traumatic intracranial hemorrhages are common causes of ICU admission for elderly patients. [4-6] Hence, we aimed to establish a model to form a scoring system using primary illness, comorbidities, physiologic and laboratory parameters obtained in the first 24-hour of admission to predict mortality in elderly neurologically compromised ICU patients.

Methodology: After IRB approval, using our ICU database from 2005-2010, we retrospectively reviewed elderly patients (age >64 years) who were admitted in our neuroscience ICU. We recorded baseline characteristics upon admission. Severity of illness was assessed daily using APACHE III, GCS, and SOFA scores. We assessed the independent contributions of primary illness, comorbidities, severity scores, and clinical and laboratory values obtained in the first 24 hours of ICU admission in a stepwise multivariable logistic regression model predicting in-hospital mortality, with significance criteria of $P < 0.05$ to enter the model and $P < 0.10$ to stay. Area under the receiver operating characteristic curve (AUROC) was calculated to assess the ability of the model to discriminate survivors from non-survivors, and the Hosmer-Lemeshow goodness of fit test was used to assess calibration of the model to the data.

Results: Of 913 elderly patients admitted to our ICU system, 584 were admitted with neurological/neurosurgical problems including strokes, traumatic and non-traumatic intracranial hemorrhages. Mean $\pm$ SD age was 76.7 ± 7.4 years. Overall mortality was 23.9%. Length of ICU stay was 33 ± 3 days. Independent risk factors for in-hospital mortality were age, smoking history, GCS, presence of CHF, presence of fever, APACHE III score at admission, and SOFA scores' hemodynamics and CNS assessment components (Table). Calibration of the model to the data was good (Hosmer and Lemeshow goodness to fit P-value of 0.77). The model including the independent risk factors was also able to predict in-hospital mortality very well, with AUROC of 0.872 (Figure).

Conclusion: In this retrospective study, smoking history, GCS, baseline diagnosis of congestive heart failure, fever at ICU admission, APACHE III score, cardiovascular and neurological components of the SOFA score at admission provided useful information to predict mortality in elderly ICU patients. Future work will have to assess the external predictive ability and calibration of our model in new ICU patients.

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Table

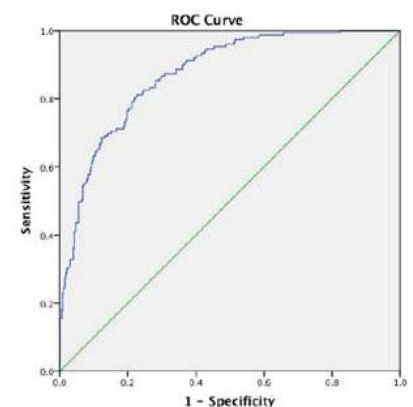
	B	p	RR	95% CI for RR
AGE (>65years)	0.66	<.001	1.068	1.0-1.1
GCS	-0.216	<.001	.806	0.7-0.9
Smoking	1.852	.002	6.375	2.0-20.3
CHF	1.139	.006	3.123	1.4-7.0
WBC	0.044	.042	1.045	1.0-1.1
Fever (>100.4°F)	0.692	.014	1.999	1.2-3.5
APACHE III Score	0.027	.005	1.027	1.0-1.0
SOFA Score-CNS Part	0.709	<.001	2.033	1.5-2.8
SOFA Score-CVS Part	0.442	.001	1.555	1.2-2.0

Area Under the Curve

Test Result
Variable(s):
Predicted
probability

Area
.872

Figure 1.



Impact of Video Laryngoscopy in a Large Tertiary Anesthesia Practice

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Background and Purpose: Fiberoptic Bronchoscopic Intubation (FOI) has been considered the gold standard for safely securing a difficult airway. The advent of video laryngoscopes (VL) provides an additional technique to manage potentially difficult airways. This study looks at the trends in airway management techniques, including the impact on FOI, before and after the introduction of VL.^{1,2}

Methods: The Mayo Clinic Anesthesia Data Mart contains a comprehensive list of anesthesia related variables. Following IRB approval, this database was queried for all airway procedures by anesthesia providers from 07/01/2007 to 12/31/2011. Only adult patients undergoing airway instrumentation were included. Data on date, type of surgery, ASA status, mask ventilation grade, direct laryngoscopy grade and airway management technique were collected. The trends in airway techniques as a percentage of total airway procedures were calculated. To assess the impact of the introduction of VL on the FOI, a pre-VL group (07-09/2007) and a post-VL group (07-09/2011) were identified and compared. Chi-square test was used to compare each airway technique between the two groups.

Results: Over the five year period, airway procedures increased by 7.9% while the total number of general anesthetics increased by 10.7%. The frequency of DL and FOI decreased while that of VL and laryngeal mask airways (LMA) increased (Figure 1). Compared to the pre-VL group, there was a significant decrease in the number of FOIs in the post-VL group (Table 1).

Table 1

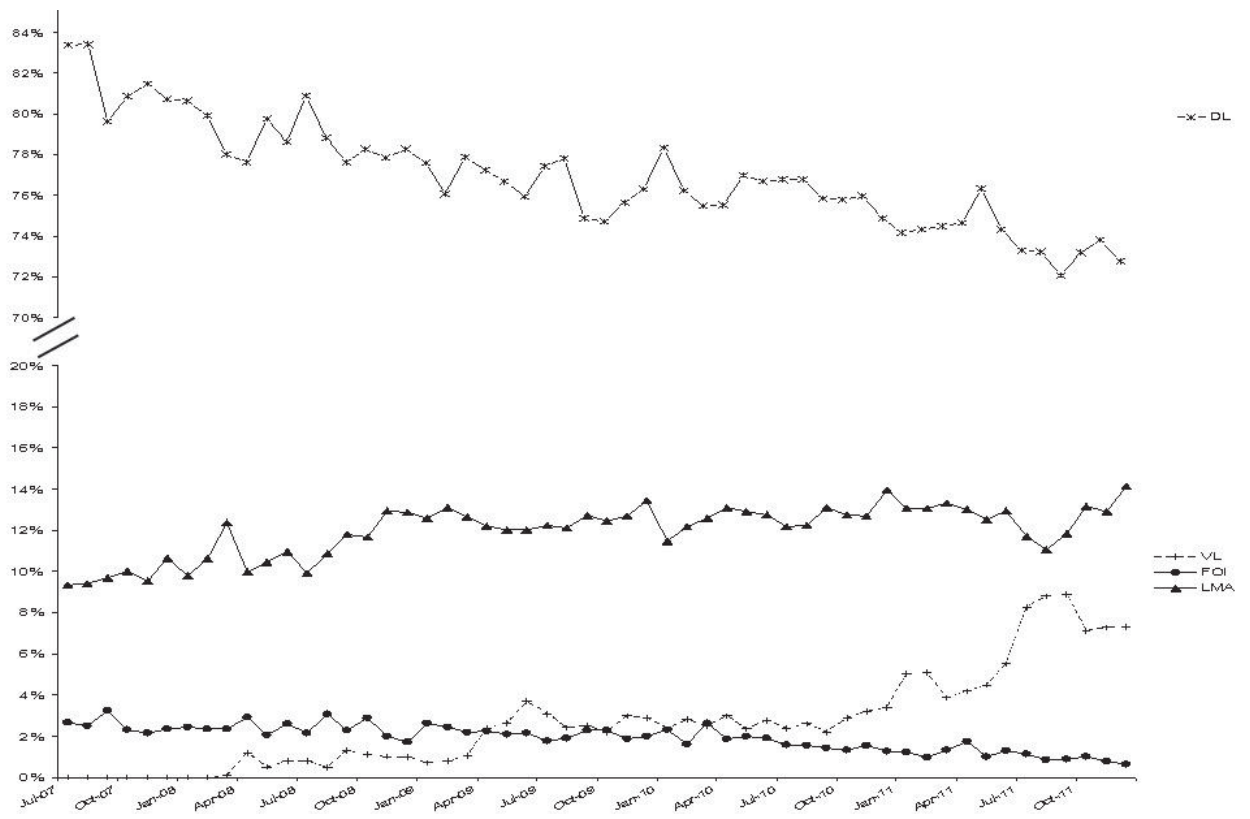
Pre-VL (%)	Post-VL (%)	p value
DL 8369 (82.24)	9195 (72.88)	< 0.01
FOB 284(2.79)	122 (0.97)	< 0.01
VL 0 (0)	1092 (8.65)	< 0.01
LMA 976 (9.59)	1454 (11.52)	< 0.01
Other 547 (5.38)	754 (5.98)	0.05
Total 10176	12617	

Pre- and Post-VL number and percent of total airway procedures. (DL = Direct Laryngoscopy, FOB = Fiberoptic Bronchoscope, VL = Video Laryngoscopy, LMA = Laryngeal Mask Airway)

Conclusion: The introduction of video laryngoscopes has resulted in a decrease in the frequency of fiberoptic intubations. The implication of this finding for trainee education, time to secure the airway which impacts operating room utilization and patient satisfaction needs further exploration.

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Gastroesophageal Reflux Disease is Not Associated With Early Postoperative Acute Lung Injury in Patients Undergoing High-Risk Thoracic And Aortic Vascular Surgery: A Retrospective Cohort Evaluation

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Mayo Clinic

Introduction: Acute lung injury (ALI) is a devastating postoperative complication with an estimated mortality exceeding 45% in certain surgical populations. Preliminary data suggest an association between gastroesophageal reflux disease (GERD) and early postoperative ALI. The objective of this investigation was to further define this potential association in patients undergoing elective high-risk thoracic and aortic vascular surgery.

Methods: After IRB approval, a retrospective cohort evaluation of the association between GERD and early postoperative ALI was performed. The study population included consecutive patients undergoing elective thoracic (esophageal and lung resection) surgery and aortic vascular surgery. Postoperative ALI was considered present if American-European Consensus Conference criteria for ALI were met within the first five postoperative days. The association between GERD and ALI was first evaluated with univariate analysis. To control for confounding factors, a subgroup analysis stratifying patients by surgical specialty (thoracic vs.

aortic vascular) and a multivariate logistic regression analysis were also performed.

Results: Out of 1845 surgical patients, 978 carried a preoperative diagnosis of GERD. A total of 120 patients developed early postoperative ALI. The frequency of ALI among those who had GERD versus those who did not was 6.9% vs. 6.1% (OR = 1.13, 95% CI = 0.78 to 1.64; $p = 0.52$). Subgroup analysis failed to identify a significant association between GERD and early postoperative ALI. After controlling for multiple confounding variables the association between GERD and ALI remained non-significant (OR 0.96, 95% CI = 0.62 to 1.49; $p = 0.849$).

Conclusion: In this investigation, GERD was not associated with early postoperative ALI in patients undergoing elective, high-risk thoracic and aortic vascular surgery. These results run contrary to recent evidence and suggest that additional well-designed studies addressing this potential association may be warranted.

Hemodynamic Relationship Between Pulse Pressure Variation And Fluid Balance

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The assessment of the intravascular volume status of ICU patients is a continuous challenge in the management of their fluid balance. Despite the importance of this evaluation, there is no single objective measure to guide the clinician. Traditionally, clinical decision making regarding fluid balance has been guided by the patient's blood pressure, heart rate, pulmonary exam, skin turgor, capillary refill, urine output, and chest X-ray. Central venous pressure (CVP) and pulmonary capillary wedge pressure (PCWP) as estimates of ventricular filling pressures have been widely used to assist in guiding fluid management despite a lack of evidence to suggest that these measurements are reliable measurements of intravascular volume.(1,2)

More recently, dynamic indices of volume responsiveness have become more widely used. These have been demonstrated to be vastly superior to invasive pressure measurements for the management of hypovolemic shock in mechanically ventilated patients. Pulse pressure variation (PPV) reflects the slope of the Starling curve at the patient's current intravascular volume. Patients on the flat portion of the Starling curve are insensitive to ventilation-induced changes in preload with a resulting low PPV, whereas those that are on the steep part of the curve have a decreased preload and high PPV.(3) Because of this relationship, PPV has been used to guide fluid management and has been shown to predict responsiveness to volume expansion in mechanically ventilated patients.(4,5)

We hypothesized that PPV may have an additional role in guiding volume removal during continuous venovenous hemofiltration or intermittent hemodialysis. We are conducting an observational study of patients undergoing renal replacement therapy to evaluate the utility of PPV in

predicting negative fluid balance. Is there an inverse correlation between PPV and fluid removal? A review of the data suggests that a higher PPV correlates with less net fluid removal during dialysis. In the patients we followed, those patients with a PPV ≥ 10 had an average positive fluid balance of 35 mL, while patients with a PPV less than 10 had an average negative fluid balance of 237 mL.

If this relationship holds true in the entire study population, these findings may permit the novel use of PPV as an objective endpoint to guide fluid removal during renal replacement therapy. Although this parameter has been previously used to determine responsiveness to fluid boluses, it may potentially guide fluid removal as well.

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Using SNOMED CT to Efficiently Identify Preoperative Patients Who Are at High Risk of Developing Postoperative Acute Lung Injury

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Introduction: Acute lung injury (ALI) is a principal cause of postoperative respiratory failure. Early identification of high-risk patients may facilitate more timely interventions as well as enrollment into ALI prevention studies. The development of universal clinical vocabularies, such as the Systematized Nomenclature of Medicine-Clinical Terms (SNOMED CT) may facilitate this time-sensitive process. The objective of this study was to determine the accuracy of SNOMED CT in identifying known risk factors for postoperative ALI.

Methods: The study population was identified from a previously established prospective cohort of 6,000 high-risk surgical patients. A random 1,000 patient subset of this cohort was utilized for the present investigation. Two patients were excluded due to duplicate entries in the dataset, leaving a study population of 998. Two independent strategies for identifying known risk factors for postoperative ALI (COPD, liver disease, diabetes mellitus, and gastroesophageal reflux disease) were then compared. The first strategy utilized recently validated automated electronic search strategies using an institutional electronic database query tool (Data Discovery and Query Builder - DDQB).⁽¹⁾ For the second data extraction strategy, SNOMED CT database queries were developed for the same list of ALI risk factors. To optimize the sensitivity of the SNOMED CT queries, a comprehensive list of applicable SNOMED CT codes was included for each variable of interest. Agreement between the two data extraction strategies (DDQB vs. SNOMED CT) was assessed with kappa statistics. Discordant results were reviewed with an exhaustive super-review of the medical record to determine the sensitivity and specificity of each search.

Results: Kappa statistics along with sensitivity and specificity of the SNOMED CT queries are presented in Table 1. The sensitivity of SNOMED CT in identifying the comorbid condition of interest was 100% for three conditions analyzed and 89% for the fourth condition. However, the specificity of SNOMED CT was inferior to that of the previously validated data extraction tool (DDQB). The majority of false positive results with SNOMED CT were due to the presence of negating terms, such as does not have history of or denies symptoms of. The panel of SNOMED CT codes could be modified to improve specificity; however, this uniformly resulted in a loss of sensitivity.

Discussion: This study evaluated the accuracy of SNOMED CT as a means of identifying established risk factors for postoperative ALI in a time efficient manner. Our results identify excellent sensitivity for identifying the conditions of interest, but specificity was suboptimal. SNOMED CT is a promising technique for the time-efficient identification of important baseline comorbidities. However, until the specificity of these strategies improves, positive cases will require further review to minimize false positive findings.

References:

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Table 1

Factor	Kappa Statistic (95% CI)	Sensitivity (95% CI)	Specificity (95% CI)
COPD	0.29 (0.25-0.33)	89% (85%-93%)	50% (46%-54%)
GERD	0.73 (0.70-0.77)	100% (99%-100%)	80% (76%-83%)
Diabetes Mellitus	0.41 (0.36-0.45)	100% (98%-100%)	36% (33%-40%)
Liver Disease	0.07 (0.05-0.10)	100% (93%-100%)	64% (61%-67%)

Compensating For Facemask Leaks During Noninvasive Ventilation (NIV) Improves Accuracy of Work of Breathing (WOB) Measurements

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Introduction: Facemask leaks during NIV predisposes to inaccurate measurements of inspiratory positive airway pressure (IPAP), expiratory positive airway pressure (EPAP), tidal volume (VT), and flow rate, resulting in errors in measuring WOB (load on inspiratory muscles during spontaneous inhalation). The purpose of this in vitro study was to determine if a facemask leak compensation algorithm applied during NIV would result in accurate measurements of WOB.

Methods: A two-lung compartment model (Michigan Instruments, TTL) composed of a driving lung inflated by a ventilator (Puritan-Bennett 7200), simulating the inspiratory muscles, caused a second lung, simulating a patient lung, to inhale. Spontaneous peak inspiratory flow rate demands (PFR), VT, and breathing frequency (f) were set by adjusting the driving lungs ventilator. Via a simulated facemask with a leak (approximately 20% of VT), an NIV ventilator (V60, Respironics) was connected to the patient lung. With a VT of 0.4 L, f 30/min, and PFR of 30 and 60 L/min, NIV settings of IPAP 5 cm H₂O with EPAP 5 cm H₂O and IPAP 10 cm H₂O with EPAP 5 cm H₂O were applied. A pressure/flow sensor, positioned between the NIV ventilator Y-piece breathing tubing and simulated facemask (site 1), and another pressure/flow sensor, positioned after the simulated facemask leak and before the patient

lung (site 2), directed data to a monitor (NM3, Respironics) and laptop computer containing leak compensation algorithm software (Convergent Engineering) for determinations of WOB per minute noninvasively (WOB_N), obviating the need for an esophageal balloon [1]. At site 1, the algorithm measures the difference in inhaled and exhaled VT (facemask leak), using the value of exhaled VT for WOB_N determinations, i. e., the leak compensated work of breathing (LC-WOB), which were compared with the actual or reference work of breathing data (A-WOB) at site 2. Data were analyzed with ANOVA, regression, and Bland-Altman analyses; alpha was set at 0.05.

Conclusions: No significant differences were found in the facemask leak-compensated WOB data compared to the actual patient WOB data. The facemask leak compensation algorithm predicted or explained 97% of the variance in WOB measurements. The algorithm accurately determined WOB, and, thus, VT and changes in pressure in the presence of a facemask leak. WOB data during NIV may be useful for guiding ventilator settings to appropriately unload inspiratory muscles.

Reference: 1. Banner MJ, et al. Crit Care Med 2006; 34: 1052-9.

PFR (L/min)	NIV setting (cm H ₂ O)	LC - WOB (Joule/min)	A - WOB (Joule/min)
30	IPAP 5, EPAP 5	3.26 ± 0.2	3.26 ± 0.22
	IPAP 10, EPAP 5	2.46 ± 0.2	2.5 ± 0.2
60	IPAP 5, EPAP 5	5.4 ± 0.3	5 ± 0.4
	IPAP 10, EPAP 5	3.8 ± 0.4	3.8 ± 0.4

The relationship between LC-WOB and A-WOB was $r = 0.98$, $r^2 = 0.97$ ($p < 0.006$), bias = 0.28 Joule/min, and precision = 1.13 Joule/min.

Fetal, But Not Adult Acetylcholine Receptors Are Upregulated Following Muscle Immobilization And Systemic Inflammation

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Introduction: Systemic inflammation and muscle immobilization are main etiologic factors for intensive care unit-acquired muscle weakness. These patients regularly suffer from muscle weakness, delayed weaning from respirators and prolonged rehabilitation. Upregulation of acetylcholine receptors after inflammation and immobilization have previously been described and are considered to be a pathophysiological factor. To date, little is known about the differential upregulation of the acetylcholine receptor isoforms. In this study, we analyzed the qualitative and quantitative expression of fetal and adult acetylcholine receptor isoforms in a latin-square rat model of inflammation and immobilization.

Material and Methods: To induce a systemic inflammation response syndrom (SIRS), 8 male Sprague-Dawley rats received three i.v. injections of heat-inactivated corynebacterium parvum (c.p.). Another 8 animals served as control and received saline. The groups were further divided to have one hind limb (op-leg) either immobilized by pinning knee and ankle or sham immobilized. The respective other leg served as control (non-op-leg). After 12 days, the animals were killed and the tibialis anterior muscles were excised. Adult and fetal acetylcholine receptor expression was quantified by Western Blot (WB), while their cellular

distribution was localized by immunohistochemistry (IHC). Data were statistically analyzed by Wilcoxon-, Mann Whitney-U- and Chi-squared-Test ($p < 0.05$).

Results: One animal of the SIRS-immobilization group died following the bacterial injections. Immobilization leads to an upregulation of fetal acetylcholine receptors (Table 1). The peak expression of fetal acetylcholine receptors occurs after the combination of immobilization and inflammation. The fetal acetylcholine receptors were cellularly predominantly localized on the surface of the muscle cells as well as at the neuromuscular junctions. The expression of adult acetylcholine receptors expression was not affected; neither by immobilization nor inflammation nor the combination of both (Table 1).

Conclusion: Immobilization leads to an isolated upregulation of fetal acetylcholine receptors without affecting the expression of the adult isoform. While inflammation alone was not able to significantly affect acetylcholine receptor expression, the combination of inflammation with immobilization had synergistic effects on acetylcholine receptor upregulation.

Group	Fetal Acetylcholine Receptor [Arbitrary Units]		Adult Acetylcholine Receptor [Arbitrary Units]	
	<i>op-leg</i>	<i>non-op-leg</i>	<i>op-leg</i>	<i>non-op-leg</i>
<i>saline + sham immobilization</i>	0.91 ± 0.12	0.91 ± 0.18	0.90 ± 0.18	0.96 ± 0.22
<i>saline + immobilization</i>	2.24 ± 0.49 ^{**}	0.96 ± 0.14	0.84 ± 0.11	1.13 ± 0.96
<i>c.p. + sham immobilization</i>	1.48 ± 0.74	1.41 ± 0.39	0.85 ± 0.39	1.21 ± 0.30
<i>c.p. + immobilization</i>	5.77 ± 2.75 ^{*§#}	1.86 ± 1.25	1.06 ± 0.17	1.04 ± 0.40

* $p < 0.05$ immobilization versus sham immobilization

§ $p < 0.05$ c.p. versus saline

$p < 0.05$ op-leg vs. non-op leg

Postoperative Outcomes After Etomidate Induction in Cardiac Surgery

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Introduction: Etomidate is widely used for induction of anesthesia in cardiac surgery patients due to its rapid onset of action and favorable hemodynamic profile. However, transient adrenal insufficiency is frequently observed after even a single dose and may last up to 48 hours. The potential for association with increased mortality, vasopressor requirement, and other unfavorable outcomes has raised concern over whether etomidate is safe to use in this population. Studies in trauma, septic, and cardiac patients show an association between etomidate and corticosteroid use, but provide conflicting data on vasopressor requirements and outcomes. The aim of this study was to determine the association between etomidate use and adverse postoperative outcomes in cardiac surgery patients.

Methods: A retrospective multivariate analysis was conducted on 3,294 consecutive patients undergoing cardiac surgery at a single academic center from 2006-2009. Major postoperative hypotension was defined as a sustained norepinephrine requirement >15mcg/min. The multivariate model included induction drug, age, sex, body mass index, preoperative creatinine, history of diabetes, history of congestive heart failure (CHF), cardiogenic shock, IABP use and type of surgery. Only variables considered to be the most important confounders were included in the model.

Results: Sixty-one percent of patients received etomidate alone or with other agents for induction. Major postoperative hypotension occurred in 10% of patients, 3.9% of patients were reintubated, and 3.8% of patients died within 30 days of surgery. Patients that received etomidate had a lower mortality compared to patients that did not by univariate analysis (3.1% vs 5%, $P=0.008$). After adjusting for other covariates, etomidate

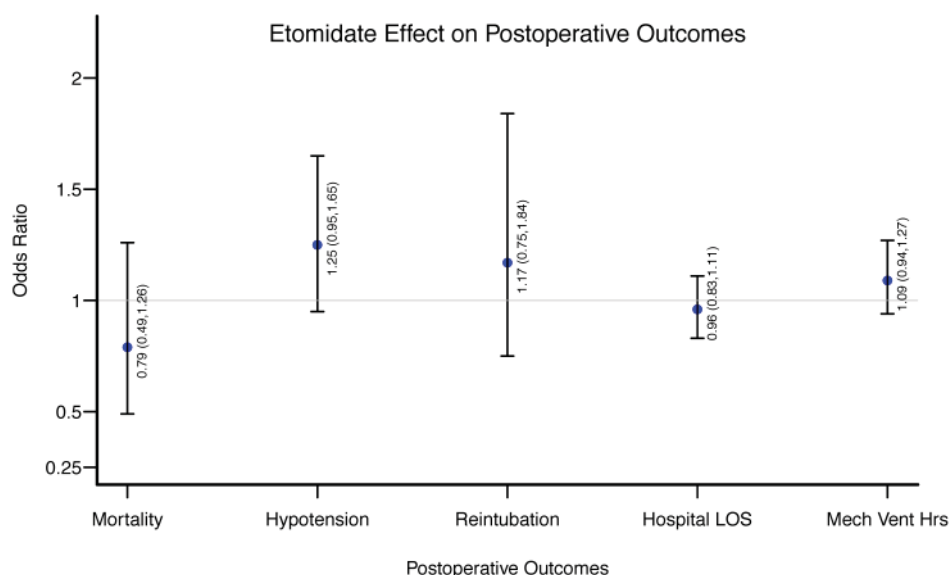
use was not associated with a significantly increased risk of major postoperative hypotension (OR 1.25; 95%CI 0.95-1.65), reintubation (OR 1.17; 95%CI 0.75-1.84), longer mechanical ventilation hours (OR 1.09; 95%CI 0.94-1.27), longer length of hospital stay (OR 0.96; 95%CI 0.83-1.11) or mortality (OR 0.79; 95%CI 0.49-1.26).

Conclusion: Single-dose etomidate is not associated with an increased risk of mortality or other adverse postoperative outcomes in this diverse cardiac surgery population. These results suggest that etomidate is an acceptable choice for induction in cardiac surgery patients.

Figure: In multivariate analysis, etomidate was not associated with adverse outcomes. Data are displayed as odds ratio with 95% confidence interval.

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The Utilization of Critical Care Services Among Patients Undergoing Spine Fusion Surgery

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Background: To date, no studies are available to determine the impact of the increasing number of patients undergoing spine fusion surgery on the utilization of critical care services. We therefore sought to identify 1) the incidence of the utilization of critical care services, 2) compare demographics of patients that did require such services to those that did not, 3) determine risk factors for the requirement of critical care service, and 4) determine the differences in outcomes between the two groups.

Methods: Data collected by Premier INC. from approximately 350 hospitals between 2006 and 2010 was accessed. Patients who underwent posterior lumbar spine fusion were identified and included in our analysis. Patient (age, gender, race, comorbidity burden, surgical indication, and number of levels fused) and health care system (hospital size, location, teaching status) related demographics for patients requiring intensive care services were compared to those who did not. The prevalence of comorbidities and postoperative complications were compared between groups. Differences in outcomes such as mortality, disposition status and hospital charges and length of stay were analyzed. A regression analysis was performed to identify risk factors for the requirement of intensive care services.

Results: We identified 95,760 entries for patients who underwent primary posterior lumbar fusion. Of those, 10% required intensive care services. Intensive care patients were on average 3.6 years older ($P<0.0001$), more frequently female (55.6% vs. 44.4%, $P<0.0001$), had a higher average comorbidity burden (average Deyo Index 0.8 vs. 0.5, $P<0.0001$) and higher incidence of individual comorbidities. Intensive

care services were utilized more frequently in large and medium sized hospitals, in an urban settings and amongst teaching institutions than in small, rural and non-teaching facilities.

Patients requiring intensive care services were operated on an increasing number of spinal levels and incurred major complications, including those affecting the cardiac, pulmonary, and renal system more frequently. Among intensive care patients, the average length of hospital stay was almost double (7.6 vs. 3.8 days, $P<0.0001$). These patients had higher mortality rates (1.14% and 0.04%, $P<0.0001$), were less likely to be discharged home (60.9% vs. 85.5%, $P<0.0001$) and more frequently required mechanical ventilation (10.6% vs 0.4%, $P<0.0001$) and blood transfusions (32.2% vs 11.2%, $P<0.0001$) compared to their non-critical care counterparts. Average hospital charges were significantly higher for intensive care versus non-intensive patients (146,659 vs. 84,729, $P<0.0001$). The risk factors with the highest odds for the requirement of intensive care services were postoperative complications, especially pulmonary, myocardial infarction and shock.

Conclusion: One in ten patients undergoing posterior lumbar spine fusion requires intensive care services. Given the large number of procedures performed in the US per year, critical care physicians need to familiarize themselves with particularities of this patient population. Clinicians and administrators need to be aware of the significant clinical and economic impact this population represents and allocate resources accordingly.

The Surgical Home: Decreased Mortality in Critically Ill Patients

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Background: Within anesthesiology, there is discussion regarding the surgical home as a model for the future of anesthesiology-- this is the care by anesthesiologists ought to encompass the pre-operative through and into the post-operative period. At the Keck Medical Center, there is a group of anesthesiologists whose practice reflects this model. Preparations are made with the surgeons prior to the day of surgery and management is extended through the intra-operative period into the post-operative period in the critical care unit. We hypothesized that with the development and implementation of a care plan spanning the critical phases of patient care along with a decrease in number of providers that there would be a measurable impact on mortality.

Methods: Five hundred ninety-five patients spanning a one year period from November 2010 through November 2011 were analyzed. Data was extracted from an IRB approved database of critical care patients. Thirty day mortality was determined as death within 30 days of the final ICU day inclusive. Using McNemar's test, all demographic, comorbid conditions, and surgeries were analyzed and considered for regression analysis if $p \leq 0.10$. Outcomes were dichotomized to the peri-operative team vs. other anesthesia providers and analyzed by logistic regression.

Results: After analysis, care provided by the peri-operative team was associated with a reduced mortality by both McNemar's test ($p < 0.001$) and logistic regression (OR 0.53; $p = 0.043$). While the majority of patients were primarily urologic, other surgical pathologies were present so the data was again analyzed comparing the mortality as determined by the Mortality Probability Model II. Predicted admission mortalities for the peri-operative team and non peri-operative teams were not statistically different (13.3% vs 14.0%) indicating that the severity and acuity were unlikely to be the cause of this difference.

Conclusions: This study highlights that a key outcome to patient care: mortality, can be improved by implementation of a surgical home model; however, there may be unknown factors at play influencing these outcomes which were not analyzed such as choice of intra-operative and post-operative therapies or impact of secondary providers and as such further study is needed to validate the results.

Tracheal Stenosis And Obstruction Due to Plastic Bronchitis in a Post-Adrenalectomy Patient: Case Report

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The patient is a forty-six year old woman who was brought to the operating room for excision of a cortisol secreting tumor. Patients medical history is significant for hypertension, obstructive sleep apnea and morbid obesity. The intra-operative course was uncomplicated and she was extubated the following morning and transferred to the floor in the afternoon of post-operative day one. The following day, the critical care resident was called by nursing to evaluate the patient for wheezing. The patient had productive sputum, no accessory muscle use, was hemodynamically stable, and improved her ventilation after a breathing treatment. On post-operative day three, her surgical team transferred her back to the critical care service over concern from this episode. A computed tomography scan was obtained to evaluate for pulmonary embolism but revealed a long standing tracheal stenosis to a diameter of 5mm. Also present in the CT scan were ground glass opacities.

The following morning, post-operative day four, the patient became apnic after a straining. The critical care team resuscitated the patient, securing an airway and restoring normal hemodynamics. During intubation, she was found to have an unexpectedly difficult airway. Only after forcing the endotracheal tube through what was described as a solid object, was a size 6 endotracheal tube placed. As a result, the patient was hypoxic for approximately five minutes. Patient's respiratory function remained concerning with significantly elevated airway pressures and pulmonary

artery pressures; oxygenation and ventilation were maintained with difficulty and inhaled nitric oxide and high dose nitroglycerin were initiated with minimal improvement.

She was taken to the operating room for treatment of her tracheal stenosis by otolaryngology. During the course of the surgery, a solid cast was pulled from her trachea and her trachea was debrided of residual gray-white fibrinous material. No stenosis was found. During bronchoscopy viscous, cast-like material was removed from her left lung; the material being so thick as to not pass through the bronchoscope. Analysis of the casts revealed no organism and pathologically was described as consisting of fibrin, mucin and neutrophils. The patient subsequently underwent additional bronchoscopies for progressive and recurrent respiratory difficulty, each of which resulted in the removal of the same viscous casts from her lungs. Each analysis revealed the same pathology with a solitary positive culture for coagulase negative staphylococcus and she was treated as if she had an hospital acquired pneumonia. Despite aggressive resuscitation and cardioprotective measures, the patient had significant hypoxic brain damage and remained in a persistent vegetative state. A final diagnosis of plastic bronchitis was made on a combination of clinical picture and pathology analysis of the specimens.

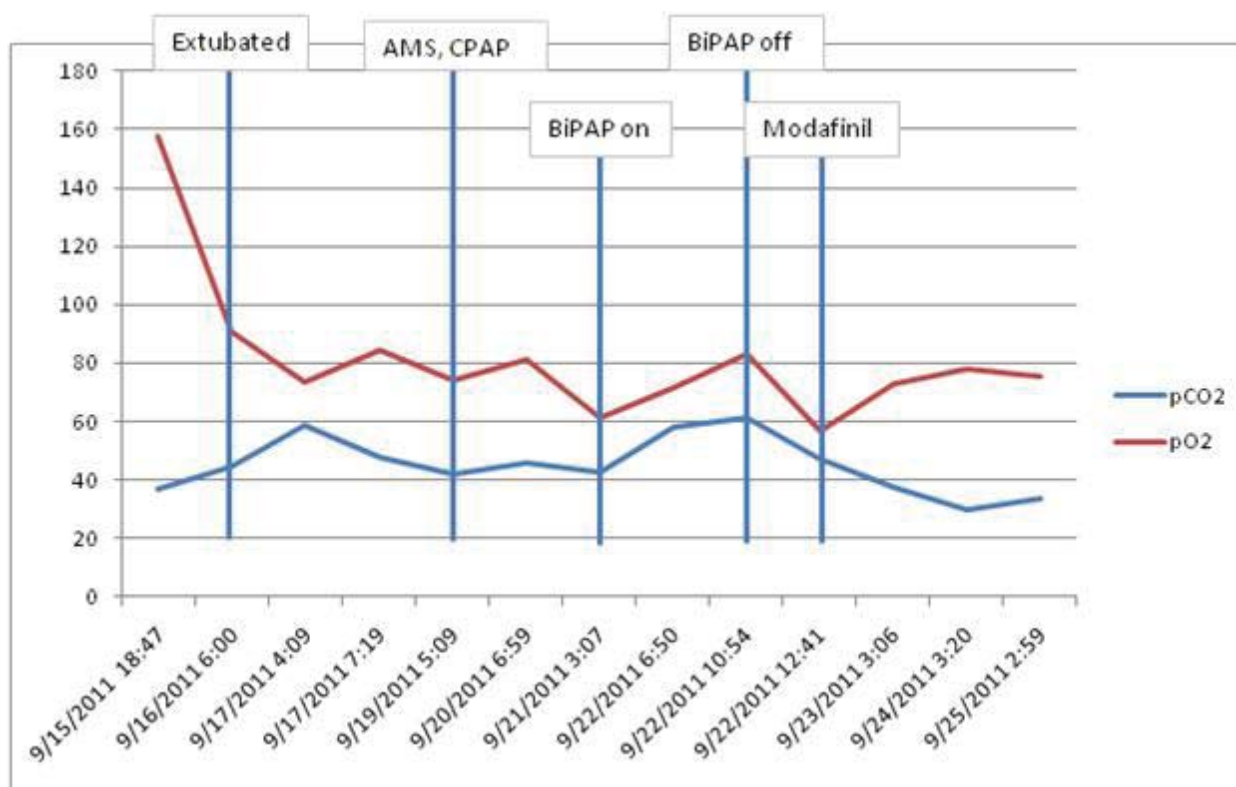
Severe Post-Operative Obstructive Sleep Apnea And Its Successful Treatment With Modafinil: Case Report

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The patient is a sixty-six year old male with a history of coronary artery bypass graft, ischemic cardiomyopathy, renal cell carcinoma and obstructive sleep apnea which resulted in prior re-intubation after a cholecystectomy. Patient was taken to the operating room for a robotic partial nephrectomy; the patient's operative course was uneventful and he was admitted to the intensive care unit, intubated, for management. He was subsequently extubated without difficulty the following morning.

The patient's course was complicated initially by acute tubular necrosis from extended renal artery clamping. It was the third post-operative day when the patient's wife approached the critical care team expressing her concern that her husband was not acting normally. Initial evaluation revealed somnolence but not altered mentation. Concern arose that his somnolence was due to the residual concentration of renally excreted medications and their metabolites; however, the subsequent day, he became confused with low oxygen saturations both during the day and night despite supplemental oxygen. Continuous positive pressure

ventilation and doxapram were begun during the night with improvement of his arterial oxygenation. He remained excessively somnolent during the day and his wife again expressed concern that he was not acting per his usual fashion. All opioids, sedatives and medications with known risk for sedation and altered mentation were ceased without resolution. Computed tomography of the patient's head did not reveal any pathology while repeat arterial blood gas during the day revealed low oxygen saturation. He was again started on BiPAP with improvement in his oxygenation but his carbon dioxide worsened and the patient's mentation further deteriorated. The BiPAP was the presumptive etiology for his worsening CO₂ retention and was discontinued. His arterial blood gas improved but not his depressed mentation. As a last resort, he was begun on modafinil. Later that morning he was no longer somnolent, his blood gas improved and his wife was satisfied with his behavior. The patient was observed in the ICU over the following two days, discharged from the intensive care unit to the floor and the following day, home.



An Evaluation of The Association Between Intraoperative Events And Patient Responses And Development of Postoperative Acute Lung Injury in Patients Undergoing High-Risk Aortic Vascular And Thoracic Surgery: A Retrospective Cohort Study

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Introduction: Acute lung injury (ALI) is a potentially lethal complication following high risk aortic vascular and thoracic surgery. As no effective treatment option exists, prevention is a key to mitigating the impact of this life-threatening syndrome. To this end, an improved understanding of the risk factors associated with postoperative ALI is imperative. The objective of this investigation was to evaluate the associations between intraoperative events and associated patient responses and the development of postoperative ALI among patients undergoing high-risk aortic vascular and thoracic surgery.

Methods: The study population included consecutive patients undergoing elective high-risk aortic vascular and thoracic (lung and esophageal resection) surgery. The associations between six pertinent intraoperative variables [American Society of Anesthesiologist's Physical Classification Status (ASA status), duration of anesthesia, intraoperative blood transfusion, surgical fluid balance, intraoperative tidal volume and intraoperative peak airway pressure] and development of postoperative ALI were evaluated with univariate analyses. To further evaluate these potential associations, multivariate logistic regression was subsequently performed.

Results: Following IRB approval, a total of 1,845 unique high-risk patients were identified for included in this investigation. 588 (31.9%)

underwent aortic vascular surgery and 1,257 (68.1%) underwent thoracic surgery. One-hundred and twenty study participants (6.5%) developed postoperative ALI. In the univariate analyses, five of the six intraoperative variables evaluated were associated with postoperative ALI (Table 1). In the multivariate logistic regression analysis, intraoperative transfusion (OR = 1.89, 95% CI = 1.06–3.41; $p = 0.03$), surgical fluid balance (OR = 1.17, 95% CI = 1.12–1.23; $p < 0.01$), and median peak airway pressure (OR = 1.09, 95% CI = 1.04–1.14) remained statistically significant predictors of postoperative ALI. ASA class, duration of anesthesia, and median intraoperative tidal volume were not associated with postoperative ALI in the adjusted analyses.

Conclusion: In patients undergoing high-risk aortic vascular and thoracic surgery, we identified the administration of blood products, surgical fluid balance, and median peak airway pressure as significant intraoperative predictors of postoperative ALI. These findings may provide an opportunity for improved ALI risk stratification while also identifying potentially modifiable ALI risk factors.

Funding: This research was supported by Grant Number 1 KL2 RR024151 from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH), and the NIH Roadmap for Medical Research.

Table 1. Anesthesia-related risk factors for postoperative ALI. Variable	Odds Ratio	95% CI	p-value
ASA score ≥ 3	2.40	1.43 – 4.34	< 0.01
Duration of anesthesia ^a	1.00	1.00 – 1.00	0.16
Intraoperative blood transfusion ^b	4.35	2.88 – 6.75	< 0.01
Surgical fluid balance ^c	1.21	1.17 – 1.26	< 0.01
Intraoperative tidal volume ^d	1.07	1.02 – 1.12	< 0.01
Intraoperative peak airway pressure ^e	1.09	1.05 – 1.14	< 0.01

ASA = American Society of Anesthesiologist's Physical Classification Score

a = per 30 minutes, b = yes/no, c = per liter, d = per 25 ml, e = per cm H₂O

Anaphylactoid Reaction During Treatment of Severe Hemorrhagic Shock

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We present a 75 yo male, with unknown past medical history, who was crushed by a forklift sustaining traumatic intra-abdominal injuries. He was urgently taken to the operating room where he received an exploratory laparotomy with uneventful intraoperative blood transfusions. Postoperatively in the intensive care unit, despite these interventions, the patient remained in hemorrhagic shock requiring continued resuscitation with intravenous fluids and a phenylephrine drip. His clinical course became more challenging due to severe vasodilatation just a few minutes into consecutive blood transfusions. This effect was linked to the transfusion and disappeared after discontinuation of each unit. Due to ongoing hemorrhagic shock and severe anemia, immediate transfusion was required. Washed blood products were requested, but unable to be obtained for a couple of hours. Thus he was pre-medicated with steroids, diphenhydramine, and famotidine. An epinephrine infusion was initiated and titrated to maintain normal vascular tone and peak airway pressures during the administration of unwashed blood products. The patient's hypersensitivity to packed red blood cells disappeared within 48 hours.

We believe that the patient's hypotension was due to an anaphylactoid reaction to the blood transfusion. The blood that the patient received was confirmed to be the correct blood type, he was IgA negative upon testing, and there were no signs of infection. In addition, there were no signs of hemolysis in his blood and urine. His current medication list was examined with no obvious causes found. No other immunologic testing was performed; therefore we are classifying this as an anaphylactoid reaction manifested by severe hypotension.

Anaphylaxis is generally used to describe anaphylactic and anaphylactoid reactions as they are clinically indistinguishable from each other. The distinction between them lies in whether the reaction is specifically

mediated by IgE or not.(1,2) The incidence of anaphylaxis to blood transfusion is rare. The Cleveland Clinic transfusion service reported the incidence of severe allergic reaction at about 1:57,869 in contrast to radiocontrast-mediated reaction, the most common cause of iatrogenic anaphylactic reaction, at 1:450.(1) IgA deficiency is the most recognized cause of anaphylactic reaction in blood transfusion, yet it is not the most common cause at only 18%.(4) Most causes are unknown.

Treatment usually entails termination and avoidance of the offending agent. Our challenge in this case was that the blood transfusion was linked to this anaphylactoid reaction, yet this offending agent was needed to treat his hemorrhagic shock. The use of an epinephrine infusion during the administration of an anaphylactoid-causing agent is one that has rarely been reported as it is usually used to support a patient hemodynamically after the offending agent has been discontinued. Thus we are offering another approach to the treatment of anaphylactoid reaction.

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Tracheostomy After Cervical Spine Fusion Surgery Incidence, Risk Factors And Outcome

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Background: The population-based incidence and characteristics of patients requiring a tracheostomy in conjunction with cervical spine fusion surgery is unknown. In this study utilizing a national representative database, we sought to (1) identify the rate of tracheostomy after cervical spine fusion, (2) determine the associated demographics and (3) analyze outcomes between groups that did or did not require such an intervention.

Materials and Methods: Data collected for the National Inpatient Sample between 1998 and 2009 was accessed and queried for records of patients who underwent cervical fusion surgery. Within this sample, we compared patients with procedure codes indicating tracheostomy performance during the same hospitalization to those without, with regard to patient and health care system related demographics and the incidence of postoperative complications.

Results: An estimated 1,634,408 cervical spine fusion surgeries were performed between 1998 and 2009. Tracheostomy was performed in 0.99% (n=16,261). Patients undergoing tracheostomy, when compared to those who did not, were on average younger (48.3yrs vs 51.0yrs*), had a slightly lower comorbidity index (mean Deyo score: 0.37 vs 0.41*), and the fraction of male patients was higher (74.16% vs 49.84%*). The indications for surgery were different between the tracheostomy vs non-tracheostomy groups (trauma: 69.72% vs 5.22%*; degenerative causes:

12.58% vs 83.05%*; oncologic: 1.55% vs 0.51%*). In tracheostomy patients, in-hospital mortality and the incidence of major complications were increased (mortality: 9.87% vs 0.30%*; acute respiratory distress syndrome: 43.47% vs 0.97%*; pulmonary embolism: 3.21% vs 0.11%*; thromboembolic complications: 8.35% vs 0.30%*; cardiac complications: 2.75% vs 0.39%*; infectious complications: 3.28% vs 0.18%*). Moreover, these patients required blood product transfusion significantly more frequently (11.81% vs 1.62*).

* all P<.0001

Conclusion: When considering a large national patient sample, we identified a significant number of patients requiring a tracheostomy in conjunction with cervical spine fusion surgery. Although they were younger and had a lower comorbidity burden, patients who underwent tracheostomy had increased rates of perioperative complications and mortality. This may in part be attributed to the critically ill condition of some of these patients, especially those being operated on after traumatic spine injury. However, also patients admitted electively for degenerative indications were affected. Administrators and clinicians can use this data to generate hypotheses for further research and for resource allocation. Ongoing analysis of our data is targeted to identify trends and risk factors for the performance of a tracheostomy.

Eliminating Central Line-Associated Bloodstream Infections: A National Patient Safety Imperative

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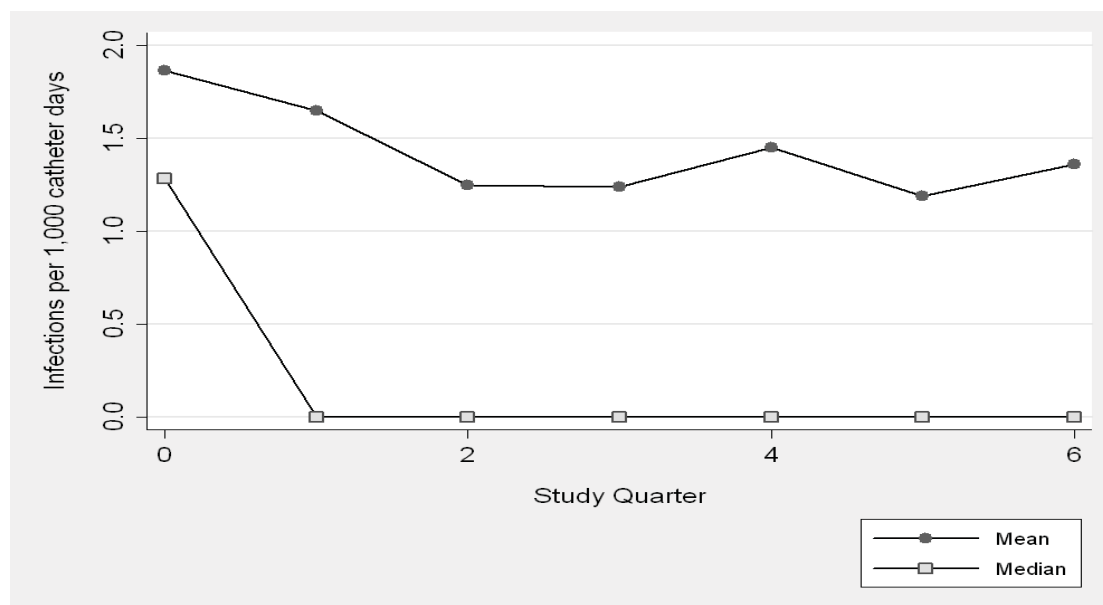
Introduction: Previous studies have demonstrated that central line-associated bloodstream infections (CLABSI) are preventable using a collaborative approach involving a checklist of evidence-based practices to prevent CLABSI, culture change, and feedback of performance. Their results were not only sustained, but were associated with a reduction in mortality and a significant cost savings. Despite their success, it is unknown whether these types of patient safety programs can be successfully spread across the U.S. As part of U.S. Department of Health and Human Services National Initiative to Reduce Healthcare-Associated Infections, the Agency for Healthcare Research and Quality and private philanthropists funded a national effort, known as the On the CUSP: Stop BSI project, to reduce these infections.

Methods: The On the CUSP: Stop BSI program was led by three entities, The Health Research & Educational Trust (HRET), The Johns Hopkins Medicine Armstrong Institute for Patient Safety and Quality, and The Michigan Health & Hospital Association. The program was organized as a state-level collaborative structured around the state sponsor, with centralized education, data collection, and coordination functions provided by the national team. We evaluated the impact of the program on quarterly CLABSI rates among adult intensive care units (ICUs) that implemented the program in 2009 and 2010. The program goal was to achieve a statewide mean CLABSI rate of <1 (median of 0) infection per 1,000 catheter-days, using standardized definitions from the National Healthcare Safety Network. Multilevel Poisson regression modeling compared infection rates at baseline, during the implementation period, and post-implementation up to 18 months after the intervention was carried out.

Results: A total of 856 ICUs from 610 hospitals in 31 states, reporting 24,048 ICU-months and 3,236,340 catheter-days of data were included in the analysis. CLABSI rates decreased during all observation periods compared to baseline, with incidence-rate ratios (IRR) steadily decreasing to 0.61 (95% confidence intervals [CI], 0.51-0.73) at 10 to 12 months post-implementation and an IRR of 0.59 (95% CI, 0.47-0.75) at 16 to 18 months (P=0.13 and P=0.03, respectively). The number of ICUs that achieved a median CLABSI rate of 0 per 1000 catheter-days increased from 205 (28%) at baseline to 539 (69%) at 10 to 12 months post-implementation and 338 (65%) at 16 to 18 months post-implementation (P<0.0001 for both). States achieving the program goal increased from 2 (7%) at baseline to 31 (100%) at 10 to 12 months post-implementation and 20 (91%) at 16 to 18 months post-implementation (P<0.0001 for both).

Conclusion: Coincident with the implementation of the national On the CUSP: Stop BSI program was a significant and sustained decrease in CLABSIs in 854 ICUs, demonstrating an overall 41% decrease by the end of the study, providing further evidence that the majority of these infections are preventable. Our results demonstrate that the On the CUSP: Stop BSI national program can be spread across the U.S. and lead to significant and sustained reductions in CLABSIs. It may also serve as a national model for reducing other causes of preventable harm and death.

Figure 1. Quarterly Rate of Central Line-Associated Bloodstream Infections for Baseline Through 18 Months of Follow-up



Perioperative Monitoring of Intracranial Pressure During Liver Transplantation Using Optic Nerve Sheath Diameter

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Introduction: Development of cerebral edema and increased intracranial pressure is a major concern in patients with acute liver failure. The benefit of knowing a patient's intracranial pressure (ICP) in the OR and ICU is to possibly institute therapy to help temporize the development of brain herniation while waiting for organ availability or during the liver transplant. However the ability to monitor and initiate therapy for this condition is greatly impaired due to a severe coagulopathy in these patients. Recently, there has been a growing literature base of the use of optic nerve ultrasound, an easily performed bedside tool, to detect elevations in ICP. We present two cases of acute liver failure for liver transplantation where we used optic nerve ultrasound to monitor ICP changes during the perioperative period.

Case Report: A 40-year-old female without significant past medical history presented to our institution in acute liver failure. A head CT revealed signs of increased ICP but due to severe coagulopathy an ICP monitor was not placed. The second patient was a previously healthy 48-year-old male admitted with fulminant hepatic failure. A CT scan of his head demonstrated diffuse generalized brain swelling and no invasive ICP monitoring was instituted due to severely abnormal coagulation studies. Both patients were listed as Status 1 and suitable organs became available shortly thereafter.

During both transplants we measured optic nerve sheath diameter every hour and treated the patient if increased ICP, evidenced by an enlarged optic nerve sheath diameter, was a concern. In patient 1 we noticed a mild increase in the optic nerve diameter, and we instituted therapy to

decrease ICP. After these maneuvers were initiated and the donor liver had been anastomosed, the optic nerve diameter slowly returned to its baseline value. Patient 2 was also monitored, but we did not appreciate an increase in diameter during the case, so no treatment was initiated.

Discussion: The use of ultrasound to measure optic nerve diameter has been described in various papers and case series for over a decade (1,2). Traditionally, ICP has been measured invasively, but carries the risk of significant bleeding even in non-coagulopathic patients. As described by many authors including Rajajee et al (3), we identified the diameter of the optic nerve sheath 3 mm below the retina and obtained all of our measurements at this distance. In the largest case series, the sensitivity was reported as 96% and the specificity as 94% using a cutoff value of >0.48cm for the optic nerve sheath diameter for an ICP >20 [3]. With the aid of this non-invasive technique, excellent neurologic outcomes were achieved in both of our acute liver failure patients.

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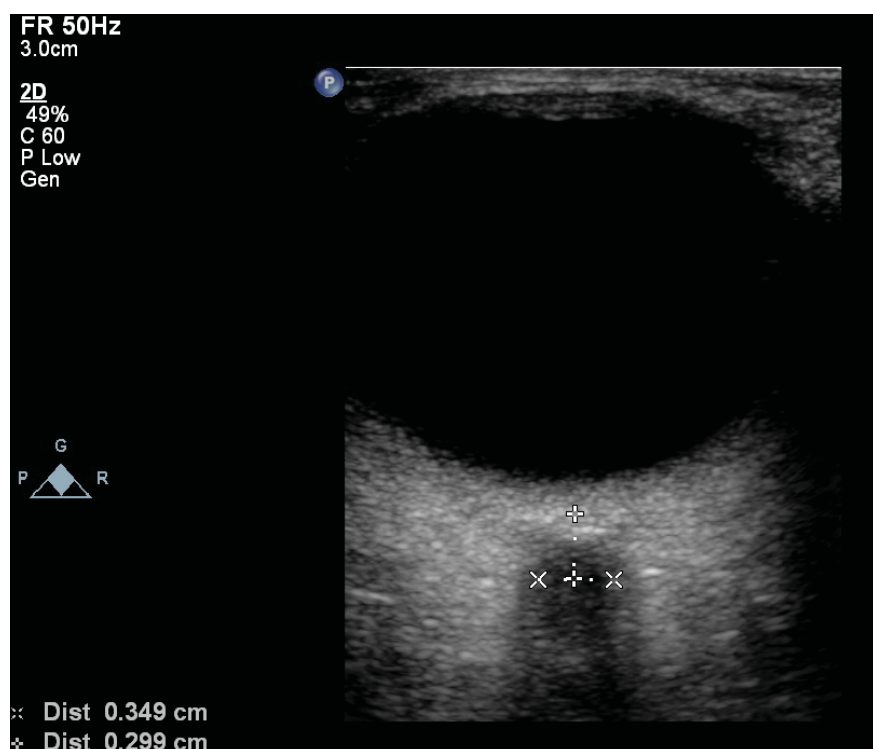


Figure 1. Baseline optic nerve sheath diameter of patient 1.

Nitroglycerin Infusion Preventing Transfusion-Related Acute Lung Injury

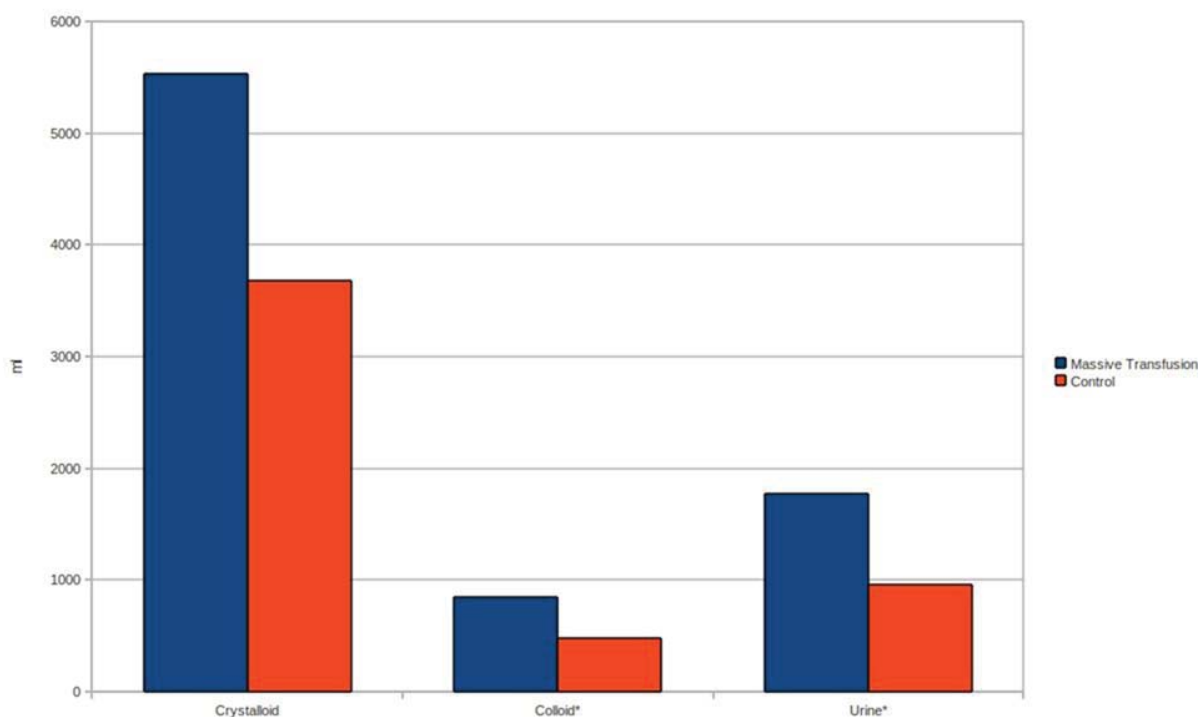
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Introduction: Acute lung injury (ALI) is a well known complication following the transfusion of blood products and is commonly referred to as transfusion-related acute lung injury (TRALI). TRALI is the leading cause of transfusion-related mortality. The incident of TRALI is estimated to occur in 0.04-0.16% of all transfused patients. Pathogenesis of TRALI is not completely understood, however, it is hypothesized that it may be related to donor antibodies such as anti-human leukocyte antigens (HLA) and anti-human neutrophil antigens (HNA) either against recipient leukocytes causing pulmonary endothelium damage and capillary leak. This capillary leak leads to pulmonary edema and TRALI. There are studies showing protective properties of endogenous release nitric oxide by pulmonary vasculature that can attenuate acute lung injury, hypothesized to be by inhibiting accumulation of neutrophil in lung, against pulmonary microvascular permeability, and against the oxygen free radical injury to lung.

Methods: The study was an IRB approved retrospective study encompassing patients admitted to the anesthesia intensive care unit (AICU) from November 2010 through November 2011 after genitourinary cases. 595 patients were in the database and evaluated during this time of which 36 had intra-operative massive transfusion (defined in the literature as greater than 6 units of pRBC). All of our massive transfusion patients had been maintained on an infusion of nitroglycerine (NTG) intraoperatively of approximately 33.3mcg/kg/min. This group was compared to other patients within the population as control who received either no blood transfusions or received less than 6 units.

Results: The analysis shows incidence of TRALI in our ICU study patients was 0% while the predicted incidence of TRALI after massive transfusion is 24-36%. Inclusion of other blood products (i.e. fresh frozen plasma/platelets) did not reveal additional patients meeting massive transfusion criteria. The mean number of units transfused in the study groups vs. control was 16.5 vs 0.5 ($p < 0.001$). The mean duration of post-operative mechanical for massive transfusion patients on ventilation was 7.5 days vs 0.77 ($p < 0.001$) for control group. Five patients from 595 in the database met criteria for TRALI or ARDS of which none had massive transfusion nor intra-operative NTG.

Conclusion: Reduced vascular nitric oxide levels can contribute to vasoconstriction, inflammation, and thrombosis in pulmonary vasculature. We hypothesize that using a systemic NO donor, nitroglycerin (NTG), significantly decreases the risk of TRALI during intraoperative massive transfusion. The proposed mechanism is due to the venodilatory and vasodilatory effects of NTG to improve pulmonary perfusion as well as inhibit inflammatory factors released by the endothelium. As shown by Kawashima and colleagues, NTG stimulated production of cGMP which acts as an intracellular second messenger in relaxing vascular smooth muscle, inhibits platelet adhesion and aggression, and adjusts vascular permeability on animal studies. These events may prevent pulmonary edema and lung tissue damage imposed by massive transfusion intraoperatively. Most importantly, NTG has a very short half-life and titrated easily.



Near-Fatal Angioedema Compromising The Airway in a Patient Following ACEI Substitution

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Case Report: Angioedema (AE) is a side effect of Angiotensin Converting Enzyme (ACE) Inhibitor therapy. We report a rare case in which a patient who had tolerated years of therapy with enalapril, developed life-threatening angioedema after being switched to ramipril in the hospital. Patient is an 81 year old with Past Medical History of Peripheral Vascular Disease, Diabetes Mellitus, Hypertension, Congestive heart failure, Coronary Artery Disease s/p Coronary Artery Bypass Grafting, Atrial Fibrillation, and Transient Ischemic Attack. Pt had undergone a femoral artery endarterectomy which became infected requiring an Incision and Drainage and flap. The patient was extubated post-operatively. Her home prescription of Enalapril was substituted with Ramipril. Six hours later, pt developed AE with stridor. Pt. received nebulized Epinephrine, Benadryl and Hydrocortisone. With the tongue swelling, the patient was correctly identified as a difficult airway, (DA) and Anesthesia was called stat to evaluate the patient. Since the patient's respiratory status was deteriorating but still temporarily adequate, and patient was likely a DA, an awake endotracheal intubation was elected. A glidescope was used to advance a 6.0 ET tube after 2 previous attempts failed. Pt. was started on a steroid taper and weaned. She was extubated uneventfully three days later.

Discussion: (1) AE is a medical emergency and requires close monitoring as is routinely provided in an intensive care unit. (2.) Identification of patients with suspected DA before considering giving sedation or inducing anesthesia, is of utmost importance. (3) Anticipating difficulty in one's ability to readily secure an airway requires the presence of specialists and equipment that will facilitate adherence to the American Society of Anesthesiologists algorithm for DA management. Rendering this patient unconscious with drugs would likely have produced a catastrophic situation where the patient could not be easily intubated, nor could be mask ventilated. This cannot ventilate, cannot intubate situation, can rapidly progress to desaturation and cardiac arrest. This is especially true in intensive care unit patients who commonly have very limited reserves. (4) Angiotensin Converting Enzymes Inhibitors (ACEI) can cause AE even after prolonged use. In this case, an acute change in the ACEI prescribed likely triggered the AE. It may be appropriate to be cautious in switching ACEI's without a compelling reason.

Comparison of Arterial And Non-invasive Blood Pressure Measurements

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Background: Arterial catheters (ABP) are a commonly used invasive means of determining blood pressure in the operating room and critical care setting. Frequently, a non-invasive blood pressure (NIBP) measurement is obtained concurrently. A systematic error between these two measurements, depending upon the underlying blood pressure, has been reported¹. This study compares the differences between concurrent ABP and NIBP using a large data set.

Methods: After IRB approval, all consenting surgical patients in the Mayo Clinic NSQIP registry receiving general anesthesia who were monitored with both arterial line and non-invasive cuff intraoperatively were retrospectively analyzed. Intraoperative vital signs are recorded every 2 minutes and stored in an institutional Perioperative DataMart. This database was queried for SBP, MAP and DBP measurements from both NIBP and ABP within the same 2 minute epoch. Artifactual values were removed. The average difference ($\pm$ standard deviation) was plotted for SBP, MAP, and DBP. Linear regression analysis was used to quantify the relationship between ABP and NIBP. Concordance correlation coefficients were calculated.

Results: 76,811 pairs of NIBP and ABP measurements from 5,663 anesthetics were identified. ABP were found to be higher than NIBP at

high BPs and lower than NIBP at low BPs (figure 1). This association was identified for SBP, MAP and DBP. For every 10 mmHg increase in systolic ABP, systolic NIBP increased by 6.9 mmHg. Interestingly, the concordance correlation coefficient between NIBP and ABP was best for SBP (0.61) and worst for MAP (0.51).

Conclusions: This study confirms that NIBP and ABP measurements can be discordant, particularly at the extremes of physiologic blood pressure. ABP tends to overestimate both hypotension and hypertension. One potential reason for this finding could be the site of measurement (radial arterial versus brachial non-invasive BP). This finding has implications for critical care decision making.

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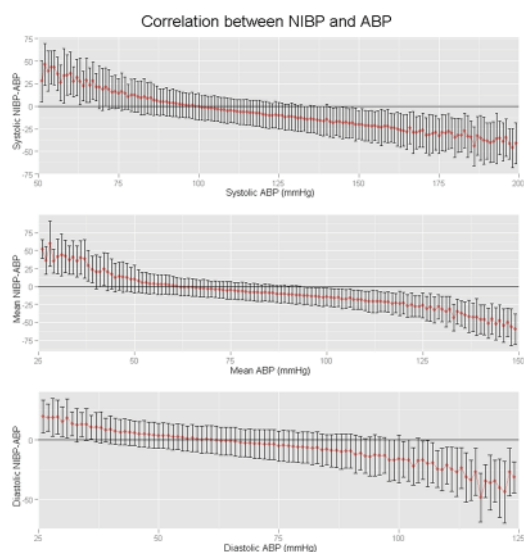


Figure 1
Graphical representation of the mean difference between NIBP and ABP across a physiologic range of systolic, mean, and diastolic blood pressures.

Reliable Cardiac Output Monitoring by Innovative Pulse Contour Analysis During Hemodynamic Drug Infusions

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A potential, practical approach for achieving continuous and minimally invasive cardiac output (CO) monitoring in critically ill patients is to mathematically analyze an arterial blood pressure (ABP) waveform obtained via an existing radial artery line. However, current pulse contour analysis devices have been shown to be unreliable, particularly during the challenging periods of major vasoconstriction or vasodilation [1].

Recently, a new pulse contour analysis technique was introduced [2]. The innovative idea of the technique is to enhance accuracy by analyzing the slow, beat-to-beat variations in the ABP waveform wherein confounding physiologic effects are minimal. The aim of this study was to evaluate this technique against gold standard aortic flow probe CO measurements from animals during major vasoactive and cardiac drug infusions.

Seven, healthy swine (~35 kg) were studied under a protocol approved by the MSU All-University Committee on Animal Use and Care. During an open-chest recovery surgery, an ultrasonic flow probe was implanted around the ascending aorta for reference CO. After about a week of recovery, general anesthesia and mechanical ventilation were instituted. A fluid-filled catheter was placed in a radial artery for the ABP waveform for analysis. Other sensors including ECG electrodes were placed. All measurements were recorded during infusions of phenylephrine, nitroprusside, norepinephrine, dobutamine, and diltiazem.

The new technique was applied to the radial ABP waveforms off-line. The CO estimates were then calibrated using a single aortic flow probe value per subject. The agreement between the calibrated CO estimates and reference measurements were assessed using Bland-Altman and concordance analyses [3].

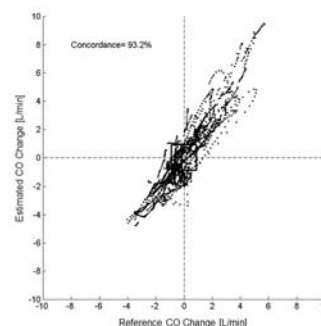
On average, CO changed from 2.8 to 9.9 L/min and mean ABP varied from 39 to 139 mmHg in each subject. The CO error ranged between 8.1

to 23.7%, with an average of 16.6%. The Figure shows that the concordance between the estimated CO changes and reference CO changes (relative to their mean value per subject) was 93.2% over all the animals. Further, the data points are generally on the identity line indicating that the magnitude of the change was also well estimated.

The innovative pulse contour analysis technique, after calibration, was able to reliably estimate CO and CO changes during major vasoactive and cardiac drug infusions. Future efforts will focus on the real-time implementation of the technique.

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Occult Thyrotoxicosis in The Trauma Intensive Care Unit: A Great Masquerader

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In the spectrum of endocrine crises, thyroid storm ranks as one of the most emergent and life-threatening. Early recognition and intervention is vital in the management of severe thyrotoxicosis as progression to thyroid storm carries with it an inherently high morbidity and mortality. Though the incidence of thyroid storm has been noted in less than 10% of patients hospitalized for thyrotoxicosis, the mortality rate approaches 20-30%¹.

Whereas the term hyperthyroidism refers to disorders that result from overproduction of thyroid hormone, thyrotoxicosis refers broadly to any cause of excessive thyroid hormone concentration. Much as acute lung injury (ALI) and adult respiratory distress syndrome (ARDS), systemic inflammatory response syndrome (SIRS) and sepsis lie on a continuum of illness, so thyroid storm represents the extreme manifestation of thyrotoxicosis with Graves disease being the most common underlying cause.

Precipitating factors for thyroid storm are similar in nature to those of diabetic ketoacidosis (DKA) and include systemic insults such as surgery, myocardial infarction, sepsis/infection, pulmonary thromboembolism, DKA itself, and parturition. Trauma has also been listed as a possible inciting factor, however, to our knowledge, there is only a handful of case reports in the literature that cite trauma as being the culprit²⁻⁴. In the critical care setting, most endocrine disorders are diagnosed and managed in the medical intensive care units; in that trauma is a very remote cause of thyrotoxicosis, new onset thyrotoxicosis is rarely seen de novo in the Trauma Intensive Care Units.

Our patient is a 32 year-old Caucasian female admitted after motor vehicle collision with multiple organ system injuries requiring initial resuscitation. Her medical history was unremarkable except methamphetamine use. She was admitted to the trauma intensive care unit (TICU) with refractory supraventricular tachycardia (SVT) and severe metabolic acidosis. Her TICU course was further complicated with development of *Pseudomonas pneumonia*, Acute Respiratory Distress Syndrome (ARDS), respiratory failure necessitating tracheostomy, multidrug resistant urosepsis and delayed splenic rupture leading to hemorrhagic shock. During her ICU course, she had multiple types of arrhythmias including SVT requiring a high dose esmolol infusion for control and later atrial fibrillation with rapid ventricular response; other intermittent symptoms included altered mental status/delirium, tremulousness, refractory diarrhea, and hyperthermia. The differential diagnosis of these symptoms initially included hypovolemia, substance intoxication with subsequent withdrawal, and/or SIRS due to either trauma or an evolving infection. In combination with intra-operative recognition of an enlarged thyroid gland during tracheostomy, and the resistant and repetitive nature of her symptoms, we were prompted to evaluate thyroid function. Careful review of her computerized tomograms confirmed thyromegaly. The results of thyroid function testing proved

her to be hyperthyroid. Additionally the presence of thyroid-stimulating immunoglobulin confirmed the diagnosis of Graves disease and the Endocrine Service was consulted for management of her thyrotoxicosis. We refer to the work of Burch and Wartofsky for the diagnostic criteria for thyroid storm; in essence, patients are scored on the presence and severity of various systemic manifestations of hyperthyroidism; a score of 45 or greater is highly suggestive of thyroid storm⁵, Table 1. At the time of discovery of her hyperthyroidism, our patient scored in the range of 90-100!

Initial treatment of her thyrotoxicosis was a regimen of propylthiouracil (PTU) via small-bore feeding tube and a combination of an esmolol infusion with titration of enteral propranolol to achieve normal sinus rhythm. Propranolol was selected for its well-documented ability to prevent peripheral conversion of thyroid hormone. Initially, a euthyroid state was achieved for a short time. However, enteral therapeutic options to control her symptoms were repetitively challenged due to malabsorption and rapid gastrointestinal transit time due to diarrhea. Eventually, due to long-standing severe malnutrition despite intakes that met expected caloric and high protein needs, the decision was made to provide nutrition with a combination of enteral and parenteral nutrition. This regimen was aimed at improving gut integrity and nutritional utilization and led to some improvements in nutritional markers. Additionally, PTU was given as a combination of both enteral and rectal administration and still her symptoms were problematic.

Discovery of the patient's tracheo-esophageal fistula further complicated her care and contributed to her poor nutritional status. This was evaluated by both the Otorhinolaryngology service as well as the General Surgery service. Plans were made to surgically repair the fistula with a muscle flap. However, this surgery was cancelled more than once due to the difficulty in controlling her hyperthyroidism which was very resistant to medical management. The decision was then made to definitively treat her refractory hyperthyroidism with a total thyroidectomy at the same surgical setting as the TE fistula was being repaired. Her postsurgical course was further complicated with recurrent delirium/altered mental status and inadvertent removal of the t-tube with destruction of her flap. She returned to the operating room for re-exploration of her TE fistula, primary closure, and inset of a pectoralis major flap anterior to her esophagus. Her hospital course stabilized as her nutritional status improved, when finally her hyperthyroidism resolved. Eventually she was able to be discharged home some four months after her admission.

Early in her course, this patient challenged us daily with symptoms often seen in the trauma population, especially those with substance abuse histories. First we treated her for substance withdrawal and poly-trauma and ARDS, then for severe infections. In retrospect it is easy to look back and say why didn't we diagnose hyperthyroidism earlier? But on a daily basis it was easy to explain many of her separate symptoms on

other issues; even her diarrhea was initially blamed on bowel meds, then antibiotic courses and so on. She had frequent fevers but was not persistently febrile. Still it was not until after Graves Disease was diagnosed that we were finally able to develop a lengthy plan of care that led to improvements. While we have elected to focus our attention to the occult presentation of thyroid storm in this patient and the difficulties in managing it, there were many other aspects of this patient's care that were extremely challenging. Adequate nutritional support was a constant and ongoing problem for our patient and it is the surgical team's opinion

that this may, in part, have contributed to the development of a tracheo-esophageal fistula that further complicated her course. Overall, we feel that despite the many challenges, her case provides ample opportunities for education, critical thinking, and introspection. She is a wonderful source of encouragement to continually cast a wide net when caring for critically ill patients, to constantly inquire and search for explanations to complicated problems, and that the answers will often time surprise all involved.

Post Operative Atrial Fibrillation After Extra Pleural Pneumonectomy: Risk Factors And The Effect of Prophylactic Beta Blockade

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Introduction: Atrial fibrillation (AF) is associated with increased mortality and morbidity following thoracic surgery. Patients undergoing extrapleural pneumonectomy (EPP) are at high risk for post operative AF. Prophylactic beta-blockers have been shown to reduce the incidence of post operative AF after lung resection, but have not been studied following EPP. We aimed to define the risk factors for AF following EPP. We tested our hypothesis that prophylactic beta-blockade reduces the incidence of AF after EPP.

Methods: 551 patients (>27y) underwent EPP for mesothelioma between 1998 and 2011 at our institution. Data for 354 patients were extracted into our database through retrospective chart review, 29 patients were excluded for preexisting AF. Patients were monitored with cardiac telemetry, and the presence of post operative AF (irregularly irregular heart rate lasting >15min) was recorded. Two patient cohorts: those who received prophylactic beta-blockade (245/354) and those who did not (108/354) were compared in our analysis. Prophylactic beta-blockade was introduced into our protocol in 2002. Univariate and multivariate analyses were conducted to identify risk factors for the development of AF.

Results: The incidence of AF was 49.7% (178/354). The time course of post op AF is shown in Figure 1. 66 (61.1%) patients without

prophylactic beta-blockade developed post operative AF vs. 109 (44.5%) of those on prophylactic beta-blockade ($p=0.0040$). Univariate analysis showed that older age ($p<0.001$), right sided surgery ($p=0.0028$), and lowest magnesium level on post op days 0-3 ($p=0.013$) were risk factors. Multivariate analysis showed that prophylactic beta-blockers can significantly reduce the risk of AF (RR: 0.582; 95% CI: 0.452-0.749). In contrast, age (RR: 1.04; 95% CI: 1.026-1.056), preoperative (home) beta-blocker use (RR: 1.519; 95% CI 1.151-2.004), right sided surgery (RR: 1.290; 95% CI 1.105-1.639) increase the risk of AF.

Conclusions: Patients undergoing EPP have a high rate of postoperative AF. Reasons specific to this patient population may include surgical stripping of the pericardium, right heart strain following the division of the right or left pulmonary artery and large fluid shifts. The introduction of prophylactic beta-blockers was associated with a statistically and clinically significant reduction in AF. Right sided EPP involves routine patch reconstruction of the pericardium which may explain the higher risk for AF in this subgroup. The increased risk of AF in patients taking beta blockers at the time of admission may be related to withdrawal of beta-blockers.

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Incidence And Risk Factors For Emergence And PACU Delirium

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Objectives: Delirium is associated with longer hospital stays, increased re-admissions, poor cognitive and functional outcomes, and increased mortality.(1-3) Prior studies examining postoperative delirium have primarily focused on hyperactive delirium, and many have not utilized validated delirium monitoring instruments.(4-6) Our primary objective was to assess for delirium in the postoperative period utilizing the Confusion Assessment Method for the ICU (CAM-ICU), a validated tool for rapid diagnosis of both hyperactive and hypoactive delirium subtypes by bedside nurses.(7) Our specific aims were to study the incidence of and risk factors for emergence and postanesthesia care unit (PACU) delirium.

Methods: A prospective cohort study of adult patients admitted to the PACU after surgery. Exclusion criteria included severe baseline dementia, anoxic brain injury or neuromuscular disorders, and deafness or inability to understand English. Preoperative, intraoperative, and postoperative data were collected. CAM-ICU delirium assessments were performed at PACU admission, 30 min, 1 hr, and PACU discharge. Emergence delirium was defined as agitated emergence per anesthesia staff report or positive CAM-ICU on PACU admission. PACU delirium was defined as positive CAM-ICU at 30 min, 1 hr, or discharge. Multivariable logistic regression was utilized to evaluate the effect of a priori defined risk factors, including age, sedative exposure, anesthetic duration, inhalation agent, and American Society of Anesthesiologists (ASA) classification, on the development of delirium.

Results: Four hundred postoperative patients were studied with a median age of 57 years and a median ASA classification of 3. Surgical cases included urology (24%), general surgery (22%), orthopedics (19%),

neurosurgery (7%), vascular (5%), and other (23%). Emergence delirium was present in 154 (38%) patients, including 75 (19%) with agitated emergence and 124 (33%) with positive CAM-ICU on PACU admission. PACU delirium was present in 67 (17%) patients overall, including 59 (15%), 32 (8%), and 15 (5%) at 30 min, 60 min, and PACU discharge, respectively. Anesthetic duration was found to be independently associated with emergence delirium ($p=0.04$), whereas total perioperative opioid administration was independently associated with PACU delirium ($p=0.006$). The additional risk factors studied did not have significant associations with either emergence or PACU delirium.

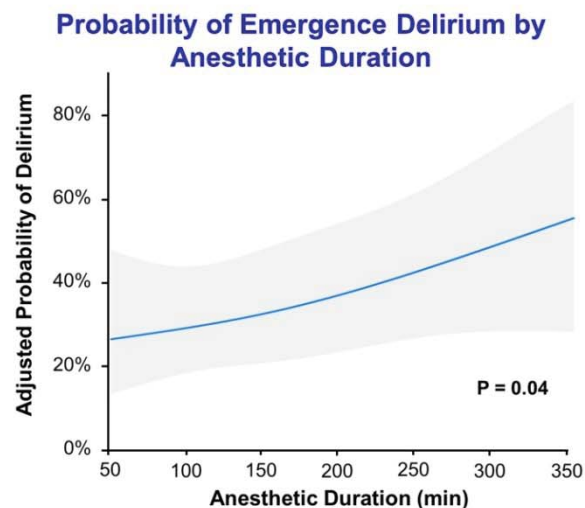
Conclusion: Emergence and PACU delirium are common after surgery, with the incidence highest on emergence from anesthesia and PACU admission and decreasing during the PACU stay. Longer anesthetic duration is associated with emergence delirium, and perioperative opioid administration is associated with PACU delirium.

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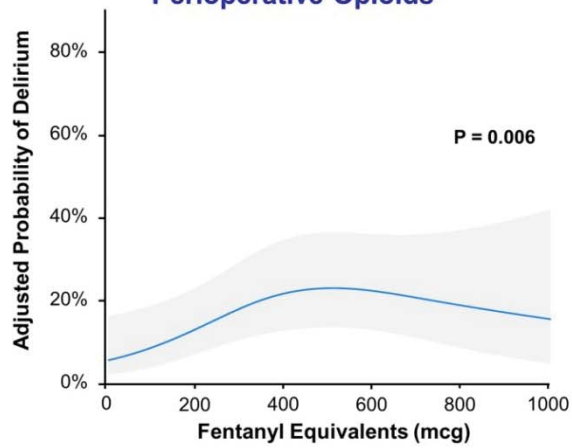
Emergence Delirium

Variable, N = 154	P
Age	0.34
Preop + Intraop Benzo	0.60
Preop + Intraop Opioid	0.32
Anesthetic Duration	0.04
Inhalation Agent	0.95
ASA Classification	0.81



PACU Delirium

Probability of PACU Delirium by Total
Perioperative Opioids



Variable, N = 67	P
Age	0.07
Preop + Intraop + Postop Benzo	0.21
Preop + Intraop + Postop Opioid*	0.006
ASA Classification	0.21

*Nonlinear

Heparin Requirements For Full Anticoagulation Are Higher For Patients Treated With Dabigatran Than For Those on Coumadin

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Background: Dabigatran is a new oral direct thrombin inhibitor that is increasingly used for chronic anticoagulation in place of coumadin. Patients on dabigatran may present for invasive catheter-based procedures requiring full anticoagulation with heparin. Little data exists to guide heparin dosing in this setting.

Goal: Assess for a difference in cumulative heparin requirement to maintain an optimal activated clotting time (ACT).

Methods: In a retrospective study of patients on dabigatran (D), coumadin (C) or neither drug (N) undergoing cardiac ablation for atrial fibrillation, timing of heparin doses and ACT values were collected. A one-compartment PKPD model relating the heparin input to the ACT was fitted to the irregularly-spaced actual data for each patient (Fig. 1A).

Using this interpolated ACT level, the average ACT achieved over the duration of the procedure due to the cumulative heparin dose could be estimated for each patient. ANOVA analysis was performed on the log-transformed, normally distributed data to test for differences between the groups D, C and N. Group C was sub-divided into patients presenting with an INR >2 (C_High) or <2 (C_Low).

Results: Patients on dabigatran required a significantly higher total dose of heparin than patients on coumadin to achieve the same level of anticoagulation (average 13,300 vs. 6,800 units per 70 kg per hour of ACT in the therapeutic range; $p < 0.001$). There was no significant difference between groups D and N, nor between C_High and C_Low as shown in Fig. 1B.

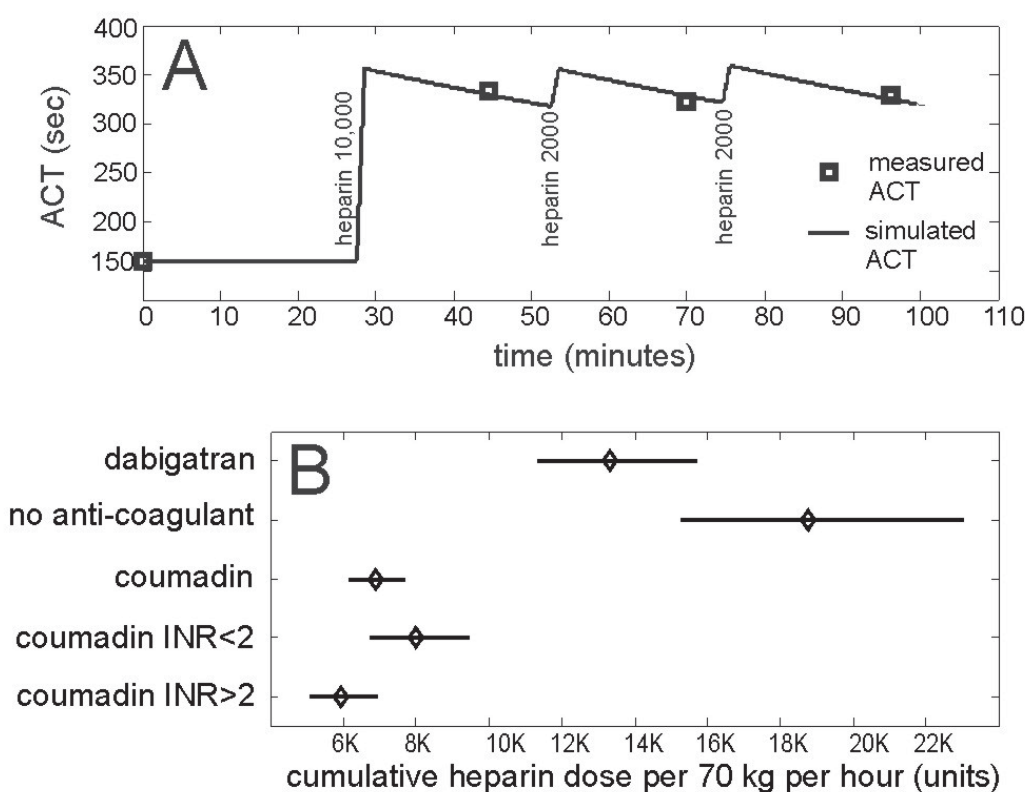


Figure 1: Example of PKPD model fitting to one sample patient in panel A. Panel B shows the ANOVA analysis with comparison of groups. Markers and bars indicate the means and 95% confidence intervals.

Attending Physician Handoffs in The Intensive Care Unit

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Background: Handoffs, transfers of responsibility for patient care, are a prominent feature of hospital care. Most of the previous research on handoffs focuses on resident physician transitions, leaving unanswered the question of how attending-level handoffs influence patient care. The aim of our study is to improve understanding of this transition by eliciting themes relating to the features of attending handoffs in the intensive care unit.

Methods: This is a qualitative semi-structured interview study of attending intensivists at multiple United States academic medical centers. The recruitment strategy being used is purposive snowball sampling, in which subjects are invited to participate and to suggest additional prospective subjects, thereby achieving breadth of specialty, experience, and geography. Recruitment will continue until reaching thematic saturation (when each interview offers minimal additional information). An estimated 30 subjects will be interviewed 15 from the author's institution and 15 from comparable academic medical centers. Grounded theory approach is utilized for transcript analysis to elicit themes in three domains: the mechanics of handoffs, handoff norms and practices, and the impact of handoffs on patients and families. Interviews are conducted in person or via telephone, and are digitally recorded, transcribed, and coded. NVivo qualitative analysis software (version 9, QSR International) is used for data management. Five pilot interviews (excluded from analysis) were conducted to develop the interview script.

Preliminary Results: 28 subjects out of a projected total of 30 intensivist subjects have completed interviews. Subjects represent 12 institutions in 9 states. Subjects' attributes are described in Table 1. Responses related to the study's three domains were as follows: DOMAIN 1

Handoff Mechanics: Most subjects routinely participate in some type of handoff activity at the end of each rotation in the ICU (n=24). The medium used for handoff varies: some subjects report using the telephone (n=12), some conduct in-person handoffs (n=2), some use electronic mail handoffs (n=2), and still other subjects use a combination of these tactics (n=8). Mean (SD) handoff duration was 3.6 (2.1) minutes per patient. DOMAIN 2 HANDOFF

Norms and Practices: Subjects reported that vital handoff elements included clinical history, resuscitation preferences, and interactions with patients' families. Most subjects would change some aspect of their current handoff practice (n=23). Typologies of handoff communication were identified: The same people who are extremely compulsive and

detail oriented, usually give the more complete and thorough sign-out. DOMAIN 3 HANDOFF

Impact On Patients/Families: Handoff was identified as potentially disruptive to patients and their families. Most subjects said that it was at least somewhat important to continue the therapeutic care plan when assuming care from another attending in order to minimize this disruption (n=21).

Conclusions: ICU attending handoff practices vary widely, but there are common themes valued by attending intensivists. The variability in attending handoffs may have implications for quality and continuity of care in the ICU and merit future study.

Table 1: Subject characteristics (n=28). Specialty of primary board certification*, n

Anesthesiology	9
Emergency medicine	2
Internal medicine	12
Surgery / trauma	6
Critical care medicine certification status, n (%)	
Board-certified	26 (%)
Board-eligible	2 (%)
Gender, n (%)	
Female	9 (32.1%)
Male	19 (67.9%)
Age, mean ($\pm$ SD)	43.9 ($\pm$ 8.0) years
Years in practice as intensivist, mean ($\pm$ SD)	11.5 ($\pm$ 8.8) years
Weeks per year in the ICU, mean ($\pm$ SD)	12.4 ($\pm$ 5.2) weeks
ICU type**, n	
Medical or medical/surgical ICU	13
Surgical/trauma ICU	15
Cardiothoracic ICU	8
Burn, neurologic or transplant ICU	3

* One subject is board certified in two specialties.

** Numbers do not sum to the total number of subjects because some subjects practice in more than one ICU type.

Clinical Impact of Post Operative Atrial Fibrillation Following Extra Pleural Pneumonectomy

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Background: Atrial fibrillation (AF) is common following thoracic surgery, and is associated with increased mortality, morbidity and hospital length of stay. Extrapleural pneumonectomy (EPP) carries a high risk of morbidity, including post operative AF. Surgery involves violation of the pericardium, significant hemodynamic changes and fluid shifts. The aim of this study was to describe the association between the development of post operative AF and outcomes in this patient group.

Methods: 551 patients (>27yrs) underwent EPP for mesothelioma between October 1998 and May 2011 at our institution. Data for 354 patients were extracted into our database through retrospective chart review. 29 patients were excluded for having a history of AF. Patients were monitored postoperatively in the intensive care unit or step down unit with continuous cardiac telemetry, and the presence or absence of post operative AF was recorded. AF was defined as an episode of irregularly irregular heart rhythm lasting at least 15 min. Hospital length of stay, ICU length of stay, time to extubation, requirement for reintubation, occurrence of post operative stroke, acute kidney injury, requirement for renal replacement therapy, in-hospital mortality and 30 day mortality were recorded. Univariate and multivariate Logistic regression analyses were used to explore the association between AF and the outcomes.

Results: The cohort of patients who developed postoperative atrial fibrillation was compared to those without AF. The incidence of AF peaked on post operative days 2 and 3. Post operative atrial fibrillation was significantly associated with increased length of hospital stay 20 days vs. 11.7 days ($p<0.0001$), increased length of ICU stay 11.9 days vs. 4.4 days ($p<0.0001$), increased in-hospital mortality 7.3% vs. 1.1% ($p=0.006$) and increased likelihood of reintubation 30.4% vs. 6.0% ($p<0.0001$). The presence of post operative atrial fibrillation was not statistically significantly associated with increased time to initial extubation, 30 day mortality, incidence of acute kidney injury, requirement for renal replacement therapy, or increased incidence of postoperative stroke. Multivariate analysis demonstrated that AF was a risk factor for in hospital mortality ($p=0.024$), independent of age, gender, left ventricular function, history of diabetes, hypertension, use of intraoperative heated chemotherapy, or use of intraoperative blood products.

Conclusion: EPP is one of two surgical interventions available for mesothelioma, at the expense of significant morbidities. Patients are at high risk for the development of post operative AF. AF was associated with a statistically and clinically significant increase in ICU and hospital length of stay, and in-hospital mortality. Although the development of post operative AF may be a marker for other underlying physiological and inflammatory changes following EPP, it is a key modifiable risk factor. The use of the most effective prophylactic pharmacotherapy should be considered in these patients.

Perioperative Risk Factors For Venous Thromboembolism in Patients With Malignant Pleural Mesothelioma: A Retrospective Analysis of Our Four Year Database

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Background: Venous thromboembolism (VTE), including deep vein thrombosis (DVT) and pulmonary embolism (PE), increases morbidity and mortality in cancer patients. The analysis of 22 million cancer patients showed 3.5% incidence of VTE within 30 days postop, for thoracic surgery patients the incidence was 4%. The incidence of VTE for malignant pleural mesothelioma (MPM) patients undergoing pleurectomy or extrapleural pneumonectomy (EPP) is unknown. VTE can worsen pulmonary hypertension, and significantly affect patient morbidity and mortality. Database analysis was performed to determine the incidence and associated risk factors for VTE.

Methods: A retrospective cohort study of patients with MPM who underwent pleurectomy or EPP from 2006 to 2010. The primary end point was occurrence of VTE within 30 days postop or during hospitalization. DVT was diagnosed by ultrasonography and PE by CT angiography. We selected candidate variables based on established risk factors for VTE. Univariate analysis was performed to determine the incidence of VTE in relationship to the candidate variables. We started with saturated model including all interested variables, then performed model reduction (backward selection) by excluding variables from the model with a p-value of >0.10 based on log likelihood ratio test.

Results: 266 patients were included in the analysis. All received postoperative DVT prophylaxis with sc heparin. The incidence of VTE was 22.2%; DVT 20.6 % and PE 1.9 %. DVT occurred in lower extremity in 17%, in upper extremity in 6.4%, and in both upper & lower extremities in 2.6%. Independent variables associated with increased risk of VTE in saturated multivariate model were: presence of preop history of (h/o) smoking, DVT, heart failure, asbestos exposure, duration of surgery,

periop coagulopathy, transfusion of FFP, need for vasopressors; postoperative development of HIT & acute kidney injury (AKI). In the reduced model, variables that remained after backward selection were: preop h/o smoking, DVT, heart failure, asbestos exposure; duration of surgery, postoperative development of HIT & AKI. The variables most strongly associated with VTE were: h/o preop DVT and postoperative HIT, AKI.

Conclusion: Despite periop DVT prophylaxis with heparin, MPM patients are at high risk for VTE. We found three modifiable risk factors: preop history of DVT, postoperative development of HIT, & AKI. Patients with VTE had significantly delayed ICU and hospital discharge. Hence, modification of these risk factors should be considered by initiating more intense prophylaxis earlier.

Analysis of Maximum Likelihood Estimates (reduced model after backward selection)	
Parameter	Pr > ChiSq
Postop HIT	<0.0001
History of DVT	0.0011
Heart failure	0.0180
Smoking	0.0616
Asbestos exposure	0.03
Duration of surgery	0.0240
AKI	0.0158

Postoperative Creatinine Increase Predicts Sustained Kidney Injury in Patients With Malignant Mesothelioma Undergoing Surgical Resection

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Background: Acute kidney injury (AKI) leads to increased morbidity and mortality and progression to chronic kidney injury via a subchronic, mid-term kidney injury (sustained kidney injury) phase is a frequent consequence of AKI. The incidence of severe AKI (serum creatinine elevation > 3 times upper limit of normal) is nearly 10% in patients undergoing surgical resection of malignant pleural mesothelioma, a procedure in which intraoperative cisplatin chemotherapy is commonly administered. Because of the high risk of AKI and the devastating consequences of chronic kidney disease and end stage renal disease in this cancer cohort, we studied the ability of early postoperative changes in serum creatinine (sCr) to predict sustained kidney injury. We hypothesized that acute sCr elevation, within 24-48 hours after surgery, can predict sustained, clinically significant decline in kidney function defined as 50% increase in sCr from baseline, 2-4 weeks after surgery.

Methods: A prospective, observational cohort of patients undergoing surgical resection (extrapleural pneumonectomy) for the treatment of malignant pleural mesothelioma at the Brigham and Women's Hospital between 1998 and 2009 were studied. Receiver operator characteristic (ROC) curves were generated to examine the diagnostic ability of 24- and 48-hour changes in sCr over baseline to identify sustained kidney injury in the derivation cohort (n=279) and tested in the validation cohort (n=207). The performance of our derived criteria was compared to various other criteria used to characterize AKI to predict the risk of

sustained kidney injury using the net reclassification index (NRI) and integrated discrimination improvement (IDI).

Results: Sustained kidney injury occurred in 8.9% (n=25) of patients in the derivation and 10.1% (n=21) in the validation cohort. A 59% or greater increase in sCr (1.59 fold) at 48 hours after surgery was most predictive of sustained kidney injury (AUCROC= 0.798; sensitivity of 68% and specificity of 87%). When compared to various other AKI criteria, we found that our prediction model had the highest c-statistic; and when compared to the RIFLE criteria the difference was statistically significant (p<0.001). Among other AKI definitions, we found that sCr increase of 0.3 mg/dl in 24 hours or 0.5 mg/dl increase in 48 hours (Waikar and Bonventre criteria) also reliably predict sustained kidney injury.

Conclusion: In this study we identified a cohort, which developed sustained kidney injury (defined as doubling of sCr present at 2-4 weeks after surgery). We found that development of clinically significant sustained kidney injury can be predicted by acute postoperative sCr elevation in patients treated for mesothelioma where a 59% (1.59 fold) sCr elevation at 48 hours was the best predictor of sustained kidney injury (positive predictive value of 41%; negative predictive value of 96%).

An Evaluation of The Efficiency of RxNorm in The Identification of Preoperative Risk Factors For Postoperative Acute Lung Injury

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Acute Lung Injury (ALI) is a leading cause of postoperative respiratory failure. Timely identification of associated risk factors is a key element of its prevention and early treatment. Automated electronic search strategies may allow more efficient collection of data. As part of the Unified Medical Language System, RXNORM was created by the NLM in order to establish a basis for naming drugs with a database that allows for system interoperability. The objective of this study was to determine the accuracy of RXNORM in identifying known risk factors for postoperative ALI.

The study population was identified from a prospective cohort of 1000 adult patients who underwent high-risk surgery between August 2010 and April 2011, did not have major risk factors for lung injury, and were mechanically ventilated for more than 3 hours during general anesthesia. Automated electronic search strategies using a web-based query tool were developed for preoperative risk factors for postoperative ALI. RXNORM concept unique identifiers were utilized to determine the presence of specific medications on a patient's profile within 90 days of surgery. All medications, both brand-names and generic, within the classes of Amiodarone, ACE Inhibitors, Angiotensin Receptor Blockers, H2 receptor antagonists, proton pump inhibitors, and Statins were searched. Results of RXNORM query were compared to results of a free-text query. The patients in which both search strategies identified the same medication were presumed to be true positives. All discordant results were manually verified. Ten percent of the results in which both searches were negative were manually verified. Agreement between

the two data extraction strategies was assessed with kappa statistics. The sensitivity and specificity of each clinical variable was calculated to measure the effectiveness of RXNORM in identifying patient medications.

Agreement between automated electronic search strategies and manual data extraction was excellent (Kappa $\approx$ 0.75) for all categories of medications. The specificity of RXNORM in identifying active patient medications at time of surgery was extremely high ($\approx$ 98% for each category). However, the RXNORM codes failed to identify patient's medications with the level of accuracy that the free text search did. See the table for complete sensitivities and specificities for each category. The lower sensitivities of RXNORM as compared to free text search is due to varying ability of the search system to identify a medication by its RXNORM code. RXNORM codes are frequently being updated by the NLM, and the query database lags in updating the system with these codes.

Using a panel of RXNORM codes may be useful for a screening tool for those who may have risk factors for developing acute lung injury postoperatively. Nonetheless, the findings suggest free text search queries provide greater sensitivity. The specificity of RXNORM queries is extremely useful in identifying patient with risk factors for ALI. This study could be strengthened by reviewing all the negatives to ensure that all are true negatives. Further investigation is needed to determine an accurate, efficient and universal strategy for stratifying risk factors for acute lung injury.

Predictor	Kappa Statistic	RxNorm Sensitivity	RxNorm Specificity
H2-receptor antagonists/PPIs	0.79 CI ₉₅ (0.76-0.83)	0.70 CI ₉₅ (0.65-0.74)	0.98 CI ₉₅ (0.96-0.99)
HMG-CoA reductase inhibitors	0.83 CI ₉₅ (0.80-0.86)	0.83 CI ₉₅ (0.79-0.86)	0.98 CI ₉₅ (0.97-0.99)
Amiodarone	0.83 CI ₉₅ (0.60-1.06)	0.71 CI ₉₅ (0.30-0.95)	0.99 CI ₉₅ (0.98-0.996)
ACE Inhibitors	0.94 CI ₉₅ (0.91-0.95)	0.91 CI ₉₅ (0.87-0.94)	0.99 CI ₉₅ (0.98-0.997)
ARBS	0.95 CI ₉₅ (0.93-0.98)	0.93 CI ₉₅ (0.86-0.97)	1.00 CI ₉₅ (0.99-1.00)

Routine Post-Procedural Chest Radiographs Are Dispensable After Central Venous Catheter Placement Through Internal Jugular Vein

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Rationale: Portable Chest X-ray (CXR) is routinely obtained after central venous catheter (CVC) placement to assess for complications such as pneumothorax, malpositioning, and hemothorax. In the US, more than 5 million CVCs are placed annually¹ and equal numbers of CXRs (costing US\$200 each²) are performed. Available evidence suggests that it is safe to omit CXRs for uncomplicated insertion of CVCs placed via the right internal jugular vein (IJV) ³. It has also been shown that the knowledge of radiographic catheter tip position is not normally required for short term use ⁴. Our hypothesis was that CVCs placed via the IJV have a low incidence of radiologically detectable complications; hence, mandatory CXRs following CVC placement could be avoided.

Methods: We performed a retrospective review of CXRs obtained for non-permanent CVCs placed via the IJV in various hospital settings between 2004 and 2010 at our adult tertiary care academic medical center. Hospital billing data was used to identify cases. CXRs were systematically reviewed for complications by the investigators and confirmed with the radiology report. Malpositioning was defined as position of CVC tip within an extrathoracic vein, the right ventricle, or a central artery, or looping of the CVC. Catheter repositioning for malpositioned catheters and clinical sequelae of pneumothorax or hemothorax identified on CXR were recorded after chart review.

Results: The retrospective review of 2500 CXRs revealed 13 pneumothoraces and no hemothorax. After excluding 568 cases of pleural dissection performed for surgical reasons, the overall incidence of pneumothorax was 0.67% (13/1932). Of the 13 pneumothoraces, 7 required pleural tube drainage (all had clinical sequelae of pneumothorax), 6 were asymptomatic and only 9 could be clearly

attributed to CVC placement. All CVCs associated with pneumothorax were subsequently used. 25 (1%) CVCs were repositioned (all multi-lumen catheters, 7 were placed in OR) though only 11 (0.40%; 6 right, 5 left) were malpositioned. Among the repositioned catheters, 1 CVC tip appeared to be in the aortic arch, which was also suspected clinically based on the arterial waveform tracing; 8 CVC tips in extrathoracic veins; 1 CVC looped in the left brachiocephalic vein and 15 were within the intrathoracic central veins. All of the CVCs placed in the OR (54.8%) were used without any complications before CXR was obtained, which was considered standard practice in that setting. Results illustrated in Table 1.

Discussion and Conclusions: The central venous pressure tracing and free aspiration of blood through all the CVC ports can be used to confirm venous placement of the catheter and thus CXR is not immediately required. The presence of a pneumothorax and/or catheter malpositioning does not exclude the use of a CVC before acquisition of CXR. Besides the huge cost, the process of getting CXR can delay patient management, which could lead to unfavorable outcomes. We conclude that it is safe to omit mandatory CXR for routine CVC placed through the IJV, and that the catheter can be used immediately after placement.

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Age (years; Mean + SD)	63.33 + 15.19			
Weight (kilogram; Mean + SD)	81.00 + 21.75			
Height (centimeter; Mean + SD)	169.62 +10.24			
Male: Female	1489: 1011			
Side of IJV cannulation	Right	Left		
	2101	399		
Type of Central Venous catheter	Right	Left	Total	
Multi-lumen catheter	1575	318	1893	
Introducer	509	71	580	
Dialysis catheter	17	10	27	
Hospital Care Unit & CVC placement	Right	Left	Total	
OR (Operating Room)	1243	127	1370	
ER (Emergency Room)	453	112	565	
Surgical ICU(Trauma, Surgery, Cardiac, Thoracic, Neurosurgery)	259	96	355	
Medical ICU	140	63	203	
Clinical Floors (Medical & Surgical)	6	1	7	
Pneumothorax	Right	Left	Total	
Total cases	9/1615 (0.55%)	4/317 (1.26%)	13/1932 (0.67%)	
Clinical sequele	5/9	2/4	7/13	
Method of Decompression				
Chest tube	5/9	2/4	7/13	
None	4/9	2/4	6/13	
Catheter Tip Location	Right CVC	Reposition	Left CVC	Reposition
Distal Superior Vena Cava	1385	0	99	0
Proximal Superior Vena Cava	567	0	143	0
Left Brachiocephalic vein	6	2	139	1
Right Brachiocephalic vein	35	0	0	0
Right Subclavian vein	14	7	0	0
Right Extrathoracic location (Axillary vein)	2	2	0	0
Left Subclavian vein	0	0	3	0
Left Extrathoracic location (Axillary Vein)	0	0	3	2
Right Internal Jugular vein				
-Intrathoracic location	21	0	0	0
-Extrathoracic location	3	3	0	0
Left Internal Jugular vein				
-Intrathoracic location	0	0	8	0
-Extrathoracic location	1	1	0	0
Right Atrium	65	5	0	0
Right Ventricle	0	0	0	0
Other intravenous positions (Azygos, Hemiazygos or Internal mammary vein)	2	0	3	1
Intra-arterial	0	0	1	1
Total	2101	20(0.95%)	399	5(1.25%)

Postoperative Delirium: A Literature Review of The Last 2 Years

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Postoperative delirium is a widespread and multifactorial process that has significant consequences for the patient, the perioperative physician, and the economy, yet remains incompletely understood. Studies have shown an increase in total length of hospital and ICU stay as well as higher rates of mortality, institutionalization, and development of dementia, with estimated costs to the health care system of up to \$152 billion(1).

Currently, the most widely accepted theory for postoperative delirium is an acute perioperative insult in a patient with a susceptible neurological substrate. A number of risk factors are well-documented, such as: certain types of surgery, medications, comorbid conditions, and physiologic derangements such as electrolyte or acid-base abnormalities, hypoxia, and anemia.

Several studies in the past two years have specifically investigated the role of anesthesia in postoperative delirium, from alterations in cerebral oxygenation, to hemodynamic changes, BIS scores, and type of anesthesia. For example, a study by Sieber in 2010 strongly suggests that depth of anesthesia may be related to the development of postoperative delirium(2).

Such insults lead to alterations in neurotransmitters and the balance of neuroinflammatory mediators(3). Numerous recent studies show an association between cortisol and CRP levels as well as several members of the interleukin family. A study by Plaschke showed a correlation between lower BIS scores and elevated cortisol levels(4), which might serve as a pathophysiologic connection between Sieber's study and the biochemical findings.

Advancements in our understanding of the cholinergic and dopaminergic systems continue to be made and still receive considerable interest due to the availability of pharmacologic interventions for these pathways. Other research methodologies such as proteomics are being developed but have as yet been unsuccessful.

Despite the ramifications of postoperative delirium, treatment modalities remain limited. The mainstay continues to be a focused, multimodal team effort around the perioperative period to limit and treat identifiable risk factors. Antipsychotics remain the preferred pharmacological therapy, with several recent studies showing continued benefit with typical and atypical antipsychotics. Though newer agents such as dexmedetomidine show promise and warrant further investigation, the evidence is currently mixed as to its benefit in treating postoperative delirium.

While a considerable amount of time and resources have been spent on understanding and treating postoperative delirium, there remains a significant amount of work to be done, particularly in the realm of intraoperative interventions that anesthesia providers may be able to monitor and treat.

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Young Investigator Award

Early BIS And Sedative Requirements During Therapeutic Hypothermia Predict Neurologic Outcome at ICU Discharge

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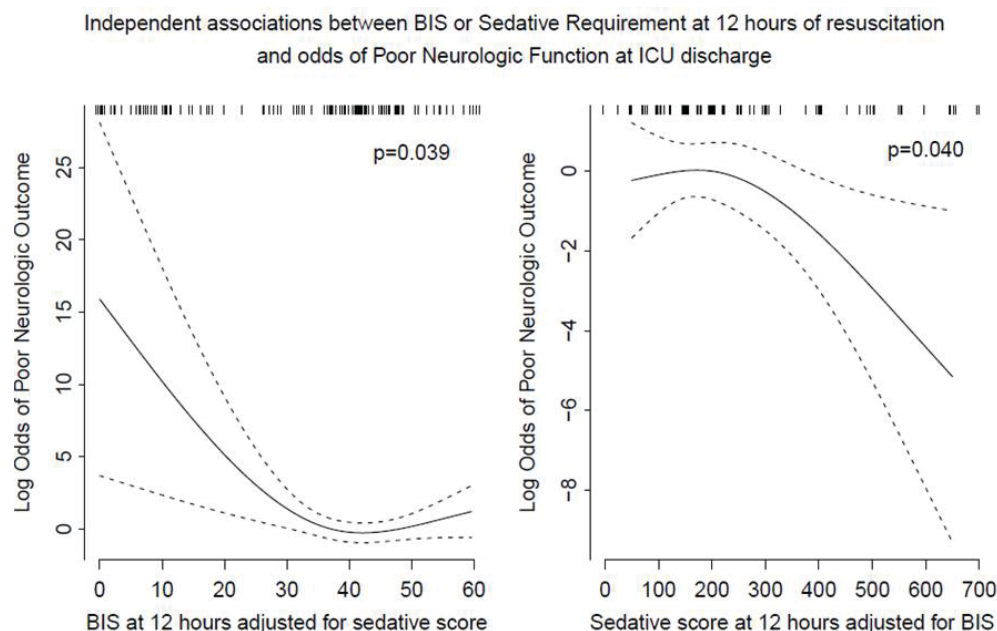
Introduction: Therapeutic hypothermia (TH) following cardiac arrest improves neurologic outcomes and decreases mortality, but the incidence of neurologically intact survival remains low. Models that predict neurologic outcome using patient characteristics gathered immediately after resuscitation do not account for the early clinical trajectory of patients and have limited usefulness for predicting poor outcomes. We hypothesized that a low bispectral index (BIS) and low sedative requirements 12 hours after initiation of TH accurately predict poor neurologic function at ICU discharge.

Methods: BIS, sedative exposure, and neurologic outcome were collected in 160 consecutive adult patients treated with TH at a single academic center from 2007-2011. TH was performed according to an institutional protocol that dictates paralysis, controlled ventilation, hourly BIS measurements, and midazolam and fentanyl sedation titrated to a BIS of 40-60. A combined sedative score equal to the sum of the hourly fentanyl dose and the midazolam dose multiplied by 50 was used (for example, a fentanyl dose of 100 μ g/h and midazolam 2mg/h is a sedative score of 200). Poor neurologic outcome was defined as a Cerebral Performance Category (CPC) score of 3, 4, or 5 at ICU discharge. Patient characteristics were compared between subjects with poor and favorable neurologic outcome, and logistic regression was used to measure the association between BIS or sedative exposure, independent of each other, and neurologic outcome.

Results: 142 of the 160 patients were treated according to the sedation protocol, survived to 12 hours, and were included in the analysis. The

median age was 59 years, 66% were male, and the median time to cardiopulmonary resuscitation was 10 minutes. Eighty-five (60.0%) patients were discharged from the ICU with a poor neurologic outcome, most of which (91.8%) died in the ICU. Patients with a poor outcome were less likely to present with VTach or VFib (50.0 vs. 85.5 %, $p < 0.001$), had longer time to return of spontaneous circulation (30.0 ± 19.8 vs. 14.3 ± 9.4 minutes, $p < 0.001$), and at 12 hours following ICU admission had a lower BIS (21.1 ± 18.0 vs. 45.6 ± 8.5 , $p < 0.001$), required less fentanyl (84 ± 63 vs. $171 \pm 114 \mu$ g/h, $p < 0.001$) and midazolam (1.79 ± 0.94 vs. 3.93 ± 2.41 mg/h, $p < 0.001$), had lower sedative scores (159 ± 103 vs. 361 ± 222 , $p < 0.001$), and had higher blood lactate levels (4.6 ± 3.5 vs. 2.4 ± 2.0 mmol/l, $p < 0.001$). After adjusting for sedative exposure or BIS, the odds of poor neurologic outcome remained significantly higher for patients with a lower BIS or lower sedative score, respectively (Figure). For example, a BIS of 30 compared to 40 was associated with 5.13 increased odds of poor neurologic outcome (95% CI 1.32-19.9), and a sedative score of 200 compared to 400 was associated with 4.80 increased odds of poor outcome (95% CI 1.41-16.30).

Conclusions: A low BIS and low sedative requirement 12 hours after initiation of TH following cardiac arrest predicts poor neurologic function at ICU discharge. Prognosis prediction models incorporating BIS and sedation requirements early in the ICU course may help inform decision-making regarding discharge planning, end of life discussions with families, and organ donation services.



Use of Dexmedetomidine in Acute Phencyclidine Toxicity

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Context: Use of the selective alpha-2 adrenergic receptor agonist dexmedetomidine has increased substantially over the last decade. We propose herein an additional clinical application—that addition being the control of the behavioral derangements caused by acute phencyclidine (PCP) intoxication.

A 37 year old man was transported to our institution's Level 1 Trauma Center emergency department (ED) in a combative state after reportedly having attempted to jump onto a moving car. He rather struck the front windshield of the car breaking it in the process. Shortly prior to this event bystanders reported the man had been witnessed to smoke what was believed to be marijuana laced with formaldehyde. Upon arrival in the ED he was agitated and combative with only minor abrasions visible. Due to his extreme combativeness with intermittent periods of no response (even to painful stimuli) he was intubated in the ED to protect his airway. A propofol infusion was started for sedation. A qualitative urine drug screen was noted to be positive for PCP and negative for cocaine, amphetamines and methamphetamines. Plain film x-rays of his chest and pelvis as well as CT scans of his head, cervical spine, abdomen and pelvis were performed and showed no acute injuries. He was then transported to the surgical intensive care unit (SICU) where the plan of care was to wean his sedation after several hours time in preparation to extubate (presumably after the acute effects of the illegal substances he had taken would be worn off).

Approximately six hours after his initial arrival in the hospital his propofol infusion was turned off in preparation to extubate. However the patient became violently agitated and was deemed to be a danger both to himself and to his caregivers so he was re-sedated with propofol and kept intubated. Dexmedetomidine was subsequently substituted for

propofol to provide sedation. Another fifteen hours were allowed to pass after which the dexmedetomidine was held and the patient was successfully extubated in a calm, relaxed state. As there were no injuries (beyond various abrasions) that required further treatment the patient was discharged directly to home from the SICU several hours after being extubated.

PCP is a centrally acting N-methyl, D-aspartic acid (NM.D.A) glutamate receptor antagonist originally developed as an intravenous anesthetic agent. Because of the frequent occurrence of hallucinations and agitation that accompanied its use further medical applications in humans were abandoned in the 1960's (1). Abuse of this drug, however persists still. In 2007 1.8 percent of high school seniors in the U.S. reported having used this drug at some point in their lives (2). While a substantially greater percentage (42 percent) of high school seniors report lifetime marijuana use (3) the relatively more adverse side effects of PCP warrant particular attention in identifying acute symptomatic treatment.

Consistency: Dexmedetomidine, Phencyclidine (PCP)

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A Case of Postobstructive Pulmonary Edema Requiring Extracorporeal Membrane Oxygenation

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Case Report: The patient is a 36 year old healthy muscular male who sustained a gunshot wound to the left knee. He underwent an uneventful removal of a bullet fragment from the left knee and open reduction and internal fixation of the left lateral femoral condyle. There was minimal blood loss and the patient did not require a blood transfusion. He was extubated after meeting all extubation criteria. Immediately after extubation the patient developed respiratory distress with inspiration and appeared to have laryngospasm. Oxygen saturation quickly decreased from 100% to 80%. As the oxygen saturation continued to drop to a low of 55%, the pt was mask ventilated and then reintubated in the operating room. Albuterol was given and then copious amounts of pink frothy sputum emerged from the endotracheal tube. The patient was placed on mechanical ventilation with an FiO₂ of 100%, PEEP 15, maintaining oxygen saturation of 70%. He was then transferred to the recovery room where a chest x-ray showed diffuse bilateral parenchymal opacities suggestive of ARDS. Peak pressures on the ventilator were consistently extremely elevated. Manual bag ventilation was extremely difficult and bilateral chest tubes were placed but did not help with ventilation. The patient now became hypotensive and a left subclavian central line was placed and norepinephrine and vasopressin infusions were started. Furosemide was given for the pulmonary edema. Transesophageal echo showed hypovolemia but no right ventricular dilation, not consistent with a pulmonary embolus. There was left ventricular hypertrophy but no intra-cardiac shunt. Copious amounts of frothy secretions continued

to emerge from the endotracheal tube and the patient continued to be hypovolemic with a hematocrit now of 60. As manual bag ventilation became increasingly difficult and the patient's oxygenation status continued to decompensate, the patient was emergently placed on veno-venous ECMO. He was eventually weaned off ECMO after 3 days with no central neurologic deficits or renal function compromise. A percutaneous tracheostomy was performed after 10 days in the ICU. He is currently still in ICU care undergoing continual weaning of ventilatory support. Postobstructive pulmonary edema, also known as negative pressure pulmonary edema occurs in approximately 1 out of every 1000 anesthetics though the actual incidence is likely higher. The most common etiology of airway obstruction is laryngospasm. Young males are at an increased risk of developing this condition as they are capable of generating large negative intrathoracic pressure [1]. This is only the second case that can be found in the literature of the need for ECMO after postobstructive pulmonary edema [2].

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Serendipitous Discovery of a Partial Anomalous Pulmonary Venous Connection in The Surgical Intensive Care Unit

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Introduction: Central venous line placement and management is an essential part of the practice of critical care medicine. Despite advances in ultrasound guided imaging and techniques of line placement, chances of anatomical misplacement are to the tune of 1%. (1,2)

Case Report: A 65-year-old male underwent a laparoscopic abdominoperineal resection for a rectal malignancy. Post operatively he was admitted to the surgical intensive care unit (SICU) for management of intractable hypertension. A routine chest roentgenogram to confirm line placement showed a left sided internal jugular central venous catheter that did not appear to cross the midline. (Fig.1) A venous blood gas sample revealed a PaO₂ equivalent to the arterial blood gas that raised suspicion for an inadvertent external carotid cannulation. However, a transduced waveform showed a venous tracing. To further elucidate the diagnosis, a CT scan of the chest was performed that showed a partial anomalous pulmonary venous connection (PAPVC) with drainage of the left upper lobe pulmonary vein into the innominate vein. The tip of the left central venous catheter was seen in the draining pulmonary vein. The catheter was removed and the patient remained asymptomatic and hemodynamically stable during this period.

Discussion: Partial anomalous pulmonary venous connection (PAPVC) is a rare congenital abnormality (incidence 0.5% of all congenital cardiac defects) in which one or more of the pulmonary veins drain oxygenated blood to the right atrium or its tributaries (superior vena cava, inferior vena cava, left innominate vein). This is an aberration from the usual

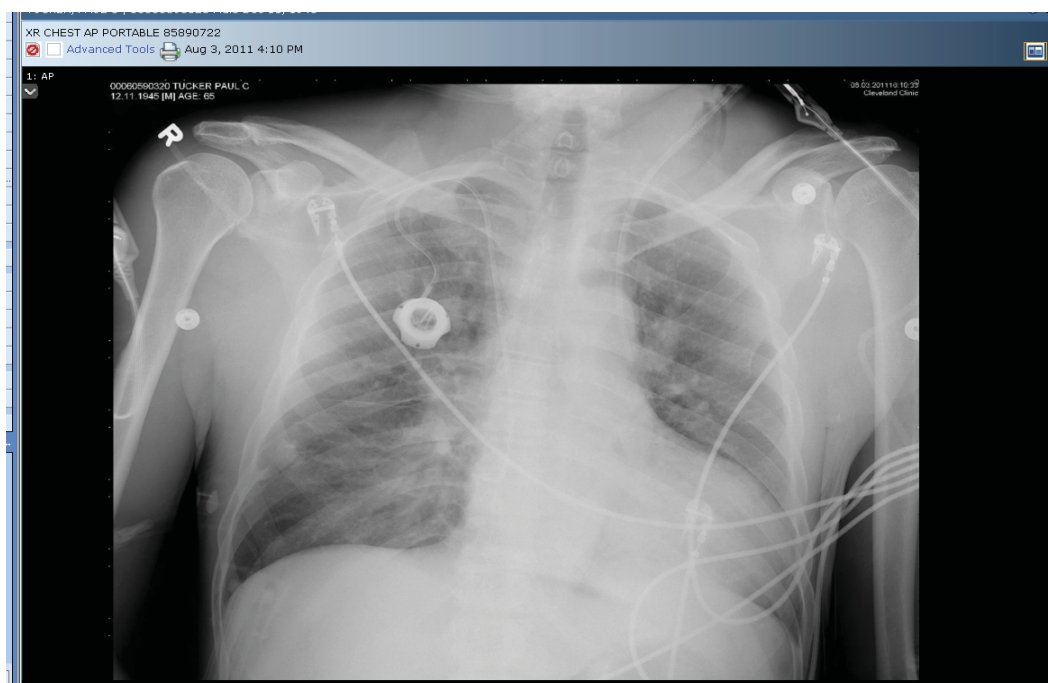
course of the pulmonary veins draining into the left atrium. An association with a sinus venosus type of atrial septal defect has been reported. (3) In most cases these patients are asymptomatic and the discovered typically as an incidental diagnosis with routine chest radiology.

It is important for the intensivist to recognize this aberration and differentiate it from a persistent left superior vena cava that may appear similar on a routine chest roentgenogram for identification of a central line placement. Our case highlights the value of peri-procedural radiology in correct identification of central venous catheter placement and the early recognition of venous malformations such as a PAPVC and its implications for the critically ill patient.

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Figure 1: Routine chest radiograph showing a left sided central venous catheter not crossing the midline. (A right sided subclavian medi-port is also seen)



Effect of Mitochondrial Dysfunction in The Development of Multi-Organ System Dysfunction Syndrome After LVAD Placement

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Multiple organ dysfunction syndrome (MODS) is the presence of altered organ function in acutely ill patients such that normal cellular process cannot be maintained without pharmacologic or mechanical intervention. The condition manifests as an uncontrolled inflammatory in response to infection, injury (surgery), poor perfusion or altered metabolism. Many hypotheses have been put forth to explain MODS in the critically ill with sepsis. These explanations include the gut hypothesis (splanchnic hypoperfusion and the subsequent mucosal ischemia leading to alterations in cellular function and increased gut permeability and increased translocation bacteria), the endotoxin hypothesis (endotoxin results in the production of pro-inflammatory cytokines that drive organ dysfunction), tissue-hypoxia hypothesis (microvascular changes result in insufficient tissue oxygenation and organ dysfunction).

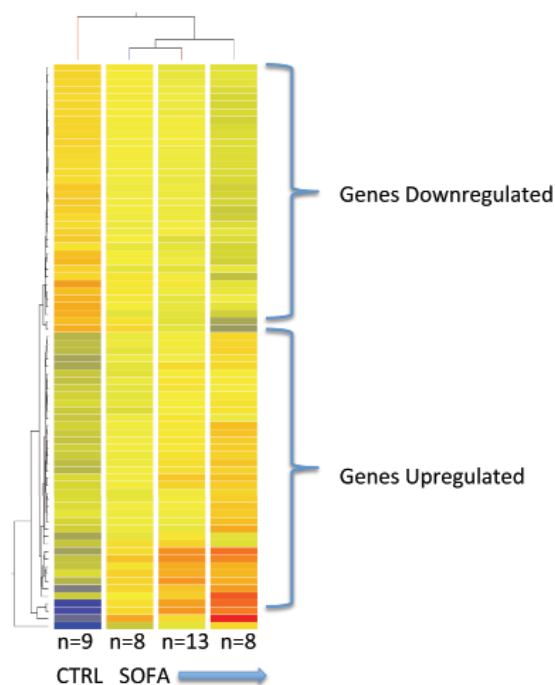
MODS a major cause of morbidity and mortality after mechanical circulatory support device (MCS) implantation in patients with advanced heart failure (AHF). MODS after mechanical circulatory support device (MCS) implantation in patients with advanced heart failure is not well understood. We hypothesized that different degrees of MOD, as quantified by the Sequential Organ Failure Assessment (SOFA) score, correlate with progressive changes in specific mitochondrial processes governed by leukocyte biology. Since MODS is a condition with aberrant leukocyte activation/suppression, we hypothesized that MODS is associated with specific leukocyte gene expression profiles (GEP), which may help detect/predict risk/treat of MODS.

In order to investigate this complex problem, we enrolled 29 consecutive HF patients undergoing MCS implantation at Columbia University Medical Center between March 5th 2010 and May 2011, and 8 healthy age-matched controls. MODS was defined by Sequential Organ Failure Assessment (SOFA) score. Patients were divided into low (<4) (n=8), intermediate (5-11) (n=13), and high (≥12) (n=8) SOFA-score groups at median 8 days. Blood samples were collected and processed for peripheral blood mononuclear cell (PBMC) separation. Total RNA was purified, amplified and hybridized on Illumina Whole Genome Expression Chips. Expression data was extracted and analyzed using GeneSpring GX 11. Biological interpretation of the signatures was performed using High-Throughput GoMiner.

The mean age of the patients was 57 ± 15 years. Using Kruskal-Wallis testing, 2444 unique transcripts were differentially expressed across groups (Benjamini-Hochberg correction, false discovery rate (FDR) 0.05,

fold change 1.5). Based on these genes, hierarchical clustering using Pearson distance metrics separated the high-SOFA groups from all other groups (Figure 1). Gene ontology and pathway analysis (FDR 0.02) revealed enrichment of about 100 pathways involved at a p-value <0.01 with multiple gene categories dysregulated including mitochondrion part/membrane/envelope, organelle envelope, cytoplasmic part.

AHF patients undergoing MCS surgery who develop postoperative MOD have unique leukocyte gene expression signatures and many genes appear to be related to mitochondrial pathways. If confirmed in larger studies and with more mitochondria-specific gene chips (ie mitochip), leukocyte gene expression signatures can be used to develop a genomic classifier to detect/predict/treat MOD in patients undergoing MCS implantation by targeting mitochondrial pathways.



Hierarchical clustering differentiates patients with high, medium, and low SOFA score against healthy controls. Geneontology categories enriched by upregulated genes in the SOFA>12 (high) group are depicted in the top box.

SOCCA Breakfast Panel at ANESTHESIOLOGY 2012

“Perioperative Respiratory Complications: The New Frontier”

Sunday, October 14, 2012, 7:00 - 8:15 a.m.

Convention Center - 207B

Objectives

Upon completion of this learning activity, participants should be able to:

1. Review existing evidence on the epidemiology and risk factors for perioperative pulmonary complications;
2. Identify and discuss optimal strategies for managing and monitoring respiratory function during the perioperative period;
3. Examine critical clinical decision making with respect to postoperative intubation/ICU management and perioperative outcomes.

When compared to cardiac complications, perioperative respiratory complications are less frequently addressed. With an aging patient population and a rising incidence of lung diseases such as COPD, respiratory complications play an increasing role in perioperative care. This panel will address current evidence with respect to the epidemiology of perioperative respiratory complications, examine preoperative risk factors and risk modification for reducing perioperative respiratory function, discuss strategies for optimizing intraoperative respiratory function, and evaluate evidence-based approaches to postoperative respiratory care including the decision to extubate.

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Presentations

Lead Speaker-Postoperative Care: The Decision to Extubate and Beyond

Mark T. Keegan, M.D.

Mayo Clinic College of Medicine, Rochester, MN

Speaker-Minimizing Iatrogenic Intraoperative Injury: What Do We Know?

John D. Lang, M.D.

University of Washington, Seattle, WA

Speaker-Perioperative Respiratory Complications: How Big a Problem and Can We Predict It?

Steven J. Lisco, M.D.

University of Cincinnati College of Medicine, Cincinnati, OH

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