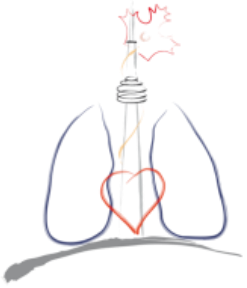
UNIVERSITY OF TORONTO | Interdepartmental Division of Critical Care Medicine



ART SLUTSKY RESEARCH DAY

Interdepartmental Division of Critical Care Medicine
University of Toronto

Tuesday June 18, 2024
Campbell Conference Facility
Munk School of Global Affairs and Public Policy
Trinity Site, 1 Devonshire Place
University of Toronto

8:00 –8:55 am Registration and Light Breakfast

8:00 – 8:45 am Poster Set-Up

Posters should be on display until **3:00 pm** so they are available for viewing both at the designated time with the authors (see below), and informally (without authors) at coffee breaks and lunch.

Please set up posters before the start of the oral presentations to avoid interruptions.
We will supply VELCRO (we are not allowed to use pins on these rented boards)

8:55 – 9:00 am Welcome and Introductory Remarks / Land Acknowledgement

IDCCM Research Director: Dr. Margaret Herridge

9:00 – 9:45 am Oral Presentations I: Mix of abstract types

Chairs: Dr. Matteo Parotto and Dr. Haifa Mtaweh

Each presentation is 10 min followed by 5 min discussion.

All speakers will be requested to strictly adhere to the time limit.

9:00 – 9:15 am **Presentation 1**: **Dr. Martin Urner**
The Association between Sex-specific Differences in Tidal Volumes and Mortality of Mechanically Ventilated Patients: A Registry-Based Cohort Study

9:15 – 9:30 am **Presentation 2: Drs. Hannah Wozniak/Erminio Santangelo**
Association of Skeletal Muscle Index and Bone Density with 1-Year Outcomes in Critically Ill Survivors of 7 or More Days of Mechanical Ventilation

9:30 – 9:45 am **Presentation 3: Dr. Dylan Ginter**
Hypotension post pediatric cardiovascular surgery with cardiopulmonary bypass and association with Acute Kidney Injury

Featured Faculty Speakers

Session Chairs: Dr. Geeta Mehta and Dr. Maha Al Mandari

9:45 – 10:05 am **Dr. Melany Gaetani**
Critical Care and our Carbon Footprint: What should our community do?

10:05- 10:25 am **Dr. Angela Jerath**
Critical Care Sedation: The Emerging Role of Inhalational Anesthetics

10:25- 10:35 am **Discussion**

10:35 - 11:00 am Morning Break

11:00 – 11:45 am **Oral Presentations II: Mix of abstract types**

Chairs: Christie Lee and Gail Annich

Each presentation is 10 min followed by 5 min discussion.

11:00 – 11:15 am **Presentation 4: Dr. Shaurya Taran**
Differences in withdrawal and withholding life sustaining therapies between patients with and without acute brain injury: a comparison from two international cohorts

11:15 – 11:30 am **Presentation 5: Dr. Diana Morales**
Propofol and Fentanyl Pharmacokinetics and Pharmacodynamics in Extracorporeal Membrane Oxygenation

11:30 – 11:45 am **Presentation 6: Dr. Vorakamol Phoophiboon**
Ventilation Distribution during Spontaneous Breathing Trial to Predict Liberation from Mechanical Ventilation: the VISION Study

11:45 am – 1:30 pm **Poster Discussion/Viewing and Lunch**
Poster numbers with corresponding Abstract numbers are at the end of the agenda.

11:45 am – 12:45 pm Poster discussion
Presenting authors and poster discussants will be at their posters

12:45 pm – 1:30 pm Lunch and independent poster viewing

1:30 – 2:00 pm **Oral presentations III: Mix of abstract types**

Chairs: Dr. Neill Adhikari and Dr. Mike Sklar

Each presentation is 10 min followed by 5 min discussion.

1:30 – 1:45 pm **Presentation 7: Dr. Kali Barrett**
High-cost users after sepsis: A population-based cohort study.

1:45 – 2:00 pm **Presentation 8: Dr. Annia Schreiber**
Longitudinal Assessment of Accessory Muscle Activity and Coordination after Traumatic Spine Injury: the ACCESSIT Study

IDCCM Special Presentations

2:00 – 2:20 pm **State of the IDCCM**, University of Toronto
Dr. Laurent Brochard

Session Chairs: Dr. Claudia Dos Santos and Dr. John Marshall

2:20 – 3:00 pm **Featured Art Slutsky Day International Guest Speaker**

Dr. Carolyn Calfee
Molecular Phenotyping of Critical Illness: New Biologic Insights and Progress Towards Implementation

3:00 – 3:10 pm **Discussion**

3:10 – 3:30 pm Afternoon Break

Featured Faculty Speakers

Session Chairs: Dr. Bruno Ferreyro and Dr. Victoria McCredie

3:30-3:50 pm **Dr. Fahad Razak**
Gemini Group/ St. Michael's Hospital
Harnessing AI and electronic clinical data for research

3:50-4:10 pm **Dr. Bourke Tillmann**
Improving Long Term Outcomes after Injury

4:10-4:20 pm **Discussion**

4:20-5:20 pm **Presentation of Certificates, Teaching Awards, Research Day Prizes and Closing Remarks**
IDCCM Faculty

5:20- 5:30 pm **End of Year Group Photo in Courtyard, Weather Permitting**

5:30- 6:30 pm **IDCCM Community Wine and Cheese Reception**

Thank you!

Have another great year of research and education and see you next year!

Art Slutsky Research Day 2024
IDCCM Chair: Dr. Laurent Brochard
IDCCM Director of Research: Dr. Margaret Herridge
IDCCM Associate Director of Research: Dr. Neill Adhikari

GUEST SPEAKERS

Featured Art Slutsky Day International Guest Speaker

Dr. Carolyn Calfee

Carolyn S. Calfee, MD MAS is Professor in Residence of Medicine and Anesthesia at UCSF, where she attends in the intensive care units at Moffitt-Long Hospital. Dr. Calfee received her undergraduate degree from Yale University and her medical degree from the University Of Pennsylvania School Of Medicine. She came to UCSF for residency in Internal Medicine and stayed to complete her chief residency and Pulmonary/Critical Care Medicine fellowship. She also completed her Masters in Clinical Research at UCSF in 2009. After research training with Drs. Michael Matthay and Mark Eisner, she joined the faculty of the division in 2007. Dr. Calfee is also a member of UCSF's Center for Tobacco Control Research and Education and an associate member of the Cardiovascular Research Institute (CVRI) and the UCSF Cancer Center.

Featured Faculty Speakers

Dr. Melany Gaetani

Melany Gaetani is a staff physician in the Department of Critical Care Medicine at The Hospital for Sick Children (SickKids), and an assistant professor in the Department of Paediatrics at the University of Toronto. She completed medical school in Dublin, Ireland at Royal College of Surgeons in Ireland and completed her paediatric residency training at Georgetown University in Washington, D.C., USA. She trained in paediatric critical care at SickKids in Toronto, Canada, followed by an additional year of training at the Royal Children's Hospital in Melbourne, Australia. She is currently completing a PhD in clinical epidemiology at the University of Toronto. Melany's research interests are in the fields of pharmacotherapy and drug administration, error recognition, utility and analysis and sustainability science.

Dr. Angela Jerath

Angela Jerath serves as an associate professor within the Department of Anesthesiology at the University of Toronto and is clinically based at Sunnybrook Health Sciences Centre.

She dedicates her research efforts into the examination and implementation of innovative critical care and surgical healthcare delivery models, and assessing their influence on patient and health system outcomes using various clinical epidemiological and translational research methodologies. Her work is funded by CIHR and Heart & Stroke Foundation of Canada and featured in mainstream media outlets including the New York Times and Washington Post

Dr. Fahad Razak

Fahad Razak is an internist at St Michael's Hospital (Unity Health Toronto), and Canada Research Chair in Data Informed Healthcare Improvement at the University of Toronto. He co-founded GEMINI (https://www.geminimedicine.ca/), the largest hospital research network in Canada, and one of few such examples globally. He was the Scientific Director of the Ontario COVID-19 Science Advisory Table and co-authored>50 science and policy briefs that shaped the policy, public health and clinical response to the COVID-19 crisis. He is active in science communication and co-founded the Rounds Table, a free podcast about new research in medicine that has been downloaded >400,000 times in 150 countries. He has written extensively for news sources such as the Globe and Mail, the Toronto Star and Maclean's.

Fahad completed a degree in Engineering Science and a Medical Doctorate at the University of Toronto. He was the first physician appointed as the David E. Bell Fellow at Harvard University. He has received >$65 million in grant funding as Principal Investigator.

Fahad has been the primary supervisor of research projects for >40 trainees and has received the Teaching Award for Excellence and the Dr. Robert Sargeant Award for mentorship at the University of Toronto.

Dr. Bourke Tillmann

Dr. Bourke Tillmann received his medical degree from the University of Western Ontario in 2010, and subsequently completed his emergency medicine residency and adult critical care fellowship. Following his fellowship training, Dr. Tillmann completed his PhD in Clinical Epidemiology at the University of Toronto's Institute of Health Policy, Management, and Evaluation. In addition to his position as an Assistant Professor in the Department of Medicine, he is Clinician Scientist at the University Health Network and an Associate Scientist at the Sunnybrook Research Institute. In his clinical practice, Dr. Tillmann is an attending intensive care physician at Toronto Western Hospital, a burn intensivist at the Ross Tilley Burn Centre, and a Trauma Team Leader at Sunnybrook Health Sciences Centre.

Dr. Tillmann's research program focuses on equity in access to critical care. His work aims to optimize short- and long-term outcomes among critically ill adults, as well as develop interventions to improve outcomes after acute brain injury

ABSTRACT JUDGES

Basic Science Category	Dr. Haibo Zhang Dr. Warren Lee Dr. Jane Batt
Clinical Research/Health Services Research Category	Dr. Chris Yarnell Dr. Geeta Mehta Dr. John Granton Dr. Neill Adhikari Dr. Haifa Mtaweh
Physiology Category	Dr. Irene Telias Dr. Mike Sklar Dr. Ewan Goligher Dr. Mayson Sousa
Quality Category	Dr. Nava Maham Dr. Andrew Helmers Dr. Cam Landry
Systematic Review/Case Report/Education Category	Dr. Briseida Mema Dr. Dominique Piquette Dr. Jenna Spring Dr. Ian Randall

POSTER DISCUSSANTS FOR ART SLUTSKY DAY

Basic/Translational Science Category I:	Dr. Haibo Zhang Dr. Jane Batt
Basic/Translational Science Category II:	Dr. Sabri Sousi
Clinical Research/Health Services Research Category I:	Dr. Gordon Rubenfeld
Clinical Research/Health Services Research Category II:	Dr. Jeff Singh

Clinical Research/Health Services Research Category III:	Dr. Brian Cuthbertson
Clinical Research/Health Services Research Category IV:	Dr. Elaine Gilfoyle Dr. Kali Barrett
Physiology Category I:	Dr. Laurent Brochard
Physiology Category II:	Dr. Irene Telias
Systematic Review/Case Report/Education Category I:	Dr. Jenna Spring Dr. Laura Dragoi
Systematic Review/Case Report/Education Category II:	Dr. Mika Hamilton Dr. Dino Alexopoulos

ORAL PRESENTATION JUDGES

Dr. Laurent Brochard	Dr. Carolyn Calfee
Dr. Margaret Herridge	Dr. Elaine Gilfoyle

ORAL PRESENTATION 1

The Association between Sex-specific Differences in Tidal Volumes and Mortality of Mechanically Ventilated Patients: A Registry-Based Cohort Study

***Urner, Martin**; Rojas-Saunero, L. Paloma ; Buyck, Katelijne; Douflé, Ghislaine; Amaral, André; Adhikari, Neill; Jüni, Peter; Hansen, Bettina ; Ferguson, Niall D. ; Fan, Eddy; Mehta, Sangeeta,*

Submission ID

50

ABSTRACT CATEGORY

Clinical/Health Services Research

INTRODUCTION:

Limiting exposure to higher tidal volumes represents a key strategy to mitigate the risk of ventilator-induced lung injury in patients with acute respiratory distress syndrome (ARDS) (1). In clinical practice, tidal volumes per predicted body weight are calculated according to a nomogram based on height and sex using the equations from the ARDS Network investigators (2). Previous work reported that during the first 24 hours of mechanical ventilation, female patients with acute respiratory distress syndrome (ARDS) received higher tidal volumes per predicted body weight than male patients, which might be associated with higher mortality (3).

OBJECTIVES:

To investigate if the association between sex-specific differences in tidal volumes and mortality persists beyond 24 hours, if the relationship holds not only for ARDS patients but for all critically ill patients requiring support with mechanical ventilation, and if the association is mainly explained by baseline factors that differ between female and male patients.

HYPOTHESIS:

The null hypothesis was that there is no direct or indirect effect, mediated by a difference in daily tidal volumes per predicted body weight, of sex on the mortality of mechanically ventilated patients.

METHODS:

In this registry-based cohort study, adult patients (≥ 18 years) were included if they were mechanically ventilated for ≥ 24 hours and recorded in the Toronto Intensive Care Observational Registry between April 2014 and December 2022. We estimated the associations between sex-specific differences in either daily tidal volumes or dynamic driving pressure and mortality during mechanical ventilation using Bayesian Joint Models (4).

RESULTS:

20,351 patients were eligible for analysis, of whom 7,635 (37%) were female. Unadjusted mortality was 18% for female (1,384/7,635) and 17% for male (2,113/12,716) patients. Every increase in daily tidal volumes per predicted body weight (1 mL/kg PBW) was associated with higher mortality (hazard ratio: 1.10, 95% credible intervals [CrI]: 1.07 to 1.13), adjusted for lung injury severity. Female patients had, on average, a lower height and consistently received higher tidal

volumes than male patients during mechanical ventilation (+0.6 mL/kg PBW, 95% CrI: +0.6 to +0.7 mL/kg PBW), thereby leading to an indirect effect of sex on mortality mediated by a difference in tidal volumes. Furthermore, we found that female patients were ventilated with higher daily dynamic driving pressures (mean difference of 5 cmH_2O, 95% CrI: 2 to 7 cmH_2O), and that was associated with increased mortality compared to male patients and adjusted for body height and respiratory tidal elastance. No direct effect of sex on mortality was observed.

CONCLUSION:

Female patients are at risk of consistently receiving higher tidal volumes throughout the course of mechanical ventilation and have an associated higher mortality compared to male patients despite a comparable degree of respiratory failure. Daily monitoring and adjustment of tidal volumes (after normalizing absolute values to predicted body weight) and driving pressures may reduce the mortality of critically ill patients requiring support with mechanical ventilation.

ORAL PRESENTATION 2

Association of Skeletal Muscle Index and Bone Density with 1-Year Outcomes in Critically Ill Survivors of 7 or More Days of Mechanical Ventilation

Santangelo Erminio , Wozniak Hannah *, McInnis Michaell , Dragoi Laura , Robles Priscila , Chu Leslie M. , Matte ,Andrea , Herridge Margaret*

Submission ID

35

ABSTRACT CATEGORY

Clinical/Health Services Research

INTRODUCTION:

In critically ill patients admitted to the intensive care unit (ICU), prior studies have underscored an association between muscle mass, bone density and short-term outcomes such as in-hospital mortality and discharge disposition[1–6]. There is a knowledge gap concerning the implications of these factors on the long-term outcomes of chronically critically ill patients.

OBJECTIVES:

The primary objective was to assess the associations between muscle indexes and bone density, measured on abdominal CT scans, with 1-year mortality in chronically critically ill patients. The secondary objective was to examine how these same measurements relate to the 7-day post-ICU discharge FIM.

HYPOTHESIS:

We hypothesized that there is an association between muscle indexes and bone density measured in the first 14 days of ICU admission with 7-day post-ICU discharge Functional Independence Measure (FIM) and 1-year mortality. This may enhance prognostic information for patients and families.

METHODS:

This study used the Canadian RECOVER Program (Phase 1) cohort [7], which consists of patients requiring mechanical ventilation for ≥7 days. Patients who underwent abdominal CT scans as part of their clinical management within the first 14 days of ICU admission were included. Skeletal Muscle Index (SMI), Psoas Muscle Index (PMI), and trabecular bone density were measured at the L3 vertebral level. Uni- and multivariable logistic regressions were performed to assess the association between each of SMI, PMI, and bone density and 1-year mortality. Uni- and multivariable linear regressions were performed to assess the association between each of SMI, PMI and bone density and the 7-day post-ICU FIM. Adjustments were made for age, sex, Charlson Comorbidity Index, ICU length of stay and the timing of the CT scan relative to ICU admission.

RESULTS:

One hundred patients were included; the median age was 57 [IQR: 45-65] and 43% were female. Median values for one-year mortality showed that non-survivors had lower muscle and bone indexes than survivors: SMI at 28.8 cm^2/m^2 [IQR:

22-34] vs. 33.5 cm^2/m^2 [IQR: 25.7-44.1], p=0.03; PMI at 3.3 cm^2/m^2 [IQR: 2.5-4.5] vs. 4 cm^2/m^2 [IQR: 3.2-5.6], p=0.02; and bone density at 131 Hounsfield unit (HU) [IQR: 100-196] vs. 175 HU [IQR: 131-220], p<0.01. Multivariable logistic regression analysis revealed significant associations with one-year mortality for decreases in SMI (OR per 10-unit decrease in SMI: 2.00, 95% CI: 1.25-3.33, p<0.01), PMI (OR per 1-unit decrease in PMI: 1.67, 95% CI: 1.11-2.5, p=0.02), and bone density (OR per 10-unit decrease in bone density: 1.11, 95% CI: 1.09-1.27, p=0.03). However, there was no significant association found between decreases in muscle mass, bone density, and the 7-day post-ICU FIM.

CONCLUSION:

Muscle mass and bone density are associated with up to 1-year mortality in chronically critically ill patients. These findings could facilitate better identification of patient trajectories and inform clinical decision-making.

ORAL PRESENTATION 3

Hypotension post pediatric cardiovascular surgery with cardiopulmonary bypass and association with Acute Kidney Injury

Ginter, Dylan *; Gaetani, Melany ; Noone, Damien ; Zappitelli, Micheal ; Honjo, Osami ; Floh, Alejandro*

Submission ID

40

ABSTRACT CATEGORY

Clinical/Health Services Research

INTRODUCTION:

Introduction and Aims

Acute kidney injury (AKI) is a common complication of pediatric cardiopulmonary bypass (CPB) surgery, occurring in up to 42% of patients[1] and 64% of neonates[2]. A Kidney Disease: Improving Global Outcomes' (KDIGO) "bundle" has been developed to attempt to prevent CS-AKI[3], which includes ensuring "optimal hemodynamics." Absence of clear hemodynamic targets to guide optimal support is an important barrier impeding its pediatric application. To better define this bundle element, the primary aim of our study is to determine if hypotension is associated with CS-AKI.

OBJECTIVES:

The primary objective of this study is to determine if hypotension (defined as mean arterial blood pressure sustained for greater than 5 minutes below the estimated 5th percentile for age) in the first 7 days post pediatric cardiac surgery with CPB is associated with moderate (stage 2 or 3) Acute Kidney injury, defined by the Kidney Disease: Improving Global Outcomes' (KDIGO) creatinine criteria within 7 days post-surgery.

HYPOTHESIS:

We hypothesize that patients who have hypotension in the first 7 days post pediatric cardiac surgery with CPB is associcated moderate (stage 2 or 3) Acute Kidney injury within 7 days post-surgery.

METHODS:

Methods

This single centre, retrospective cohort study focused on pediatric patients undergoing CPB surgery, who have at least 5 mins of continuous blood pressure recording available following admission to the cardiac critical care unit. Patients with pre-existing primary kidney disease, previous AKI, or pre-emptively receive postoperative kidney replacement therapy were excluded. The primary outcomes was development of moderate or severe AKI as defined by KDIGO creatinine criteria (stage $\geq$ 2) within 7 days of CPB. Hypotension was defined as a mean arterial blood pressure < 5th percentile for age and height lasting $\geq$ 5 minutes, within 7 days of CCCU admission. Blood pressure was recorded in 5-second intervals and stored in a physiologic database. The time to AKI (stage 2 and 3) was analyzed using competing risk methods. The association between the time-dependent covariate hypotension and the time-dependent outcome AKI was modelled using cause-specific hazard regression, and results were presented as Hazard ratios (HRs); the corresponding 95% confidence intervals (CIs) and p-values were evaluated using Wald's statistics.

RESULTS:

Results

A total of 1639 patients who underwent a total of 1812 surgeries between 2018-06 and 2022-12 were included. The mean age at surgery was 0.6 (SD 0.3-4.6) years old and 843 (46.5%) were female. The number of patients with just one operation was 1493. A total of 123 had 2 surgeries, 20 had 3, 2 had 4, and 1 patient had 5 surgeries. Discrete hypotensive events were identified in 788 patient surgeries (49.6% of patients). Patients experiencing hypotensive events had a longer CPB time [116 mins (82-160) vs 92 mins (66-126), p=< 0.001] and a higher STS-EACTS Mortality Risk Category [Category 1 (Low risk) 399 (39.0%) for non-hypotensive group vs 171 (21.7%) hypotensive group, and Category 4 (higher risk) 185 (18.1%) for non-hypotensive vs 224 (28.4%) for hypotensive group, p=<0.001]. Stage 2 or 3 AKI occurred in 188 (10.4%) of patient surgeries. Hypotension was associated with an increased hazard for AKI [HR=1.76 (95% CI 1.205,2.579), *p*=0.004] after adjusting for the sex, age, height, weight, duration of bypass and STS-EACTS score. Analysis of secondary outcomes are currently being completed.

CONCLUSION:

Conclusion

Hypotension post CPB surgery is associated with an 80% increased risk for stage 2 or 3 AKI. Results from this study could inform recommendations on optimal hemodynamic parameters to help prevent CS-AKI, such as duration and severity of hypotension, and mean perfusion pressure, taking into consideration central venous pressure.

ORAL PRESENTATION 4

Differences in withdrawal and withholding life sustaining therapies between patients with and without acute brain injury: a comparison from two international cohorts

Taran, Shaurya; *Frutos-Vivar, Fernando; Burns, Karen; Scales, Damon; Ferguson, Niall D; Liu, Kuan ; McCredie, Victoria A; Adhikari, Neill KJ.*

Submission ID

7

ABSTRACT CATEGORY

Clinical/Health Services Research

INTRODUCTION:

Most deaths in the ICU occur after a decision to withdraw or withhold life-sustaining therapies (WLST)[1]. Among patients with acute brain injury (ABI), there are concerns that WLST decisions often occur too early, at a time when accurate long-term neuroprognostication is not always possible[2,3]. In one study of patients with traumatic brain injury in 6 hospitals across Canada, 64% of patients who died by day 3 following ICU admission had life-sustaining therapies withdrawn[3]. Whether early WLST represents a broader international phenomenon in a diverse group of ABI conditions beyond traumatic brain injury remains unknown. In addition, differences in the prevalence and timing of WLST decisions between ABI and non-ABI patients have not been explored.

OBJECTIVES:

We sought to compare differences in time to WLST in patients with and without ABI and to evalute whether ABI is associated with higher odds of WLST compared to non-ABI conditions. Our secondary objective was to compare the magnitude of variability in WLST decisions across ICUs among ABI vs non-ABI patients.

HYPOTHESIS:

We hypothesized that WLST decisions would occur earlier in patients with ABI and that ABI conditions would be associated with a higher odds of WLST compared to non-ABI conditions.

METHODS:

This was a secondary analysis of two prospective, international studies (NCT02731898 and NCT03955874) with patient recruitment from March 2004-Dec 2016. Data were merged across common elements to create a single, harmonized cohort. Our main exposure was ABI, defined as brain trauma, intracranial hemorrhage, ischemic stroke, seizures/status epilepticus, or meningitis/encephalitis. The comparator was any non-ABI condition requiring ICU admission. The main outcome was WLST in the ICU, defined as withdrawal or withholding any of the following: vasopressors, inotropes, dialysis, or non-invasive/invasive mechanical ventilation.

Time to WLST was evaluated using cumulative incidence curves accounting for the competing risk of non-WLST deaths.

Differences in WLST between ABI and non-ABI patients were quantified using multilevel logistic regression models adjusted for patient and hospital-level characteristics and including a random intercept for ICU. Variability in WLST decisions was evaluated using subgroup-specific median odds ratios (mOR) derived from a random slope for the main exposure.

Subgroup analyses were done considering patients with brain trauma, ischemic stroke, and intracranial hemorrhage as distinct exposures. For comparison, we also reported WLST outcomes in patients admitted to the ICU with sepsis or acute respiratory distress syndrome (ARDS). In sensitivity analyses for the primary outcome, we 1) used multiple imputation to account for missing data, 2) refitted models in each of the primary studies, 3) used inverse probability weighting to achieve similar baseline characteristics and illness severity between ABI and non-ABI groups, and 4) considered ICUs with at least 20 patients or (separately) at least 5 WLST events.

RESULTS:

We included 21,970 patients from 40 countries, of whom 13,526 patients were male (61.6%), median age was 63 years (IQR 50-74), and 2,896 (13.2%) had ABI. WLST occurred in 1,909 patients (12%) and was more common in individuals with ABI (17.0% vs 11.5% in non-ABI patients; standardized mean difference (SMD), 0.16), despite similar age and illness severity at ICU admission. WLST decisions occurred earlier in the ABI group (median 4 days after ICU admission (IQR 2-9), vs 6 days (IQR 2-13) in the non-ABI group; SMD, 0.12), with consistent findings across each of the 3 different ABI subgroups. Earlier WLST among ABI patients occurred in both high-income and upper-middle income countries. By contrast, there was no difference in time to a first WLST decision for patients with ARDS or sepsis (compared to patients without ARDS or sepsis, respectively).

In adusted analyses, patients with ABI had a 2.42-fold increase in odds of receiving a WLST decision compared to non-ABI patients (95%CI, 1.89-3.12), which represented an effect size comparable in magnitude to the association between WLST and age >70 years (relative to age ≤50 years). Findings were consistent across each of the sensitivity analyses. By contrast, there was no difference in WLST for patients with ARDS, whereas patients with sepsis had a lower odds of WLST. Variability in WLST decisions was high across ICUs for both ABI and non-ABI subgroups (respectively, mOR 3.04, 95%CI 2.54-3.67; and mOR 2.59, 95%CI 2.38-2.78).

CONCLUSION:

In this secondary analysis of two large, multicenter international cohorts, we found that patients with ABI experienced higher odds of WLST compared to non-ABI patients and received earlier WLST decisions, at a time when accurate long-term neuroprognostication can be challenging. Findings were similar across all ABI subgroups. Understanding these differences is essential to improving the quality of WLST decisions for ABI patients, especially as many patients who have factors typically associated with poor prognosis (e.g., coma) can go on to make significant neurologic recovery beyond the acute illness period.

ORAL PRESENTATION 5

Propofol and Fentanyl Pharmacokinetics and Pharmacodynamics in Extracorporeal Membrane Oxygenation

Morales Castro, Diana *; Balzani, Eleonora ; Abdul-Aziz, M. Hafiz ; Hernandez-Mitre, Maria Patricia ; Wong, Irene ; Turgeon, Julien ; Tisminetzky, Manuel ; JuradoCamacho, Felipe ; Morris, Idunn ; Dresser. Linda ; Granton, John ; Uetrecht, Jack ; Pang, K. Sandy ; Chen, Eric ; Shekar, Kiran ; Fan, Eddy*

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ABSTRACT CATEGORY

Clinical/Health Services Research

INTRODUCTION:

Drug-dosing optimization in critically ill patients is challenging due to organ dysfunction, altered volume of distribution, fluid resuscitation, and potential drug-drug interactions. (1) This complexity increases with the addition of extracorporeal membrane oxygenation (ECMO), where inflammation and circuit surface areas can alter drug pharmacokinetics (PK). (2) ECMO-induced alterations in sedative PK can lead to therapeutic failures, higher incidence of agitation and delirium, and increased risk of secondary or adverse effects. (3) Despite the potential risks associated with sedation, there is a paucity of pharmacokinetic/pharmacodynamic (PK/PD) data for propofol and fentanyl in patients supported with veno-venous extracorporeal membrane oxygenation (V-V ECMO).

OBJECTIVES:

Describe propofol and fentanyl PK/PD in patients supported with veno-venous ECMO (V-V ECMO), including an exploration of sex-based differences.

HYPOTHESIS:

We hypothesize significant ECMO-induced changes in the pharmacokinetic (PK) parameters and pharmacodynamic (PD) responses of propofol and fentanyl.

METHODS:

This was a prospective, single-center, open-label PK/PD study at the Toronto General Hospital ICU between July 2022 and January 2023. Patients were eligible if they were aged 18 years or older, requiring V-V ECMO support for ARDS, and receiving propofol and/or fentanyl infusion for more than 24 hours. Exclusion criteria included pregnancy, ongoing massive blood transfusion requirement (> 50% blood volume transfused in the previous 8 hours), therapeutic plasma exchange and/or renal replacement therapy in the preceding 24 hours, and expected death or withdrawal of life support within 48 hours of V-V ECMO initiation.

Sedation was titrated to Riker-Sedation and Agitation Scale (SAS) per routine clinical practice. Patient State Index (PSI), an objective scale derived from processed electroencephalography ranging from 0 to 100 (0 representing the deepest level of sedation and 100 the awake state), was recorded when blood samples were taken. Deep sedation (SAS 1-2) and light sedation (SAS 3-4) were used to generate the receiver-operating characteristic curve (ROC) for distinguishing between different sedation levels using patient state index (PSI). PSI<40 was considered over-sedation. (4) ECMO initiation was defined within the first ten minutes post-cannulation.

Blood samples were collected at the following times: pre-ECMO initiation, 10 and 30 minutes, 1, 2, 4, and 8 hours, and 2, 3, 5, and 7 days post-ECMO initiation. Using high-performance liquid chromatography-tandem mass spectrometry, propofol and fentanyl total concentrations were measured. A two-stage sequential PK/PD analysis with parametrization for volume of distribution and clearance, employing the first-order conditional estimation extended-least squares method and a multiplicative residual error was performed with the software Phoenix WinNonlin and NLME Version 8.4 (Certara LP, USA), A covariate shotgun search was done to identify potential effects of independent covariates (sex, age, body surface area, SOFA score, bilirubin, creatinine, GFR, ECMO blood, and sweep gas flow). PK model validation involved a visual predictive check with 1000 estimates, and model robustness was evaluated through non-parametric bootstrapping with 1000 replicates. Sedative PD were characterized using a compartmental model with k_{e0}, the efflux constant, describing the effect-site concentration (C_e). PD endpoints included processed electroencephalography (PSI) for sedation, and expiratory occlusion pressure (P_{occ}), and airway occlusion pressure during the first 0.1 seconds ($P_{0.1}$) for respiratory effort. To quantify the PD goodness of fit, the coefficient of determination ρ^2 was calculated.

RESULTS:

Eleven patients underwent 106 evaluations over a median (IQR) follow-up of 146 (116-146) hours. Patient's average (±SD) age was 43 (±13) years, and 55% were female. Females had lower mean (SD) weight (68±16 vs 99±23 kg, *p*=0.03) and height (1.6±0.1 vs 1.8±0.1 m, *p*=0.009) than males. AKI was present in two (33%) females and three (60%) males at baseline, with males exhibiting higher median (IQR) creatinine levels [181 (65-344) vs 69 (46-85), *p*=0.03)] than females, but no different GFR [100 (71-114) vs 56 (21-114), p-0.4) post-ECMO initiation.

During the study period, the median (IQR) infusion doses for propofol and fentanyl were 50 mcg/kg/min (40-60) and 200 mcg/h (100-200), respectively, with no significant differences in infusion doses before and after ECMO initiation. Females received lower median (IQR) propofol [50 (40-50) vs 60 (50-70) mcg/kg/min, *p*<0.001)] and fentanyl [100 (100-200) vs 200 (200-225) mcg/h *p*=0.03)] infusion doses than males following ECMO initiation. In addition, females received fentanyl for a longer period [median (IQR) 124 (82-145) vs. 40 (26-92) hours, *p*=0.02]. Propofol and fentanyl PK were adequately described by a two-compartment model with multiplicative residual error. Derived PK models were parameterized in terms of the central volume of distribution (V_1) and peripheral compartment (V_2), clearance, and intercompartment clearance. There was a significant increase in propofol (*p*=0.01) and fentanyl (*p*=0.03) clearance within 10 minutes of ECMO initiation, plateauing after 8 hours of ECMO support. Females exhibited higher sedative central volume of distribution and lower propofol clearance (Figure 1). No other covariates, including weight, body surface area, bilirubin, or creatinine clearance, were identified as having a significant effect on sedative clearance or volume of distribution.

PSI levels ranged from 2-90 and SAS between 1-4, with males having lower SAS scores (*p*<0.001) and PSI values (*p*=0.05) than females. The area under the ROC curve for detecting deep sedation using PSI was 0.97 (95% confidence interval 0.94-0.97) with an optimal PSI cut-off point at 62 (specificity 0.91 and sensitivity 1.0). Over-sedation (PSI < 40) occurred in 74% of the observations (Figure 3A) and was common during the first 72 hours of ECMO support. Propofol-PSI PD were appropriately described using a sigmoid E_{max} model [coefficient of determination (ρ^2) =0.78, Figure 2], incorporating fentanyl concentrations and neuromuscular blockers as covariates in the propofol-PSI model resulted in a performance error reduction to 16%. Regarding respiratory effort, 34 observations under neuromuscular blockade were excluded. $P_{0.1}$ and P_{occ} ranged between -14 to 0 and -45 to 0 cmH_2O, respectively. A linear PD model best described the association between sedative concentrations and respiratory effort, with no significant effect of sweep gas flow, PaO_2, and $PaCO_2$ as covariates. However, the coefficient of determination was ρ^2<0.3, and the performance error was 100% for both P_{occ} and $P_{0.1}$.

Table 1. Sedative pharmacokinetic and pharmacodynamic parameters.

	Propofol			Fentanyl		
Parameter	**Estimated value**	**Between-subject variability (%)**	**Bootstrap median (95% CI)**	**Estimated value**	**Between-subject variability (%)**	**Bootstrap median (95% CI)**
Pharmacokinetic model						
V_1 (L)	89	29	86 (54-374)	80	70	85 (27-273)
V_2 (L)	2093	No RE	2274 (1217-6520)	523	46	525 (244-1361)
CL (Lh^{-1})	136	24	139 (98-178)	52	62	49 (27-69)
Q (Lh^{-1})	56	32	59 (40-140	42	No RE	43 (11-68)
Residual error	0.26	-	0.26 (0.2-0.31)	0.16	-	0.16 (0.12-0.2)
PE PK (%)	13.6	-	-	10.1	-	-
Pharmacodynamic models						
Parameter	**PSI**	**$P_{0.1}$**	**P_{occ}**	**PSI**	**$P_{0.1}$**	**P_{occ}**
k_{e0} (h^{-1}) E_0 E_{max} EC_{50} (µg/L) γ Residual error ρ^2 PE PD (%)	1.67 (1.2-2) 87 (82-90) 20 (10-30) 1288 (990-1590) 2.33 (1.1-3.6) 13 (9-16) 0.78 16*	1.67 -3 (-4 to -3) -3 (-4 to -2) 1009 (880-1139) - 2.4 (1.8-3.6) 0.25 100	1.67 -9 (-12 to -7) -7 (-9 to -7) 903 (782-1024) - 9.3 (5.5-13.1) 0.14 100	6.7 (6.3-7.1) 56 (20-91) 24 (23-24) 1.8 (1.7-1.8) 22 17-25) 19 (15-23) 0.46 28.9	6.7 -3 (-4 to -3) -3 (-4 to -2) 1.3 (0.9-1.8) - 2.4 (1.2-3.6) 0.27 100	6.7 -8 (-12 to -7) -7 (-7 to -5) 0.9 (0.7-1.2) - 9 (5-12) 0.18 100

RSE: relative standard error, V_1: central volume, V_2: peripheral volume, CL: central clearance, Q: intercompartmental clearance, nV: volume variance, nCL: clearance variance,
RE: random effects, PE: performance error, k_{e0}: effect-site efflux constant, E0= PSI value in the absence of propofol, E_{max}= PSI corresponding to maximum drug effect,
EC_{50}= effect-site concentration that caused 50% of the maximum PSI decrease, γ: slope of the sigmoid relationship, $\rho^{2:}$ coefficient of determination, * PE when fentanyl concentrations
and neuromuscular block were used as covariates for E_{max}, PSI: patient state index, $P_{occ:}$ expiratory occlusion pressure, $P_{0.1:}$ occlusion pressure during first 0.1 seconds.

Figure 1. Sex-adjusted PK parameters: central volume of distribution (V_1) and clearance (CL) trends over time. A. Propofol*, B. Fentanyl**

Figure 2. Population simulation plots showing propofol effect-site concentration and pharmacodynamic response.

CONCLUSION:

Propofol and fentanyl clearance and total volume of distribution during V-V ECMO correspond with earlier studies of critically ill patients. (5, 6) Despite a significant increase in sedative clearance upon V-V ECMO initiation, the effect normalized rapidly without resulting in patient under-sedation. Indeed, over-sedation was present in the majority of observations, particularly in the first 72 hours of V-V ECMO support, emphasizing the potential benefit of employing objective sedation monitoring tools in ECMO patients. Second, there were sex-based PK differences, with lower propofol clearance and higher sedative central volume of distribution in females. Moreover, significant differences were also found in sedation practices, with females having higher sedation scores and receiving lower sedative doses but longer fentanyl infusions. While sex-based disparities in sedative and analgesic use have been reported in other populations, further investigation in critically ill and ECMO patients is warranted. Finally, there was an inconsistent association between the degree of respiratory effort and sedative PK/PD modeling, with variable effort observed across the range of sedative effect-site concentrations.

ORAL PRESENTATION 6

Ventilation Distribution during Spontaneous Breathing Trial to Predict Liberation from Mechanical Ventilation: the VISION Study

Phoophiboon, Vorakamol *; Rodrigues, Antenor; Vieira, Fernando; Ko, Matthew ; Schreiber, Annia; Madotto, Fabiana ; Sun, Nannan; Sousa, Mayson L.A.; Docci, Mattia ; Sandhu, Gyan; Brault, Clement; Telias, Irene; Piraino, Thomas ; Goligher, Ewan C; Brochard, Laurent*

Submission ID

29

ABSTRACT CATEGORY

Physiology

INTRODUCTION:

Spontaneous breathing trial (SBT) is employed as a diagnostic test to predict successful immediate separation from mechanical ventilation (MV). However, using result of SBT alone to predict definite liberation from the ventilator, including extubation success, is not sufficient. In addition, clinical decisions may diverge from the SBT, which do not always have well defined criteria. Electrical impedance tomography (EIT) is a non-invasive tool to assess global and regional ventilation distribution in real time. Few studies have used EIT during SBT and used advanced off-line analyses. An abnormal pattern of distribution of ventilation may reflect a situation at risk of long-term liberation failure.[1-3]

OBJECTIVES:

This prospective observational study aimed to identify regional ventilation distribution in patients eligible for SBT, transitioning from partially supported MV to spontaneous breathing as a way to predict the likelihood of complete liberation from MV.

HYPOTHESIS:

1. Ventilation distribution may change rapidly during transition from PSV to SBT and these changes may be different according to the needs of the patient.
2. Ventilation distributions during SBT may differ between patients with MV liberation success and failure.

METHODS:

We enrolled consecutive ventilated ICU patients who met criteria to perform SBT at our center. This physiological observational study used a discovery cohort followed by a validation cohort to assess regional ventilation distribution during pressure support ventilation (PSV), and then during the changes to SBT and the next 30 minutes of SBT when successful. EIT during the SBT was analysed as follows: the tidal image on the EIT was divided into two layers, representing the ventral and dorsal region respectively, the percentage of regional ventilation being displayed in real time (Figure 1). Our primary outcome was the absolute difference (in percent) of ventilation between ventral and dorsal regions: absolute (V-D difference). Liberation failure was defined as i. extubation followed by unplanned escalation in ventilatory support (HFNC and/or NIV), ii. reintubation within 7 days, iii. SBT followed by tracheostomy and iv. not being extubated the same day or the next day of the enrolment SBT. Liberation success was defined as successful SBT and extubation at the same or the next day of the enrolemnt SBT.

Figure 1. Representative examples of two electrical impedance tomography (EIT) screenshots allowing absolute ventral-to-dorsal difference calculation at the bedside. The ventral region was displayed in region of interest (ROI) 1 and duplicated in ROI 2. The dorsal region was displayed in ROI 3 and duplicated in ROI 4. These adjustments resulted in 2 customized ROIs which displayed ventral versus dorsal ventilation distribution, as a percentage. A) V% was 50 and D% was 50, the absolute ventral-to-dorsal difference was 0%. B), V% was 78 and D% was 22, and the absolute ventral-to-dorsal difference was 56%.

RESULTS:

One hundred and ten mechanically ventilated patients were enrolled and 98 patients were included in the MV liberation outcome analysis [mean age of 58 (16) years, 64 (65%) were male]. Eighty-five patients (87%) passed the SBT. Of the 98 patients, liberation failure occured in 58 (59%) paitents for the following reasons: i. extubation followed by unplanned escalation in ventilatory support (n=5; all passed SBT), ii. reintubation within 7 days (n=7, all passed SBT), iii. tracheostomy (n=17; passed SBT, n=9; failed SBT, n=8) and iv. not being extubated quickly after the SBT (n=29; passed SBT, n=25; failed SBT, n=4).

At each time point, the mean absolute (V-D difference) was lower in liberation success than all groups of liberation failure (Figure 2; PS level, $p = 0.0005$ and SBTs, $p<0.0001$). An absolute (V-D difference) at the first few minute of SBT > 20% predicted failure to liberate from MV with sensitivity and specificity of 71% and 83%, respectively and positive predictive value of 84% in the validation cohort. A multivariable analysis confirmed that the absolute (V-D difference) > 20% was the strongest predictor of failure (adjusted odds ratio of 13, 95% confidence interval 4 to 47, $p <0.0001$)), together with severity and indication for intubation.

Figure 2. Absolute (V-D difference) in MV liberation outcome at PSV level, and 1, 2, 3, 4, 5, 10, 20, and 30 minutes of SBT. In liberation failure, from left to right: escalation in ventilatory support, light blue; reintubation, purple; tracheostomy, dark blue; not being extubated the same day or the next day of enrolment SBT, grey. The p-value pertained to the comparison between liberation success and failure.

CONCLUSION:

We have identified a novel finding in terms of regional ventilation distribution during spontaneous breathing trial. A simple parameter - the absolute (V-D difference) > 20% in the first minutes of an SBT can help to identify patients who are at risk of liberation failure, including those passing an SBT.

ORAL PRESENTATION 7

High-cost users after sepsis: A population-based cohort study.

Barrett Kali A*; Sheikh, Fatima; Chechulina, Victoria; Chung, Hannah; Dodek, Peter; Rosella, Laura; Thavorn, Kednapa; Scales, Damon and on Behalf of Sepsis Canada*

Submission ID

45

ABSTRACT CATEGORY

Clinical/Health Services Research

INTRODUCTION:

Importance: Sepsis is a life-threatening disease that is associated with high morbidity, mortality, and economic costs to the healthcare system. Identifying patients at risk of becoming high-cost users (HCU) is important for healthcare planners.

OBJECTIVES:

Objective: To determine the association between hospitalization with sepsis and future HCU status.

HYPOTHESIS:

Hypothesis: Sepsis is associated with future HCU status.

METHODS:

Design, Setting, and Participants: Population-based, propensity score-weighted cohort study that included all adults aged ≥18 years who were hospitalized in Ontario, Canada between January 2016 and December 2017 who had not previously had a hospitalization with sepsis.

Exposure: First hospitalization where sepsis is identified using a validated algorithm based on International Classification of Diseases, Tenth Revision (ICD-10) code.

Main Outcome(s) and Measure(s): Adults who become a persistent HCU (in the top 5% of total health care spending for 90 consecutive days) after hospital discharge, and the proportion of follow-up time since discharge as a HCU (top 5%). Sensitivity analyses were conducting using the top 1% HCU threshold, and stratified by previous health care costs at the top 10% threshold.

RESULTS:

Results: We included 927,057 hospitalized adults. After propensity score weighting, individuals who had sepsis had longer mean length of stay in the intensive care unit (ICU) (9.95 versus 3.15 days), were more frequently admitted to an ICU (17.6% versus 15.0%) and were more likely to be mechanically ventilated (9.41% versus 4.26%). The cost of index hospitalization was higher among individuals who had sepsis compared to those who did not ($17,395 versus $7925). Individuals who had sepsis were more likely to be a top 5% HCU for 90 consecutive days at any time after discharge compared to those without sepsis (OR 2.24; 95% CI 2.04 – 2.46), and spent on average 42.3% of their follow up time as a top 5% HCU compared to 28.9% of time among those without sepsis (RR 1.46 (95% CI 1.45-1.48). Individuals with sepsis

were more likely to be a top 1% HCU for 90 consecutive days compared to those without sepsis (10% versus 5.1%, OR 2.05 [95% CI 1.99-2.11]), and spent more time as a top 1% HCU (18.5% of time compared to 10.8% of time, RR 1.68 [95% CI 1.65-1.70]). Individuals with sepsis who were not previously in the top 10% of previous health care costs were also more likely to be among the top 5% or top 1% HCUs.

CONCLUSION:

Conclusions and Relevance: Individuals who have sepsis during their hospitalization are more likely to be a HCU after discharge to hospital, highlighting the impact of sepsis on future healthcare spending. Policies that aim to prevent sepsis or to reduce its burden could result in significant cost savings.

ORAL PRESENTATION 8

Longitudinal Assessment of Accessory Muscle Activity and Coordination after Traumatic Spine Injury: the ACCESSIT Study

Schreiber, Annia; *Vieira, Fernando; Rodrigues, Antenor, Madotto, Fabiana ; Ko, Matthew; Phoophiboon, Vorakamol; McFarlan, Amanda ; Brault, Clément ; Subirà, Carles; Sing, Jeffrey; Reid, W. Darlene; Rigamonti, Andrea ; Baker, Andrea; Brochard, Laurent.*

Submission ID

19

ABSTRACT CATEGORY

Clinical/Health Services Research

INTRODUCTION:

The need for mechanical ventilation (MV) greatly impacts the life expectancy and quality of life of spinal cord injury (SCI) patients (1).
The residual activity and function of each respiratory muscle, as well as the possibility of their improvement and recovery after SCI, are likely crucial in influencing the likelihood of weaning from MV.
However, the pattern of activation of the different respiratory muscles, their coordination in the different types of SCIs, and their evolution over time remain largely unknown.
The structure and function of these muscles after injury, and how potential improvements influence the possibility of weaning, have never been assessed.

OBJECTIVES:

Our objectives were to assess and monitor non-invasively and prospectively:
1) Respiratory muscle coordination, the relative contribution of rib cage and abdomen to breathing, and indices of asynchrony and paradoxical breathing.
2) The structure, contractile activity, and function of the different respiratory muscles.
3) The trajectory of physiological muscular parameters in relation to weaning outcome.
following traumatic spine injury, in patients with or without SCI.

Weaning success was defined as extubation without reintubation or discharge from intensive care unit (ICU) without MV.

HYPOTHESIS:

We hypothesized that after a traumatic spinal cord injury:
1) Several respiratory muscles would atrophy over a few days
2) Some accessory muscles could preserve or progressively regain the ability to contract and gradually restore their function, even when clinically the lesion seemed complete (2,3).
3) After an initial disruption, the amplitude, intensity, and timing of activation of the accessory muscles, as well as rib cage and abdomen coordination, would progressively improve in the weeks after the injury, but with high variability between patients and lesion types.
If these muscles are consistently activated or progressively regain the ability to contract after a SCI, we believe they

could be targeted for specific rehabilitative techniques, with a potential for better recovery. A potential for training and recovery should translate into enhanced probability of weaning success and mitigate the unfavorable outcomes related to ventilator-dependency.

METHODS:

In this prospective observational study, we enrolled ventilated adult patients with spine trauma (with or without SCI, the latter used as controls) within 72 hours of ICU admission. Primary outcomes were indices of synchrony, asynchrony, or paradoxical breathing between the rib cage and abdomen, assessed with respiratory inductive plethysmography (RIP) (4). Secondary outcomes included the thickness of respiratory muscle (diaphragm, parasternal intercostal, and abdominal muscles) measured via ultrasound (5,6).
The impact of respiratory muscle parameters and coordination on weaning success probability was assessed using logistic regression analysis. To evaluate the discriminatory capability of individual parameters in predicting successful weaning, the area under the curve (AUC) was calculated.

RESULTS:

We enrolled 30 patients (66.7% male, mean age 50±20y, 15 [50%] SCI); 18 (60%) were weaned at the first attempt, 24 (80%) at ICU discharge, with no difference between SCI and non-SCI patients ; 4 (13.3%) died in the ICU.
The RIP Konno-Mead plots at the last measurement before experiencing the outcome (and not at measurements on admission) (Figure) showed that abdominal-rib cage correlation was lower (0.06±0.6 vs 0.66 ± 0.22, p =0.023), and several parameters, including total loop area/tidal volume(Vt) (190±142 vs 54±31ml^2/ml, p=0.007), inspiratory area/Vt (130±105 vs 34±20ml^2/ml, p=0.007), and the area of 2nd and 4thquadrants/Vt (77±21 vs 45±25, p=0.027 and 48±67 vs 1.1±2.1, p=0.049) were all greater in patients who would fail weaning compared to patients who would succeed, regardless of SCI presence. The best discriminative abilities between weaning failure and success were shown by total loop area/Vt and inspiratory area/Vt (AUCs=0.95, 95%CI 0.79–1.00).

In weaning failure patients, diaphragm thickness was higher on admission (2.42±0.46mm vs 1.87±0.60mm, p=0.048), while parasternal intercostal thickness was higher at discharge (3.67±0.97mm vs 2.28±0.63mm, p<0.001); conversely, internal oblique thickness was lower at discharge (3.50±0.67mm vs 5.24±1.35mm,p=0.004).

A lower total loop area/Vt (OR= 0.971, 95%CI 0.942–1.001, p= 0.05) and a higher abdominal-rib cage correlation (OR= 1.575 [95%CI 0.992–2.501], p= 0.054) were associated with higher probability of weaning success. A lower thickness of the parasternal intercostal (OR= 0.861, 95%CI 0.751–0.988, p= 0.033) and a greater thickness of the internal oblique at discharge (OR= 1.247, 95%CI 1.013–1.535, p= 0.037) were associated with higher probability of weaning success.

CONCLUSION:

Indexes of asynchrony were consistently greater in traumatic spine injury patients who would fail weaning compared to those who would succeed, independently of SCI. The presence of an asynchronous breathing pattern, more than SCI, represents an accurate indicator of weaning outcomes in patients with spine trauma.

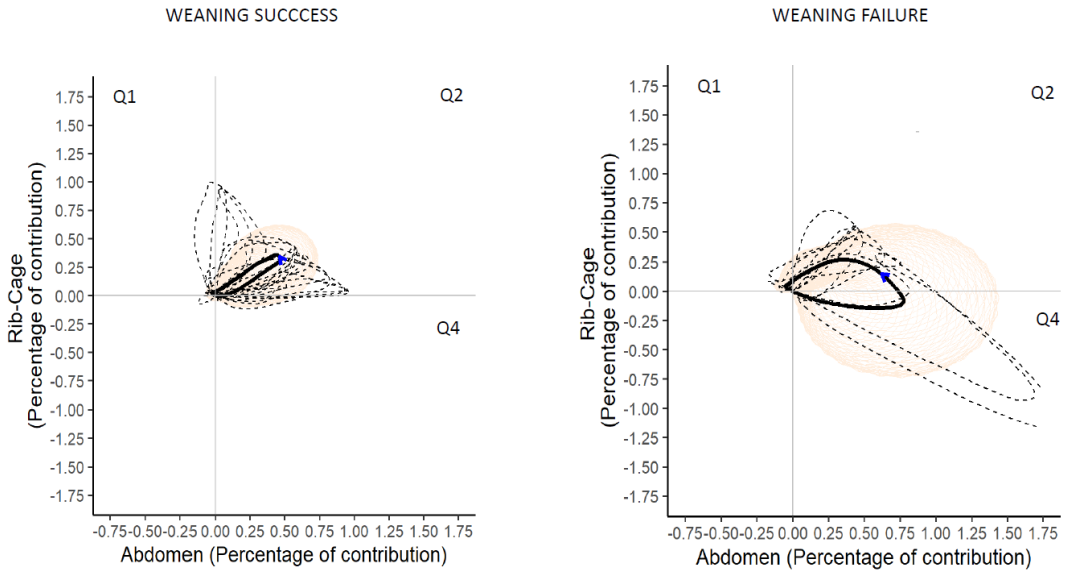

Figure. Respiratory inductive plethysmography Konno-Mead plots of ribcage-abdomen motion (expressed as a percentage of contribution to the tidal volume) in weaning success and weaning failure patients, at the last assessment before the final outcome (weaning, discharge, or death), during spontaneous unassisted breathing. Dotted black lines represent individual patient loop, solid black lines represent the average loop for each category, faded orange lines show standard deviations of the loops. Q1, Q2 and Q4 represent different plot quadrants.

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