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Critical Care Canada Forum 2022 Abstracts

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A Pilot Study of the Incidence and Clinical Outcomes of Patients Admitted with Substance use to Intensive Care at the Royal Alexandra Hospital, Edmonton, Alberta

Submission ID

96

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INTRODUCTION

Substance use disorders (SUD), specifically opioid and stimulant use are a significant public health emergency in Alberta and across Canada. Patients with SUD pose additional complexities to ICU patient care, health care costs, and are represented within a broad spectrum of medical, trauma, and perioperative diagnostic groups. In ICU, the opioid use epidemic has led to an increase in the number of patients requiring direct care for opioid intoxication/overdose and opioid-tolerant patients requiring intensive care for other conditions (1). Opioid-tolerance and withdrawal significantly complicates perioperative and postoperative management with regards to analgesia requirements (2). Patients presenting with methamphetamine use in the trauma setting are more likely to be admitted to ICU and contribute to resource overutilization (3, 4). A better understanding of the magnitude and characteristics of patients being admitted to ICU with preexisting opioid, stimulant and other use disorders will inform future clinical management and research in this area.

OBJECTIVES

The primary specific aim of this observational cohort study was to determine the incidence of all substance use disorders in a population of critically ill patients admitted to the Royal Alexandra Hospital (RAH), Edmonton, Alberta Intensive Care Unit over a 2-month period from December 2021 to February 2022. Secondary specific aims were to determine the duration of ICU and hospital stay (LOS) and days requiring mechanical ventilation, as well as the utilization of renal replacement therapy, vasoactive drugs and mortality. Additionally, secondary outcomes from all SUD patients were compared with a contemporaneous cohort of ICU patients not-suffering from SUD as a primary or non-primary diagnosis and using a previously validated database (Alberta Health Services

(AHS) eCritical/TRACER repository).

METHODS

The cohort consisted of all patients admitted to the RAH ICU between December 13, 2021 and February 22, 2022 after institutional ethics approval. All patients 18 years or older who met the DSM-V criteria for opioid, stimulant, alcohol use disorder, other substance use disorder, and intentional overdose of substance(s) delegated as the primary or non-primary illness at admission were included (5). Data was obtained from a validated ICU-specific database (eCritical/TRACER) and additional detailed medical record abstraction was performed for patients identified as having SUD as their primary or non-primary admitting diagnosis prospectively. Specific variables obtained included demographic, diagnostic, APACHE-II score, duration of ICU/hospital stay, duration of mechanical ventilation, requirement for renal replacement therapy and vasoactive drugs, and vital status at hospital discharge. All chart abstracted data was entered into a REDCap repository. We stratified the cohort into three groups for statistical comparison according to their SUD diagnosis: group 0 (G0): patients admitted to ICU without diagnosis of SUD and whose data was abstracted from TRACER; group 1 (G1): patients admitted to ICU with any SUD as primary diagnosis; group 2 (G2): patients admitted to ICU with SUD as non-primary diagnosis. Patients admitted with a cardiac-arrest secondary to an overdose of opioids/stimulants/other drugs were classified into group 2.

RESULTS

Over the two month period, 287 patients were admitted to the ICU. Seventy (24%) met the pre-defined criteria for SUD of whom fifteen (21%) had SUD as their primary diagnosis and fifty-five (79%) had SUD as their non-primary diagnosis. The mean age in group 0 was 58.3 years, 39.4 years in group 1, and 45.0 years in group 2. The mean APACHE II score in group 0 was 22.9, 17.2 in group 1, and 21.7 in group 2. There was no significant difference in ICU LOS (p=0.31), Hospital LOS (p=0.13), days on invasive mechanical ventilation (p=0.74), number of patients requiring renal replacement therapy (CRRT, p=1.00; IHD, p=0.26), when comparing G0 and G2. There was no significant difference in ICU and hospital survival between G0 and G2; with ICU survival being 82.0% in G0 and 87.3% in G2; hospital survival being 50.2% in G0 and 56.4% in G2 (ICU, p=0.22; hospital p=0.25).

CONCLUSION

In a single-center pilot study within a mixed medical-surgical trauma ICU, admission for SUD as a primary diagnosis represented 5.2% of patients, 2.4% of ICU days and 1.6% of total days on mechanical ventilation, with no patients requiring renal replacement therapy (RRT). Admission for SUD as a secondary diagnosis represented 19.1% of patients, 18.3% of ICU days and 17.2 % of total days on mechanical ventilation, with 14.5% requiring RRT. There was no significant difference in illness severity, ICU/ hospital mortality, ICU/hospital LOS, number of days requiring mechanical ventilation or the requirement for RRT between non-SUD and patients admitted with SUD as a non-

primary diagnosis.

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Table 1. Demographic Characteristics of Patient Cohort

Characteristic	G0 (Non-SUD) (*n = 217*)	G1 (SUD, Primary Dx) (*n = 15*)	G2 (SUD, Secondary Dx) (*n=55*)	p-value *
Age (years): mean ± SD; median	58.3 ± 15.9; 60	39.4 ± 14.3; 37	45.0 ± 13.7; 44	≤ 0.001**
Gender				
Male: n (%)	121 (55.8%)	13 (86.7%)	38 (69.1%)	
Female: n (%)	96 (44.2%)	2 (13.3%)	17 (30.9 %)	
APACHE II Score: mean ± SD	22.9 ± 8.8	17.2 ± 9.4	21.7 ± 8.6	0.35**

* p-Value for comparisons between G0 versus G2; ** Two-Tailed Independent T-Test

Table 2. Outcomes

Characteristic	G0 (Non-SUD) (*n = 217*)	G1 (SUD, Primary Dx) (*n = 15*)	G2 (SUD, Secondary Dx) (*n=55*)	p-value*
ICU Length of Stay; Total Days (%)	1575.97 (79.4%)	46.67 (2.8%)	362.39 (18.3%)	0.31 **
Hospital Length of Stay (days); mean ± SD	14.0 ± 17.9	4.5 ± 3.9	8.8 ± 8.2	0.13 **
ICU Survival: n (%)	178 (82.0%)	14 (93.3%)	48 (87.2%)	0.22 †
Hospital Survival; n (%)	109 (50.2%)	13 (86.7%)	31 (56.4%)	0.25 †
Number of Days on Invasive Mechanical Ventilation; Total Days (%)	1018.50 (81.2%)	20.21 (1.6%)	215.99 (17.2%)	0.74 **
(days) mean ± SD	6.8 ± 118.6	2.0 ± 1.6	4.5 ± 5.4	
Number of Patients Requiring Renal Replacement Therapy; Total n (%)	37 (17.1%)	0	8 (14.5%)	
Continuous (CRRT): n (%)	14 (6.5%)	0	3 (5.5%)	1 **
Intermittent Hemodialysis (IHD): n (%)	23 (11.0%)	0	5 (9.1%)	0.26 **
Days on Vasoactive Medications				
Norepinephrine; mean ± SD	2.7 ± 3.3	1.0 ± 1.0	2.3 ± 2.6	0.75 **
Vasopressin; mean ± SD	2.2 ± 2.4	1.6 ± 2.2	1.8 ± 1.4	0.95 **
Dobutamine; mean ± SD	1.1 ± 0.44	0	3.2 ± 3.0	0.44 **
Milrinone; mean ± SD	0.98 ± 1.0	0	2.2 ± 0.8	0.25 **

* p-Value for comparisons between G0 versus G2; ** Rank Sum Two-Sided Wilcoxon (Mann-Whitney) Test; † Fischer's Exact Test

Table 1. Demographic Characteristics of Patient Cohort

Characteristic	G0 (Non-SUD) (*n = 217*)	G1 (SUD, Primary Dx) (*n = 15*)	G2 (SUD, Secondary Dx) (*n=55*)	p-value *
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Gender				
Male: n (%)	121 (55.8%)	13 (86.7%)	38 (69.1%)	
Female: n (%)	96 (44.2%)	2 (13.3%)	17 (30.9 %)	
APACHE II Score: mean ± SD	22.9 ± 8.8	17.2 ± 9.4	21.7 ± 8.6	0.35**

* p-Value for comparisons between G0 versus G2; ** Two-Tailed Independent T-Test

Table 2. Outcomes

Characteristic	G0 (Non-SUD) (*n = 217*)	G1 (SUD, Primary Dx) (*n = 15*)	G2 (SUD, Secondary Dx) (*n=55*)	p-value*
Average ICU Length of Stay (Days); mean ± SD	7.3 ± 12.0	3.1 ± 2.3	6.6 ± 7.4	0.31 **
Average Hospital Length of Stay (days); mean ± SD	14.0 ± 17.9	4.5 ± 3.9	8.8 ± 8.2	0.13 **
ICU Survival: n (%)	178 (82.0%)	14 (93.3%)	48 (87.2%)	0.22 †
Hospital Survival; n (%)	109 (50.2%)	13 (86.7%)	31 (56.4%)	0.25 †
Average number of Days on Invasive Mechanical Ventilation (days) mean ± SD	6.8 ± 118.6	2.0 ± 1.6	4.6 ± 5.4	0.74 **
Number of Patients Requiring Renal Replacement Therapy; Total n (%)	37 (17.1%)	0	8 (14.5%)	
Continuous (CRRT); n (%)	14 (6.5%)	0	3 (5.5%)	1 **
Intermittent Hemodialysis (IHD); n (%)	23 (11.0%)	0	5 (9.1%)	0.26 **
Average days on Vasoactive Medications				
Norepinephrine; mean ± SD	2.7 ± 3.3	1.0 ± 1.0	2.3 ± 2.6	0.75 **
Vasopressin; mean ± SD	2.2 ± 2.4	1.6 ± 2.2	1.8 ± 1.4	0.95 **
Dobutamine; mean ± SD	1.1 ± 0.44	0	3.2 ± 3.0	0.44 **
Milrinone; mean ± SD	0.98 ± 1.0	0	2.2 ± 0.8	0.25 **
Total ICU Days	1575.97 (79.4%)	46.67 (2.8%)	362.39 (18.3%)	
Total days on Invasive Mechnical Ventilation	1018.50 (81.2%)	20.21 (1.6%)	215.99 (17.2%)	

* p-Value for comparisons between G0 versus G2; ** Rank Sum Two-Sided Wilcoxon (Mann-Whitney) Test; † Fischer's Exact Test

A Window in the Brain: Novel Quantitative Seizure Detection with Minimal Density EEG Montage

Submission ID

24

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INTRODUCTION

Seizures frequently occur in paediatric intensive and critical care. Up to 74% of these are subclinical, not having any clinical symptoms. Timely seizure detection can be difficult[1]. Prompt recognition and treatment of seizures reduces the length of stay and improves neurological outcomes of these patients, thereby saving hospital costs and improving their quality of life[2].

Gold-standard seizure detection using multi-channels electroencephalograms (EEG) is labour intensive and requires trained clinical physiologists to apply scalp electrodes and highly specialised neurologists to interpret and identify seizures.

Phase synchrony (PS) can capture the changes in EEG signals before and during seizures[3]. However, this quantitative method of seizure detection has not yet translated into clinical use in paediatric critical care (PCC) settings.

OBJECTIVES

In this project, we aim to test the seizure detection performance of PS using only eight and four channels of the routinely collected EEG and further improve the performance of seizure detection.

METHODS

Using the existing BrainsView (BV) seizure detection algorithm (PS-only), we determined the baseline seizure detection performance on eight and four pre-selected channels of the 64-channels routinely collected fully anonymised paediatric EEG (n = 40).
The eight-channels montage included the circumferential scalp electrodes consisting of T3, T4, T5, T6, F7, F8, O1, and O2. The four-channels montage is selected based on a

configuration that is readily applied by the bedside PCCU staff, which are C3, C4, P3, and P4.

We then refined the BV algorithm by adding an extra feature extraction method (cross-channel amplitude coherence, i.e. CA) to the existing PS calculation. Seizures identified using the original (PS-only) and revised (combined PS + CA) seizure detection algorithms were then compared with the gold-standard neurologist-identified seizure annotations on the EEG to determine if the new algorithm offers enhanced seizure detection performance.

RESULTS

Using BV calculations on 8-channels of the standard clinical EEG, seizures were detected with 65.5% accuracy and 70.9 % specificity compared to the gold-standard seizure detection. The average false alarm rate was 0.35. The reduction in number of EEG channels to four slightly reduced the accuracy and specificity to 62.8% and 64.7%, respectively. The average false alarm remained at 0.35.

Enhanced seizure detection performance was achieved with the revised algorithm (combined PS + CA) for both EEG montages. Accuracy and specificity for eight and four-channels improved to 76.5% and 77.2%, 82.2% and 83.4%, respectively. The false alarm for eight and four-channels were 0.22 and 0.21, respectively. (107 words)

CONCLUSION

Quantitative ictal activity can be captured with as few as four EEG channels using our seizure detection algorithm with 70% accuracy. A larger-scale validation study is required to ascertain its performance before facilitating clinical translation.

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Adapting a Program to Deliver High-Flow Nasal Oxygen Cannula on the Medical Ward During the Coronavirus Pandemic and the Effect on Health Care Providers and Models of Critical Care: A Qualitative Implementation and Structured Interview Study

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56

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INTRODUCTION

The World Health Organization (WHO) on March 11, 2020, declared the novel coronavirus (COVID-19) outbreak a global pandemic. Since then, the world has been inundated with thousands of critically ill patients, many of whom develop acute respiratory failure requiring admission to an intensive care unit (ICU).

Ontario is now at the end of its seventh wave of COVID-19. During the first three waves, hospitals have needed to expand ICU capacity and implement novel strategies to manage growing numbers of acutely ill patients. The use of high-flow nasal cannula therapy (HFNC) is a potentially effective non-invasive oxygenation strategy to support COVID-19 patients with severe respiratory failure. In Ontario, there is no standardized approach to its use in hospitals. In our institution, we have implemented a nursing- and respiratory therapist-championed initiative to support patients on HFNC on the general medical ward in an effort to preserve capacity in ICU.

OBJECTIVES

To understand the feasibility and impact on patients and health care providers caring for patients with respiratory failure on a medical ward.

METHODS

We performed a retrospective review of patients admitted to hospital with a diagnosis of COVID-19 and supported by HFNC on the medical ward from April 2020 - June 2021. We described the baseline characteristics of these patients and the hospital outcomes. We performed structured interviews of allied health professionals who were involved in

championing the HFNC ward program and who actively managed these patients. A second round of interviews including a critical care manager and nursing special projects liaison were performed in September 2022 to identify changes in the challenges as the pandemic has evolved. A modified Delphi approach was used to develop educational materials for teaching, safety and continued quality improvement.

RESULTS

Patients

346 patients with COVID-19 pneumonia were managed with HFNC on the general medical ward.

Allied health professionals

4 allied health professionals were interviewed regarding their experience managing COVID-19 patients with severe respiratory failure supported by HFNC on the medical wards. Summarized themes and answers are detailed in **Table 1**. All participants identified challenges with managing acutely ill patients on a medical ward but also recognized learning opportunities. All participants felt more comfortable managing HFNC post waves 1-3 compared to pre-pandemic. The 2 additional allied health professionals identified the major challenges in the current phase of the pandemic are principally related to human health resources, nursing retention and strategies to mitigate burnout, as detailed in **Table 2.**

Education materials

Stakeholders created the following educational materials: principles of oxygen administration, HFNC anatomy and physiology, CCRT activation process, principles of self-prone positioning, ventilator setup and alarm guide, anatomical airway assessment (**Figure 1**).

CONCLUSION

Novel approaches to the delivery of care to critically-ill patients are required to maintain ICU capacity and expand clinicians' abilities to care for an increasingly large number of patients with acute care needs. Allied health professionals believe that the expansion of ICU-level care to the medical ward has important challenges but presents unique opportunities to deliver patient-centered, high-quality critical care. Our experience with HFNC offers unique insights to other institutions and policy makers for protocols and policies for care amidst future waves of COVID-19 but also highlights a new phase of the pandemic, principally related to health human resources crises.

REFERENCES

N/A

Table 1: Summarized interview themes and answers: During pandemic

Theme	Summarized Answers
Interventions for implementation of program	1. Equipment • Massimo portable monitors • Increased # of HFNC delivery circuits with use of V60 BiPAP and Hamilton ventilators • Education sessions for RTs on equipment 2. Staff • Increase staffing RTs • Select/identify one RT for COVID wards • Increased MD coverage for COVID wards with a new model to provide adequate coverage 3. Patients/patient flow • HFNC patient place on designated floors to aid in providing care (geographic location, response time, team training, designated RT etc)
Barriers to optimization	1. Equipment • Comfort level mastered mainly by RTs pre-pandemic and had to be developed in RN/MDs 2. Staffing • Staffing shortage especially for volume of patients 3. Patients/patient flow • # of patients/volume/acuity (over 30 patients or 50% of the COVID ward on HFNC) • PPE needs for HFNC limiting response time to patients and flow of medical rounds • Visitation policy limited in patients with HFNC and as a consequence, the quality of the GOC conversations
Safety/Outcomes	• Hypoxic patients who were delirious present more challenges to be managed safely on the wards • DNR patients died due to pulling off O2 and not being monitored • RN perspective is that some outcomes could have been better had some patients been in ICU • RT, RN, MD perspective that transportation of HFNC patients from ward to ICU for intubation was challenging/risky
Suggestions for future	1. Equipment • Remote monitoring of O2 is important 2. Staff • Add another CCRT RN • Consider other model for nighttime CCRT coverage • More education for nurses re: HFNC • Additional MD coverage at night (daytime and weekend model had been stepped up but no additional nocturnal coverage) 3. Patients/patient flow: • Consider step-up unit for those HFNC/COVID patients

Table 2: Summarized interview themes and answers: The health human resource phase of the pandemic

Theme	Summarized Answers
Current pandemic issues	• Focus has shifted from volume and acuity of patients to the daily struggle to safely staff an ICU (and other units in the hospital) • Impact on staff personal lives ○ sick relatives, loss of relatives, loss of jobs and income, which exacerbated the workplace impact
Health human resources	• Absolute number of nurses per shift is drastically different • Number of nurses on shift not yet completed critical care certificate has increased • Challenging to compete with "agency" and "travel nursing" compensation, which is typically much higher than current nursing salary and benefit
Potential solutions	• Governmental bodies must consider broad range of stakeholders when implementing policy and solutions to current phase of pandemic • While increasing wages is one solution, it does not address the root of the problem • There were signs that an imminent HHR crisis was looming and this was compounded by the effects of the pandemic • Adaptive training models for nursing ○ Off-cycle hiring from schooling schedule
Anticipating an 8th wave this fall	• Pod-based nursing, team model to be practiced in advance, prepare people to be adaptable and be flexible; change in mindset

Figure 1: Education resource board on the medical ward

Adapting the Critical Care Pain Observation Tool for Family Caregiver Use (CPOT-Fam)

Submission ID

93

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INTRODUCTION

Pain is commonly experienced by patients in the intensive care unit (ICU).[1,2] Due to their clinical condition many ICU patients are non-communicative and cannot self-report their pain.[3,4] In these scenarios, family caregivers (e.g., family members, significant others, close friends) may be able use their personal knowledge of the patient to assist in clinical pain assessment.[2,4,5] Involving family caregivers in the pain assessment of non-communicative patients has the potential to facilitate earlier pain recognition, reduce anxiety for families, and improve satisfaction with care for patients and their loved ones.

OBJECTIVES

We undertook a multi-phase study aiming to a) adapt a validated pain tool used by ICU nurses (Critical Care Pain Observation Tool or CPOT) for family caregiver use (creating the CPOT-Fam), b) pre-clinically test the CPOT-Fam, and c) revise the CPOT-Fam in preparation for clinical pilot testing.

METHODS

We conducted this study through three distinct phases:

1. CPOT adaptation for family caregiver use (to create the CPOT-Fam): We formed a working group of patient partners (individuals with experience as ICU patients or family caregivers of ICU patients), ICU clinicians, and critical care researchers. The working group discussed adaptation of the CPOT as well as development of accompanying educational material (i.e., modules to help orient family members to pain and pain assessment in the ICU) and sample cases (i.e., for participants to

practice scoring using the CPOT-Fam). The group met monthly and completed iterative revisions of these items until consensus was reached.

2. CPOT-Fam pre-clinical testing: We recruited interested members of the public to view educational materials and score four randomly selected sample cases (from 162 cases representing all possible CPOT-Fam scoring combinations) using the CPOT-Fam. We compared participant CPOT-Fam scores on the sample cases to reference scores (assigned by the diverse research team) to assess agreement and identify sections of the CPOT-Fam requiring revision. Open-ended feedback on the CPOT-Fam was collected.
3. CPOT-Fam revision: Using feedback from study participants and the working group, we revised the CPOT-Fam in preparation for clinical testing.

RESULTS

The working group developed a draft of the CPOT-Fam **(Figure 1)** which evaluated 1) facial expression, 2) body movements, 3a) compliance with ventilator if intubated or 3b)vocalization if not intubated, and 4) muscle tension using five questions.
In pre-clinical testing, overall agreement between CPOT-Fam participant scores and reference scores was high (intraclass correlation coefficient (ICC=0.92)). Specifically, agreement was highest for the *vocalization* dimension (ICC=1.0) and lowest for the *body movements* dimension (ICC=0.85).

Twenty-seven (90.0%) of n=30 total participants provided text responses to the question: *Please describe your experience with using the pain detection method (i.e., CPOT-Fam) in a few words*. Text responses were categorized into CPOT-Fam *tool characteristics to retain* (n=19), *opportunities for improvement* (n=5), and *participant-indicated pain cues* (n=5) **(Figure 2)**. Overall, participants indicated they found the CPOT-Fam to be“easy-to-use” but “not graphic enough”. Based on feedback received, our working group restructured the tool into an image-based flow-diagram format **(Figure 3)** to improve clarity.

CONCLUSION

In this study, we adapted an existing tool used by ICU nurses to assess pain for use by family caregivers (CPOT-Fam). Pre-clinical testing of the CPOT-Fam suggested that family caregivers find the CPOT-Fam valuable and easy to use for pain assessment. Clinical evaluation is needed to evaluate feasibility, acceptability, and performance of the tool in clinical circumstances.

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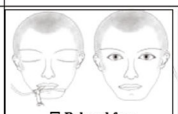
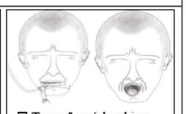
During which condition are you observing the patient's pain? ☐ At rest ☐ During or immediately after a procedure

If you are observing the patient's pain during or immediately after a procedure, what kind of procedure was it? (examples: repositioning, blood draw) _____

Read the questions below and check off the observation that most closely matches yours.

How is the patient breathing? *Answer only if the patient is breathing using a breathing tube and breathing machine.*	☐ Breathing comfortably ☐ Breathing comfortably with occasional coughing ☐ Choking or struggling to breathe
Is the patient making any sounds? *Answer only if patient is breathing on their own, without a breathing tube and breathing machine.*	☐ Talking in normal or quiet voice ☐ Sighing or moaning ☐ Calling out or sobbing
What is the patient's facial expression? *Please choose from the faces[1] shown. Faces on the left side of each square are patients breathing with a breathing machine and faces on the right side of each square are patients breathing without a breathing machine.*	 ☐ **Relaxed face**  ☐ **Frowning**  ☐ **Tense face** (clenching jaw, uneasy, or biting on breathing tube)
What are the patient's body movements like?	☐ Relaxed or comfortable (examples: lying down, sitting, or moving without pain) ☐ Moving slowly & carefully (example: touching the site of pain) ☐ Restless or trying to pull out tubes (examples: breathing or feeding tube, intravenous tube, catheter)
Does the patient have stiff muscles?	☐ Calm and relaxed (no stiffness) ☐ Some tense or stiff muscles ☐ Most muscles tense or stiff

[1] Illustrations of faces adapted with permission from Gelinas et al (2013).

Figure 1

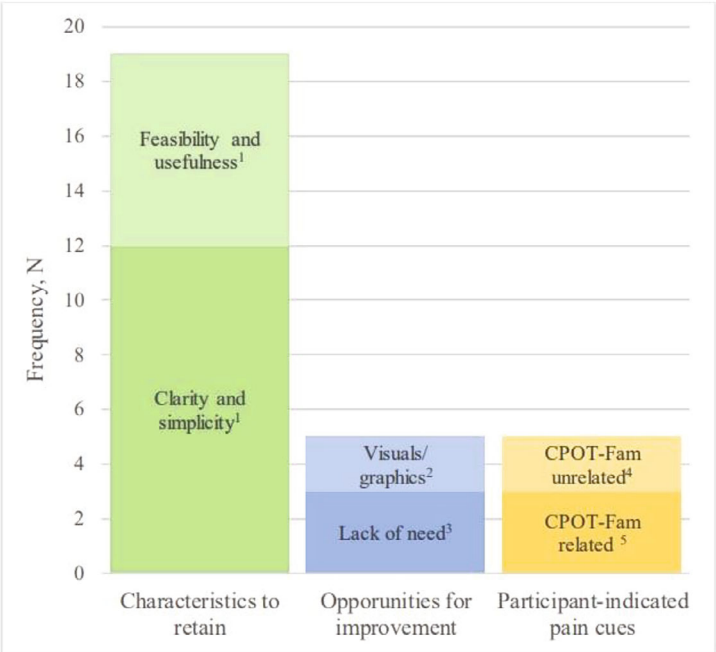


Figure 2

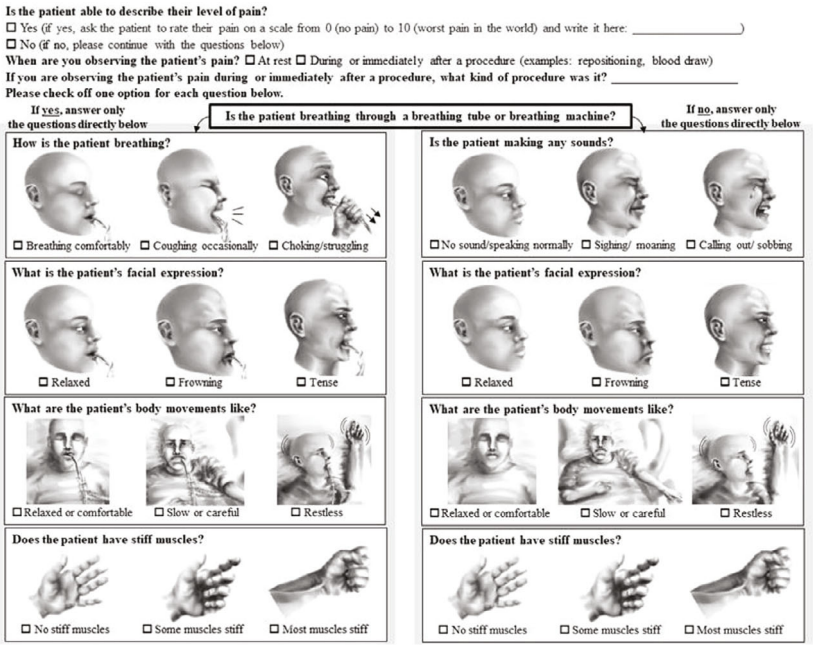


Figure 3

An Elusive Etiology of Pericardial Effusion with Resultant Cardiac Tamponade

Submission ID

74

AUTHORS

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INTRODUCTION

A pericardial effusion is defined as the accumulation of fluid within the saclike structure which surrounds the heart. This phenomenon is relatively common and is often secondary to infection, malignancy, periprocedural iatrogenic causes, uremia, myocardial infarction, collagen vascular disease, hypothyroidism, or rheumatologic disease.[1] In many cases, it can be difficult to elucidate the underlying cause, or it may never be discovered.[2] A sound diagnostic approach to pericardial effusion is vital as this finding can be a harbinger of serious systemic illness requiring specific urgent treatment.

CASE DESCRIPTION:

A 74 year old male presented to his primary care provider (PCP) with a two week history of low grade fevers, 3.2 kg weight loss, and poor appetite and was found to be tachycardic with mild anemia (Hgb 12) and transaminitis in the 100s. These findings were attributed to viral illness and treated with supportive care.

OBJECTIVES

Over the subsequent two weeks, his fatigue severely worsened, he developed a cough, and both his anemia (Hgb 10) and LFTs worsened (~200). Labs were notable for d-dimer elevated to 1.6, CRP elevated to 15.1, ferritin of 1,852, and low iron (13), TIBC (159), and transferrin saturation (8%). Pertinent negatives included hemolysis labs, acute hepatitis serology, and ANA. CT PE showed no PE but demonstrated a diffusely thickened pericardium with trace pericardial effusion concerning for pericarditis.

He was admitted to Abbott Northwestern Hospital (ANW) and Cardiology was consulted. EKG showed subtle diffuse PR depression which was attributed to pericarditis, and he was started on ibuprofen and colchicine. His transaminitis was attributed to congestive hepatopathy. Echogram was concerning for constrictive pericarditis. Cardiac MRI showed pericardial thickening (7 mm) consistent with acute pericarditis in addition to a small pericardial effusion. Infectious Disease was consulted, and all workup was

negative including blood cultures, CMV, EBV, Coxsackie, Lyme, Mycoplasma, Tuberculosis, Histoplasma,

METHODS

Blastomyces, and Cryptococcus. Rheumatologic labs were also negative including RF, anti-CCP, and ANCA. His fever curve improved, and he was discharged on ibuprofen and colchicine.

At PCP follow up two weeks later, he had lost an additional 2.3 kg. Repeat labs showed continued transaminitis in the 100s, ESR > 120, CRP of 23, leukocytosis to 11, thrombocytosis to 553, and worsened anemia with Hgb of 9. Rheumatology was consulted and felt the clinical picture was concerning for an autoimmune process with serositis. C3, C4, dsDNA, SM RNP, and IgG4 were unrevealing. He was started on prednisone and hydroxychloroquine.

Several weeks later, he entered atrial flutter with RVR detected by his Apple watch and confirmed on EKG at a subsequent urgent Cardiology visit. Repeat echocardiogram showed a large circumferential pericardial effusion with tamponade. He was re-admitted to ANW for urgent pericardiocentesis. 300 cc of hemorrhagic fluid were removed with resolution of tamponade. Ferritin returned elevated at 4,159. Rheumatology expressed suspicion for Adult-Onset Still's disease vs. Giant Cell Arteritis. He underwent temporal artery biopsy which was negative.

One month later, he returned to the ANW emergency department and was re-admitted with worsening dyspnea on exertion and new bilateral pitting edema.

RESULTS

Repeat echocardiogram showed findings concerning for development of constrictive pericarditis and resultant acute diastolic heart failure. Cardiac MRI showed a moderate loculated pericardial effusion with severe pericardial thickening to 8 mm. Both ventricles were of small volume with ventricular interdependence and tethering of both the LV and RV lateral walls. Pericardiectomy was recommended, however, the patient decided to discharge to seek a second opinion at the Mayo Clinic.

One week later, he was admitted to Mayo Clinic with low output cardiogenic shock and new renal failure. He underwent pericardiectomy but was unable to be extubated post-procedure and required multiple vasopressors and initiation of renal replacement therapy. Pathology revealed sarcomatoid type malignant mesothelioma of the pericardium. Hematology was consulted who relayed the general prognosis of pericardial sarcoid mesothelioma to confer median survival of only 6 months in patients who receive chemotherapy. The patient and his family elected comfort care and he passed the same day.

CONCLUSION

This case illustrates the importance of maintaining a broad differential diagnosis in determining the cause of a pericardial effusion. Broad panels of laboratory tests are a reasonable diagnostic starting point, however, are less likely to reveal the underlying cause than analysis of the pericardial fluid and the pericardium itself. Diagnostic yield of pericardial biopsy is near 40% and the procedure can likely be foregone if the patient's disease is mild.[3] However, invasive sampling should not be delayed in the setting of severe disease with an elusive but potentially treatable etiology.

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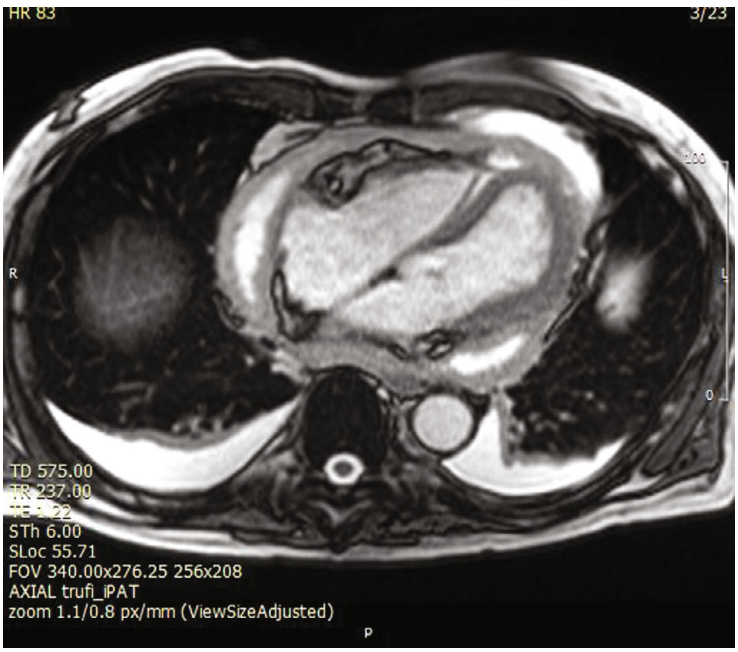

Arm Cycle Ergometry in Critically Ill Patients: A Systematic Review

Submission ID

42

AUTHORS

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INTRODUCTION

Patients surviving their intensive care unit (ICU) stay are at risk of poor quality of life due to physical and cognitive impairments that can remain after discharge. At least 25% of ICU survivors have ICU- acquired weakness, which leads to long-term impairments in physical function (1). Early mobility in the ICU is safe and may improve physical function. Leg cycling was introduced as an early mobility technique as it overcomes barriers of sedation, mechanical ventilation, and lines and tubes (2). However, leg cycling does not address impairments in the upper extremity (UE), which is important for activities of daily living like dressing and feeding. Measures of physical function, including UE dressing, at 7-days of ICU discharge are shown to be predictive of 1-year mortality and recovery trajectory (3). Therefore, in ICU arm cycle ergometry (ACE) may help limit UE functional loss and promote independence in activities of daily living (4,5).

OBJECTIVES

We conducted a systematic review to examine the impact of in-ICU ACE on physical function, and other important patient outcomes.

METHODS

This systematic review was registered in PROSPERO (CRD 42022326239)**.** We searched 6 electronic databases from inception to February 2022. We included both randomized and non-randomized studies of critically ill adults admitted to the ICU, comparing ACE interventions to any other form of physiotherapy care. Our primary outcome was physical function; secondary outcomes were mortality, length of stay (LOS; ICU and hospital), length of mechanical ventilation, and safety. Independently and in duplicate, we conducted citation screening, data abstraction, and risk-of-bias assessments. We assessed certainty of outcomes using the Grading of Recommendations Assessment, Development, and Evaluation approach (GRADE). A meta-analysis was planned if there was sufficient homogeneity between studies. Alternatively, we planned a narrative synthesis.

RESULTS

Of 814 citations, 3 studies enrolling 97 patients (1 randomized, 1 non-randomized, and 1 observational feasibility) were included (Figure 1). No studies reported hospital LOS or length of mechanical ventilation (Table 1). Due to heterogeneity, meta-analysis was not performed. For our primary outcome, 1 non-randomized study reported no difference in Barthel Index scores [ACE (Mean±SD) (n=15; 44.66±38.05); standard physiotherapy (n=20; 51.75±38.19; p=0.957)] or in Ambulation Score [ACE n=15; 3.20±2.18; control n=20; 3.75±2.22, p=0.096] at ICU discharge. Of our secondary outcomes, no studies reported any deaths. One non-randomized trial showed no difference in ICU LOS [n=35; ACE median 18; control median 8.50 days; p=0.169]. No studies reported any safety adverse events in ACE groups, however some cycling sessions were terminated due to cardiovascular and respiratory symptoms (10/57). All results were very low certainty based on the GRADE approach due to the few RCTs, bias and imprecision (Table 2).

CONCLUSION

ACE initiated in the ICU is a feasible intervention that is likely safe. Based on the limited number of ACE studies, there were no differences in physical function, mortality or ICU length of stay. Studies did not report duration of mechanical ventilation nor hospital length of stay. Future research should focus on rigorously designed randomized control trials of ACE in the ICU, evaluating important outcomes for patients such as physical function, in the short- and long- term.

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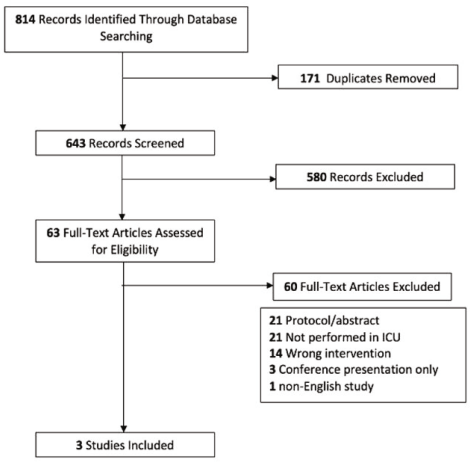

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) flow diagram. We display the process of screening and selecting studies for inclusion in the review

Table 1. Summary of included studies.

Author(s), Year	Study Design	Participants		Intervention	Comparator	Outcomes
		Intervention (n), Age [Mean (SD)] or [range], Female [n (%)], APACHE II [Mean (SD)]	Control (n), Age [Mean (SD)] or [range], Female [n (%)], APACHE II [Mean (SD)]	Frequency, Intensity, Time, Type	Frequency, Intensity, Type, Time	
Cinar *et al.*, 2020	Non-RCT	Intervention: 15 Age= 63 (20.50) yrs Female= 7 (47%) APACHE II: 21.92 (7.80)	Control: 20 Age= 56 (24.81) yrs Female= 11 (55%) APACHE II= 18.80 (9.45)	F: 5 days/week, 20 minutes I: passive and/or active T: not reported T: in-bed ACE and standard PT (as per control)	F: 5 days/week I: NR T: NR T: respiratory physiotherapy, ROM, mobilization in and out of bed	Physical function LOS Mortality Safety
Porta *et al.*, 2005	RCT	Intervention: 25 Age: 70 (5.6) Female =10 (40%) APACHE II: NA	Control: 25 Age= 72 (5.2) Female= 11 (44%) APACHE II: NA	F: daily, 15 sessions total, 20 minutes I: active T: within 96h following weaning T: ACE and standard PT (as per control)	F: 6x/week, 45 minutes I: NR T: within 96h following weaning T: ROM, chest PT, assisted, strength exercise, sitting and standing balance, gait training	Mortality Safety
Wilkinson *et al.*, 2021	Observational feasibility	Intervention: 12 Age: 20-89 Female: NA APACHE II: 18.33 (6.30)	No control group	F: 1 session, 30 mins I: passive T: NR T: in-bed ACE	No control group	Safety

Definition of abbreviations: ACE= arm cycle ergometry; APACHE II= Acute Physiology and Chronic Health Evaluation II; h= hours; ICU= intensive care unit; I+V= intubation and ventilation; L= level; LOS= length of stay; NR= not reported; PT= physiotherapy; RCT= randomized control trial; RIICU= respiratory intermediate ICU; ROM= range of motion

Table 2. Results from included studies

Outcome of Interest	Study	Absolute Effect		Difference Score (d)	Certainty
		Arm Ergometry	Control		
Physical Function	Cinar *et al.*, 2020	Mean±SD Ambulation Score at ICU discharge (n=15) 3.20±2.18	Mean±SD Ambulation Score at ICU discharge (n=20) 3.75±2.22	-0.55	Very low
		Mean±SD Barthel Index at ICU discharge (n=15) 44.66±38.05	Mean±SD Barthel Index at ICU discharge (n=20) 51.75±38.19	-7.09	
ICU Length of Stay	Cinar *et al.*, 2020	Mean (days) (min-max; n=15): 18 (3-70)	Mean (days) (min-max; n=20): 8.50 (3-44)	9.5 days	Very low
Mortality	Porta *et al.*, 2005	0 / 25	0 / 25	0	Very low
	Cinar *et al.*, 2020	0 /15	0 /20	0	
Safety	Porta *et al.*, 2005	0/25	0/25	0	Very low
	Cinar *et al.*, 2020	No adverse events (0/15); 9/45 sessions (20%) terminated	Not reported	Unable to calculate	
	Wilkinson *et al.*, 2021	No adverse events (0/12); 1/12 sessions terminated (8.3%)	No controls	Unable to calculate	

Definition of abbreviations: SD=standard deviation, d= difference score; No studies reported hospital length of stay or duration of mechanical ventilation.

Autoresuscitation After Circulatory Arrest: An Updated Systematic Review

Submission ID

30

AUTHORS

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INTRODUCTION

Ensuring that a person is not prematurely declared dead is an important cornerstone of trustworthy death determination, especially in the context of deceased organ donation. In organ donation following death determination by circulatory criteria (DCD), circulation must be determined to have permanently ceased to ensure that death has occurred. Current practice recommends a 5-minute observation period following circulatory arrest to monitor for an unassisted return of circulation, known as autoresuscitation.

OBJECTIVES

In light of newer data, the objective of this updated systematic review was to determine if a 5-minute observation time was still adequate in DCD.

METHODS

We searched four electronic databases from inception to August 28, 2021 for studies evaluating or describing autoresuscitation events after circulatory arrest. For this review, an autoresuscitation event was defined as the unassisted return of spontaneous cardiac activity, arterial blood pressure, electrocardiogram, breathing, or other (i.e., as defined by investigators) that was identified by the bedside clinician. Citation screening

and data abstraction were conducted independently and in duplicate. We assessed certainty in evidence using the GRADE framework.

RESULTS

Of 3741 unique citations assessed, 136 full texts were reviewed, and 73 studies met eligibility criteria. Of these, 45 studies were included in our previous reviews, leaving 18 new studies identified in this update consisting of 14 case reports and four observational studies. Most studies evaluated adults (n=15, 83%) and patients with unsuccessful resuscitation of cardiac arrest (n=11, 61%). Overall, timing of autoresuscitation after circulatory arrest ranged from 1 to 20 minutes. Across all studies on autoresuscitation identified by our reviews (n=73), seven observational studies have been conducted. When examining studies of withdrawal of life-sustaining measures with or without DCD (n=6), 1037 adult and 12 pediatric patients have been evaluated with 19 total autoresuscitation events (1.8%; 95% CI 1.1-2.8%). All resumptions occurred within 5 minutes of circulatory arrest and all patients with autoresuscitation died.

CONCLUSION

In the context of controlled DCD, the current evidence demonstrates that 5 minutes is sufficient observation time for death determination by circulatory criteria (moderate certainty). The findings of this systematic review will be incorporated into a Canadian guideline on death determination.

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N/A

Bleeding Complications Related to Pharmacomechanical Catheter-Directed Thrombolysis in Deep Vein Thrombosis, a Quality Improvement Study

Submission ID

13

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INTRODUCTION

Deep vein thrombosis (DVT) is a common disease with an estimated incidence of 1-2 cases per 1,000 persons annually in Canada. Anticoagulant therapy is the mainstay of treatment for DVT and aims to prevent short and long term complications, such as post-thrombotic syndrome. Patients who present with extensive thrombosis are at higher risk of developing post-thrombotic syndrome.[1] Hence catheter-directed thrombolysis may be considered in extensive thrombosis to accelerate symptoms relief and prevent complications.[1,2] Efficiency of catheter-directed thrombolysis has been questioned in more recent studies while bleeding risk is higher when compared to anticoagulation alone. [2,3,4,5]

OBJECTIVES

Assess bleeding complications in patients with DVT undergoing catheter-directed thrombolysis at our institution.

METHODS

We performed a retrospective, quality improvement study including all consecutive patients admitted in our institution between 2013 and 2019 with a diagnosis of deep vein thrombosis and for whom a pharmacomechanical catheter-directed thrombolysis was performed. Patients were selected using the hospital informatic database. Patients baseline characteristics and details related to the performed thrombolysis were manually extracted from the hospital database.
Bleeding events occurring during the same hospital admission as the performed thrombolysis were categorized as per the Internal Society of Thrombosis and Haemostasis (ISTH) non-surgical venous thrombo-embolism studies criteria.
We reported counts and proportion for binary variables and mead or medians, as appropriate, for continuous variables. Using SPSS software, we tested the association between bleeding complications and patients' age, BMI, dose and duration of

thrombolytic agents administered.

RESULTS

We identified 68 patients, 41 (60%) were female, mean age 43.8 y.o. (SD 17.2). 44 patients (64.7%) presented with a lower limb DVT. DVT was associated with an anatomic abnormality in 42 cases (61.8%), mostly May-Thurner and Paget-Schroetter anomalies. Seven patients (10.3%) had a DVT related to a central venous catheter.
All patients underwent catheter-directed thrombolysis using recombinant tissue plasminogen activator infusion combined with a fixed dose of heparin infusion (400 Units per hour).
Overall, 24 patients (35.3%) bled. Major bleeding, as per ISTH definition, occurred in 18 patients (26.5%), mostly with hemoglobin drop of more than 20g/L. Seven patients (10.3%) needed two or more blood transfusions. Furthermore, seven patients (10.3%) needed an investigation and/or intervention related to their bleeding complication.
We found no association between the bleeding complication and the patients characteristics, including dose and duration of thrombolytics agents administered.

CONCLUSION

Our study demonstrated a higher bleeding rate than reported in the literature, with approximatively a quarter of patients presenting significant bleeding.
Our study is the first « bleeding-designed » study without any exclusion criteria and assessing all types of hemorrhagic complications related to pharmacomechanical catheter-directed thrombolysis.
Considering the uncertain benefice related to this intervention for DVT, careful patient selection and risk divulgation is mandatory.

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Brain Connectivity in Critically Ill Patients with Delirium: A Systematic Review

Submission ID

129

AUTHORS

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INTRODUCTION

Delirium is an acute, confusional state characterized by a disturbance in cognition, awareness and perception[1]. Delirium can occur in the context of systemic disturbances such as severe sepsis, substance withdrawal or surgery[2-4]. Despite an increasing interest in delirium in critically ill patients over recent years, our understanding of the underlying pathophysiological basis of delirium has not advanced much. A widely accepted theory for delirium is known as the systems integration failure hypothesis explained by neurotransmitter dysregulation and network dysconnectivity triggered due to a combination of neuroinflammation, oxidative stress, neuroendocrine dysregulation and circadian dysregulation. In this context, we conducted a systematic review of studies of brain connectivity in critically ill patients with delirium.

OBJECTIVES

From conducting a systematic review of studies evaluating brain connectivity in critically ill patients with delirium, we hope to:
1) Evaluate current literature on pediatric/non-pediatric brain connectivity in critically ill patients with delirium
2) Examine potential markers for delirium that may be used for early diagnosis
3) Review and evaluate current hypotheses for delirium based on findings
4) Outline directions of future research in the context of brain connectivity and delirium

METHODS

This systematic review followed PRISMA guidelines. Two distinct literature searches were designed done to enhance sensitivity. We searched CINAHL Complete, EBM Reviews - Cochrane Central Register of Controlled Trials, Embase Classic+Embase, Ovid MEDLINE(R) ALL, APA PsycInfo, and Web of Science. Eligible studies included those with patients (of any age) diagnosed with delirium or encephalopathy, who were currently critically ill (study setting: intensive care unit, emergency or acute care) and had some form of structural or functional neuroimaging done around this period. The neuroimaging could take place before the delirium diagnosis, while delirium was still present, or after the patient had recovered. Studies must be published in English, and may have been published anytime. In addition, all forms of studies were accepted (case reports, clinical trials, chart reviews etc). Relevant data such as the population, mode of neuroimaging, timing of neuroimaging in relation to delirium, outcomes reported, and key findings were extracted to review. Figures 1 & 2 detail the identification of studies in the two searches.

RESULTS

A total of 5044 studies were screened, with 25 studies included in the final review. A meta-analysis could not be completed due to the high degree of variability and heterogeneity in the data, inconsistent comparators, variable populations, and different forms of neuroimaging. Adult studies report a longer duration of intraoperative EEG suppression, and an inability of the brain to hold strong frontal alpha power under anesthesia. The latter was associated with post-operative emergence delirium[5]. In PET studies, fluorodeoxyglucose uptake in the posterior cingulate cortex was found to be correlated with severe attention impairment, a hallmark of delirium. Pediatric studies report a shift to random order in higher frequency bands (especially the alpha band), as well as an increased frontal lobe functional connectivity following the termination of anesthesia for children with emergence delirium.

CONCLUSION

There are few studies focusing on brain connectivity in acutely ill patients with delirium and this area is ripe for further research. In the few included studies, there was no consistency in how brain connectivity was studied or reported. However, there were certain functional measurements which should be investigated further, and more rigourously. Further research on brain connectivity in intensive care unit delirium could not only deepen our understanding regarding its pathogenesis but also pave the way for more objective prediction, diagnosis and prognostication based on brain connectivity network measures.

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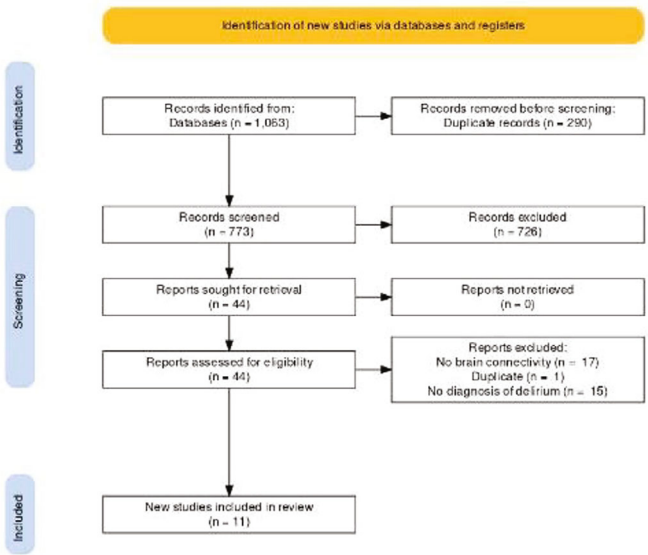
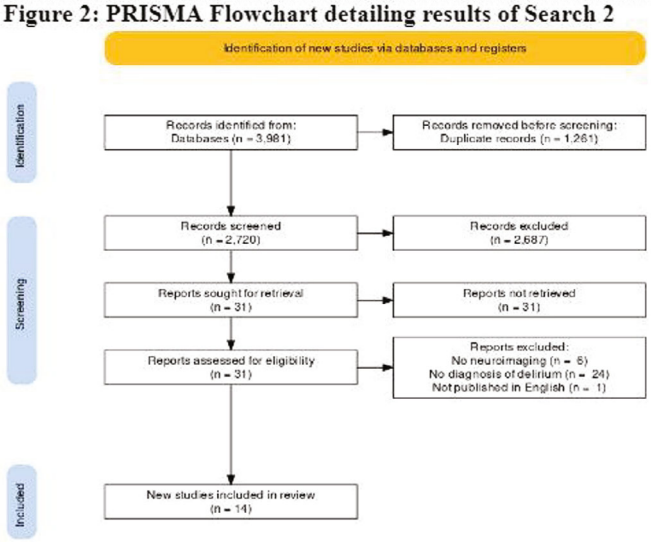


Figure 1: PRISMA Flowchart detailing results of Search 1

Figure 2: PRISMA Flowchart detailing results of Search 2



Can a Limited Use Tomography Restricted to the Area of Pain Rule out Acute Aortic Syndrome?

Submission ID

18

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INTRODUCTION

Acute aortic syndrome (AAS) includes aortic dissection, intramural hematoma and penetrating atherosclerotic ulcer. The most common investigation used is a computed tomography (CT) of the chest, abdomen and pelvis and is usually negative for AAS. We hypothesize that most AAS present with pain in the area of damage. Therefore, if we confine imaging to that area and AAS is not found, a CT of the entire aorta is unnecessary. This approach may reduce patient exposure to radiation.

OBJECTIVES

Does a restricted imaging strategy in hemodynamically stable patients with no known aortic disease have a high sensitivity in ruling out AAS?

METHODS

Multi-centre retrospective cohort of adults presenting to emergency departments from 2002-2019 with a diagnosis of AAS on CT. Data was extracted using a standardized data collection form. AAS was defined according to radiological standards. Sensitivity, specificity and likelihood ratios with 95% confidence intervals were calculated. A sample size of 148 patients for a sensitivity of 100% (95% CI 98-100%) was estimated.

RESULTS

We included 148 patients diagnosed with AAS (25% thoracic, 14% abdominal, 60% thoracic/abdominal). 24% presented with only abdominal pain, 46% with only chest pain and 30% with abdominal/chest pain. The sensitivity of restricted imaging strategy was 96% (95% CI 91.4-98.5%). Of the 6 cases missed, 5 had known aortic aneurysm/repair and 1 was hypotensive. Cohort was restricted to those with systolic >90mmHg and without aortic aneurysm/repair (n=86). Restricted imaging strategy had a sensitivity of

100% (95%CI 96-100%).

CONCLUSION

A restricted imaging strategy in hemodynamically stable patients with no known aortic aneurysm has a high sensitivity in ruling out AAS. External validation in a larger cohort of patients is needed to ensure sufficiently narrow confidence intervals prior to implementation.

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Cardiac Tamponade After Direct Catheter Thrombolysis for Pulmonary Embolism: A Case Report

Submission ID

57

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INTRODUCTION

Acute pulmonary embolism (PE) is a common and potentially fatal illness that affects up to 900,000 individuals in the United States each year. To manage pulmonary embolism , heparin, direct-acting oral anticoagulants (DOACs) thrombolytics, either systemic or catheter-directed (CDT), and surgical thrombectomy may be used, the choice of agent depending on the severity of the physiologic consequences of the pulmonary arterial obstruction. The critical predictor of acute morbidity in PE is the degree of right ventricular (RV) dysfunction, which may be absent in low-risk cases, asymptomatic in intermediate-risk (sometimes referred to as submassive) cases, and hemodynamically substantial in massive PE(1). In recent years, two randomized clinical trials have compared the use of systemic thrombolytic agents with heparin in submassive PE and found a statistically significant decrease in the combined outcome of hemodynamic instability and death in the lytic group albeit with a higher rate of significant bleeding complications (2,3) .

CASE DESCRIPTION

A 66-year-old man has been treated with Prednisolone for 20 years for pulmonary sarcoidosis. The patient was admitted to the hospital complaining of the acute onset of shortness of breath while working in the garden. On presentation, his vital signs were stable: BP 144/96; HR 96/minute; RR 22/minute; and he was afebrile. A CT scan of the thorax revealed significant pulmonary embolic affecting the right major pulmonary artery, segmental and subsegmental branches. Additionally, the scan demonstrated right heart strain with dilated right heart chambers and interventricular flattening and no evidence of pericardial disease. A point-of-care ultrasound of the thorax revealed the absence of pericardial fluid. Initial troponin levels were elevated at 309 ng/L, a value which rose the next day to 2493 ng/L .

Given the diagnosis of submassive pulmonary embolism, a 5 French pigtail catheter was

inserted into the right pulmonary artery and an infusion of tissue plasminogen activator was started.

The following day, the patient started to complain of chest discomfort. A repeat transthoracic echocardiogram revealed a large, circumferential pericardial effusion demonstrating signs of tamponade physiology and for which there was no need for vasopressors. The TPA was discontinued, and an IVC filter was inserted. Several days later, a heparin infusion was initiated, which was followed a few weeks later by the introduction, in the outpatient clinic, of oral anticoagulation with a direct oral anticoagulant (DOAC).

Unfortunately, He returned to the Emergency department six weeks later, complaining of a lump in his neck. A CT scan of the neck and lower chest revealed the presence of both a sub-mental mass and an extensive pericardial fluid collection which was subsequently drained for approximately 1 litre of the bloody fluid. The submental mass was later biopsied to reveal a T-cell lymphoma.

DISCUSSION

In recent years, systemic thrombolytic therapy for treating submassive pulmonary embolism has been studied in two randomized trials and found to decrease the combined outcomes of death and hemodynamic deterioration while increasing the rate of significant bleeding. In particular, intracranial hemorrhage(4,5).

In the only randomized controlled trial comparing CDL with heparin anticoagulation, Kucher and colleagues reported a 24-hour decrease in right ventricular dilatation and pulmonary artery pressure without an increase in the risk of severe bleeding (6). In their retrospective report, D'Auria and associates described their experience comparing CDT and anticoagulation. They found a significant mortality decrease in the former at 30 days and one year without the need for increased transfusions in the lytic group (1). Most recently, Ismail and colleagues performed a meta-analysis in which they found that when compared to systemic anticoagulation alone, CDL decreased in-hospital, 30-day, and 90-day mortality without increasing either minor or significant bleeding risk.[13]

CONCLUSION

Therefore, tamponade should be considered in any patient who deteriorates after CDL especially given that both CDL failure and worsening right ventricular function – 8% in Avgerinos'report [7] - and pericardial tamponade may present similarly with worsening hemodynamic compromise accompanied by elevated right-sided atrial pressure. In this context, an immediate bedside echocardiogram would readily distinguish between the two.

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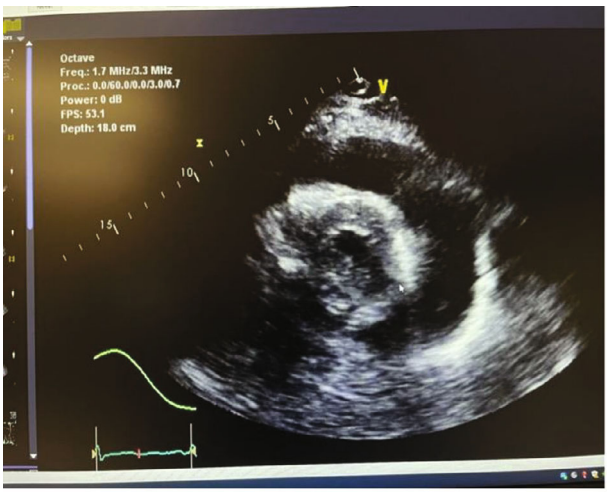

Figure 1

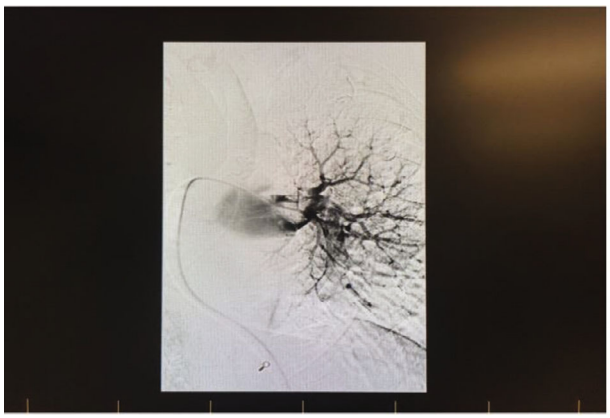

Figure 2

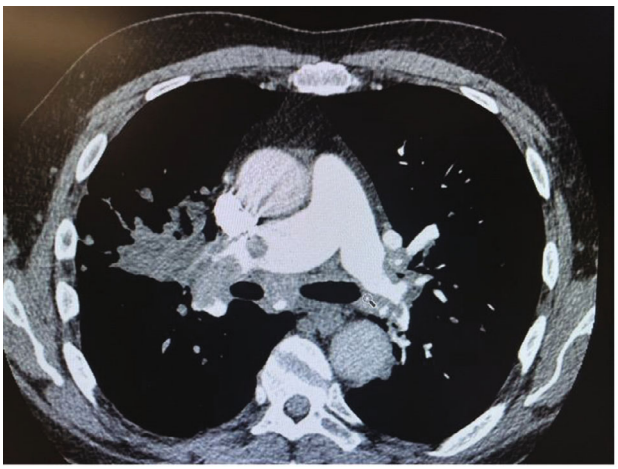

Figure 3

Characteristics and Timing of Detection of Brain Abnormalities on Neuroimaging in Pediatric Extracorporeal Cardiopulmonary Resuscitation

Submission ID

109

AUTHORS

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INTRODUCTION

Severe neurologic injury is a frequent cause of death or withdrawal of life-sustaining therapy among children who undergo extracorporeal cardiopulmonary resuscitation (ECPR). Infants are the most common age group to receive ECPR in paediatrics, but the timing and features of brain injury have not been well characterized in this population. Understanding the type of injury and their evolution may help tailor management, neuromonitoring, the timing of interventions that may increase the risk of secondary injury (e.g., clamp and weaning trials), and the timing of neuroprognostication.

OBJECTIVES

The objective of this study was to characterize the type and timing of neurological abnormalities visible on neuroimaging using a cohort of infant ECPR. We hypothesized that the frequency of hemorrhagic abnormalities would be higher than ischemic ones.[1,2]

METHODS

This was a single-center retrospective observational study of patients <18 years treated with in-hospital ECPR between January 2015 and December 2020. The analysis sample for this study included infants in whom standard clinical practice includes a daily cranial ultrasound starting on day-1 following cannulation to ECPR.[3] The primary outcome was frequency of abnormalities detected on clinical cranial ultrasound. All image reports

were anonymized and then classified independently by two coders blinded to the clinical characteristics of the events using a standardized system.

RESULTS

Of 92 ECPR events, 23 patients (median age 32 days, IQR 17-93) underwent repeated cranial ultrasound and were included in the analysis. Of the 130 cranial ultrasounds that we reviewed, 129 (79%) ultrasounds in 21 patients had hypoxic ischemic abnormalities and 35 (66%) had hemorrhage in 9 patients. A total of 7 patients (30%) had both hemorrhages and hypoxic ischemic lesions. The most common abnormalities were abnormal gray-white matter differentiation (N 15) patients and intraparenchymal hemorrhage in 9 patients. Only 2 patients had no abnormalities across all their imaging studies. Most hemorrhages were observed on the first ultrasound, whereas hypoxic ischemic abnormalities were not typically apparent until the second ultrasound. The extra-axial cerebral spinal fluid space was increased in 31 studies among 8 patients. In-hospital survival was 22%. All survivors had a favorable neurologic outcome (Pediatric Cerebral Performance Category 1-3).

CONCLUSION

Among infants who underwent ECPR, there was high rate of brain abnormalities detected on ultrasound, hypoxic-ischemic injury was more common, which is in keeping with post cardiac arrest outcomes, compared to neonatal ECMO where intracranial hemorrhage is the dominant pathology. Increase in extra-axial cerebral spinal fluid space deserves more study given the brain volume loss reported by some following ECMO in MRI studies. Further study of the characteristics and time-course post-ECPR brain injury may inform clinical strategies to improve neurologic outcomes. Limitations: Size of the sample didn't allow the exploration of relationship between the duration of resuscitation and risk of neurological abnormalities.

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Comparator Groups in ICU-Based Trials of Physical Rehabilitation: A Scoping Review

Submission ID

79

AUTHORS

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INTRODUCTION

Physical rehabilitation (PR) started in the intensive care unit (ICU) can improve physical function for ICU survivors in hospital and after discharge. However, results of clinical trials of PR in the ICU have demonstrated mixed results regarding intervention efficacy. A recent systematic review identified mixed results regarding the impact of PR on physical function outcomes, also documenting poor reporting of the difference in PR received between groups.[1] To interpret trial results, we must understand the PR received in intervention and comparator groups (CGs). An earlier scoping review of studies of PR in the ICU identified gaps in reporting characteristics of intervention and CGs, but was primarily focused on characterizing intervention groups. [2] Given the known reporting gaps and previous focus on intervention groups, we have a gap in understanding the characteristics of CGs. To address this gap, we conducted a scoping review to characterize CGs in trials of ICU PR.

OBJECTIVES

1. To characterize CGs in trials of PR in the ICU, including the type (e.g., usual care, sham treatment) and content (i.e., PR activities); and
2. To describe the completeness of CG reporting in ICU-based PR trials.

METHODS

This study followed a 5-stage scoping review methodology,[3,4] and was prospectively registered (DOI: 10.17605/OSF.IO/BS342).

Eligibility Criteria: We included prospective trials with $\geq$ 2 arms that enrolled mechanically ventilated adults $\geq$ 18 years and studied any planned PR intervention started in the ICU. We did not restrict trials by CG or outcome type.

Search, Screening, and Data Charting: We searched 5 databases from inception to June 30th, 2022. Screening, data charting, and completeness of reporting assessments [Consensus on Exercise Reporting Template (CERT)][5], were completed independently and in duplicate using Covidence (2020, Veritas Health Innovation, Melbourne, Australia).

Synthesis and Analysis: We categorized similar CGs according to the author(s) description. We reviewed each study and classified content into individual activities (e.g., positioning, standing). Using counts and proportions, we summarized CG types and content.

Completeness of CG reporting was assessed as a proportion (number reported / total applicable CERT items). We summarized reporting scores by item and across trials.

RESULTS

We screened 84,273 citations and 2,323 full-texts, including 124 trials (Figure 1). Tables 1 and 2 summarize trial/participant characteristics.

The 124 trials represented 126 CGs with five unique categories (Figure 1). Three trials (2.4%) did not report whether PR was planned. PR was planned in 111 CGs representing four categories: usual care (n=80, 65.3%), alternative treatment (n=18, 14.3%), alternative treatment plus usual care (n=7, 5.6%), and sham (n=6, 4.8%). Twelve CGs (9.5%) did not plan any PR. 90 CGs with planned PR reported 100 unique activities, most commonly passive range of motion (n=30, 27.0%) and positioning (n=28, 25.2%). Twenty-one (18.9%) CGs did not specify what activities occurred.

The median CG CERT score was 47.1% (25.3, 73.3%). Setting (CERT item #12) was most reported (n=119, 96.0%) and motivation (CERT item #6) was least (n=8, 9.3%). PR characteristics necessary for replication were poorly reported, including frequency (n=77, 62.6%) and duration (n=57, 46.3%).

CONCLUSION

The most common type of CG in ICU-based PR trials was usual care. We identified gaps in the reporting of CG PR content, and heterogeneity in the PR activities that occurred. Almost 20% of all CGs did not report included activities. We also identified important CG reporting deficiencies according to CERT. Further work is needed to guide the selection, design, and reporting of CGs in ICU-based PR trials. This will improve the design and conduct of future studies and advance the field by facilitating better interpretation of trial results.

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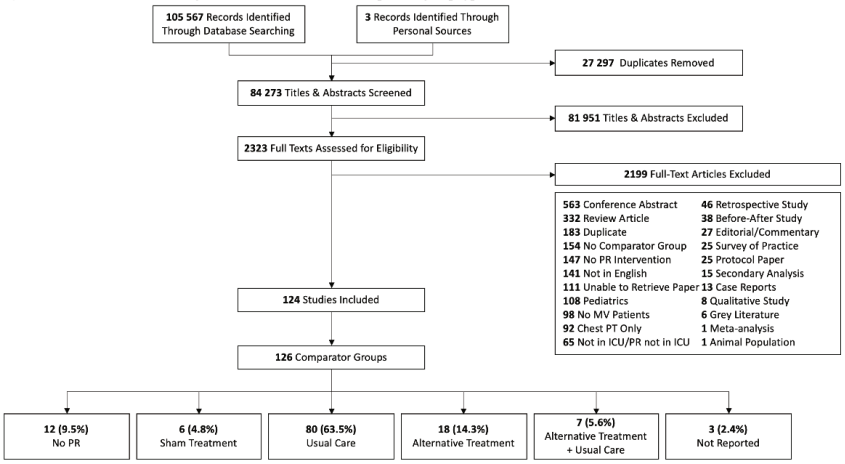
Figure 1. PRISMA-ScR flow diagram of included trials and comparator group types.



Legend: This diagram represents the flow of screening for included studies. Two studies each had two comparator groups, representing 126 comparator groups total. Three studies did not report whether the comparator group received PR. Twelve comparator groups did not receive PR while 6 received sham treatment. Eighty received usual care (classified based on author description and including similar terms such as standard care, routine care etc.) while 18 received an alternative intervention (PR intervention which was not usual care and distinct from that delivered in the intervention group). Seven studies received an alternative intervention in addition to usual care.
Abbreviations: PR – physical rehabilitation; MV – mechanical ventilation; PT - physiotherapy; ICU – Intensive Care Unit

Table 1. Trial characteristics.

	N = 124 trials
Countries n (%)	
United States	15 (12.1)
Brazil	15 (12.1)
China	13 (10.5)
Australia	9 (7.3)
Belgium	6 (4.8)
Japan	6 (4.8)
Taiwan	6 (4.8)
France	4 (3.2)
Greece	4 (3.2)
Iran	4 (3.2)
Italy	4 (3.2)
Switzerland	4 (3.2)
United Kingdom	4 (3.2)
Other[a]	30 (24.2)
Year of Publication, n (%)	
<2000	2 (1.6)
2001-2005	2 (1.6)
2006-2010	9 (7.3)
2011-2015	26 (21.0)
2016-2020	66 (53.2)
2021- Jul 2022	19 (15.3)
Trial Design	
RCT	92 (74.2)
2-arm	79 (85.9)
3-arm	10 (10.9)
4-arm	3 (3.3)
Non-RCT	19 (15.3)
Other[b]	13 (10.5)
ICU type	
Mixed	55 (44.4)
Medical	12 (9.7)
General	14 (11.3)
Neurosurgery/neurotrauma	10 (8.1)
Other[c]	14 (11.3)
Not specified	19 (15.3)
Number of centers per trial	
Median (1st, 3rd Quartiles)	1 (1, 1)
Range (Min-Max)	1-7
Patients enrolled per trial	
Median (1st, 3rd quartiles)	60.0 (35.5, 107.5)
Range (min-max)	8-647

[a] **Other countries (n=30):** India, Turkey, Germany (n=3 for each trial). Austria, Denmark, Israel, Thailand (n=2 for each country). Argentina, Bangladesh, Canada, Colombia, Czech Republic, Egypt, Iceland, Indonesia, Korea, Netherlands, South Africa, South Korea, Sweden (n=1 for each country).
[b] **Other trial designs (n=13):** Within-patient RCT 5 (4.0), historical control trial 3 (2.4), cluster RCT 2 (1.6), randomized crossover RCT 2 (1.6), cluster non-RCT 1 (0.8).
[c] **Other ICUs (n=14):** Surgical 6 (4.8), respiratory 4 (3.2), cardiac 2 (1.6), trauma 1 (0.8), thoracic 1 (0.8).

Table 2. Patient characteristics.

	Overall	Intervention	Control
Patients enrolled	11 624	5977[a]	5341[a]
N (%) female	4493 (39.3)[b]	2005 (40.1)[c]	1853 (40.8)[c]
% Female per trial			
Median (1st, 3rd quartiles)	39.2 (31.8, 49.1)[b]	37.8 (30.8, 47.6)[c]	40.0 (31.3, 50.0)[c]
Range	0.0-74.7	0.9-85.7	6.7-87.0
Age			
Median (1st, 3rd quartiles)	61.1 (54.8, 65.6)[d]	59.9 (54.0, 65.0)[e]	60.5 (55.2, 66.0)[e]
Mean (standard deviation)	59.3 (9.2)[d]	58.9 (9.2)[e]	59.3 (9.4)[e]
ICU LOS (days)			
Median (1st, 3rd quartiles)	12.8 (7.4, 20.0)[f]	12.0 (7.2, 19.0)[g]	13.5 (7.9, 19.5)[g]
Range (min-max)	2.6-46.2[f]	2.6-38.8[g]	2.7-56.9[g]
Duration of MV (days)			
Median (1st, 3rd quartiles)	8.3 (5.3, 11.5)[h]	7.0 (5.1, 10.1)[i]	8.0 (5.8, 12.8)[i]
Range (min-max)	0.0-51.2[h]	0.0-32.7[i]	0.0-98[i]

[a] N=112 trials, 12 trials reported overall trial enrollment, not by group.
[b] N=119 trials (11429 patients), 5 trials did not report sex.
[c] N = 108 trials (intervention – 5906 patients, control n = 5290), 11 trials reported overall sex, not by group.
[d] N=120 trials, 4 trials did not report age.
[e] N=109 trials, 11 trials reported overall age, not by group.
[f] N=76 trials, 48 trials did not report ICU LOS.
[g] N=73 trials, 3 reported overall LOS, not by group.
[h] N= 62 trials, 62 trials did not report duration of MV
[i] N=59 trials, 3 trials reported overall duration of MV, not by group.

Abbreviations: LOS - length of stay; MV – mechanical ventilation.

Comparing Physiological Effects of Asymmetrical vs. Standard High-Flow Nasal Cannula: A Bench Study

Submission ID

87

AUTHORS

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INTRODUCTION

High-flow nasal cannula (HFNC) is largely used to manage a variety of abnormal ventilatory conditions and has been associated with better outcomes compared to conventional oxygen therapy, and non-inferiority in comparison to non-invasive ventilation (1). The positive pressure generated by HFNC can increase end-expiratory lung volume. Pressure in the upper airways can be increased by enhancing the occlusion of the nares by the cannula size and by higher flow rates(2). The recently launched asymmetrical (Figure 1) nasal cannula might be used as a strategy to enhance the pressure generated by HFNC since this new cannula design allows greater occlusion on one side of the nostril while preserving leakage on the counter side nostril. The asymmetrical cannula was developed with the purpose of preserving leaks and improving dead-space washout(3); however, differences from the standard cannulas are still unknown.

OBJECTIVES

To compare, in a bench model, the asymmetrical cannula (Optiflow+ Duet: OPT966, Fisher & Paykel Healthcare, NZ) using a large size (AS_L), as a strategy to generate the highest airway pressure during HFNC therapy, with the standard cannula (Optiflow+: OPT944, Fisher & Paykel Healthcare, NZ), medium size (ST_M), as the standard strategy (Figure 1). The following physiological effects are studied: end- expiratory nasopharyngeal pressure (eeNP) through a multiperforated catheter, inspiratory muscle pressure (Pmus) by measuring the pressure moving the whole simulated respiratory system, airway resistance, and upper airway CO_2 washout. We hypothesized that the higher total cross-sectional area of the AS_L nasal interface would promote higher occlusion of the nares, consequently generating a higher nasopharyngeal pressure and a higher resistance to breathe, in comparison with the ST_M nasal interface.

METHODS

In this bench study, a manikin equipped with airways (Laerdal® Airway Management Trainer, Norway) was connected to a lung test machine chamber (Dual Adult TLL®-1600, Michigan Instruments, USA), while a mechanical ventilator (BellaVista 1000e, Vyaire Medical) delivered the set ventilation (volume control mode) into the 2nd chamber (CH-2) to promote the expansion of the 1st chamber and consequently simulate manikin`s breathing (tidal volume [VT] ~ 450mL). Both nasal cannulas $AS_L$ and $ST_M$ were applied to the manikin`s nostril stepping up the flow rate by 10L.min^{-1} every 2 minutes, from 0 to 60L.min^{-1}, at respiratory rates (RR) of 10, 20, 30 and 40 (maintaining the same I:E ratio = 1:2, for every RR). Last, 6L.min^{-1} CO_2-5% flow was delivered inside the chamber to simulate a constant 300mL.min^{-1} CO_2 production. Capnography (Main-stream) was measured in the trachea, close to upper airways. Data were recorded by FluxMed system (Fluxmed MBMed SA, Argentina) and analyzed using R-4.0.3.

RESULTS

The AS_L system generated higher eeNP than the ST_M (6.0 versus 3.0 cmH_2O at HFNC 60L.min^{-1} and RR of 10bpm). The eeNP progressively increased with the RR (up to 9.6cmH_2O with AS_L, versus 4.0cmH_2O with ST_M at HFNC 60L.min^{-1} and RR of 40bpm), probably due to dynamic hyperinflation (Figure 2- Top panels). The inspiratory Pmus also increased (more during AS_L) with the increasing of HFNC flow rates and RR (Figure 2- Mid panels): the increasing HFNC flow rates increased the inspiratory and expiratory resistances to breathe with both strategies (Figure 3), as shown previously(4). The rebreathing volume from the upper airways (inspiratory volume to drop 10% in CO_2 partial pressure) was lower during AS_L, suggesting a higher efficiency to promote washout in the upper airways compared to the ST_M. The higher RRs decreased the washout efficiency of both nasal cannulas (Figure 2- Bottom panels), as previously reported(5).

CONCLUSION

Compared to the ST_M, the AS_L generated a higher eeNP and promoted a more efficient CO_2 clearance in the upper airways, since the rebreathing volume from the upper airways was lower for any HFNC flow rate. However, the higher resistance to breathe and higher Pmus during AS_L strategy, makes the overall superiority over the ST_M questionable. The higher resistance to breathe during AS_L strategy may explain higher eeNP and Pmus and have magnified the difference between the two strategies at higher RRs. A physiological study in healthy volunteers will be performed to address these questions.

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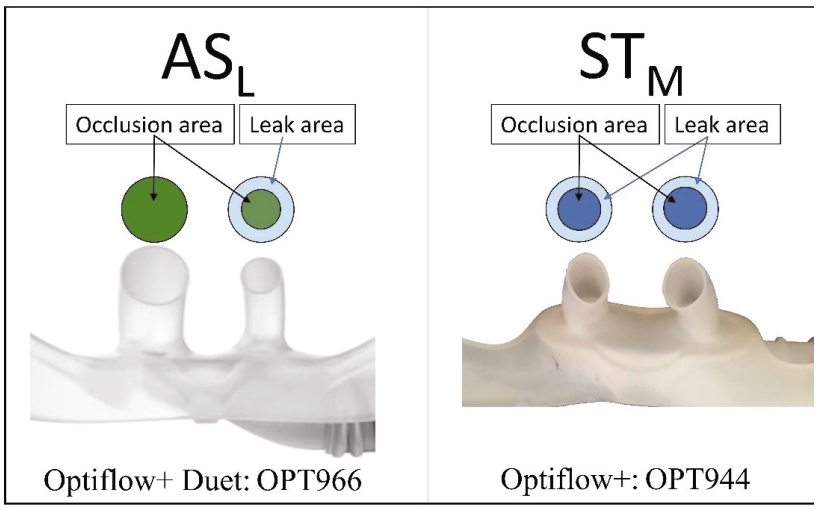

Figure 1- Asymmetrical Cannula-Large (AS_L) and Standard Cannula- Medium (ST_M): areas of occlusion and leakage in the nares.

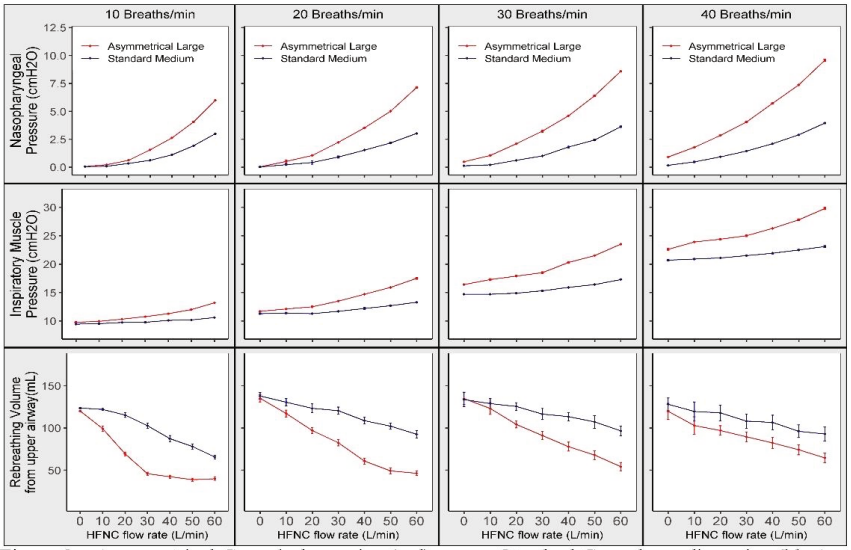

Figure 2 - Asymmetrical Cannula large size (red) versus Standard Cannula medium size (blue) at different flow rates and respiratory rates. Uppers panels= end-expiratory nasopharyngeal pressure, Mid panels= Inspiratory muscle pressure, Bottom panels= Rebreathing volume from the upper airways

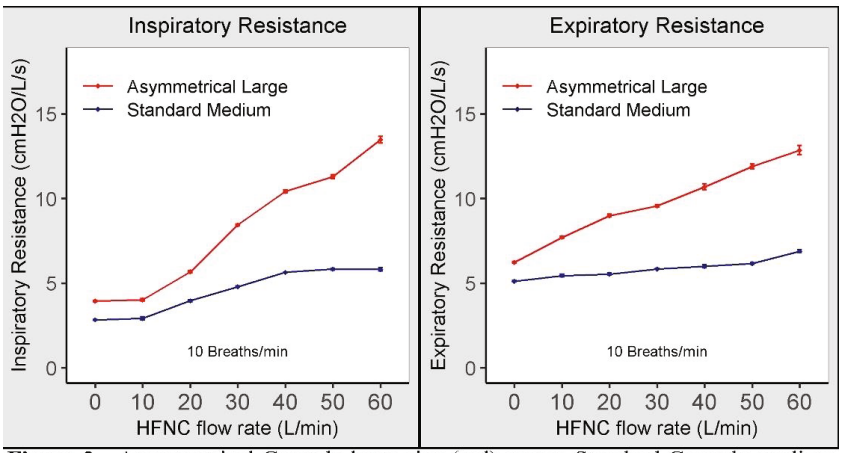

Figure 3 - Asymmetrical Cannula large size (red) versus Standard Cannula medium size (blue): resistance to breathe

Comparing the Intraoperative use of Balanced Crystalloids Vs. 0.9% Saline on Postoperative Outcomes: A Systematic Review and Meta-Analysis

Submission ID

45

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INTRODUCTION

Crystalloids are commonly used intraoperative fluids due to their low cost, ease of use, and effectiveness in fluid resuscitation. Balanced crystalloids, such as Ringer's lactate or plasmalyte, are crystalloids which have an electrolyte composition that closely resembles blood plasma. Whereas 0.9% saline (saline), an unbalanced crystalloid, contains only sodium and chloride. The evidence regarding optimal crystalloid use in the intraoperative period remains unclear.[1]

OBJECTIVES

The objective of this review is to assess whether use of balanced crystalloids as compared to saline leads to differences in postoperative blood test results and patient outcomes.

METHODS

We searched Ovid MEDLINE, Embase, the Cochrane library, and Clinicaltrials.gov for randomized control trials (RCTs) that compared intraoperative use of balanced crystalloids to saline. Two reviewers independently screened citations in two stages and extracted study data using a predesigned case report form. We pooled data using a random effect model and present risk ratios (RR) or mean differences (MD), along with 95% confidence intervals (CIs). We assessed risk of bias (RoB) using the modified Cochrane RoB tool and certainty of evidence using GRADE methodology. For postoperative blood results, if multiple endpoints were available, we used the time point closest to the end of surgery.

RESULTS

Of 5232 citations, we included 41 RCTs (n=3290 patients) examining patients undergoing neurosurgery, general surgery, renal transplantation, obstetric surgery, orthopedic

surgery, cardiac surgery, and endoscopic procedures. Pooled analysis showed that use of balanced crystalloids as compared to saline had an uncertain effect on postoperative mortality (RR 1.65, 95% CI: 0.40 to 6.90, very low certainty), and may have no effect on hospital length of stay (MD 0.07 days fewer (95% CI: 0.98 days fewer to 0.85 days more, low certainty). Intraoperative use of balanced crystalloids probably leads to a higher postoperative serum pH (MD 0.05, 95% CI: 0.04 to 0.06) and higher postoperative serum bicarbonate (MD 2.45 mmol/L, (95% CI: 1.81 to 3.09), and a lower postoperative serum chloride (MD 6.18 mmol/L lower, 95% CI 3.98 to 8.37 lower) compared to saline (all moderate certainty) and may lead to higher postoperative serum lactate (MD 0.18 mmol/L, 95% CI: 0.01 to 0.35, low certainty).

CONCLUSION

Use of balanced crystalloids in the intraoperative settings has an uncertain effect on mortality and may have no effect on hospital length of stay as compared to 0.9% saline. Balanced crystalloid use is probably associated with increased postoperative serum pH, chloride, and bicarbonate levels and may increase postoperative lactate levels. This review has the potential to inform future guidelines regarding intraoperative fluid management.

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Figure 1: Effect of intraoperative balanced crystalloid use on postoperative bicarbonate levels (mmol/L)

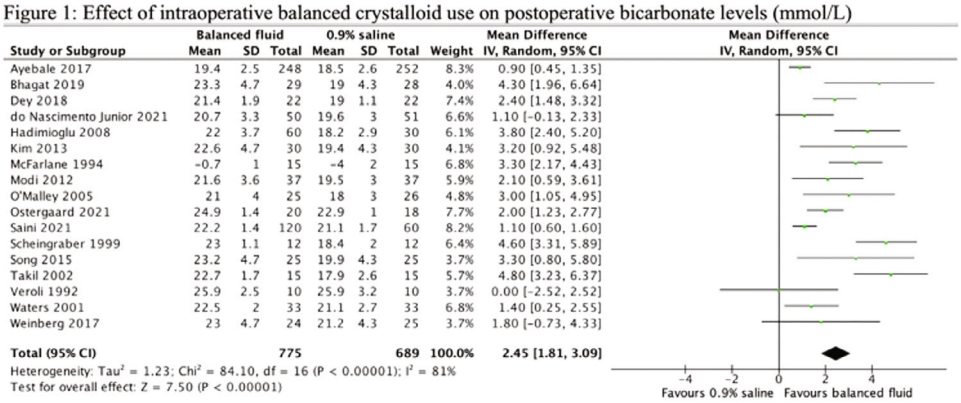


Figure 2: Effect of intraoperative balanced crystalloid use on postoperative chloride levels (mmol/L)

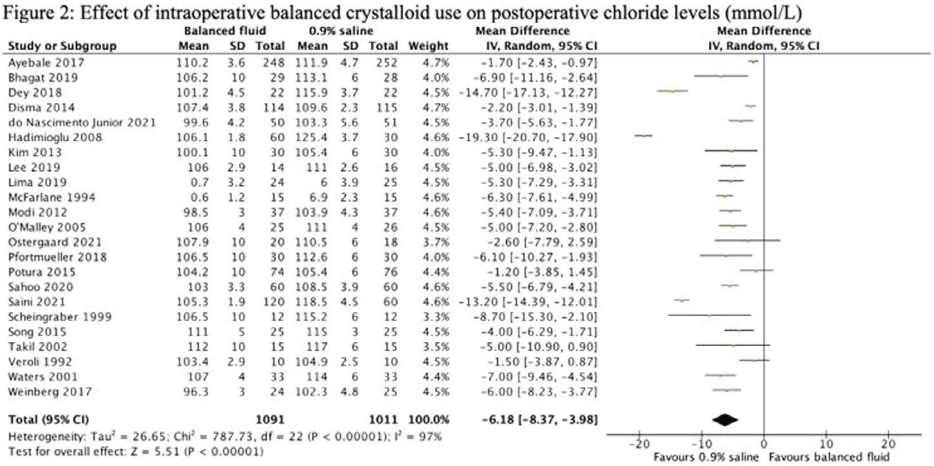
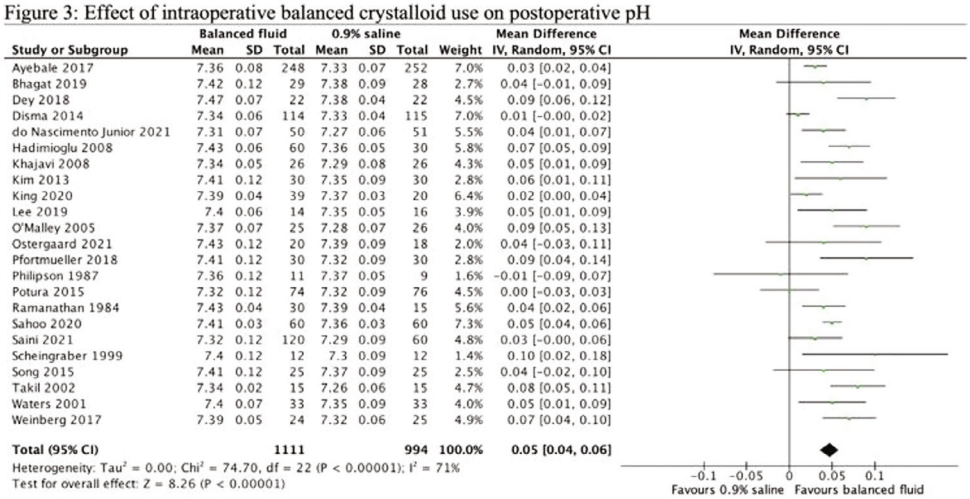


Figure 3: Effect of intraoperative balanced crystalloid use on postoperative pH



Comparison of Three Qualified Nutritional Indexes as Prognosis Predictors in Hospitalized Patients with COVID-19: A UHN Cross-Sectional Study

Submission ID

121

AUTHORS

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INTRODUCTION

Malnutrition is common among hospitalized COVID-19 patients. The catabolic inflammatory response caused by SARS-CoV-2 results in physical immobility, poor nutrient intake, as well as frequent gastrointestinal involvement. (1) In light of this, previous studies suggested that nutritional status plays a significant role in predicting the outcome of these patients. (2) Despite widespread recognition of the malnutrition role, there is not yet a straightforward and valid assessment tool that can be used for screening purposes. As a matter of fact, the pandemic has opened up the possibility of developing a new nutritional approach that takes into consideration both the acute inflammatory nature of the infectious disease as well as the patient's nutritional status. (3) It is necessary to evaluate quantitative laboratory indexes such as the prognostic nutritional index (PNI), the neutrophil-to-lymphocyte ratio (NLR), and the CRP albumin ratio (CAR) based on hospital admission information to prioritize patients for special care. (4-5)

OBJECTIVES

The present study aims to compare PNI, NLR, and CAR as quantified measures of the nutritional status of hospitalized COVID-19 patients regarding the pre-defined description of poor prognosis. We divided all patients into two groups of well-prognosis and poor-prognosis based on hospital death or length of hospital stay (LOS) of nine days or more, whichever comes first.

METHODS

Adult patients admitted to Toronto General Hospital in Canada for COVID-19 from March 2019 to May 2021 were eligible for this study. We divided all patients into two groups of well-prognosis and poor-prognosis based on mortality status or length of hospital stay (LOS). As the median value for LOS in the selected population is nine days, LOS equal to

and higher than nine days was considered the cut-off point for placing patients into poor prognosis groups.
Demographical and clinical data of patients included were collected by searching records in electronic patient records (EPR). The PNI was calculated as serum albumin (g/L) + 5 × lymphocyte count (109/L). In addition, neutrophil to lymphocyte ratio (NLR) and C-reactive protein/Albumin ratio (CAR) were also calculated and included as potential risk factors.
We performed independent Student's t, and Mann-Whitney U tests to analyze differences between two groups of normally distributed and non-normally distributed variables. A Chi-square test was performed to examine the difference between categorical variables. Then, univariate and multivariate logistic regression were sequentially performed to explore mortality risk factors in COVID-19 patients. A P value <.05 was considered significant.

RESULTS

In this retrospective study, a total of 200 patients confirmed with COVID-19 were included. Patients were divided into two groups, 117 well-prognosis and 83 poor-prognosis with a mortality rate of 24.3%. We found that the poor prognosis group had a higher level of hemoglobin (Hb), white blood cell (WBC), neutrophil, platelet, aspartate aminotransferase (AST), C-reactive protein (CRP), D- dimer. However, the level of fasting blood sugar (8.22% vs 9.51%, P < .05), albumin at admission (33.96% vs 35.41%, P < .05) and albumin at discharge (31.17% vs 35.89%, P < .05) was significantly lower in the poor prognosis group. Moreover, the value of PNI (34.1 vs 35.41, P < .05) was significantly lower in the poor prognosis group while the value of CAR (2.53 vs 1.96, P =.16) and NLR (7.77 vs 5.76, P =.05).

CONCLUSION

The PNI, composed of albumin level and lymphocyte count, could reflect nutritional and inflammatory status more comprehensively in COVID-19 patients than neutrophil to lymphocyte (NLR) and CRP to albumin (CAR) ratios. The PNI is inversely associated with outcomes in COVID-19 patients. The prognostic model incorporating PNI shows good performance in predicting the outcome of COVID-19 patients.

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Comparison of Various Scoring Systems and Mortality Prediction Models; Characteristics, Variables, and Performances, to be used in our Artificial Intelligence (AI) Death Prediction Model

Submission ID

122

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INTRODUCTION

ICU scoring systems, outcome prediction models, and severity scales are the prognostic tools to predict the probability of an outcome. (1) These predictive tools can be applied in ICUs to categorize patients into different risk groups. Various variables are used in different scoring systems to predict outcomes and mortality. These scoring systems usually provide an estimation of the mortality rate based on data of previous populations. (2)
Scoring systems, which are usually calculated by patients' physiological parameters, have been shown to help with predicting mortality during the patients' ICU admission.
Although many scoring systems, such as APACHE I-V, SAPS I- III, and SOFA scores, have been developed to categorize patients into different risk groups, APACHE II, SOFA and SAPS have been the most commonly used ones. (3–5)
The result of this scoping review will be used in our AI death prediction model in order to increase the donor pool.

OBJECTIVES

The objective of this study is to provide an overview of the available mortality prediction models for the adult patients admitted to Intensive Care Units (ICU) in hope of developing a more accurate and feasible mortality prediction model using a combination of routine clinical variables and available severity scores.

METHODS

We conducted a scoping review of the literature to assess the models that have been used to predict the survival of the patients admitted to the ICU, using Medline, Embase, Cochrane Database of Systematic Reviews via Ovid, CINAHL via Ebsco and PubMed. The

following inclusion criteria have been implemented: the studies that were in English and used mortality prediction models for adult patients (above 18 years old). Exclusion criteria included systematic reviews, case reports, animal studies, posters, and conference papers.

We then summarized the characteristics, variables, and performances of all mortality models.

RESULTS

Using a comprehensive search, 8263 studies were identified. Title, abstract and full-text screening left 310 studies, including 92 cohorts, 168 case series, 41 case controls and 9 clinical trials. In this preliminary report, 47 mortality prediction models were included, of which 16 were only internally validated and 14 externally, while 11 were both internally and externally validated. 41 models were used to predict mortality in the general adult ICU population, and 6 were used for elderly patients only. Some studies have also reported on modified predicting models. In most studies, the area under the receiver operating characteristic curve (AUC) was used to measure the performance. Hosmer-Lemeshow test and calibration plot were the most commonly used measures for calibration. Overall mortality rate ranged from 5% to more than 60%.

CONCLUSION

Although common ICU mortality models have shown to have fairly accurate overall mortality prediction, they have poor calibration. It was shown that APACHE II and SAPS II scales had better discrimination, calibration, and power to predict death in ICU compared to SOFA. Finally, we suggest that a separate mortality prediction model can be developed for different groups of patients admitted to ICUs. Our aim is to determine and develop the appropriate scoring systems to use in our AI model to develop a death prediction model for ICU patients.

This abstract is prepared based on preliminary results.

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Critical Appraisal of Machine Learning in Neurocritical Care: A Systematic Review

Submission ID

65

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INTRODUCTION

Within the complex sociotechnical environment of neurocritical care, thousands of individual elements of structured information are collected daily, including advanced brain physiologic monitoring, systemic vital signs, neuroimaging, laboratory data, medications, and nursing records. Intensivists face the fundamental challenge of managing these large amounts of information, the processing and analysis of which may be beyond human cognitive ability. Conventional models to predict deterioration and outcomes in neurocritically ill patients are based on a combination of clinical, physiologic, and imaging parameters using traditional statistical approaches, however emerging studies have shown that the machine learning prediction models may have the potential to predict neurological deterioration and outcomes more accurately, and hence identify patients suitable for earlier treatment interventions. The advancement of machine learning offers the potential of enhancing clinical decision-making in neurocritical care. However, gaps remain between algorithm development and bedside implementation.

OBJECTIVES

This systematic review aims to comprehensively synthesize, rigorously evaluate, and critically appraise the application of machine learning in neurocritical care.

METHODS

A systematic search was conducted in Medline, Embase, Cochrane Central Register of Controlled Trials, Web of Science, IEEE Xplore Scopus, and ProQuest Digital Dissertations

Global to identify eligible studies. Two independent reviewers and one arbitrator performed screening, extraction, and quality assessment. Risk of bias was assessed using Prediction model Risk Of Bias ASsessment Tool (PROBAST), and transparent reporting standards were evaluated using Transparent Reporting of a multivariable prediction model of Individual Prognosis Or Diagnosis (TRIPOD).

RESULTS

We included 267 out of the 9368 studies. The primary neurological condition was traumatic brain injury (35%), seizure (26%), or hemorrhage (16%). Machine learning was used to diagnose a neurological condition or predict mortality or functional outcomes in neuro-ICU patients. Over half (60%) of the studies used retrospective hospital registries to train and test the models. The majority (94%) of the studies used supervised machine learning techniques, including neural networks, support vector machines, and random forests. For the clinical readiness of the models, 90% of the studies were identified to be at the level 3 and 4 model prototyping and development stage. Notably, 92% of the studies were rated as high risk of bias, often due to lack of model calibration or insufficient sample sizes. For reporting standards, adherence was generally high for reporting study objectives and outcome definitions but low for reporting sample sizes and model usage. The overall reporting adherence is 50.2%.

CONCLUSION

Despite an increasing number of machine learning models being developed for potential usage in neurocritical care, the clinical readiness levels remain premature from implementation, along with a high risk of bias and inadequate reporting. Future research should not only focus on innovative new models but also on allocating effort to rigorous reporting, proper calibration, and real-time model testing to improve clinical applicability.

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Critical Care Nursing Resource Recovery Strategy: Not Just About Recruitment, Responding with a Focus on Retention and Tailored Education Programs at London Health Sciences

Submission ID

58

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INTRODUCTION

Health human resource challenges, specifically a shortage of critical care nurses continues to overwhelm healthcare systems in the recovery from the COVID -19 pandemic. Critical care nurses are choosing to retire early and considering less stressful nursing practice opportunities. The growing shortage of critical care nurses requires a different approach to workforce retention and recruitment. A strategic plan for retaining, onboarding and educating critical care nurses was necessary for efficient recruitment efforts. Current recruitment processes did not support quick recovery of human resource needs. Turnover and natural attrition were continually contributing to challenges in maintaining a stable workforce to support critical care patient program needs. A sustainable plan to address resource gaps while planning for future needs to support population growth, funding for incremental beds to support seasonal COVID-19, and surgical recovery was required.

OBJECTIVES

A robust recovery plan to build the critical care workforce to baseline staffing levels at London Health Sciences (LHSC), necessitated recruitment of 35 net new critical care nurses requiring a multiprong approach: Retention of the current workforce by evaluating what nurses need to stay, engagement of retired nurses to return on a casual basis, providing mentorship and content expertise; job share opportunities to allow for flexible work schedules, and partnerships with critical care corporate educators to develop a multi-stream education approach that responds to prior candidate experience, is tailored to individual learning needs, and supports new graduate entry into critical care nursing practice. Establishment of a supportive teaching and learning culture with an increase in number of dedicated preceptors to facilitate a higher than usual

recruitment volume, and planning for flexible onboarding to support candidate preferences.

METHODS

As part of a 6-month process, administrative leadership, professional practice, human resource leaders, corporate educators; and front-line charge nurses held engagement meetings to collaborate on an approach for resolution of a growing nursing shortage. An open house information event was held in March, 2022 to engage new graduate nurses, re-assuring them of how they would be supported to succeed in critical care, without prior nursing practice experience. 17 participants, 30% of which were new graduate nurses attended the information session. Job postings were refreshed with human resource and union partner support to reflect a new process. Candidates were hired as helping hands to existing staff, and allocated to 1 of 4 education streams: Experienced nurses with formal critical care education completed, level 2 trained nurses without critical care experience, a minimum 1 year of entry level nursing experience and new graduate nurses. An additional educator was hired to facilitate development of new orientation streams. Additionally, a retention survey to understand current turnover rates, a social media strategy to attract applicants, fast track interview schedules with plans for job offers and start dates in early spring were coordinated.

RESULTS

Recruitment of critical care nurses to staff 70 critical care beds and 5 additional beds to support surge capacity was at 91% completion by end of August, 2022. Of newly hired nurses, 34% were new graduates, some internationally trained, 19% were retirees who had returned to casual status as mentors, ensuring a workforce with senior level critical care nursing expertise, and 38% hired were experienced critical care nurses. Education programs varied from 2-3 months and 3-6 months duration depending on experience level; with a frontloaded orientation program where, new hires were precepted for 2-12 weeks before formal education began, exposing candidates to the critical care environment similar to how nurses were deployed to assist during the worst of the pandemic. Bi-weekly learner self-reflections, assessments to develop programming to meet individual needs, and educator, leader check-ins contributed to a tailored approach. Preceptor feedback was incorporated in individual candidate development.

CONCLUSION

New hires had a positive impact on staffing levels, enabling safe, acceptable nursing ratios. Ongoing peer mentorship offered graduate nurses an opportunity, adding valuable capacity to critical care nursing. Education partnerships, flexibility, and a customized approach maximized recruitment, supporting specialty services and regional trauma care programs. Stakeholder collaboration reduced deployment from other areas of the hospital to support critical care staffing gaps. An aggressive critical care recruitment strategy where education is adapted to candidate skill set supported an investment in diverse experience levels enabling development of a critical care work

force. Successes required alignment of applicant pool experiences. Stakeholder agility and a non-traditional approach to education contributed to efficient recruitment efforts supportive of candidate needs.

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N/A

Definitions, Rates and Attributable Mortality of Pneumonia in Critically ill Patients: A Multicenter Cohort Study

Submission ID

108

AUTHORS

Johnstone, Jennie[1]; Heels-Ansdell, Diane[2]; Sligl, Wendy[3]; Lauzier, Francois[4]; Marshall, John[1]; Duan, Erick[2]; Dionne, Joanna[2]; Rochwerg, Bram[2]; Centofanti, John[2]; Thabane, Lehana[2]; Surette, Michael[2]; Zytaruk, Nicole[2]; Saunders, Lois[2]; Cook, Deborah[2] For the PROSPECT Investigators and the CCCTG.

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INTRODUCTION

PROSPECT (Probiotics: Prevention of Severe Pneumonia and Endotracheal Colonization Trial) was a large randomized blinded trial of invasively mechanically ventilated patients ≥18 years old, evaluating the efficacy of the probiotic *Lactobacillus rhamnosus* GG versus placebo on incidence of ventilator-associated pneumonia (VAP) and other clinically important outcomes. The trial, which took place in 44 ICUs in Canada, the United States and Saudi Arabia (NCT02462590), showed no benefits to this probiotic regimen. This large database of 2,650 patients affords a unique opportunity to compare different pneumonia definitions, examining how the diagnostic criteria influence the incidence and impact of pneumonia, given no current universal accepted definition.

OBJECTIVES

The objectives of this study were to document the rates of pneumonia in a cohort of critically ill, mechanically ventilated adults, with an anticipated ventilation of ≥72 hours, according to timing (early VAP, late VAP and post-extubation pneumonia) and according to several different established pneumonia definitions, reporting the attributable hospital mortality for each definition.

METHODS

For this nested pre-planned multicenter cohort study, Research Coordinators recorded and submitted to the Methods Center relevant clinical, laboratory, microbiologic and radiographic data for patients with clinically suspected pneumonia. Two physicians blinded to allocation and center independently adjudicated each event. The PROSPECT primary outcome was VAP informed by: invasive mechanical ventilation for >2 days, a new/progressive/persistent radiographic infiltrate on chest radiograph plus any 2 of: 1)

fever (>38 °C) or hypothermia (<36 °C); 2) leukopenia (<3.0 x 106/L) or leukocytosis (>10 x 106/L) and 3) purulent sputum. Pneumonias were also classified as early VAP (3-5 days after initiating mechanical ventilation), late VAP (after ≥ 6 days of ventilation, including up to 2 days after ventilation discontinuation), and post-extubation pneumonia (arising ≥ 3 days after ventilation discontinuation). We also adjudicated pneumonia by 6 alternative definitions: the Clinical Pulmonary Infection Score (CPIS), ACCP as adapted by Morrow et al., Calandra et al., Reducing Oxidative Stress (REDOXS), Centers for Disease Control (CDC), and based on invasive microbiologic confirmation. Disagreement was resolved through discussion and consensus or a third adjudicator. Using Cox proportional hazards analysis, adjusting for baseline APACHE II score, we estimated the risk of hospital mortality associated with each definition.

RESULTS

In total, 573/2650 (21.6%) of patients fulfilled the PROSPECT primary outcome of VAP. Figure 1 shows that most episodes were late VAP (17.9%); a minority represented early VAP (4.2%) or post extubation pneumonia (1.6%). The frequency of pneumonia varied with the definition used, as displayed in Figure 2 (range 1.9% - 25.0%). The CDC definition and requirement for microbiologically positive specimens from invasive testing resulted in the lowest incidence of pneumonia (1.9%). VAP diagnosed by PROSPECT criteria (HR 1.31 [1.08 – 1.60]) according to Calandra et al. (HR 1.32 [1.09 - 1.60]), according to CPIS (HR 1.30 [1.08 – 1.58]) and according to ACCP (HR 1.22 [1.00 – 1.47]) were all associated with increased mortality risk (Table 1). The association between mortality and pneumonia was not statistically significant when defined by CDC criteria (HR 1.01 [0.75-1.35]), or with positive invasive microbiologic testing (HR 1.55 [0.90 – 2.67]).

CONCLUSION

In critically ill, mechanically ventilated patients, differing definitions of pneumonia are associated with different incidence rates. In terms of practice and quality improvement, variable definitions can influence clinician propensity to treat, antibiotic stewardship metrics, and quality indicators. These different definitions may also help to explain heterogeneous research findings and inform study sample size calculations using pneumonia as a primary or secondary endpoint. The primary outcome of VAP as adjudicated in PROSPECT is associated with an increased risk of death. Pneumonia definitions requiring microbiologically positive invasive testing likely underestimates the true burden of illness.

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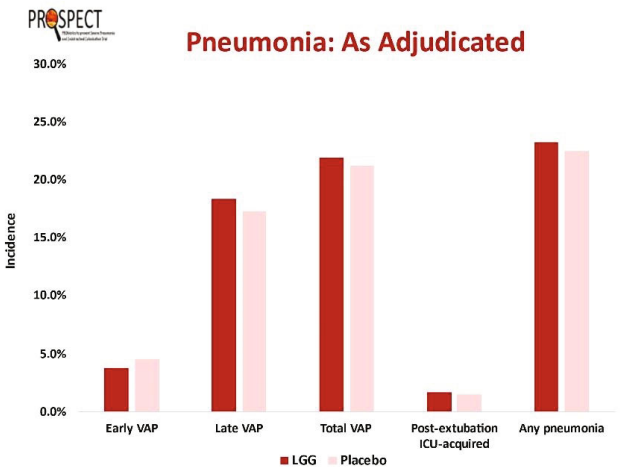

Figure 1

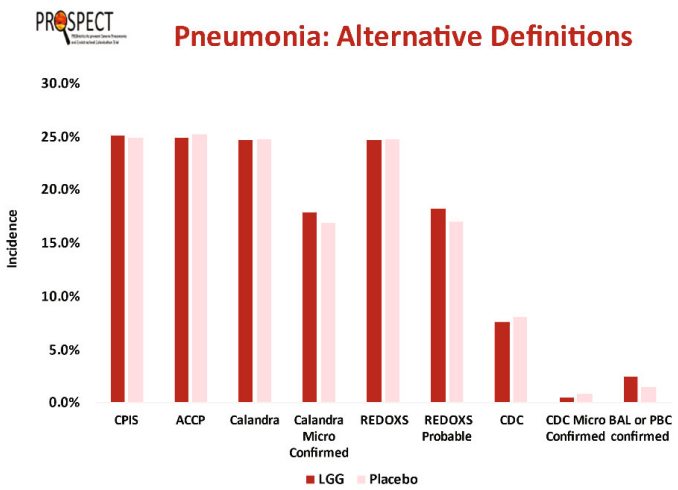

Figure 2

PROSPECT

Pneumonia: Risk of Hospital Mortality

(Adjusted for APACHE II Score)

Definition	N	Mortality	Adjusted Hazard Ratio
PROSPECT Adjudicated +	607	31.6%	1.34 (1.10, 1.63)
CPIS $\geq$ 6	660	31.4%	1.30 (1.08, 1.58)
ACCP	663	31.1%	1.22 (1.004, 1.47)
Calandra (micro+, probable)	647	32.0%	1.32 (1.09, 1.60)
REDOXS (def, probable)	466	32.8%	1.30 (1.06, 1.61)
CDC	207	30.4%	1.01 (0.75, 1.35)
BAL+ or PBC +	51	35.3%	1.55 (0.90, 2.67)

Figure 3

Early Versus Delayed Coronary Angiography After Out of Hospital Cardiac Arrest Without ST-segment Elevation – A Systematic Review and Meta-analysis of Randomized Controlled Trials

Submission ID

37

AUTHORS

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INTRODUCTION

Identifying and treating the underlying cause of out-of-hospital cardiac arrest (OHCA) is among the guiding principles of post-arrest care. Multiple guidelines strongly recommend early angiography after OHCA with ST elevation post return of spontaneous circulation (ROSC). However, in patients without ST elevation post ROSC, the incidence of acute coronary occlusion is much lower and the potential benefits of early angiography are less certain.

OBJECTIVES

The objective of this systematic review and meta-analysis of randomized controlled trials (RCTs) was to evaluate the efficacy and safety of early coronary angiography versus delayed coronary angiography following OHCA without ST elevation.

METHODS

We performed a systematic search of MEDLINE, PubMed EMBASE, CINHAL, and unpublished sources including WHO ICTRP, Clinicaltrials.gov, and the Cochrane trial registry from inception until March 9th, 2022 for RCTs examining adult patients with OHCA without ST elevation who were randomized to early as compared to delayed angiography. Reviewers screened and abstracted data independently and in duplicate. We pooled data using a random effects model and assessed risk of bias using a modified Cochrane Risk of Bias 2 tool. We assessed the certainty of evidence for each outcome

using the Grading Recommendations Assessment, Development and Evaluation approach. The protocol was pre-registered on PROSPERO (CRD 42021292228).

RESULTS

We included 5 RCTs examining 1,524 patients[1-5]. The timing of early angiography varied from immediately after randomization to within two hours following cardiac arrest. The timing of delayed angiography varied from between six hours to four days after cardiac arrest. For patients randomized to early angiography, 731 of 766 (95.4%) received angiography, compared to 453 of 758 patients (59.8 %) randomized to delayed angiography. Pooled analysis demonstrated that, compared to delayed angiography, early angiography probably has no effect on mortality (relative risk [RR] 1.04; 95% confidence interval [CI], 0.93 to 1.17; Risk Difference [RD] 1.8% increase; 95% CI, 3.1% reduction to 7.6% increase; moderate certainty). Early angiography may have no effect on survival with good neurologic outcome (RR 0.96; 95% CI, 0.85 to 1.08; RD 1.9% reduction; 6.5% reduction to 3.3% increase; low certainty), or ICU length of stay (LOS) (mean difference [MD] 0.41 days fewer; 95% CI -1.3d to 0.5d; low certainty).

CONCLUSION

In OHCA patients without ST elevation, early angiography probably has no effect on mortality, and may have no effect on survival with good neurologic outcome and ICU LOS as compared to delayed angiography. The lack of benefit of early angiography post OHCA may be due to the heterogenous population included in this group without ST elevation post ROSC. Further studies are required to identify which patients without ST elevation post ROSC may benefit from an early angiography strategy.

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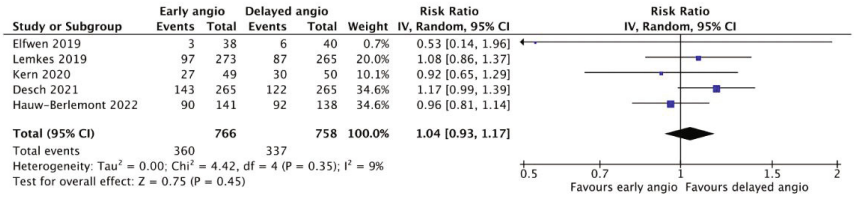
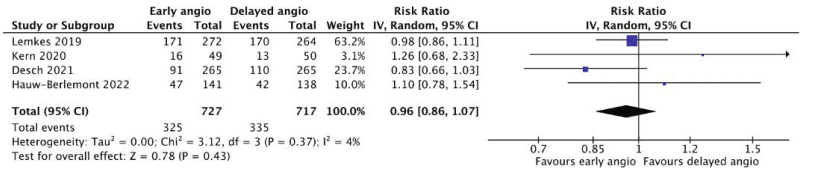


Forest plot comparing early versus delayed angiography after out of hospital cardiac arrest without ST segment elevation for mortality at longest point of follow-up

Figure 1



Forest plot comparing early versus delayed angiography after out of hospital cardiac arrest without ST segment elevation for survival with good neurological outcome as defined by Cerebral Performance Score of 2 or less.

Figure 2

Certainty assessment							№ of patients		Effect		Certainty	Narrative Summary
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Early Angiogram	Late/No Angiogram	Relative (95% CI)	Absolute (95% CI)		
Mortality at Longest point of Follow-Up												
5	randomised trials	not serious	not serious	not serious	serious[a]	none	360/766 (47.0%)	337/758 (44.5%)	**RR 1.04** (0.93 to 1.17)	**18 more per 1,000** (from 31 fewer to 76 more)	⊕⊕⊕◯ Moderate	There is probably no difference in mortality with early angio compared to late/no angio.
Survival with Good Neurologic Outcome												
4	randomised trials	not serious	serious[b]	not serious	serious[b]	none	325/727 (44.7%)	335/717 (46.7%)	**RR 0.96** (0.86 to 1.07)	**19 fewer per 1,000** (from 65 fewer to 33 more)	⊕⊕◯◯ Low	There may be no difference in survival with good neuro outcome with early angio compared to late/no angio.
ICU Length of Stay												
3	randomised trials	not serious	serious[d]	not serious	serious[e]	none	576	570	-	MD **0.41 days lower** (1.3 lower to 0.48 higher)	⊕⊕◯◯ Low	There may be no difference in ICU length of stay with early angio compared to late/no angio.
Hospital Length of Stay												
2	randomised trials	not serious	not serious	not serious	serious[f]	none	414	403	-	MD **0.17 days more** (2.76 fewer to 3.1 more)	⊕⊕⊕◯ Moderate	There is probably no difference in hospital length of stay with early angio compared to late/no angio.
Duration of Mechanical Ventilation												
2	randomised trials	not serious	not serious	not serious	serious[g]	none	311	305	-	MD **0.01 days lower** (0.33 lower to 0.31 higher)	⊕⊕⊕◯ Moderate	There is probably no difference in duration of mechanical ventilation with early angio compared to late/no angio.
Need for Renal Replacement Therapy												
3	randomised trials	serious[c]	not serious	not serious	serious[h]	none	58/570 (10.2%)	50/546 (9.2%)	**RR 1.10** (0.78 to 1.57)	**9 more per 1,000** (from 20 fewer to 52 more)	⊕⊕◯◯ Low	There may be no difference in need for RRT with early angio compared to late/no angio.

CI: confidence interval; **MD:** mean difference; **RR:** risk ratio

Explanations

a. The 95% CI ranges from 31 fewer deaths to 76 more deaths. As such, we rated down for imprecision as this does not exclude important harm or benefit.
b. Despite low heterogeneity, non-overlapping confidence intervals suggests important inconsistency which lowers our certainty in effect.
c. Low number of events and extremely wide confidence intervals that don't exclude important harm/benefit lowers our certainty in effect.
d. High I squared of 59% and non-overlapping confidence intervals suggests important inconsistency which lowers our certainty in effect.
e. Point estimate suggests no difference however lower end of CI suggests important reduction with early angiography; as such, we lowered our certainty in imprecision.
f. Limited sample in both arms and wide confidence intervals that don't exclude harm with early angiography lower our certainty in effect.
g. Only 2 studies reported this outcome with a limited sample in both arms which lowers our certainty in effect.
h. Low numbers and extremely wide CI that fail to exclude benefit and harm lowers our certainty in effect.
i. 84.5% of the weight for this outcome come from high RoB studies; this lowers our certainty in effect.

GRADE Evidence Profile for Early vs Delayed Angiography After Out of Hospital Cardiac Arrest Without ST Elevation

Figure 3

Effects of Prone Positioning on Acute Respiratory Distress Syndrome Outcomes of Trauma and Surgical Patients: A Systematic Review and Meta-Analysis

Submission ID

118

AUTHORS

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INTRODUCTION

The prone position has been accepted as a rescue therapy for acute respiratory distress syndrome. Regarding LUNG SAFE study, ARDS related to a surgical condition represented 3.7% to 9% of patients, while ARDS related to trauma accounted for only 2% to 7.1% of cases. However, there is limited evidence of the effects of ARDS on trauma or surgical patients who were insulted with different causes. Most studies focused on specific concerns, such as the risk of complications after proning in surgical patients.

OBJECTIVES

This study aimed to determine the effects of PP on the ARDS outcomes of trauma and surgical patients. The outcomes investigated were the PF ratio (partial pressure of arterial oxygen divided by the fraction of inspired oxygen), mortality, ICU length of stay, mechanical ventilator days, complications, and effects on hemodynamics.

METHODS

MEDLINE, EMBASE, and Cochrane database searches were conducted. An additional search of relevant primary literature and review articles was also performed. The studies included in this meta-analysis were cohort studies (prospective or retrospective) of trauma or surgical patients diagnosed with ARDS. A random effects model was used to estimate the PF ratio, mortality rate, mechanical ventilator days, and intensive care unit length of stay. All statistical analyses were performed using Review Manager (RevMan)

version 5.4.1 (The Cochrane Collaboration, 2020). We extracted the proportions and 95% confidence intervals (CIs) from each study and pooled them using a random effects model. Cochran's Q test was performed and quantified using the I^2 statistic to determine the statistical heterogeneity among the included studies. A funnel plot visualized the presence of a publication bias.

RESULTS

Of 1032 studies, 16 articles were included in this meta-analysis. The prone position significantly improved the PF ratio compared with the supine position (mean difference, 79.26; 95% CI, 53.38 to 105.13). The prone position group had a statistically significant mortality benefit (risk ratio [RR], 0.48; 95% CI, 0.35 to 0.67). Although there was no significant difference in the intensive care unit length of stay, the prone position significantly decreased mechanical ventilator days (-2.59; 95% CI, -4.21 to -0.97). Regarding the systematic review, most patients were complicated with minor resolving conditions, especially facial edema. There were no differences in local wound complications.

CONCLUSION

Prone position significantly improves the PF ratio and has a mortality benefit for trauma and surgical patients who develop ARDS. The position can cause minor complications, such as facial edema. There were no significant differences in local wound complications compared with those of the supine position. The prone position can be used as an effective rescue therapy for trauma and surgical patients.

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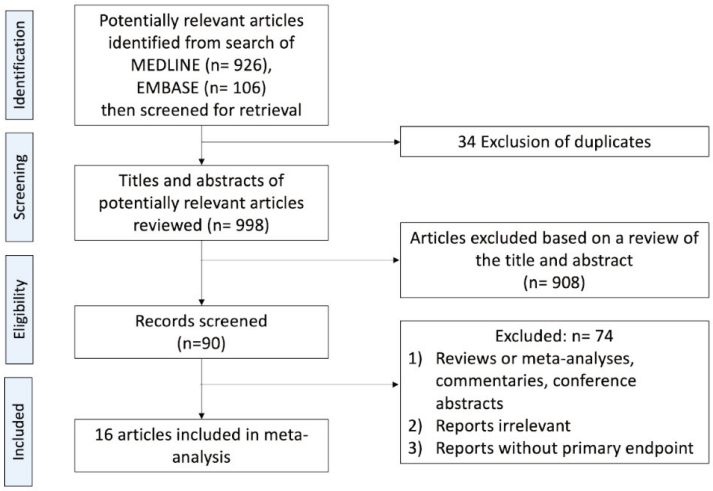

Figure 1

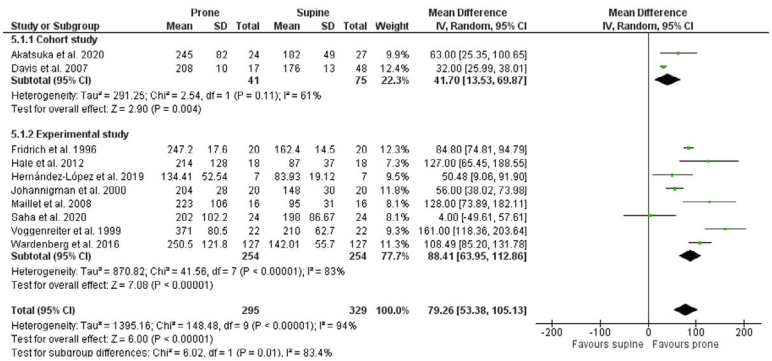

Figure 2

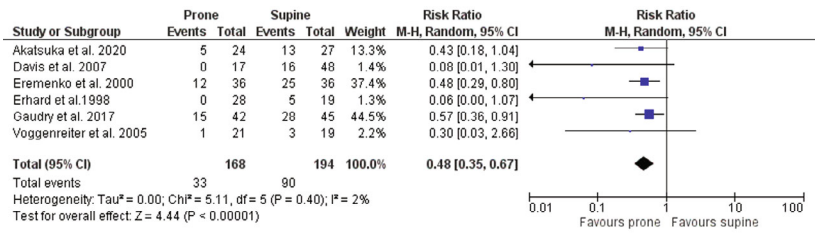

Figure 3

Efficacy and Safety of Corticosteroids in Cardiac Arrest: A Systematic Review, Meta- Analysis and Trial Sequential Analysis of Randomized Control Trials

Submission ID

28

AUTHORS

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INTRODUCTION

Post cardiac arrest, outcomes for most patients are poor, regardless of setting (1). Many patients who do achieve spontaneous return of circulation (ROSC) require vasopressor therapy to maintain organ perfusion. There is some evidence to support the use of corticosteroids post cardiac arrest to increase survival and ROSC. Though corticosteroids may help reduce time to shock reversal and survival, their mechanism of actions remains uncertain. A number of randomized control trials (RCTs) have been conducted to assess this question (2–5). However, there still remains uncertainty as whether patients post cardiac arrest should receive corticosteroids.

OBJECTIVES

The objectives of this systematic review and meta-analysis are to summarize the evidence from RCTs addressing the safety and efficacy of corticosteroid administration in patient post cardiac arrest. The outcomes of interest include mortality, ROSC, survival with good functional outcome, and corticosteroid related complications.

METHODS

We searched CINAHL, EMBASE, LILACS, MEDLINE, Web of Science, CENTRAL, ClinicalTrails.gov, and ICTRP for RCTs published from database inception until June 1st, 2022. We screened all citations independently and in duplicate. We included RCTs if they met the following criteria: use of intravenous corticosteroids with placebo or standard care, adult patients (> 18 years of age), drug administered during or immediately following cardiac arrest (any initial rhythm or etiology). We included both in-hospital and

out-of-hospital cardiac arrest patients. We assessed Risk of Bias (ROB) independently and in duplicate using the Cochrane ROB tool and certainty of evidence for each outcome using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework. We conducted trial sequential analysis (TSA) using a random effects model for the outcome of mortality. For the TSA, we used a statistical significance level of 5%, a power of 80%, and a relative risk reduction of 15%. We examined five a priori subgroups of interest including: high ROB vs. low ROB studies, corticosteroid type, initiation of corticosteroids after cardiac arrest vs. during cardiac arrest, corticosteroid, and in-hospital cardiac arrest vs. out-of-hospital cardiac arrest.

RESULTS

We included 8 RCTs which enrolled a total of 2,213 patients. Corticosteroids have an uncertain effect on mortality in the setting of cardiac arrest, measured at the longest follow-up end point (8 trials, 2,213 patients, RR 0.96, 95% CI 0.90 to 1.02, very low certainty, Fig 1.). Corticosteroids probably increase ROSC corticosteroids (4 trials, 919 patients, RR 1.32, 95% CI 1.18 to 1.47, moderate certainty) (Fig 2) and may increase survival with good functional outcome (6 trials, 1,029 patients, RR 1.40, 95% CI 0.87 to 2.54, low certainty) (Fig 3). In terms of complications of therapy, corticosteroids may decrease the risk of ventilator associated pneumonia (RR 0.71, 95% CI 0.46-1.09, low certainty) and increase renal failure (RR 1.29, 95% CI 0.84 to 1.99, low certainty.

CONCLUSION

In patients post cardiac arrest, corticosteroids have an uncertain effect on mortality but may increase spontaneous return of circulation and the likelihood survival with good functional outcome. The effect on complications is based on low or very low certainty evidence. Further high-quality RCTs assessing the effects of corticosteroids post cardiac arrest need to increase the certainty of these outcomes.

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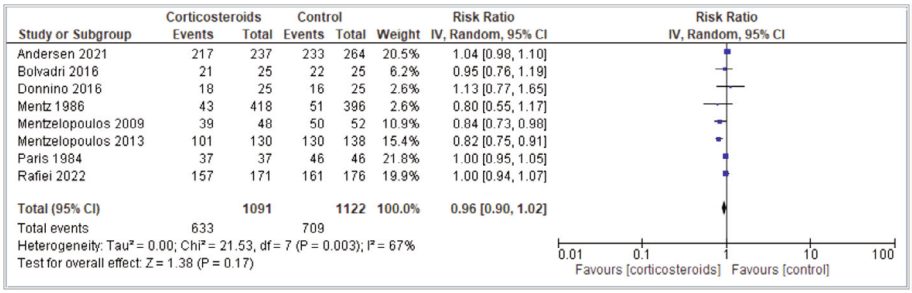

Figure 1

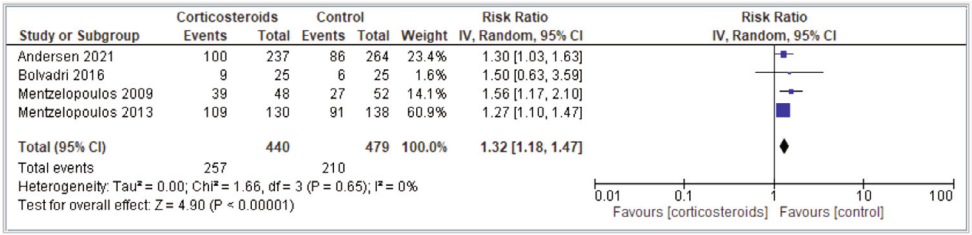

Figure 2

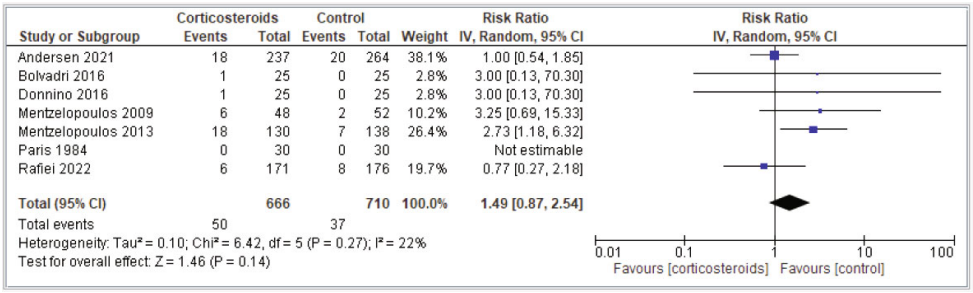

Figure 3

ESCAPADE - Evaluating Discontinuation of Gastric Acid Suppressants During and After Discharge from ICU: A Retrospective Chart Review

Submission ID

75

AUTHORS

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INTRODUCTION

Gastric acid suppressants (proton pump inhibitors [PPIs] and histamine-2 receptor antagonists [H2RAs]) are commonly prescribed for stress ulcer prophylaxis, documented in 73% of all patients admitted to an intensive care unit (ICU) in a recent international study (1). While clinical practice guidelines recommend that these medications are used in critically ill patients who are deemed high risk for gastrointestinal bleeding (2), previous studies suggest these medications are sometimes continued after ICU discharge (3). Gastric acid suppressants are associated with short-term and long-term risks, such as increased infections (pneumonia, C. difficile), micronutrient deficiencies (including B12, magnesium), chronic kidney disease, dementia, and osteoporosis (4). Evaluating the deprescribing practices for gastric acid suppressants following critical illness is important, given frequent prescription of these medications in the ICU, the potential for side effects, and the propensity to continue prescribing them after ICU discharge and on discharge home.

OBJECTIVES

The aim of this study was to describe to what extent PPIs and H2RAs are discontinued during ICU admission and after ICU discharge, and to characterize factors associated with continuation of these medications. The primary outcome was the proportion of patients prescribed PPIs and/or H2RAs in the ICU who had these drugs discontinued at the two timepoints: discharge from the ICU and discharge from the acute care facility. Secondary outcomes included the proportions of patients prescribed each medication class (PPI, H2RA), and the identification of differences between patients (including factors such as pre-hospital gastric acid suppressing medication, comorbidities, concomitant medications that increase bleeding risk, and in-hospital outcomes) for whom gastric acid suppression was continued versus discontinued.

METHODS

This retrospective chart review involved data abstraction from electronic medical records at St. Joseph's Healthcare Hamilton, a tertiary care hospital with a 28-bed mixed medical-surgical ICU. Patients were included if they were discharged from the ICU between July 1 to December 31, 2021 and received a PPI or H2RA during their ICU admission. Patients who died, were discharged with palliative needs, or were transferred to another acute care institution were excluded. The exclusion criteria were applied at each time point separately (ICU discharge and discharge from acute care) to determine the population for analysis at that time point. Data collection included demographics, past medical history, in-hospital outcomes, prescription and indication of gastric acid suppressants and other relevant concomitant medications prescribed at prespecified time points. Data collection was performed by a single investigator. Mechanically ventilated patients enrolled in the ongoing blinded REVISE trial (5) receiving pantoprazole versus placebo were included in this study; their drug exposure was considered to be PPI for this analysis. Descriptive statistics were used and comparisons were tested for significant differences as relevant.

RESULTS

265 ICU admissions met inclusion criteria (mean age 60.5 years); 263 patients received a PPI and 6 patients received an H2RA. In 35.5% of patients, the PPI/H2RA was discontinued at ICU discharge. (n=94). Patients with discontinued PPIs at ICU discharge were younger (57.1 vs. 62.4 years, p=0.0129), had longer ICU stays (15.1 vs. 9.9 days, p=0.048), and were less likely to have been on PPI prior to admission (13.8% vs 69.8%, p<0.00001). At acute care discharge, there were 179 eligible patients; PPI/H2RA was discontinued in 35.2%. Patients not prescribed PPI at acute care discharge were less likely to have a pre-hospital PPI (11.1% vs. 71.3%, p<0.00001), and less likely to be prescribed an anticoagulant, antiplatelet, or NSAID (36.4% vs 54%, p=0.01468). Of patients who received a PPI and evaluated at ICU discharge (n=263) and discharge from acute care (n=178), there was no documented reason for continuation in 37.6% and 43.3% of patients respectively.

CONCLUSION

Gastric acid suppressants prescribed during an ICU admission are commonly continued at discharge from ICU and from acute care, often without a documented reason. The use of gastric acid suppressants during an ICU stay and after ICU discharge should be frequently re-assessed to ensure an appropriate, valid indication for ongoing prescription.

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EXIT ICU: A Qualitative Study on the Causes of ICU Turnover

Submission ID

105

AUTHORS

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INTRODUCTION

The COVID-19 pandemic has placed intense stress on Canadian hospitals and intensive care units. ICU clinicians worldwide have reported high rates of depression, PTSD and burnout during the pandemic, with Canadian clinicians experiencing especially high levels of distress related to factors such as fear of infecting loved ones, lack of support from political, health authority and hospital leadership, and verbal abuse from patients and families. (1-6) There is concern that these factors have led to increased turnover among Canadian ICU staff, with a recent survey by Mehta et al. finding that 37% of respondents indicated an intention to leave their ICU jobs.(3) To date, however, no studies have described the reasons why Canadian ICU staff left their jobs during or after the COVID-19 pandemic.

OBJECTIVES

The purpose of this study was to interview ICU healthcare workers as to reasons for ICU turnover during the pandemic.

METHODS

This qualitative descriptive study included 21 semi-structured interviews with ICU staff (registered nurses, respiratory therapists, social workers) from one hospital in Alberta, Canada who had left, or were seriously considering leaving, their ICU positions. Interviews were coded separately by two researchers with training in qualitative methods. We then used thematic analysis, guided by the principles of Braun and Clarke, to create themes describing the factors that influenced participants' decisions to leave their ICU positions.

RESULTS

Participants described burnout as the primary reason for leaving ICU. We constructed four themes to describe this burnout. **Theme 1: toxic work environment.** Many participants described feeling socially isolated at work, and noted a lack of team cohesion exacerbated by pandemic workplace restrictions. Participants reported feeling

unsupported by management and many who left noted frequent bullying amongst staff. **Theme 2: Inadequate staffing.** Participants detailed worsening staff shortages leading to increased workload and reduced time off. **Theme 3: Stressors related to the pandemic.** Participants described how the pandemic vastly increased the number of patient deaths, and led to increasingly confrontational situations with patients and families. They also mentioned how the pandemic intensified staff shortages and caused further deterioration in morale, collegiality, and workplace bullying. **Theme 4: Inability to practice in accordance with values.** Participants felt that staff shortages, especially during the pandemic, caused them to provide substandard care, and that ICU patients often received inappropriate life-extending interventions.

CONCLUSION

Our study provides insight into factors that contributed to ICU healthcare worker attrition in Alberta, Canada during the COVID-19 pandemic. We identified themes related directly to pandemic stressors, as well as themes that reflect long-standing workplace concerns, made worse by the COVID-19 pandemic. Interventions aimed at addressing these factors may help retain ICU staff at a time when intensive care units under intense strain.

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Exploring the Impact of Age, Frailty, and Multimorbidity on ICU interventions: A Systematic Review

Submission ID

52

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INTRODUCTION

Intensive care unit (ICU) demographics are shifting. Recent data from the United States has demonstrated that patients aged 85 and older account for 20% of all ICU admissions,[1] and Canada has seen a similar aging of its ICU population compared to 15 years ago.[2] These trends coincide with medical advances that have allowed for a higher quality of life into older age and reduced mortality from critical illness. With the emergence of novel critical care therapeutics, the question arises whether older adults respond similarly to such treatments given differences in homeostasis and underlying pathophysiology. However, it is not clear whether patients with increased age, frailty, or multimorbidity respond differently to ICU interventions, as very few trials have specifically examined these populations.

OBJECTIVES

This systematic review addresses the prevalence of subgroup effect modification – statistically significant differences in relative effect – in older patients, those with increased frailty, and/or those with multimorbidity, as reported by randomized controlled trials (RCTs) examining any critical care intervention published in high-impact journals in the last 10 years. This review also seeks to explore whether there are study characteristics associated with subgroup effect modification by age, frailty, or multimorbidity. It is hypothesized that baseline risk may influence the absolute effect of an intervention, but differences in relative effects based on subgroups will be rare.

METHODS

We conducted a systematic search of high-impact general medicine (JAMA, NEJM, Lancet, JAMA-IM, Annals of Internal Medicine, CMAJ) or critical care journals (Critical Care Medicine, Intensive Care Medicine, American Journal of Respiratory and Critical

Care Medicine, CHEST, Lancet Respiratory Medicine) for RCTs published between January 1, 2011 and December 31, 2021. We included studies if they examined any intervention or treatment strategy in the ICU and reported data for any of the subgroups of age, frailty, and/or multimorbidity (all as defined by study authors) for any outcome of interest. Studies were screened independently and in duplicate first by title and abstract, and then full-text to determine eligibility. We defined a statistically significant subgroup effect as an interaction p-value of <0.05. For any statistically significant subgroup effect, we assessed credibility in the subgroup finding using the ICEMAN tool.[3] We present results descriptively using proportions and tabular outputs.

RESULTS

Of 2037 citations, we included 48 RCTs (n=50,779 patients) comprising 23 different interventions. All studies reported subgroup data for age (variably defined), two reported subgroup data for multimorbidity, and one reported subgroup data for frailty. Seven (14.6%) RCTs found evidence of statistically significant effect modification based on age. Interventions examined in these RCTs which were more effective in older adults than younger adults included restrictive blood transfusion in cardiovascular surgery patients (moderate credibility), immediate angiography in out-of-hospital cardiac arrest patients without ST elevation (low credibility), lower blood pressure targets for vasopressor therapy in shock (low credibility), and C1-esterase inhibitor use in sepsis (very low credibility). Interventions examined in these RCTs which were less effective in older adults included hypothermia in status epilepticus (low credibility) and talactoferrin use in severe sepsis (very low credibility). The multimorbidity or frailty subgroups did not find evidence of statistically significant effect modification.

CONCLUSION

Most critical care RCTs do not examine subgroup effects by age, frailty or multimorbidity. Even when age is considered, true effect modification is rare. As such, if an intervention or care strategy shows benefit in the generalized critical care population, it is likely that the same benefit will remain for older patients. Although interventional effects are likely similar across age groups, shared decision making based on individual patient preferences must remain a priority. RCTs focused specifically on critically ill older adults or those living with frailty and/or multimorbidity would be crucial to further addressing this research question.

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Extracorporeal Cardiopulmonary Resuscitation in a Pregnant Patient with Amniotic Fluid Embolism – A Case Report

Submission ID

59

AUTHORS

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INTRODUCTION

Amniotic fluid embolism is a rare but potentially fatal complication of pregnancy. Although poorly understood, the disruption of the maternal-placental interface allows for entry of amniotic contents into the maternal circulation, precipitating disseminated intravascular coagulation (DIC), severe acute pulmonary hypertension, and cardiovascular collapse. Veno-arterial extracorporeal membrane oxygenation (VA ECMO) has been reported as a rescue therapy for patients with amniotic fluid embolism with severe shock, and rarely, as extracorporeal cardiopulmonary resuscitation (ECPR) in patients with ongoing cardiac arrest[1,2].

OBJECTIVES

In this report, we present a case of amniotic fluid embolism resulting in cardiovascular collapse requiring ECPR.

METHODS

A 37-year-old female at 22 weeks' gestation presented to the Emergency Department in severe DIC as the result of amniotic fluid embolism. She continued to deteriorate, and developed acute right ventricular failure. Shortly after admission to the Intensive Care Unit, she suffered a witnessed cardiac arrest. She was initiated on femoral VA ECMO during the resuscitation of her in-hospital cardiac arrest. Anticoagulation was withheld due to risk of bleeding with the underlying coagulopathy. Fetal monitoring revealed an intrauterine fetal demise. Using an interdisciplinary surgical team, definitive therapy occurred via damage control hysterectomy within 24 hours while on VA ECMO support.

RESULTS

Cardiac function returned to normal after five days and the patient was successfully decannulated from VA ECMO. She was discharged home four weeks after cardiac arrest without significant functional disability.

CONCLUSION

Given the transient and potentially reversible course of amniotic fluid embolism, ECPR may be considered as a rescue therapy in patients with cardiac collapse due to amniotic fluid embolism at experienced ECMO centres.

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Facial Pressure Injuries in Mechanically Ventilated Proned Patients: A Narrative Review

Submission ID

44

AUTHORS

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INTRODUCTION

Critically ill patients are at risk of developing pressure injuries (PIs) due to illness severity, immobility, infrequent repositioning, and use of medical devices in contact with the skin. Proning became a common therapy for intubated and ventilated COVID-19 patients in acute hypoxic respiratory failure. While proning could increase survival, patients are at higher risk of PIs, with particular concern for the face.

Before undertaking a quality improvement study to address facial PIs due to proning in mechanically ventilated patients, we sought to understand the prevalence and locations of facial PIs reported in the literature. We identified a literature review of recommendations to prevent skin damage for mechanically ventilated proned patients;[1] however, the authors did not specifically report primary data on facial PIs. Thus, we conducted a narrative review to summarize the primary evidence related to prone positioning and facial PIs in mechanically ventilated patients.

OBJECTIVES

The primary objective of this narrative review was to summarize the available evidence related to prevalence and location of facial PIs in mechanically ventilated proned patients in the Intensive Care Unit (ICU). Results from this review will enable us to benchmark local data and inform further quality initiatives in the ICU around known proning practices and interventions.

Facial PIs were selected because prone positioning can impede practitioners' ability to conduct standardized facial skin assessments and visual inspection required to provide timely and appropriate intervention. The increased use of proning during the COVID-19 pandemic and the lack of data and subsequent evidence-based guidelines on the prevention and treatment of facial PIs in proned patients provided the incentive for this review.

METHODS

Inclusion criteria: The population of interest was mechanically ventilated patients exposed to prone positioning. The primary outcomes of interest were prevalence and location of facial PIs. We sought original research reports and had no study design restrictions.

Search strategy: This narrative review was conducted in multiple steps. First, we reviewed all citations in Fourie et. al's review[1] to identify primary studies of mechanically ventilated proned patients reporting facial PIs. These articles and their reference lists were hand searched to extract articles meeting inclusion criteria. A literature search was then conducted in PubMed, EMBASE, and OVID AMED databases from inception to January 24, 2022 using search terms "pressure injury OR pressure ulcer" AND "prone OR proning".

Data abstraction: We abstracted author names, year, study design, study population, identification of COVID-19 patients, description of the prone positioning intervention, comparison (if applicable), and facial PI metrics.

Data synthesis and analysis: Study and patient data were summarized using descriptive statistics.

RESULTS

Study characteristics: The Fourie et al.[1] review included one relevant primary research paper[2] and our subsequent search retrieved a total of 169 citations. Thirteen studies met inclusion criteria. Studies included adults only and six included COVID-19 patients (Table 1).

Proning and facial PI characteristics: The 13 studies reported 2,959 mechanically ventilated patients (1,663 proned). Eight reported 462 facial PIs across 829 proned patients. Four reported 167 facial PIs in 416 proned patients. Of the 8 studies reporting facial PIs, 1 did not report location. The number of facial PIs was not reported in three studies (two of which did not indicate location) (Table 2; Figure 1).

COVID-19 studies: Six studies enrolled 1,104 mechanically ventilated patients (618 proned). Five studies with 557 proned patients reported 340 facial PIs. Of 5 studies reporting location, 407 facial PIs were experienced, with the mouth/lip occurring most frequently (22.1%) and the eye/periorbital space least frequently (2.5%).

CONCLUSION

This narrative review yielded important findings about facial PIs in mechanically ventilated proned patients. The available data demonstrate a lack of consistent and universal reporting practices of prevalence and location of facial PIs in this patient population, While the reporting of these metrics improved over time (2001-2022), only

two studies (one COVID-19) reported the prevalence, location, and number of total facial PIs across patients.

Consistent reporting of these metrics is necessary to improve the evidence base and inform practitioners who care for this patient population. In resource strained ICUs, targeting additional strategies to optimize facial wound prevention is suggested.

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Table 1. Description of included studies

Author last name, year	Study Design	Population	N enrolled	Intervention	Comparison	PI metrics
Johnson, 2022*	Retrospective cohort	Adults with COVID-19 and ARDS	130	Wound and skin care nurse on care team (n=52)	No wound and skin care nurse on care team (n=78)	Incidence of PIs
Binda, 2021*	Cross-sectional	Adults with COVID-19 and invasive mechanical ventilation	63	Prone positioning (n=63)	N/A	Incidence of complications, including PIs
Capasso, 2021*	Retrospective cohort	Adults with severe ARDS secondary to COVID-19 undergoing mechanical ventilation	147	Prone positioning with various pressure redistribution products (n=147)	N/A	Risk factors for development of PIs
Douglas, 2021*	Retrospective cohort	Adults with COVID-19 pneumonia/ARDS requiring intubation and prone position ventilation	427	Prolonged prone positioning (n=61)	N/A	Incidence and severity of PIs
Ibarra, 2021*	Case-control	Adults with COVID-19 and mechanical ventilation	74	Prone positioning (n=57)	Supine positioning (n=17)	Incidence and characteristics of PIs
Shearer, 2021*	Retrospective cohort	Adults with COVID-19 requiring intubation	263	Prone positioning (n=143)	N/A	Incidence of facial PIs
Challoner, 2021	Retrospective cohort	Adults with severe ARDS	87	Prone positioning (n=62 > 1 day proned)	N/A	Incidence and severity of PIs
Lucchini, 2020	Retrospective cohort	Adults with ARDS undergoing invasive mechanical ventilation	170	Prone positioning (n=170)	N/A	Incidence and severity of PIs
Girard, 2014	Randomized controlled trial	Adults with ARDS	466	Prone positioning (n=237)	Supine positioning (n=229)	Incidence of PIs
Romero, 2009	Prospective pilot feasibility study	Adults with severe ARDS undergoing invasive mechanical ventilation	15	Prolonged prone positioning (n=15)	N/A	Incidence of complications, including PIs
Chan, 2007	Prospective observational study	Adults with acute respiratory failure caused by severe community-acquired pneumonia	22	Prone positioning (n=11)	Supine positioning (n=11)	Incidence of complications, including PIs
Guerin, 2004	Randomized controlled trial	Adults with a $PaO_2/FiO_2 \leq 300$ undergoing mechanical ventilation	791	Prone positioning (n=413)	Supine positioning (n=378)	Incidence of complications, including PIs
Gattinoni, 2001	Randomized controlled trial	Adults with acute lung injury or ARDS undergoing mechanical ventilation	304	Prone positioning (n=152)	Supine positioning (n=152)	Incidence of complications, including presence, site, and severity of PIs

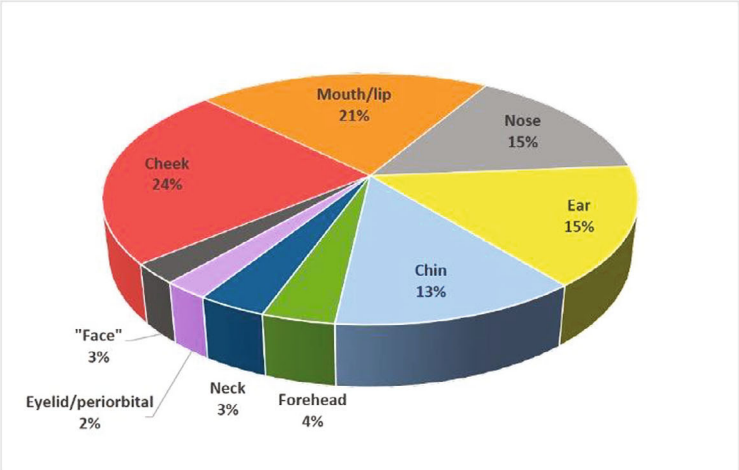
*COVID-19 study; N/A = not applicable

Table 2. Facial PI reporting

Author last name, year	Patients enrolled (N)	Proned patients (n)	Proned patients with facial PIs (n)	Proned patients with facial PIs (%)	Total number of facial PIs	Location of facial PIs reported (Y/N)	Comments
Johnson, 2022*	130	130	NR	NR	20	N	
Binda, 2021*	63	62	NR	NR	28	Y	
Capasso, 2021*	147	147	NR	NR	66	Y	
Douglas, 2021*	427	61	44	72.1	NR	Y	
Ibarra, 2021*	74	74	NR	NR	94	Y	
Shearer, 2021*	263	143	63	44.1	132	Y	
Challoner, 2021	87	87	NR	NR	101	Y	
Lucchini, 2020	170	170	NR	NR	19	Y	
Girard, 2014	466	197	58	29.4	NR	N	
Romero, 2009	15	15	2	13.3	2	Y	
Chan, 2007	22	11	NR	NR	NR	N	Reported presence of facial PIs (n=2 in the proned arm)
Guerin, 2004	791	413	NR	NR	NR	N	Reported presence of facial PIs (n=208 in proned arm)
Gattinoni, 2001	304	152	NR	NR	NR	N	Reported only presence of facial PIs (cheekbones) in the proned arm; number not reported

*COVID-19 study; NR = not reported

Figure 1. Location of facial pressure injuries (7/13 studies)



Has the Speaker Gender Gap at Critical Care Conferences Improved? A Follow-up Study.

Submission ID

98

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INTRODUCTION

We previously identified a gender gap among invited speakers at 5 international critical care conferences (2010–2016), with men significantly outnumbering women[1]; and we suggested organizational strategies to reduce the gender gap.

OBJECTIVES

In this follow-up study, our objective was to determine if the representation of women faculty at these 5 critical care conferences has improved since 2016; and to explore other diversity variables among conference faculty.

METHODS

We conducted a retrospective audit of the annual scientific programs of the 5 conferences for the years 2017 to 2021 to identify the proportion of women among speakers, moderators, and program committees. Additionally, we recorded participants' profession, visible minority status (SCCM and CCCF), and sexual orientation (SCCM). The 5 international critical care conferences are: European Society of Intensive Care Medicine (ESICM), International Symposium on Intensive Care and Emergency Medicine (ISICEM), Society of Critical Care Medicine (SCCM), Critical Care Canada Forum (CCCF), and UK Intensive Care Society State of the Art Meeting (ICS SOA). Faculty demographic data were provided by the congress organizers, were established from the congress programs, or through an internet search of each faculty member.

RESULTS

To date we have analyzed data for 3 conferences: CCCF, ESICM, SCCM (Table 1). Women speakers were underrepresented relative to men at all 3 conferences across all 5 years. Women comprised 20-48% of speakers, and was highest at SCCM and CCCF (37% across 5 years). The proportion of women speakers increased significantly over time at CCCF and ESICM ($p<0.05$). At SCCM 2021, the representation of women speakers (48%) was

nearly equal to men. Women physicians remain under-represented compared to men physicians (15-32% vs 42-75% speakers). Representation of women among program committee members was 23-36% and 24-30% at CCCF and SCCM respectively, and 11-28% at ESICM. Nursing and allied health professionals represented 5-36% speakers, of which >50% were women. Of all speakers at CCCF and SCCM across 5 years, 23% represented a visible minority group (Figure 1). Overall, 46% SCCM speakers reported their sexual orientation; 2% were from a sexual minority group.

CONCLUSION

While the overall speaker gender gap is improving at critical care conferences, women remain under-represented as speakers, moderators and program committee members. Scientific conferences should collect and report diversity demographics of invited faculty.

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Table 1. Representation among Conference Speakers, moderators, and Program Committees

Congress	2017 n (%)	2018 n (%)	2019 n (%)	2020 n (%)	2021 n (%)
CCCF	*n* = 124	*n* = 118	*n* =108	*n* = 175	*n* = 144
Women speakers	38 (31)	43 (36)	42 (39)	65 (37)	60 (42)
Women physician speakers	31 (25)	36 (31)	30 (28)	56 (32)	45 (31)
Women Moderators	30/87 (34)	26/80 (33)	29/73 (40)	31/80 (41)	26/58 (45)
Women Program Committee members	3/13 (23)	3/13 (23)	3/12 (25)	5/14 (36)	5/14 (36)
All nursing and allied health [a] Women nursing and allied health	10 (8) 7 (6)	11 (9) 6 (5)	13 (12) 11 (10)	13 (7) 9 (5)	17 (12) 12 (8)
Other speakers [b]	0	3 (3)	2 (2)	1 (1)	3 (2)
SCCM	*n* = 310	*n* = 313	*n* = 291	*n* = 456	*n* = 284
Women speakers	111 (36)	107 (34)	98 (34)	163 (36)	136 (48)
Women physician speakers	61 (20)	62 (20)	51 (18)	84 (18)	62 (22)
Women Moderators	25/91 (27)	34/102 (33)	36/97 (37)	-	-
Women Program Committee members	29/93 (31)	25/75 (33)	26/69 (38)	23/72 (32)	21/70 (30)
All nursing and allied health [a] Women nursing and allied health	71 (23) 49 (16)	74 (24) 41 (13)	75 (26) 43 (15)	117(26) 77 (17)	102 (36) 75 (25)
Other speakers [b]	6 (2)	6 (2)	5 (2)	2 (0.4)	2 (1)
ESICM	*n* = 345	*n* = 391	*n* = 320	*n* = 317	*n* = 448
Women speakers	69 (20)	86 (22)	83 (26)	116 (37)	172 (38)
Women physician speakers	52 (15)	64 (16)	58 (18)	90 (28)	123 (27)
Women Moderators	-	-	-	-	-
Women Program Committee members	2/17 (11)	2/17 (11)	2/17 (11)	5/18 (28)	5/19 (26)
All nursing and allied health [a] Women nursing and allied health	33 (10) 17 (5)	37 (9) 22 (6)	36 (11) 24 (8)	36 (11) 26 (8)	65 (15) 49 (11)
Other speakers [b]	0	0	1 (0.3)	2 (0.6)	1 (0.2)

n represents the total number of speakers at each conference. Moderator data was unavailable for ESICM for all years and SCCM for 2021 and 2022

[a] Represents men and women in nursing and allied health professions.

[b] Non-healthcare speakers (e.g., patients, family members, etc.)

CCCF had an increase of 2.28% per year in women speakers; 95% CI: 0.076-4.473%; P=0.046

SCCM had an increase of 2.57% per year in women speakers; 95% CI: -2.401-7.548%; P=0.20

ESICM had an increase of 5.14% per year in women speakers; 95% CI: 2.512-7.765%; P=0.008

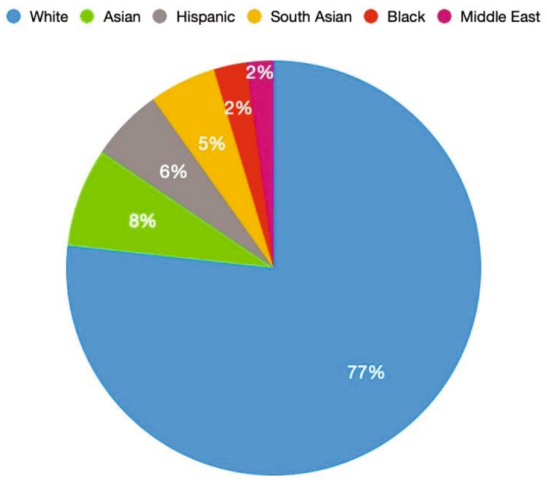

Figure 1. Racial and ethnic representation of SCCM and CCCS invited speakers.

Hypocalcemia Predict Mortality in Trauma Patients: A Meta-Analysis

Submission ID

123

AUTHORS

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INTRODUCTION

The trauma triad of death - hypothermia, acidosis, and coagulopathy - has been recognized as a significant cause of death in trauma patients. This triad resulted in worsening hemorrhage and eventual death. Recent data have introduced a fourth component, hypocalcemia, plays a key role in the outcome of trauma patients. In vitro data demonstrate that thrombin generation and clot formation cannot occur with an ionized calcium less than 0.25 mmol/L. Calcium is also essential for normal cardiac contractility and vasoconstriction, consequently appropriate cardiac output, which prevents hypoperfusion and acidosis. Moreover, hypocalcemia and hypothermia work in a deleterious combination on the heart, worsening cardiac output. Though, it has been proposed as an essential factor in trauma resuscitation. To date, there was no explicit data regarding the effect of hypocalcemia on mortality in trauma patients.

OBJECTIVES

The objective of this study was to determine the effect of hypocalcemia on the mortality in trauma patients. The hypothesis was the severity of hypocalcemia might related to higher mortality and transfusion would worsen hypocalcemia and affected mortality.

METHODS

Ovid, EMBASE, and Cochrane database searches were conducted.
Randomized controlled trial and cohort studies reporting the mortality rate associated trauma patient with hypocalcemia were selected. Normal ionized calcium was defined by the level of 4.0 to 5.2 mg/dL (1.0 to 1.3 mmol/L). Any level below this range was considered hypocalcemia. Severe hypocalcemia was defined as serum calcium < 7.2 mg/dL (1.8 mmol/L) or serum ionized calcium < 3.6 mg/dL (0.9 mmol/L).All data analyses were performed by RevMan 5.3 software from the Cochrane Collaboration (London, UK). We extracted the proportions and 95% confidence intervals from each study and pooled

then using the random-effect model. The Cochran *Q* test and I^2 statistic were used to determine the statistic heterogeneity of the studies. P-values less than 0.05 were considered statistically significant.

RESULTS

Of 3,403 studies, 11 were selected for meta-analysis. A pooled analysis of 11 studies had been conducted by using a random effects model. Trauma patients with hypocalcemia showed a significantly increase mortality compared with trauma patients with normocalcemia (RR, 3.02; 95% CI, 1.86 to 4.93; I^2, 77%). This significant increase mortality was also represented in subgroup based on time calcium level measurement (before blood transfusion: RR 3.72; 95% CI, 1.87 to 7.40; I^2, 69%; after blood transfusion: RR 1.97; 95% CI, 1.42 to 2.73; I^2, 0%; no mention about the period: RR 11.67; 95% CI, 2.37 to 57.36). Patients with mild hypocalcemia had no significant difference in mortality rate comparing to patients with normocalcemia (RR, 2.23; 95% CI, 0.70 to 7.13; I^2, 24%). A funnel plot of the reporting bias shows relatively symmetric and showed no publication bias.

CONCLUSION

Severe hypocalcemia, regardless of before or after transfusion, it demonstrated significantly increased mortality among trauma patients. Despite the association between hypocalcemia and mortality, the benefit of prophylactic calcium administration requires the further trial to support. However, integrating hypocalcemia with the trauma lethal triad (hypothermia, acidosis, and coagulopathy) might help predicting prognosis and improving on traumatic shock patients. The large multicenter prospective evaluation is warranted.

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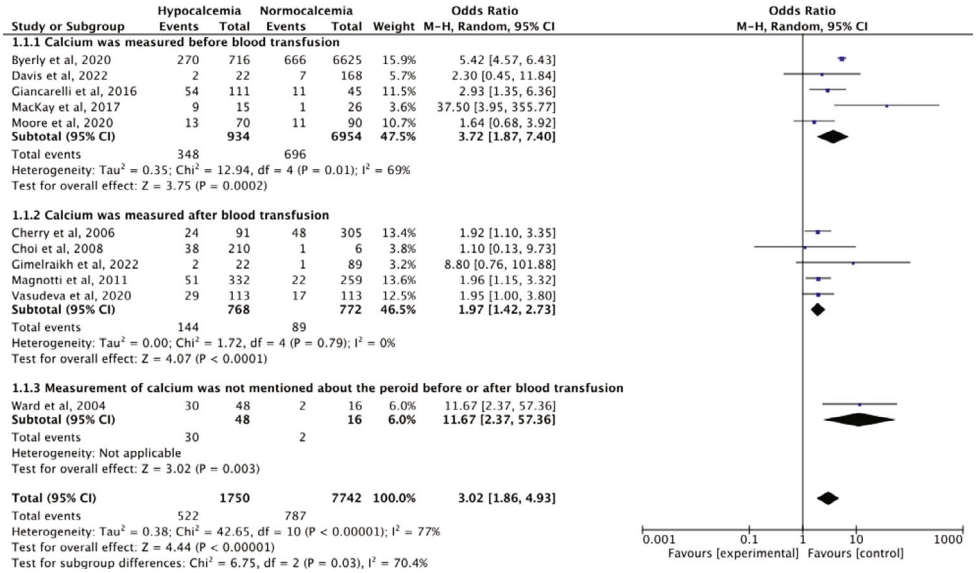

Figure 1

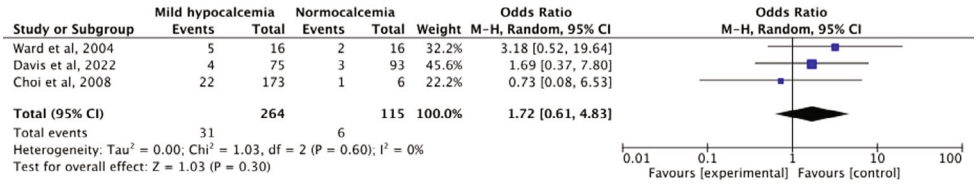

Figure 2

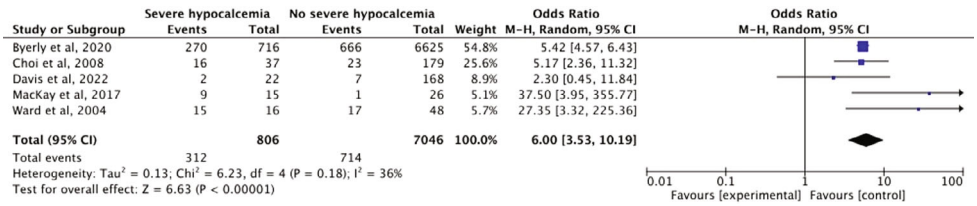

Figure 3

Identification of Interprofessional Activities for the Operationalization of the Competency-Based Approach in Interprofessional Education in Intensive Care Units

Submission ID

15

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INTRODUCTION

Interprofessional collaboration is essential in intensive care units (ICU) and interprofessional education (IPE) allows the teaching of the competencies required.

OBJECTIVES

The first objective of this study was to identify essential interprofessional activities that characterizes the ICU to operationalize the competency-based approach (CBA) in ICU IPE. Similarly to the entrustable professional activities from the Royal College of Physicians and Surgeons of Canada, these activities were termed Sustainable Interprofessional Activity (SIPA). The second objective of this study was to assess the appropriateness of the methodology.

METHODS

A pilot exploratory sequential mixed design was conducted. First, a narrative literature review allowed the identification of interprofessional activities in the ICU using a qualitative analysis. Next, a Delphi consensus method was conducted, and involved ICU experts from seven distinct professional groups recruited from a tertiary university hospital. Four rounds of quantitative and qualitative surveys, interspersed with controlled feedback, were conducted. The study's acceptability and feasibility were assessed at each stage using quantitative and qualitative questions.

RESULTS

The literature review identified 16 interprofessional activities. Following the first round, 25 interprofessional activities were defined and modified according to the experts' comments. Subsequent rounds acknowledged 19 of these as SIPA. Of the 35 experts

recruited, an average of 31.8% of participants were lost to follow-up. This was mainly explained by the redundancy of the survey questions occurring during each round.

CONCLUSION

The absence of clear theoretical foundations in the literature, combined with the limited sample of professionals from a single centre, require the confirmation of the SIPA identified in this study. A nominal group process of experts in CBA, followed by a real-time Delphi method if ICU experts would address the difficulties perceived. The validity of SIPA as an indirect measure of interprofessional competencies must henceforth be confirmed.

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Identifying Strategies for Antipsychotic Medication Minimization and Deprescribing Among Critically-Ill Adult Patients at Transitions of Care: A Multi-Stage Research Program

Submission ID

61

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INTRODUCTION

Critically ill adults are typically prescribed antipsychotics for delirium, agitation, and sleep disruptions[1]. Although the sedating properties of antipsychotics are used in the management of agitation, these medications have not been shown to reduce the incidence or duration of delirium or improve sleep quality[2,3].Antipsychotics are also often continued at transitions of care in critically ill patients when they may no longer be necessary and expose patients to the risk of impaired cognition, reduced executive functioning and psychoactive polypharmacy (i.e., use of two or more classes of psychoactive medications simultaneously) at hospital discharge[4,5]. The current literature on antipsychotic minimization and deprescribing in critically ill patients is sparse and understanding the relevant factors influencing current prescribing practices is an essential step in the optimization of pharmacotherapy. The development of evidence-informed strategies to facilitate antipsychotic minimization and deprescribing are needed to avoid potential ongoing prescription of these medications without appropriate indication at transitions of care in critically ill patients.

OBJECTIVES

We embarked on a program of research to: 1) describe the factors that impact antipsychotic prescribing and deprescribing practices among healthcare professionals that care for critically ill adult patients during and following critical illness; 2) characterize

the literature on healthcare professional antipsychotic prescribing practices and their perceptions on antipsychotic prescribing and deprescribing; and 3) develop consensus with key healthcare professional stakeholders on strategies to facilitate antipsychotic deprescribing among critically ill adults.

METHODS

Our multi-stage research program utilized the following methods: 1) semi-structured individual interviews with critical care and ward healthcare professionals to identify key behaviour domains contributing to antipsychotic prescribing practices in adult patients with and following critical illness; 2) scoping review to summarize the literature on healthcare professional in-hospital antipsychotic prescribing practices and perceptions; and 3) modified Delphi process to prioritize evidence-informed consensus statements on antipsychotic minimization and deprescribing for critically ill patients during hospitalization. Results from both the semi-structured interviews and scoping review informed proposed consensus statements generated for the modified Delphi process.

RESULTS

Interviewed healthcare professionals identified common indications leading to antipsychotic prescribing including patient and staff safety, facilitation of patient sleep, and clinician concern for team members safety. Our scoping review highlighted that healthcare professionals perceived antipsychotics as effective adjuncts for delirium management that did not pose a high enough risk of adverse events to limit their prescribing practices. Our stakeholder panel from the modified Delphi consensus process prioritized six strategies from for consideration when developing interventions to guide antipsychotic minimization and deprescribing. These strategies focused on limiting antipsychotic prescribing to patients 1) with hyperactive delirium, 2) at risk to themselves, their family, and/or staff due to agitation, and 3) whose care and treatment are impacted by agitation or delirium, and ensuring strategies prioritize 4) communication among staff about antipsychotic effectiveness, 5) direct and efficient bidirectional communication tools on antipsychotic deprescribing at transitions of care, and 6) medication reconciliation and review at transitions of care.

CONCLUSION

We developed evidence-informed consensus statements regarding antipsychotic prescribing practices that can be utilized to develop interventions to promote antipsychotic minimization and deprescribing strategies for patients with and following critical illness. These strategies focus on the use of bidirectional communication tools integrated into transfer and discharge summaries as well as additional purposeful medication reconciliation at transitions of care. Adapting these strategies to center-specific needs will be important when considering monitoring and measuring implementation.

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Lung Ultrasound and Chest Radiograph Assessment Amongst Trainees

Submission ID

49

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INTRODUCTION

Point of care ultrasound is increasingly utilized in patient assessment to help with rapidly diagnosis at the bedside. Lung ultrasound (LUS) is well established in emergency medicine and critical care, with evidence suggesting high diagnostic accuracy for many respiratory pathologies[1-4]. Previous studies have shown that trainees can better interpret LUS compared to chest radiographs (CXR) in the setting of pulmonary edema[5].

OBJECTIVES

It is not known if trainees are also better at LUS interpretation in the setting of patients with undifferentiated respiratory illness. We hypothesized that internal medicine (IM) residents would have better agreement with experts when interpreting LUS images compared with CXR.

METHODS

IM residents in post-graduate years 1-3 were recruited and randomized to two groups. The first group completed an online e-learning module on lung ultrasound, followed by a lung ultrasound assessment module, while the second group completed a chest radiograph interpretation module followed by a chest radiograph assessment module. After a two-week period, the groups crossed over and trainees were asked to undertake the modules for the imaging modality they had not yet completed.
Assessment modules were created using a series of 16 LUS studies with paired CXR taken within the same 24-hour period. Images were reviewed by radiologists and intensivists with expertise in chest imaging and lung ultrasound respectively, to provide a reference

interpretation of the primary pathology.
The primary outcome was the percentage of correct interpretations of the primary pathology by trainees. Secondary outcomes included percentage of correct identification of secondary pathologies and confidence in interpretations using a Likert scale (1-5, not at all confident to very confident).

RESULTS

We present preliminary results from the first 14 participants. Pre-module confidence was rated significantly higher on a continuous scale (0-100) for CXR compared to LUS interpretation (60.14 vs 17.86, $P < 0.0001$). For CXR, there was 50.9% agreement between residents and the expert, compared to 46.0% for LUS (OR=0.81, CI=0.55-1.19, p=0.2836). Median confidence in image interpretations was 2 (IQR 2-3) for LUS and 3 (IQR 2-3) for CXR. Trainee feedback was generally positive with regards to the e-learning and assessment modules.

CONCLUSION

Compared with CXR interpretation, there was no significant difference in trainee interpretation of LUS images as compared to expert interpretations when it pertains to overall interpretation. Trainee's report receiving significantly more training in CXR interpretation and generally feel less confident with LUS training, although this was somewhat improved post-module. This suggest accuracy of lung ultrasound imaging interpretation may be similar to that of chest radiograph interpretation despite significantly less training in the former. We are currently performing the analyses related to secondary pathologies and completing participants recruitment.

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Magnitude and Physiological Consequences of Synchronous and Dyssynchronous Inspiratory Efforts During Mechanical Ventilation. A Novel Method.

Submission ID

114

AUTHORS

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INTRODUCTION

Patients with acute hypoxemic respiratory failure (AHRF) during mechanical ventilation exert synchronous and dyssynchronous inspiratory efforts, frequently reverse triggering. Both their magnitude and timing can influence their effects on the lung and diaphragm.

There is clinical and experimental evidence for specific mechanisms by which dyssynchronous efforts might be more deleterious than synchronous (*e.g.*, breath-stacking, pendelluft or eccentric contractions(1)). However, a recent animal study has shown that the relative risk vs benefit of reverse triggering on diaphragm function varies according to the magnitude of breathing effort during the events (2). In humans, an intermediate range of effort regardless of the synchrony, similar to that of healthy subjects at rest, was associated with better outcomes(3). The epidemiology of the magnitude and consequences of synchronous vs dyssynchronous efforts on stress/strain during mechanical ventilation at a large scale is unknown, because of the technical challenge of quantifying the magnitude of these efforts automatically.

OBJECTIVES

In this study we 1) develop and validate a software to classify and quantify synchronous and dyssynchronous efforts based on muscular pressure (Pmus) reconstructed from esophageal pressure (Pes) and 2) describe the main characteristics of synchronous and dyssynchronous efforts in a cohort of patients with AHRF, their impact on stress/strain and directly compare them to that of healthy subjects breathing at rest measured using the same technique.

METHODS

Two independent datasets from existing physiological studies were used for development and validation of the software. Respiratory cycles were labelled by experts (TPh, TPi, RC, IT and LB) as: machine-triggered (MT) passive, machine-triggered with reverse-triggering (RevT) without breath-stacking (BS) or with BS, patient-triggered (PatT) without BS and with BS, and patient-triggered with ineffective efforts**.** The algorithm generates muscular pressure (Pmus) (\(Pmus = {[Volume (time) \times Chest Wall Elastance]- Pes (time)}\)). An effort is detected based on the deformation of Pmus using the first derivative. The parameters that define the deformation corresponding to an effort, start and end were derived from the derivation dataset. Parameters that quantify the magnitude of effort for each breath were automatically calculated based on Pmus (Pmus-swing, pressure-time product per breath and per minute -PTPmus) including the proportion of eccentric contraction (*i.e.*, eccentricity, proportion of effort occurring during exhalation). Changes in dynamic driving transpulmonary pressure and tidal volume were used as surrogates for changes in stress/strain. Mixed-models were used to compare the characteristics of different types of effort. Interaction terms were introduced to explore the differential effects of effort in volume-control (VCV) vs pressure-control ventilation (PCV).

RESULTS

72 subjects and 22,000 breaths were included for software development and validation (healthy subjects, patients after cardiac surgery, and 54 with AHRF). Accuracy for effort detection and classification of dyssynchronies was 95% and > 96% respectively.
In patients with AHRF, median(IQR) Pmus-swings for patient-triggered breaths were 10.3(7.1-13.2) and 11.8(7.0-22.7) cmH_2O during spontaneous and assist-control modes, and 8.7(6.1-12.5) cmH_2O during reverse-triggering.
Cycles with breath-stacking had the highest Pmus-swings: 17.5(11.3-22.1) cmH_2O.
Breathing effort per minute for reverse-triggering (PTPmus/min 81.4(43.7-118.2) cmH_2O.sec/min) was comparable to healthy subjects at rest ($p = 0.59$) and recordings with patient-triggered breaths on assist-control had the highest effort (PTPmus/min 214.5(102.0-326.4) cmH_2O.sec/min). Highest eccentricity was found for ineffective efforts (median (IQR) 100(99.5-100) %), followed by reverse-triggering without breath-stacking (median (IQR) 68.0(30.4-61.0) %).
During pressure-control driving transpulmonary pressure increased linearly with increasing Pmus-swing ($p < 0.001$), and less predictably during volume-control.

CONCLUSION

We provide a novel means of automatically quantifying the magnitude of synchronous and dyssynchronous efforts and consequences on stress/strain in general. Consequences of breathing efforts depend on magnitude, timing, and mode of ventilation.
We also provide new insights on the magnitude of synchronous vs dyssynchronous efforts in patients with AHRF. These patients have increased susceptibility to the deleterious effects of excessive efforts and the current algorithm, by quantifying the magnitude and timing of effort, changes in driving transpulmonary pressure, occurrence of breath-stacking, and proportion of eccentric contraction, allows to estimate the potential protective vs injurious effects of effort on them.

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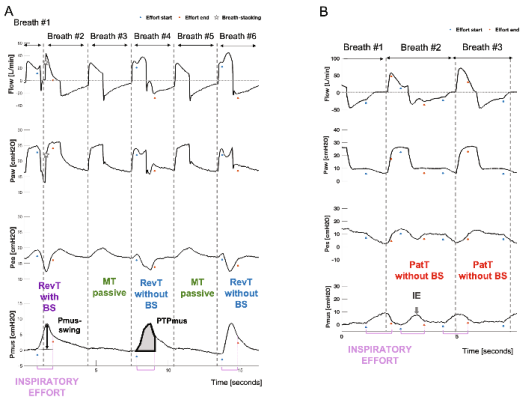
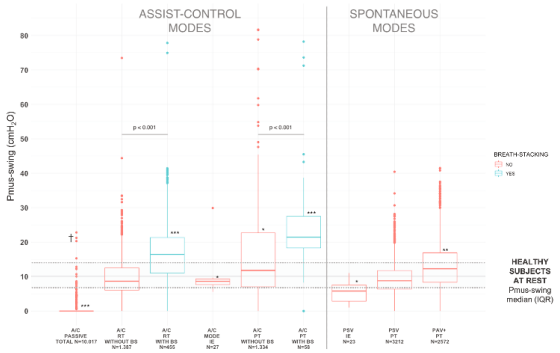
Figure 1. Recordings of two patients on pressure-control ventilation illustrating the different types of events.



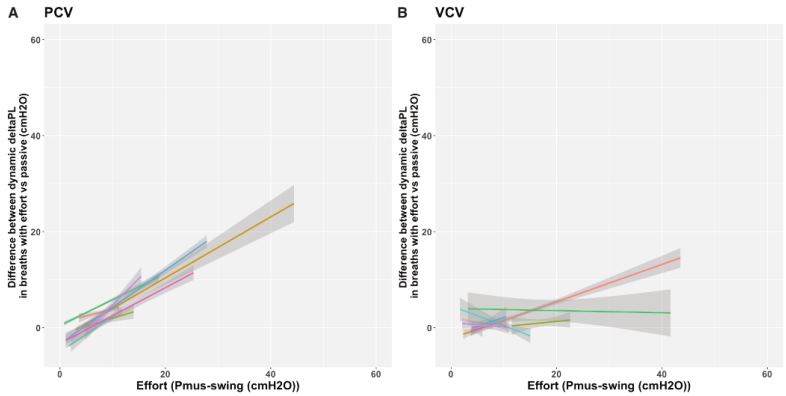
Legend: From top to bottom flow, airway pressure, esophageal pressure and muscular pressure tracings are displayed. Start and end of each respiratory cycle (breath) is defined by the zero-crossing of flow (vertical dashed-lines). The presence of an inspiratory effort is defined by the deformation in the muscular pressure signal (horizontal violet line). Start and end of each inspiratory effort is marked with a blue and red triangle respectively in each of the tracings. A) Reverse-triggering events interposed with machine-trigger passive events are seen (with a 1:2 ratio on breaths #1, #2, #4, and #6). The first reverse-triggering event (breaths #1 and #2) results in breath-stacking (star). The black vertical arrow on breath #2 illustrates the measurement of Pmus-swing and grey area that of pressure-time product. B) Patient-triggering events are seen with an ineffective effort (breath #2).
List of abbreviations: Paw airway pressure; Pes esophageal pressure; Pmus muscular pressure; RevT reverse-triggering; BS breath-stacking; MT machine trigger; PatT patient-trigger; IE ineffective effort; Pmus-swing maximum positive deflection in muscular pressure during each inspiratory effort; PTPmus pressure-time product measured according to the algorithm.

Figure 2. Pmus-swings according to the type of event and mode of ventilation in patients with acute hypoxemic respiratory failure.



Legend: Each boxplot represents the median [interquartile range] of the maximum positive deflection in muscular pressure during each inspiratory effort (Pmus-swing) for each type of event and mode of ventilation. Events occurring during assist-controlled modes (volume-control and pressure-control) are displayed on the left and during spontaneous modes on the right (including pressure-support and proportional-assist ventilation with adjustable gain factors). The reference median and interquartile range of Pmus-swing for inspiratory effort of healthy subjects breathing at rest without inspiratory assistance are displayed as grey horizontal full and dashed lines respectively. Events without breath-stacking are seen in red and with breath-stacking in blue. P-values for pairwise comparison of reverse and patient-trigger breaths without breath-stacking vs with breath-stacking are displayed.
*p < 0.05; ** p < 0.01; *** p < 0.001 vs healthy subjects breathing at rest.
† 63 efforts out of 10.017 machine-trigger passive events were erroneously detected by the algorithm due to artifact in the esophageal pressure signal in passive breaths (false positive < 1%) resulting in measurement of effort.
List of abbreviations: Pmus-swing maximum positive deflection in muscular pressure during each inspiratory effort; A/C assist control mode; PSV pressure-support mode; PAV+ proportional-assist ventilation with adjustable gain factors; RT reverse-triggering; PT patient-trigger; IE ineffective efforts.

Figure 3. Relationship between the magnitude of effort (during patient-triggered and reverse-triggering breaths without breath-stacking) and the change in dynamic driving transpulmonary pressure compared to passive breaths.



Legend: The difference in dynamic driving transpulmonary pressure of breaths with effort vs the median value for passive breaths in the same recording is shown as a function of the magnitude of the breathing effort for recordings on pressure-control (A) and volume-control (B). Each colored line represents the linear regression and shaded area 95% confidence interval for each recording. Linear mixed-models to assess the relationship between the magnitude of effort and the difference in dynamic driving transpulmonary pressure were performed for tracings on pressure-control and volume-control respectively considering the patients as a random effect. There is an overall significant linear relationship between the magnitude of effort and changes in dynamic driving transpulmonary pressure on PCV ($p < 0.001$) but not on VCV ($p = 0.433$).
List of abbreviations: VCV volume-control ventilation; PCV pressure-control ventilation; deltaPL driving transpulmonary pressure; Pmus-swing maximum positive eflection in muscular pressure during each inspiratory effort.

Measuring Compliance and Outcomes in Multiple Evidence Based Clinical Guidelines in the Pediatric Intensive Care Unit

Submission ID

34

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INTRODUCTION

Evidence-based clinical care guidelines improve medical treatment by reducing error, improving outcomes, and lowering costs. While there is some data on strategies to increase individual guideline compliance, no data exists on practicality and feasibility of measuring the overall compliance to multiple guidelines.

OBJECTIVES

To investigate the plausibility of measuring compliance to multiple evidence-based guidelines and compare to overall clinical outcomes. We hypothesized compliance would increase as study progressed in response to observation.

METHODS

Design: Prospective cohort single-center design. Data collected June 2016—June 2017, analysis reported from 2019—2021. Adherence to elements of 19 different clinical practice guidelines were prospectively measured by a research coordinator.

Setting: Tertiary academic medical-surgical PICU.

Patients: Population sample of all pediatric patients admitted to the ICU for greater than 24 hours.

Analysis: A compliance score was generated for each patient by choosing which guidelines are relevant to that patient that day and assigning a binary value of “0” for non-compliant and “1” for compliant. A “non-compliance reason score” (NCRS) was generated when a guideline element was not adhered to. NCRS was scored as; NCR1 - good reason, NCR2 - no time for guideline, NCR3 – guideline not believed by care provider/individual practice variance, and NCR4 – no reason was given. Relevant NCR was denoted by way of Boolean values, and criteria compliance was calculated as 1 – ∑NCR Value. Compliance was then calculated for each guideline, and the total

facility. Linear regression with compliance as the dependent variable, and month, events and admissions as predictors was applied to test for possible Hawthorne effect.

RESULTS

Overall facility compliance to 19 guidelines was 77.8% over 4512 compliance events, involving 826 admissions by 814 patients. Guidelines with the highest compliance were stress ulcer prophylaxis (97.1%) and transfusion administration of fresh frozen plasma (97.4%) and platelets (94.8%); guidelines with the lowest compliance were ventilator associated pneumonia prevention (28.7%), central venous line protocol (44.6%) and vitamin K administration (34.8%). There was no significant change in compliance over time. Overall compliance to guidelines with binary decision branch points/checklist were 90.6%. Multidisciplinary guideline compliance was 49.9%.

CONCLUSION

Measuring guideline compliance was complicated and time intensive. Overall facility compliance was surprisingly high, despite a lack of electronic medical record forced functionality. Guideline compliance did not improve over time as hypothesized, and varied widely between guidelines. Similarities in high adherence guidelines included easy readability, binary decision branch points or checklist format. Poor compliance was more often seen with poor perception of guideline trustworthiness, limited time to review/implement guideline steps, and in multidisciplinary involvement without early stakeholder engagement. Measuring guideline compliance, though onerous, allows for targeted evaluation of current clinical practices and identifies actionable areas for institutional improvement.

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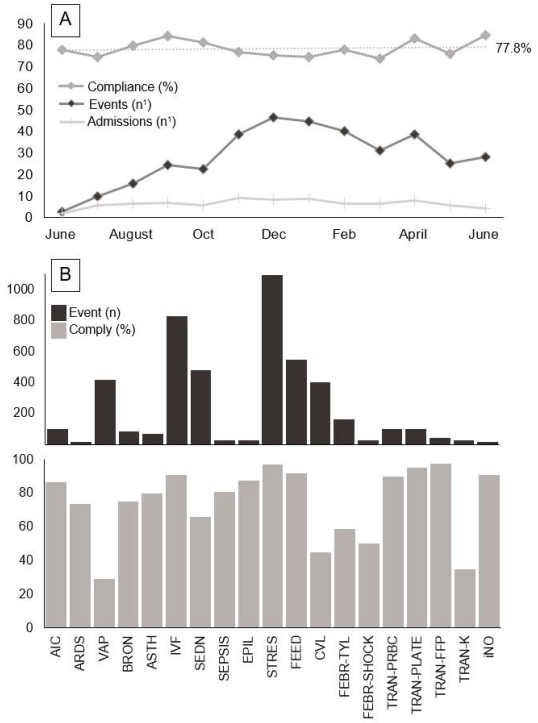
A
90
80
70
60
50
40
30
20
10
0
77.8%
Compliance (%)
Events (n¹)
Admissions (n¹)
June
August
Oct
Dec
Feb
April
June
B
1000
800
600
400
200
Event (n)
Comply (%)
100
80
60
40
20
0
AIC
ARDS
VAP
BRON
ASTH
IVF
SEDN
SEPSIS
EPIL
STRES
FEED
CVL
FEBR-TYL
FEBR-SHOCK
TRAN-PRBC
TRAN-PLATE
TRAN-FFP
TRAN-K
iNO

Figure 1

Mechanical Ventilation After Traumatic Spinal Cord Injury – A Multi-Centric Registry-Based Study and a Predictive Score for Weaning Success: The Bicycle Study

Submission ID

83

AUTHORS

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INTRODUCTION

Successful weaning from mechanical ventilation (MV) greatly impacts life expectancy and quality of life of patients with traumatic spinal cord injury (tSCI).[1,2] However, predictors of weaning have not been systematically assessed and no validated prediction model exists.[3]

OBJECTIVES

In this multi-centric registry-based cohort study, in ventilated patients after tSCI, we aimed to investigate weaning outcomes (weaning success was defined as ventilator free breathing at discharge from the primary intensive care unit - ICU) and the associated clinical predictors, and to develop a prediction model for weaning success.

METHODS

We included adult patients with tSCI requiring MV, admitted between January 2005 and December 2019 to an ICU belonging either to the Toronto St. Michael's Hospital Trauma Registry or to the Rick Hansen SCI Registry (7 ICUs across Canada). The entire cohort was used for model development and internal validation to build a robust prediction model, following methodological recommendations.[4,5]
Associations between baseline characteristics and weaning success or time to liberation

from MV were measured using multivariable logistic and competing risk regressions, respectively. We developed and internally validated via bootstrap a prediction model and a prediction score for weaning success at ICU discharge, which discriminative ability was assessed using ROC curve analysis and compared to the Injury Severity Score (ISS) through pairwise testing. To estimate the time to liberation and its predictors while accounting for the competing risk of death, cumulative incidence curves were plotted, and Fine-Gray competing risk regression models were built.

RESULTS

Of 459 patients requiring MV after tSCI analyzed, 246(53.6%), 302(65.8%) and 331(72.1%) were alive and free-of-MV at Day 14, 28, and ICU discharge, respectively; 54(11.8%) died in ICU. Median time to liberation from MV was 13 days; weaning success at a given timepoint was lower in patients with C3-or-above or C4-or-below lesions, compared to patients with thoracic lesions (p=0.03 and p<0.0001, respectively) and to patients with lumbar lesions (p=0.012 and p<0.0001, respectively)(**Figure 1**).

Factors associated with weaning success at ICU discharge were **B**lunt injury (OR2.96, p=0.010), **I**SS (OR0.98, p=0.025), **C**omplete lesion (OR0.53, p=0.009), age in **Y**ears (OR0.98, p=0.003), and **C**ervical **LE**vel lesion (OR0.60, p=0.045). From the linear combination of these variables, the "**BICYCLE**" score was generated, which showed a much better performance predicting weaning success than the ISS (AUROC=0.689, 95%CI 0.631–0.743, vs 0.537, 95%CI 0.479–0.595, p<0.0001). Factors relevant for weaning success, along with the number or comorbidities (p=0.049), also predicted time-to-liberation. Different BICYCLE score quartiles reflected different cumulative probability of events (weaning, death, or remaining ventilated)(**Figure 2**).

CONCLUSION

72% of patients were discharged from primary ICU alive and free of MV after tSCI. A newly developed score based on readily available patient characteristics on admission could predict weaning success with good discriminative properties in one of the largest cohorts available of patients with tSCI.

Acknowledgements: The AUTHORS would like to thank the Rick Hansen Spinal Cord Injury Registry (RHSCIR) participants and network, the Alberta Trauma Services Team, and Trauma Registry in providing data for the RHSCIR. The RHSCIR and this work are supported by funding from the Praxis Spinal Cord Institute, Health Canada, Pacific Economic Development Canada, and the Governments of Alberta, British Columbia, Manitoba and Ontario.

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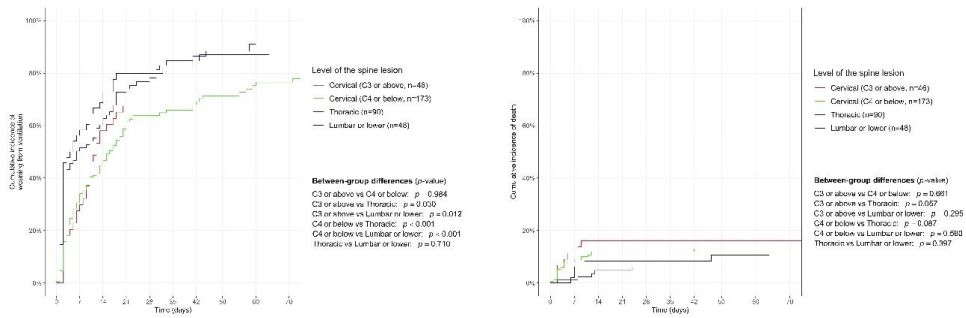

Figure 1

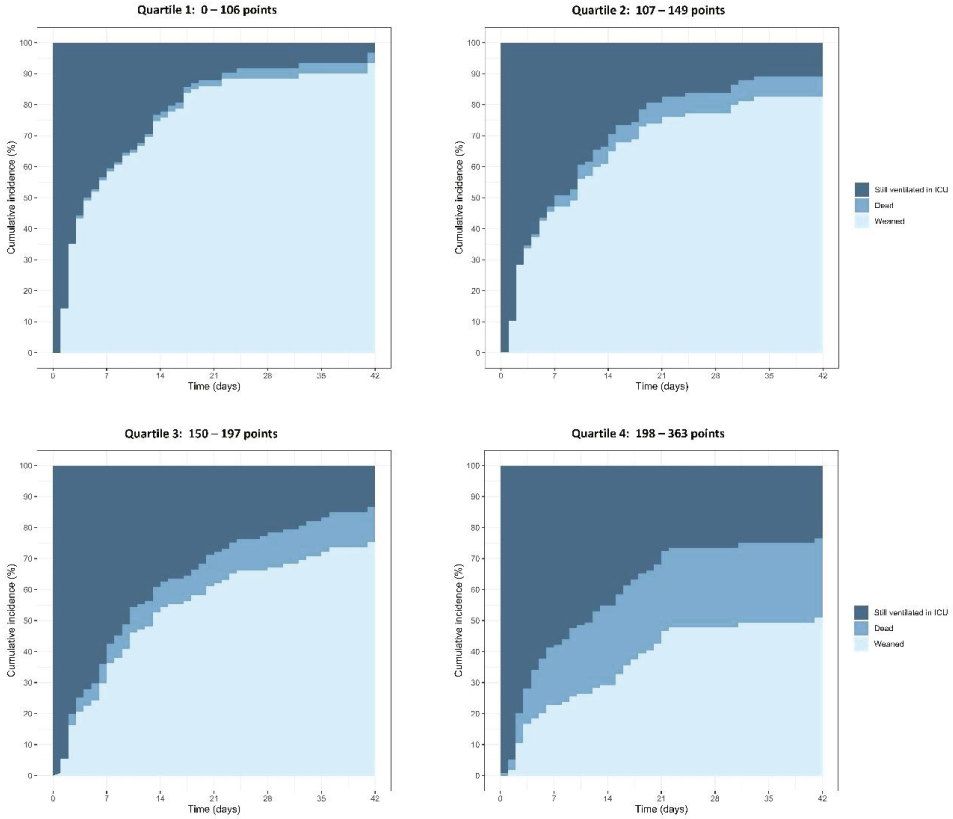
Quartile 1: 0 – 106 points
Quartile 2: 107 – 149 points
Quartile 3: 150 – 197 points
Quartile 4: 198 – 363 points
Cumulative incidence (%)
Time (days)
Still ventilated in ICU
Dead
Weaned

Figure 2

Methodological Analysis of Sample Size Determination and its Influence on Outcome of Trauma Hemorrhage Trials

Submission ID

36

AUTHORS

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INTRODUCTION

Hemorrhagic shock remains the most common cause of preventable mortality in trauma[1]. In order to guide clinical practice, RCTs provide high-quality evidence to inform clinical decision making[2]. The clinical relevance and inferences made by RCTs are dependent on assumptions made during sample size calculation[3]. Many sample size calculations are poorly conducted and reported or based on unrealistic assumptions regarding baseline risk and anticipated risk reduction[3]. Prognostic enrichment strategies can inform more precise estimates and decrease heterogeneity of baseline risk[4]. Using the minimally important difference (MID) ensures RCTs are targeting a treatment effect that is both plausible but also one that would be important to patients, rather than using an arbitrary effect estimate based on assumptions[5].

OBJECTIVES

1. Systematically review RCTs evaluating interventions aimed at improving survival in adults with trauma-related hemorrhage.
2. Describe the methodological quality and justification for sample size determination.
3. Compare expected versus observed study outcomes.

METHODS

We created a search strategy for Medline and Embase databases including RCTs published until July 2022. We included all English language RCTs meeting the following criteria: 1) enrolled patients aged 15 years old or older having sustained blunt and/or penetrating trauma meeting any criteria for clinically significant bleeding (as defined by study authors), 2) compared either intervention vs placebo, or one intervention to another in a planned superiority analysis and 3) evaluated mortality as the primary outcome. We excluded cluster RCTs, pilot studies, feasibility studies and those with planned non-inferiority analyses as their methods for sample size calculation differ from superiority studies. Two reviewers abstracted data from included studies. Data was pooled using random-effects models and presented with effect estimates with 95% confidence intervals.

RESULTS

We identified 1,688 citations of which we included 13 studies involving 24, 885 patients in the analysis. We noted a high rate of negative trial results (11 of 13 studies). Most studies were multi-center and conduced in North America, evaluating patients with blunt and penetrating injuries. The criteria for hemorrhagic shock varied across studies. All studies did not accurately estimate the mortality rate during sample size calculation. All but one study overestimated the mortality reduction during sample size calculation; the median absolute mortality reduction was 3%, compared to a target of 10%. Only the CRASH-2 study used a minimal clinically important different for treatment effect target. No RCTs employed prognostic enrichment. Most studies were terminated (8 of 13), mainly for futility.

CONCLUSION

Taken together, this review highlights that current clinical trial methodology is limited by imprecise control group risk estimates, overly optimistic treatment effect estimates and lack of transparent justification for such targets. These limitations result in studies at high risk for futility and potentially premature abandonment of promising therapies. Given the high morbidity and mortality of trauma-related hemorrhage, we recommend that future conduct of trauma RCTs incorporate 1) prognostic enrichment to inform baseline risk, (2) justify target treatment differences based on clinical importance and realistic estimates of feasibility, and (3) be transparent and provide justification for the assumptions made.

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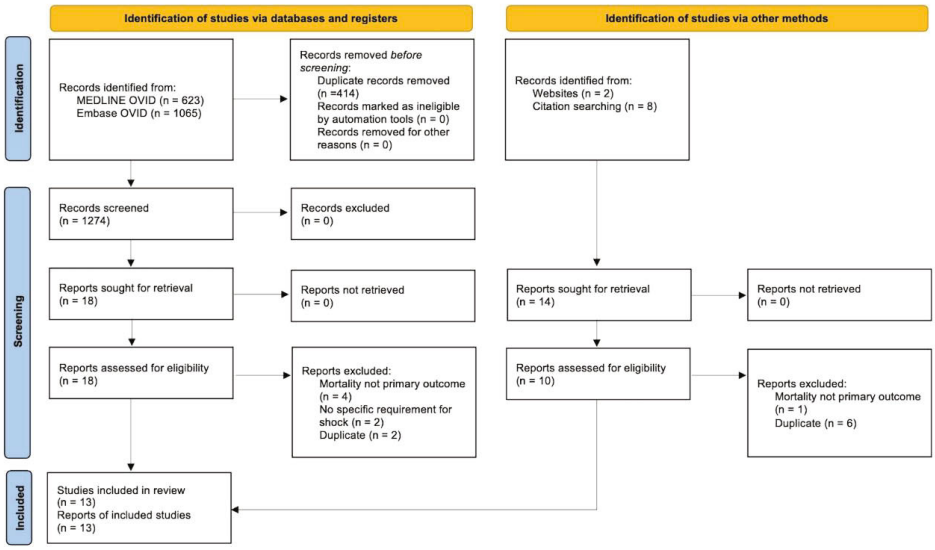
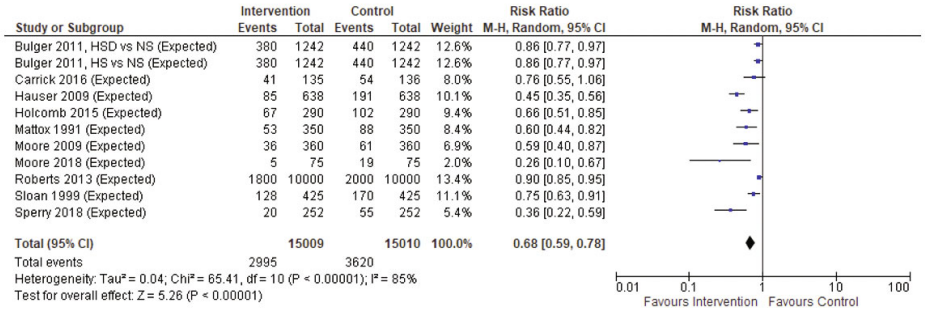


Figure 1

Study	Region	Study Design	Setting	Injury	Sample Size	Intervention	Outcome (Mortality)	Study Result
Bulger 2011	North America	Multicenter	Prehospital	Blunt and Penetrating	853	Intravenous Fluid	28-Day All-Cause	Terminated (Negative)
Carrick 2016	North America	Single center	In-hospital	Penetrating	164	Resuscitative Strategy	30-Day All-Cause	Terminated (Negative)
Chang 1995	North America	Multicenter	Prehospital	Blunt and Penetrating	291	Procedure	In-Hospital All-Cause	Negative
Roberts 2013	Multi-Continental	Multicenter	In-hospital	Blunt and Penetrating	20211	Pharmacologic Therapy	28-Day All-Cause	Positive
Hauser 2010	Multi-Continental	Multicenter	In-hospital	Blunt and Penetrating	542	Pharmacologic Therapy	30-Day All-Cause	Terminated (Negative)
Holcomb 2015	North America	Multicenter	In-hospital	Blunt and Penetrating	680	Resuscitative Strategy	30-Day All-Cause	Negative
Kerner 2003	Europe	Multicenter	Prehospital	Blunt and Penetrating	110	Pharmacologic Therapy	5-Day All-Cause	Terminated (Negative)
Mattox 1991	North America	Multicenter	Prehospital	Blunt and Penetrating	416	Intravenous Fluid	24-Hour All-Cause	Terminated (Negative)
Moore 2009	North America	Multicenter	Pre and In-Hospital	Blunt and Penetrating	714	Pharmacologic Therapy	30-Day All-Cause	Negative
Moore 2018	North America	Single center	Prehospital	Blunt and Penetrating	125	Intravenous Fluid	28-Day All-Cause	Terminated (Negative)
Sloan 1999	North America	Multicenter	In-hospital	Blunt and Penetrating	112	Pharmacologic Therapy	28-Day All-Cause	Terminated (Negative)
Sperry 2018	North America	Multicenter	Prehospital	Blunt and Penetrating	501	Intravenous Fluid	30-Day All-Cause	Positive
Vassar 1993	North America	Multicenter	Prehospital	Blunt and Penetrating	166	Intravenous Fluid	In-Hospital All-Cause	Terminated (Negative)

Figure 2

A. Expected



B. Observed

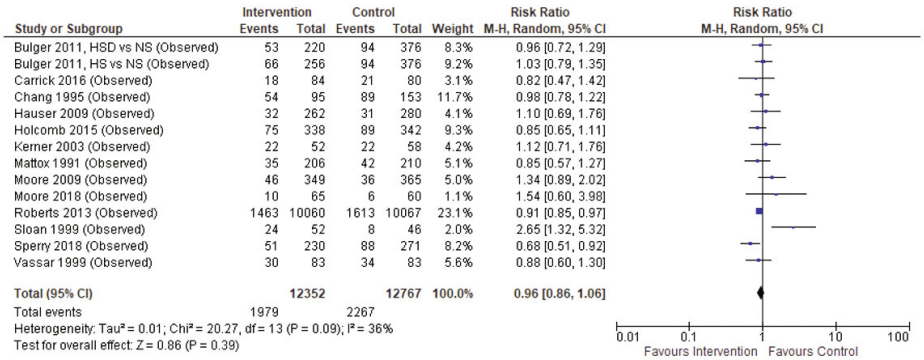


Figure 3

Methods for Determination of Optimal Positive End Expiratory Pressure: A scoping review

Submission ID

29

AUTHORS

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INTRODUCTION

Titration of positive end expiratory pressure (PEEP) is an important part of safe mechanical ventilation. Setting an appropriate PEEP can have many benefits including improved oxygenation and respiratory mechanics(1). Inadequate or excessive PEEP can have negative consequences such as barotrauma or atelectrauma(2). The method by which optimal PEEP is determined and titrated varies widely, and there is no consensus as to what defines optimal PEEP. Many methods for determining optimal PEEP have been assessed in clinical studies but only some have been tested by rigorous randomized trials. A clearly superior method of optimal PEEP determination has not been determined (3, 4). To better understand the methods of determining optimal PEEP, we used scoping review methodology to identify the methods of optimal PEEP determination that have been described, and the contexts in which they have been studied.

OBJECTIVES

In adults admitted to hospital undergoing invasive mechanical ventilation:
(1) Describe the strategies for determining optimal positive end-expiratory pressure that currently exist in the literature.
(2) For each method of determining optimal PEEP, describe the patient populations, settings, study designs, and outcomes (both clinical and physiological) that have been used.

METHODS

This review was conducted according to the PRISMA Extension for Scoping Reviews and was registered using Open Science Framework (https://osf.io/atzqc). Inclusion and exclusion criteria were developed using the recommended Population, Concept, Context framework. Articles selected for inclusion were primary research studies involving hospitalized adults undergoing invasive mechanical ventilation for any reason including acute respiratory distress syndrome, hypoxemic respiratory failure, or for a non-pulmonary indication. To be included, it was necessary for the article to evaluate a method of determining optimal PEEP and to measure a clinical or physiologic outcome associated with the setting of PEEP. The search was developed with an expert librarian, and was peer reviewed by a second librarian using PRESS methodology. Databases searched included MEDLINE, EMBASE, Web of Science, CENTRAL, and Scopus. Articles published up until December 2021 were included. All titles and abstracts were screened independently by two authors for eligibility of full text review. Disagreements about inclusion were resolved through discussion or with a third reviewer. Data were abstracted from included papers using a standardized data extraction form. Abstracted data included the method of PEEP determination, study setting, population, primary and secondary reported outcomes, study design, country or continent of origin, and funding source.

RESULTS

The search identified 9,596 unique citations, among which 217 articles met inclusion criteria (Figure 1). A total of 18 different methods of determining optimal PEEP were described (Table 1). Studies were either in an intensive care unit (ICU) or operating room (OR). The two most common study designs included observational (n=143;66%) and randomized controlled trials (RCTs) (n= 58;27%). Among the RCTs, 11 different methods of PEEP titration were tested. The two methods studied with the most RCTs were best compliance and use of PEEP-FiO_2 tables. The titration methods and the frequency with which they were studied changed over time (Figure 2). The majority of RCTs in the ICU had a clinical outcome as the primary endpoint (n=19;53%), and most RCTs in the OR had physiologic measures as the primary endpoint (n=17;77%). Among ICU RCTs, the most common clinical outcomes (primary or secondary) were ventilator-free days/duration of mechanical ventilation (n=28;78%) or mortality (n=27;75%).

CONCLUSION

Although 18 methods of determining optimal PEEP amongst mechanically ventilated patients were identified, only 11 have been tested with an RCT. The six most studied methods include best compliance, PEEP-FiO_2 tables, imaging-based, use of esophageal probe, oxygenation, and use of pressure-volume curves. The methods of PEEP titration studied have changed over time and have focussed on different outcomes. Studies of PEEP in the ICU have focused on duration of mechanical ventilation and mortality in contrast to studies in the OR which have focused on physiological outcomes. Several methods remain untested and should be considered for future RCTs.

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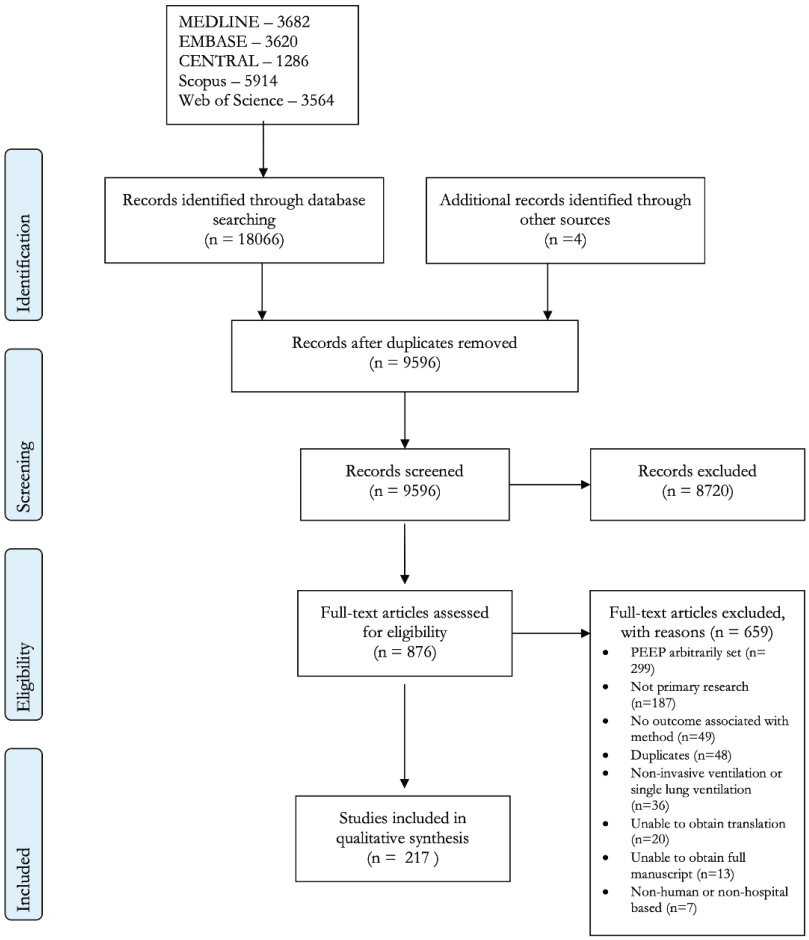

Figure 1 – PRISMA Flow Diagram

Method of determining optimal PEEP	Overall n (%)	Setting n (%)		Randomized controlled trials n (%)
		Intensive Care Unit	Operating Room	
All studies	217	181	36	58
Compliance	60 (27.6)	42 (23.2)	18 (50.0)	24 (41.3)
PEEP Table	44 (20.2)	44 (24.3)	0 (0.0)	20 (34.5)
Imaging-based	43 (19.8)	31 (17.1)	12 (33.3)	10 (17.2)
Esophageal Probe	37 (17.1)	30 (16.6)	7 (19.4)	10 (17.2)
Oxygenation	35 (16.1)	31 (17.1)	4 (11.1)	10 (17.2)
Pressure-Volume Curves	23 (10.6)	23 (12.7)	0 (0.0)	6 (10.3)
Shunt	10 (4.6)	10 (5.5)	0 (0.0)	2 (3.4)
Auto-PEEP	10 (4.6)	10 (5.5)	0 (0.0)	0 (0.0)
Plateau Pressure	9 (4.1)	9 (5.0)	0 (0.0)	2 (3.4)
Computer-Based	9 (4.1)	9 (5.0)	0 (0.0)	1 (1.7)
Driving Pressure	6 (2.8)	4 (2.2)	2 (5.6)	3 (5.2)
Dead Space	6 (2.8)	4 (2.2)	2 (5.6)	0 (0.0)
End expiratory lung volume/ Functional residual capacity	5 (2.3)	5 (2.8)	0 (0.0)	1 (1.7)
Intra-abdominal pressure	4 (1.8)	3 (1.7)	1 (2.8)	0 (0.0)
Stress index	3 (1.4)	3 (1.7)	0 (0.0)	0 (0.0)
Oxygen delivery	2 (0.9)	2 (1.1)	0 (0.0)	0 (0.0)
Airway opening pressure	2 (0.9)	2 (1.1)	0 (0.0)	0 (0.0)
Weight	1 (0.5)	1 (0.5)	0 (0.0)	0 (0.0)

Table 1 – Number of studies published by different methods of determining optimal PEEP. Stratified by study setting as well as how many randomized controlled trials for each method. Some articles study more than one method so the sum of all methods may be greater than the total.

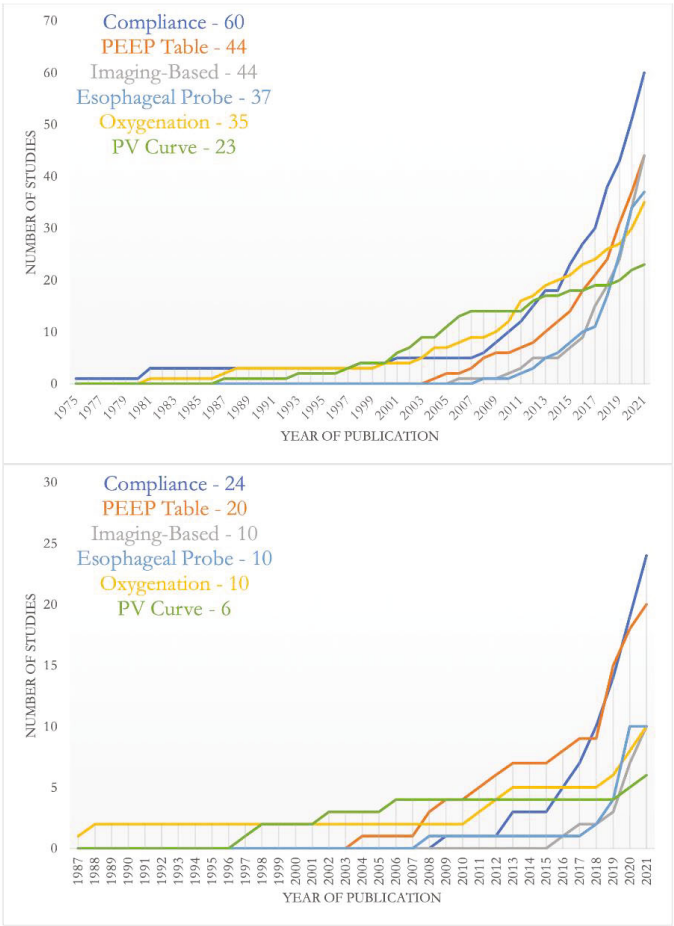

Figure 2 – Cumulative number of studies assessing methods of determining optimal positive er expiratory pressure published over time, stratified by method a) overall number of studies publ b) randomized controlled trials published

Monitoring Cessation of Circulation for Death Determination by Circulatory Criteria: A Systematic Review

Submission ID

100

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INTRODUCTION

Circulatory criteria are used for donation after circulatory determination of death (DCD). The current preferred method to confirm the absence of blood pressure in adult and pediatric Canadian guidelines is the absence of blood pressure via invasive arterial line monitoring (IAP).

OBJECTIVES

To synthesize the available evidence comparing non-invasive methods of measuring the cessation of circulation in patients who are potential organ donors undergoing death determination by circulatory criteria, to the current accepted standard of invasive arterial blood pressure.

METHODS

We searched (from inception until April 27, 2021) MEDLINE, EMBASE, Web of Science, and Cochrane Central Register of Controlled Trials. We screened citations and manuscripts independently and in duplicate for eligible studies that compared methodologies assessing circulation on patients who were monitored during a period of cessation of circulation. We performed risk of bias assessment, data abstraction, and quality assessment using Grading of Recommendations, Assessment, Development and Evaluation in duplicate and independently. We presented findings narratively.

RESULTS

We included 21 eligible studies (n = 1,383 patients). Meta-analysis was not possible due to study heterogeneity. We identified low-quality evidence from five indirect studies (n=226) showing pulse palpation is less sensitive and specific than IAP (reported sensitivity range 0.76-0.90, specificity 0.41-0.79). Isoelectric electrocardiogram (ECG) has excellent specificity for death (2 studies, 0%, 0/510), but likely increases the average time to determination (moderate quality evidence). We are uncertain whether point of care ultrasound (POCUS) pulse, cerebral near-infrared spectroscopy (NIRS) or POCUS cardiac motion are accurate tests for the determination of circulatory cessation (low to very low quality evidence).

CONCLUSION

There is insufficient evidence that ECG, POCUS pulse, cerebral NIRS, or POCUS cardiac motion are superior or equivalent to IAP for death determination by circulatory criteria. Isoelectric ECG is specific but can increase the time to determine death. POCUS techniques are emerging therapies with promising initial data but limited by indirectness and imprecision.

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None.

N95 Respirators for a Diverse Population of Healthcare Workers: A Mixed-Methods, Prospective, Pilot and Feasibility Study

Submission ID

50

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INTRODUCTION

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has had a global effect.[1] Although most of the transmission occurs by droplets, SARS-CoV-2 can be transmitted through virus-containing aerosols.[2] The use of N95 respirators reduces the risk of infection[3]; however, in the absence of standardized testing facilities, Canadian healthcare workers (HCW) had to rely on the United States (US) standards and respirators. In Canada, women represent 82% of HCWs, but most masks and respirators have been designed based on the anthropometrics of average men in the US and Europe.[4,5] In the absence of a tight seal, female HCWs and HCWs who do not fit the average male head and face, including individuals of different ethnicities, are at risk of contracting SARS-CoV-2. Thus, there is a knowledge gap on the effects of gender and ethnicity on the fit of N95 respirators and the implications of poor fit on the well-being of HCWs.

OBJECTIVES

Primary: Feasibility of a multi-center mixed-method study, with a sample size of 100, 50% of participants self-identifying as non-white and having at least one one of the following characteristics: religious head covering (e.g., hijab, turban), glasses and/or facial hair. Secondary: (1) Generate quantitative evidence on N95 fit using a PortaCount fit test, (2) describe participant-reported feelings on fit and breathability, and (3) evaluate the impacts of the pandemic and limited supply of N95's on a HCWs overall physical and mental well-being.

METHODS

This study was a mixed-method prospective pilot and feasibility study consisting of (1) a quantitative fit test and (2) a qualitative survey on N95 fit and comfort, as perceived by HCWs. The quantitative fit was assessed using a TSI PortaCount test and facial measurements of bizygomatic breadth and menton-sellion length. In parallel, a survey was administered to collect sociodemographic information, gauge the HCW's assessment

of N95 fit and comfort, and assess the impact of PPE- related challenges on the physical and mental well-being of HCWs.
Analysis. Primary: The sample size, the proportion of various HCWs, and the number of participants who completed both aspects of the study were reported using descriptive statistics. Secondary: The results of the quantitative fit test, as well as the domains assessed in the survey using Likert scales, were summarized using descriptive statistics. Additional patient-reported assessments were collated and presented to provide a comprehensive reflection of the feelings and attitudes of HCWs on the fit and comfort of respirators.

RESULTS

Following a study amendment to increase eligible sites, 37 of the 41 (90.2%) approached HCWs consented to participate, 36 of the 41 (97.3%) were successfully fitted, and all 36 completed the survey. Female HCWs who identified as non-White had the lowest mean fit factor. Differences in menton-sellion length and bizygomatic breadth were also observed between males and females and between white and non-White HCWs. When these values were assigned to the NIOSH bivariate panel, 27 of the 36 (75%) HCWs were out of range, 4 of the 36 (11.1%) were assigned to panel 6, 3 (8.3%) to panel 3, and 1 (2.8%) was assigned to panels 1 and 4 (Figure 1). On average, female HCWs reported lower scores in all measured domains, and most HCWs reported physical discomfort, and negative impacts on their psychological well-being, as a result of fit, availability, and prolonged use of N95s.

CONCLUSION

Despite the challenges of conducting research during COVID-19 pandemic, we've identified gender and ethnicity as key factors in the fit of N95 respirators and the negative implications of existing respirator designs on the well-being of HCWs. Future studies, including a larger mixed-method study, are necessary to inform evidence-based testing, and new Canadian standards for N95s. Specifically, future studies should (1) employ strategies for recruiting a truly diverse sample of HCWs, (2) include additional anthropometric measures, and (3) an exploration of factors such as occupation and duration of wear that may contribute to the fit and comfort of N95 respirators.

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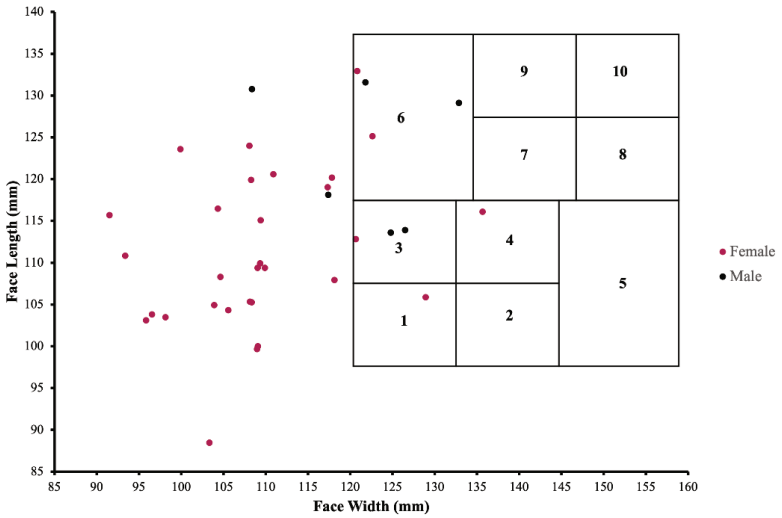

Figure 1

Neuro-COVID and What We Know About It

Submission ID

17

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INTRODUCTION

In 2019, a cluster of viral pneumonia caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was first reported. More than 30% of SARS-CoV-2 patients have persistent symptoms after acute illness, including neurological symptoms. Early in infection, nonspecific symptoms such as headache, light-headedness, and myalgias are common, as are more SARS-CoV-2 specific symptoms, anosmia, and dysgeusia. Recent studies have also shown that SARS-CoV-2 infection has been associated with cerebral changes. In a recent study, Douaud et al. showed SARS-CoV-2 infection is associated with long-term change in grey matter thickness, decrease in global brain size, and cognitive decline when compared with the control group[1]. Additionally, intensive care stay has been associated with a higher rate of new neuropsychiatric manifestations in SARD-CoV-2 patients. Moreover, compared to influenza patients, COVID patients have a higher risk of subsequent psychiatric or neurological diagnoses (Hazard Ratio: 1.44 (95% confidence interval, CI 1.40-1.47))[2].

OBJECTIVES

Cytokine storm syndromes (CSS) are disorders in which overactivation or dysregulation of the immune system results in systemic hyper inflammation and multiorgan injury. COVID CSS has been associated with a broad range of cerebral abnormalities, including white matter hyperintensities, hypoperfusion, and ischemic events, known as Neuro-COVID[3]. Multiple processes and mechanisms have been suggested for Neuro-COVID. This narrative review summarizes the current state of knowledge about the neuropsychiatric sequela of COVID, focusing on immunological and inflammatory mechanisms that contribute to Neuro-COVID.

METHODS

We searched the literature using the Medline, PubMed, and Cochrane Reviews databases for all papers published between 2019 and 2022 containing the following key terms: “neuro-covid” OR “neurocovid-19” OR “long-hauler covid-19”. The yielded papers were evaluated independently by two authors and selected if containing pertinence to

neuro-covid regarding one or more of the following areas: vasculopathy, blood biomarkers, CSF cytokines, chemokines, and immune studies, functional imaging, autopsy studies, animal models, anosmia/Dysgeusia, brain fog, Vaccine-induced thrombotic thrombocytopenia, and cerebral venous sinus thrombosis.
We excluded manuscripts written in languages other than English. Our senior author rated the studies and selected hundred forty-five studies for this narrative review. In this abstract, we summarize our narrative review.

RESULTS

Multiple studies support Neuro-COVID being a by-product of inflammatory response dysregulation rather than direct brain parenchymal viral invasion including: 1) The presence of virus in autopsy studies is variable regardless of patient's inflammation severity[4], 2) inflammatory markers, and in particular Interleukin (IL)-6 has consistently emerged as predictive biomarker in SARS-CoV-2 , 4) Markers of axonal damage are similar between Neuro-COVID and other cytokine dysregulation processes with similar neuropsychiatric sequeala[5]. In addition, data from cerebrospinal fluid (CSF) studies in Neuro-COVID showed increased permeability of the blood brain barrier. Given the immune privilege of the central nervous system (CNS) conferred by the blood-brain barrier, cytokine-mediated permeability of the blood-brain barrier is a likely key determinant of the immune environment of the CNS[1,3] and thus may play an important role in the neurological manifestations of COVID.

CONCLUSION

Several neuropsychiatric complications are associated with COVID-19, many of which seem more common than with other upper respiratory tract infections. This points to immune dysregulation playing a strong role in these manifestations. Research to date suggests that a combination of factors contribute to Neuro-COVID including, systemic vasculopathy, neurological complications of severe systemic illness and hypoxemia, iatrogenic effects of medications, increased blood brain barrier permeability and psychosocial impacts of disease. Over the following years, an effort to better quantify the incidence of neuro-COVID will be essential to our understanding of the disease and may be generalizable to other severe viral illnesses.

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Neuropsychological Sequelae of COVID-19 Critical Illness: A Prospective Observational Study

Submission ID

46

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INTRODUCTION

Patients who survive severe COVID-19 report a multitude of neuropsychological effects, often described as 'brain fog', that persist long beyond the period of acute illness.[1] Assessing neuropsychological deficits often requires administration of a series of tests by trained personnel in an office setting, which may be time-consuming, expensive and may hinder patient evaluation. The Cambridge Brain Sciences (CBS) is a widely used, web-based neurocognitive battery that assesses memory, verbal skills, and reasoning ability and can be self-administered by patients remotely. CBS has been administered in several large patient cohorts including critical illness survivors,[2,3] and has a large normative database (> 75,000) to enable sex- and age-matched comparisons of patients' performance.[4,5] An abbreviated version of this battery, the CBS-6, has been validated among survivors of critical illness.[2]

OBJECTIVES

We aimed to determine the feasibility of administering a web-based neuropsychological battery, the CBS-6, among patients who survived severe or critical COVID-19.

METHODS

We conducted a pilot, feasibility study at University and Victoria hospitals in London, Ontario. We recruited eligible adult patients => 18 years old that were admitted to the intensive care unit since March 2020 and survived hospitalization with severe or critical COVID-19 prior to enrolment. We excluded patients with pre-existing dementia, stroke, traumatic brain injury, visual or motor impairment that prohibits use of a computer/

tablet, inability to speak/read/understand English and lack of access to computer/ tablet connected to the internet.

After obtaining electronic informed consent, patients completed the 6-test version of the CBS (CBS-6)[5] remotely using a computer or tablet between 6 and 12 months after their COVID-19 hospitalization. Demographic and personal health information is recorded from participants from a telephone conversation and illness-related data is collected from patients' electronic medical charts. We defined cognitive impairment on each test as a raw score that was 1.5 standard deviations below age- and sex-matched norms from healthy controls. Patients' performance on each cognitive domain (short-term memory, reasoning skills, and verbal processing) was calculated using factor loading, a process where the z-score on a particular test is multiplied with a value reflective of the weight of a particular domain in that test.

RESULTS

Among 116 eligible patients, 56 were reached by telephone, and 40 agreed to participate in the study. However, only 35 patients completed the neuropsychological assessment. Of the 35 patients, we analyzed the neurocognitive performance of the 30 patients that completed the battery in full. Among these, 13 were women and the median age was 62 years (IQR = 48 - 74). We found that administration of the CBS-6 among survivors of severe or critical COVID-19 was feasible. Among 30 patients, 21 (70%) showed marked impairment on at least one test on the CBS-6 battery. On the cognitive domains, 18 (60%) had impaired verbal processing, 11 (36.7%) had impaired reasoning skills, and 8 (26.6%) had impaired short-term memory.

CONCLUSION

This study introduces a feasible approach to remote neuropsychological assessment among high-risk patients that adheres to physical distancing policies. We found that assessing neuropsychological function remotely is limited by follow-through among recruited patients. However, the administration of the remote battery was highly feasible, with rare technological challenges that were easily addressed through telephone guidance. Although our sample size was limited, the findings support the presence of long-term neuropsychological deficits among patients who survive COVID-19 and demonstrates a specific pattern of neurocognitive impairment. The findings of this study will inform future research to identify the natural history and therapeutic interventions to address this debilitating problem.

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Outcomes and Predictors of All-Cause Mortality in Adults Admitted to US Hospitals with Community-Acquired Pneumonia, 2006-2019

Submission ID

88

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INTRODUCTION

Community-acquired pneumonia (CAP) is a life-threatening lung infection and the most common cause of infection-related mortality globally. CAP is a widely heterogenous syndrome, with varying features depending on the patient and the type of infection. Because national estimates of precise outcomes from CAP are highly variable in the literature, we used the largest inpatient database in the United States, the National Inpatient Sample (NIS), to better quantify all-cause mortality and thrombotic complications, and to identify predictors of mortality.

OBJECTIVES

1. To determine the incidence of all-cause mortality, thrombotic complications, and respiratory failure (need for non-invasive positive pressure ventilation or mechanical ventilation) in patients admitted to hospital with CAP.
2. To identify independent risk factors for all-cause mortality in patients with CAP and with respiratory failure due to CAP.

METHODS

This was a retrospective cohort analysis. We identified adult patients admitted to hospital with CAP between 2006 – 2019 using the NIS, a federal, all-payer database representing 20% of all US hospitalizations. We defined a CAP admission as ICD-9 coding identifying a principal diagnosis of pneumonia (ICD-9-CM code 480-486, 487.0, 488.01, 488.81), or secondary diagnosis of pneumonia with a principal diagnosis of either respiratory failure (ICD-9-CM 518.81, 518.82, 518.84, 799.1) or sepsis (ICD-9-CM 038, 785.52, 995.91, 995.92). ICD-9 codes were converted to ICD-10 after the fourth quarter of 2015. A secondary cohort included only patients with CAP requiring non-invasive positive pressure ventilation (NIPPV) or mechanical ventilation (MV). We obtained patient demographics (age, sex, race, income quartile, pre-existing medical conditions) and hospital information (hospital type, rurality, size, and geographic region). The primary outcome was in-hospital all-cause mortality. Secondary outcomes included incidence of stroke, venous thromboembolism (VTE), pulmonary embolism (PE), myocardial infarction (MI), and respiratory failure (need for NIPPV or MV). A multivariate logistic regression model was constructed to identify patient characteristics predictive of in-hospital mortality. Variables in the model were selected a priori. A second multivariate logistic regression model was constructed to assess predictors of mortality in patients who required MV.

RESULTS

A total of 105,037,775 hospital admissions were screened, and 4,078,481 (3.8%) were included in the final analysis. In-hospital all-cause mortality was observed in 316,229 (7.8%). The overall incidence of MI, PE, VTE and stroke were 3.57%. 1.20%, 1.8%, and 0.72%. Use of NIPPV occurred in 7.02% of patients, and mechanical ventilation in 12.2%. In patients requiring NIPPV, overall incidence of MI, PE, VTE, and stroke were 6.8%, 1.7%, 2.6%, and 0.92%, respectively. In those requiring mechanical ventilation, the overall incidence of MI, PE, VTE, and stroke were 11.5%, 2.8%, 5.1%, and 2.9%.

The strongest independent predictors of mortality were the need for mechanical ventilation, need for NIPPV, solid organ malignancy, metastatic cancer, lymphoma, hepatic disease, and MI.

A total of 497,978 (12.2%) patients with CAP received mechanical ventilation. Of these, 154,520 (31.0%) died. The strongest independent predictors of mortality included metastatic cancer, liver disease, lymphoma, solid organ malignancy, and coagulopathy.

CONCLUSION

Mortality from CAP remains a significant risk. The incidence of thromboembolic complications (MI, PE, stroke, VTE) are increasing over time, likely owing to increased provider awareness, improved sensitivity of diagnostic tools, and enhanced screening protocols. Further studies are needed to better understand the impact of thomboinflammatory responses to CAP and their impact on mortality.

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N/A

Patient and Family Centered Care, Communication and Relationship Development in the ICU: A Scoping Review

Submission ID

92

AUTHORS

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INTRODUCTION

Communication in the ICU is difficult due to several ICU-specific factors: care complexity, number of healthcare providers involved, nature and pace of the decisions, and the emotional and physical toll of having a loved one in critical condition.[1] Connecting to, and building trusting relationships with, patients and their loved ones is an imperative skill for ICU clinicians that has been challenged by restrictive visitation policies in the COVID-19 pandemic, which has, in turn, amplified challenges faced by loved ones from rural and remote communities and those with competing commitments that keep them from being in the ICU.[1-3] Healthcare providers are creating new ways to include loved ones in patient care, such as video calls or virtual rounds.[4] However, technological solutions can be limited when loved ones do not have access to a functional and reliable device and/or internet connection.

OBJECTIVES

The purpose of this scoping review was to collect and synthesize information about patient and family centered care (PFCC), communication, and relationship development in the ICU. We further aimed to identify what communication technology is currently being used in ICU settings.

METHODS

We adopted an established framework for conducting a scoping review: identifying and refining the research question; identifying and selecting relevant studies; charting and

extracting themes and data; and collating, summarizing, and reporting the results.[5] The search was conducted between May and December 2021. Search terms constructed in OVID Medline were peer-reviewed by a health science librarian, then terminology and syntax were optimized for EBSCO CINAHL, EMBASE, and Web of Science. Sources were exported to Covidence - a review and synthesis software - for a three-stage asynchronous review by members of the research team. In the title and abstract screening phase, two researchers independently reviewed each source. If there was agreement between the two reviewers, the source either advanced to the full text review stage or was deemed irrelevant. In situations of disagreement, a third team member screened the source to resolve the conflict. The same process took place in the second stage where the full text was assessed for eligibility to be included in the scoping review. Rigor and trustworthiness of the scoping review were enhanced using qualitative thematic content analysis to extract themes, and by consulting with the multidisciplinary research team to confirm and contextualize the results.

RESULTS

59,101 sources were imported to Covidence, of which 13,805 were duplicates. The 45,296 unique sources have undergone a three-stage review process: a title and abstract screening resulting in 44,654 sources excluded using stringent inclusion and exclusion criteria; a resulting full text review of 551 sources with 110 sources meeting the inclusion criteria; and a thematic analysis of the 110 sources was completed by several research team members. Thematic analysis of these 110 sources resulted in 4 overall themes: Communication technology (12), End-of-life care complexities (13), Limitations to patient capacity for decision-making/communication (11), and Patient and family lived experience (74); the last theme includes relationships/interactions in the ICU.

CONCLUSION

This scoping review will provide a foundational understanding of communication technologies used in ICU settings and will support a larger research initiative that will use a Design Thinking process to envision future solutions in the ICU where technology supports trust, relationships, patient empowerment, PFCC, and three-way communication. Early insights are that the literature has largely focused on qualitative descriptions of elements of PFCC and relationship building, as well as the challenges of implementing these elements into routine ICU communication, rather than the testing of solutions. The complexity inherent to ICU communication may be a significant barrier to identifying, implementing, and testing solutions.

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Perceptions of End-of-Life Care on the Acute General Internal Medicine Wards: A Survey of Frontline Nurses

Submission ID

47

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INTRODUCTION

Despite the preference by most people to die at home[1], the majority of Canadians die in hospital[2]. Given the historical medical model focusing on cure, it can be challenging in hospital to provide comforting end-of-life (EOL) care that is person-centered, recognizing the inherent dignity of each individual. The 3 Wishes Project (3WP) is an intervention focused on honouring the lives and preferences of patients dying in the Intensive Care Unit (ICU)[3]. Building on this successful foundation, we recently expanded the 3WP to the General Internal Medicine (GIM) wards at our centre.

OBJECTIVES

Our overarching aim is to further enhance EOL care practices on the GIM wards, providing personalized, compassionate care to dying patients and their loved ones. The objective of this initial step in our multi-phase program was to understand from frontline GIM nurses, their perception of EOL care, learning needs regarding EOL care, and perceived barriers and facilitators to providing EOL care.

METHODS

Survey development was informed by 2 knowledge translation (KT) theories: 1) Capability-Opportunity-Motivation-Behaviour system (COM-B), which acknowledges the interaction of Capability (e.g., knowledge, skills), Opportunity (e.g., social influences, resources), and Motivation (e.g., intentions) for behaviour to occur[4], and 2) Theoretical Domains Framework (encompasses 14 behavioural domains)[5]. Each behavioural domain

links to Capability, Opportunity, or Motivation to identify factors that could influence behaviour. Item generation was informed by literature review and interviews with nurses, educators, managers, and physicians.

The instrument contained 84-items across 2 main domains (Knowledge and Practice; Delivering EOL Care) with 7 subsections. Most questions used 7-point Likert-type scales. We conducted pilot (n=7) and clinical sensibility (n=14) testing that suggested a 20-min completion time and generated feedback on face validity. In November 2021, we invited survey participation to GIM nurses. We analyzed and compared results by domain and COM-B attribute (i.e., sum of items contributing to Capability, Opportunity, and Motivation) using t-test or rank sum, and Kruskal-Wallis or ANOVA depending on data distribution. We also conducted an a priori subgroup analysis based on duration of practice (≤5 and >5 years). We evaluated items with median scores of <4/7 as barriers. Higher scores indicate fewer learning needs and barriers.

RESULTS

There were 144 nurses who completed the survey for a 61% response rate (**Figure 1**). Most were female (93%) with >5 years of experience (51%). Respondents had similar mean scores (standard deviation) in the Knowledge (76% (12%)) and Delivering Care domains (75% (9%)). Median scores [1^{st}, 3^{rd} quartiles] for Capability items were significantly higher than Opportunity (79% [68%,88%] and 74% [66%,82%], respectively; p=0.04). Nurses with >5 years' experience had significantly higher scores across domains and COM-B attributes compared to those with ≤5 years (p<0.05 for all; **Figure 2**). Barriers identified included challenging engagement with families having strong emotional reactions, handling goals of care conflicts between patients and families, and high staffing pressures. Additional resources requested were formal training, information binders, and more staff. While most respondents (83%) indicated that they would find debriefing opportunities helpful, only 26% participated in a debrief in the last year, mostly due to limited opportunities.

CONCLUSION

Frontline GIM nursing staff reported an interest in learning more about EOL care and identified several specific learning needs. They also shared important general and local barriers to provide optimal EOL care. Opportunities for future consideration included formalized on-the-job training, comprehensive and accessible information binders, and debriefing sessions. These survey results will inform specific KT interventions to help build capacity among bedside nurses and enhance EOL care practices for dying patients on the GIM wards.

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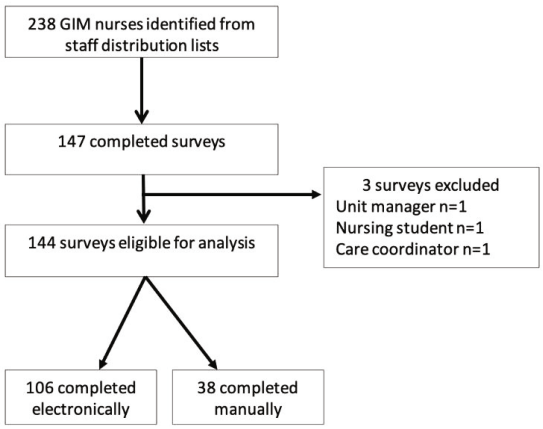

Figure 1. Flow diagram of survey participants.

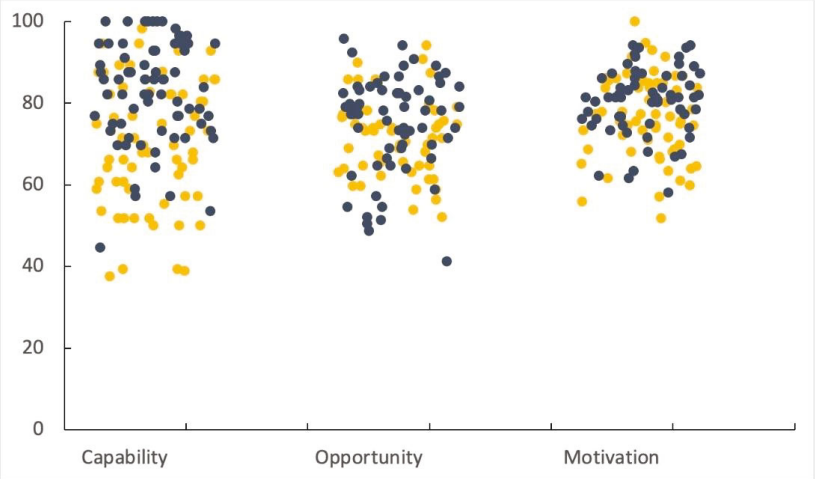

Figure 2. Distribution of respondents' median proportional scores for items contributing to Capability, Opportunity, and Motivation. Yellow represents scores for nurses with duration of practice ≤5 years; blue represents scores for nurses with duration of practice >5 years.

Protocol for a Scoping Review and Subsequent Mixed-Methods Analysis of Discharge Communication for Patients who are Discharged Directly home from the ICU

Submission ID

10

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INTRODUCTION

Communication between providers, patients, and their families are a key element of healthcare. (1,2) While many opportunities to communicate exist in healthcare, transitioning from an acute healthcare setting to the community requires clear, precise, and timely communication. (3) The quality and content of information shared between providers and patients can impact care outcomes and perspectives. Despite communication being critical during transitions in healthcare, it is performed inconsistently. Discharge from the intensive care unit (ICU) adds a layer of complexity, as patients transition from the highest level of care to ambulatory medical supports at home.

With direct discharge home (DDH) from the ICU occurring with greater frequency, we seek to understand the impact of communication between providers, patients, and their families on patient outcomes and satisfaction.

OBJECTIVES

Our scoping review will seek to consolidate the evidence on discharge communication for patients discharged directly home from the ICU. By gathering this evidence, we hope to better understand communication during ICU discharge, and how it may impact patient care. The steps taken and tools used when transferring patients' home will also be studied to evaluate the current standards of practice. In sum, we seek to evaluate how discharge communication given to providers, patients, and their families influences safe discharge to home from the ICU.

METHODS

Our scoping review will search MEDLINE, EMBASE, Google Scholar, and CINAHL for original research, research commentaries, and pre-print manuscripts. Furthermore, literature from recent international critical care conferences will be reviewed to capture research in progress. Included studies will focus on patients directly discharged from an ICU to home. Emphasis will be placed on verbal or written communication between providers, patients and their families. Our search strategy will include an initial pilot of 50 articles, with a further screening of texts for inclusion once that strategy has been confirmed. Once the articles have been selected for full text review, both qualitative and quantitative data will be extracted in order to develop a mixed-methods analysis. Data will be synthesized from this extracted data using a realist evaluation, whereby the information about communication will be framed as relationships using a series of contexts, mechanisms, and outcomes (CMOs) (5) Through these CMOs we will develop "middle-range theories", which will allow us to understand how communication influences patient DDH from the ICU.

RESULTS

Our scoping review is in the protocol submission phase, with data to be extracted this summer.

Our scoping review of communication methods used during DDH from the ICU will meet two needs in the current literature. The first is to generate a better understanding of how communication occurs between high acuity providers and the community. Previously, there has been sufficient room in the healthcare system to transition patients to lower levels of care in hospital before being discharged to the community. With the increasing stains on the healthcare system, there is an increasing need to understand how communication systems will adapt to allow safe transitions home from the ICU.

Second, is to generate further discussions around communication practices in the ICU. We believe the themes generated from this work may lead to further quality improvement projects in our healthcare system that will improve patient, family and provider safety and satisfaction.

CONCLUSION

This scoping review of discharge communication home from the ICU seeks to provide information on how to obtain safer outcomes for patients. Following this scoping review, we hope to pursue quality improvement initiatives that address any gaps seen for patients following DDH from the ICU and to develop recommendations.

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RecruitmEnt Assessed by eleCtRical Impedance Tomography (RECRUIT study): A Multicentre Study

Submission ID

115

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INTRODUCTION

Defining the potential for lung recruitment is a crucial aspect of safe PEEP selection in mechanically ventilated patients, but no valid method exists to define the best PEEP.

OBJECTIVES

By using electrical impedance tomography (EIT), we aim to quantify recruitability and determine the potential beneficial and harmful physiological effects of PEEP in patients with COVID-19 related acute respiratory distress syndrome (ARDS).

METHODS

In this observational study from the PLUG group (NCT04460859) COVID-19 patients with moderate-severe ARDS were enrolled within the first week of ARDS diagnosis. EIT recordings, ventilator data, hemodynamics and arterial blood gases were obtained

during lung (de)recruitment maneuvers. PEEP was set to 6, 16 and 24 cmH_2O for 5-min per step, after which a decremental PEEP titration from 24 to 6 cmH_2O (steps of 2 cmH_2O) was performed. Recruitment-to-inflation (R/I) ratio was assessed with a single-breath maneuver during a 16 to 6 cmH_2O PEEP drop, and an EIT-based R/I ratio was calculated for these same breaths. Lung collapse, overdistension and compliance were calculated for each step. We determined the PEEP level at the intercept of the relative overdistention and collapse curves during a decremental PEEP trial (ref.1). Recruitability was defined based on the amount of recruitable collapse when increasing PEEP 6 (start protocol) to PEEP 24 cmH_2O, further referred to as $\Delta Collapse_{6\text{-}24}$. To facilitate the presentation, patients were defined as lower, medium or higher recruiters based on the tertiles of $\Delta Collapse_{6\text{-}24}$. Differences in parameters between groups were assessed with the Wilcoxon rank sum test or per a linear mixed effects model for continuous parameters to test for the interaction effect of PEEP and group.

RESULTS

108 COVID-19 patients were enrolled. Patients with $\Delta Collapse_{6\text{-}24}$ <25.3%, between 25.4–39.6%, or >39.6% were categorized as lower, medium, or higher recruitability. Higher recruitable patients were younger and had higher BMI, but did not differ in ARDS severity on ICU admission (Table 1). R/I ratio correlated with the $\Delta Collapse_{6\text{-}24}$ ($r=0.52$, $p=0.001$). Collapse and overdistention during the decremental PEEP trial for the groups is shown in Fig.1, resulting in different optimal PEEP levels as per the crossing point: 10 [7.5; 13.5] vs. 13.5 [12; 15] vs. 15.5 [13.8; 17] cmH_2O for patients with lower vs. medium vs. higher recruitability, respectively ($p<0.05$). At the crossing point, the amount of collapse and overdistention, and respiratory mechanics were similar between groups, with medians for collapse and overdistention below 5% and 10%, respectively (Table.1).

CONCLUSION

Recruitability varies widely among COVID-19 patients; most do not require very high PEEP levels. EIT seems useful to identify recruitability and to support selecting a personalized PEEP.

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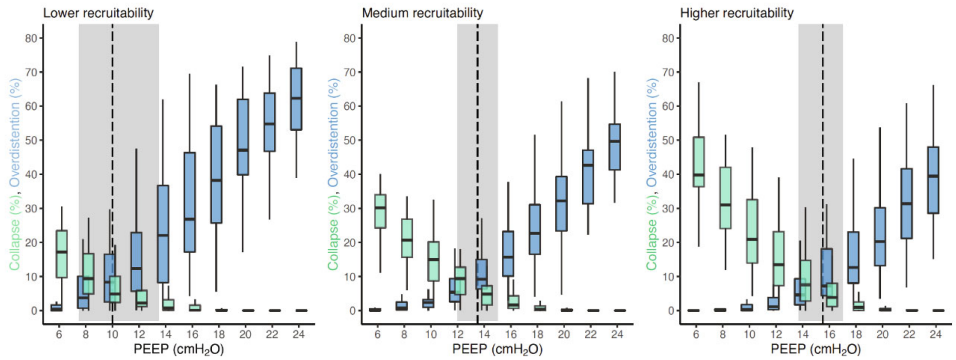
Table 1. Characteristics of recruiters and non-recruiters, and their response to increases in PEEP

	Lower recruitability (n=36)	Medium recruitability (n=36)	Higher recruitability (n=36)	p-value
Patient characteristics				
BMI, kg/m^2	28.4 [24.8; 31.5]	30.1 [26.6; 31.9]	32.9*# [27.2; 39.4]	0.0134
Age, years	65 [57.6; 70]	61 [54; 65]	55* [46; 63.5]	0.0051
PaO_2/FiO_2, ICU admission	113 [97; 134]	120 [100; 142]	113 [99; 141]	0.9070
Recruitability				
Ventilator-based R/I ratio	0.59 [0.43; 0.75] (n=30)	0.82 [0.54; 0.95]* (n=34)	0.83 [0.68; 1.04]* (n=29)	0.0034
EIT-based R/I ratio	0.79 [0.59; 1.02] (n=23)	0.92 [0.83; 1.10] (n=30)	1.08 [0.95; 1.35]* (n=22)	0.0026
$\Delta Collapse_{6\text{-}24}$, %	16.9 [11.1; 22.2]	32 [27.3; 34.9]	46.4 [42.5; 51.6]	<0.001
PEEP titration				
Costa PEEP level (cmH_2O)	10 [7.5; 13.5]	13.5* [12; 15]	15.5*# [13.8; 17]	<0.001
Mechanics at Costa PEEP level				
Crs, ml/cmH_2O	29.2 [24.4; 38.4]	37.4 [28.2; 46.6]	35.6 [30.8; 39.5]	0.054
ΔPaw, cmH_2O[1]	8.2 [7.5; 9.7]	8.6 [7.1; 10.1]	8.4 [7.1; 10.9]	0.923
Collapse, %	4.8 [3.1; 7.2]	6.0 [4.4; 7.3]	4.5 [3.2; 5.8]	0.216
Overdistention, %	8.3 [4.9; 9.9]	8.0 [7.0; 10.1]	6.3 [4.8; 7.9]	0.053

Values are presented as median with interquartile range [IQR]. [1] p-value for the interaction effect of PEEP level x group, as assessed per a linear mixed effects model. Abbreviations: Crs, respiratory system compliance; EIT, electrical impedance tomography; FiO_2, fraction of inspirated oxygen; ICU, intensive care unit; PaO_2, partial arterial oxygen pressure; ΔPaw, airway driving pressure (calculated from Crs and the set tidal volume); PEEP, positive end-expiratory pressure; R/I ratio, recruitment-to-inflation ratio

Figure 1 - Collapse and overdistention during PEEP trial and comparison of crossing point



Social Determinants of Sepsis: A Case-Control Chart Review

Submission ID

51

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INTRODUCTION

Sepsis, defined as organ dysfunction from a dysregulated host response to infection, is a significant cause of morbidity and mortality worldwide.[1] In 2017, an estimated 48.9 million incident cases and 11 million sepsis-related deaths were reported worldwide, representing approximately 20% of all global deaths.[2] Additionally, the overwhelming importance of social determinants of health (SDoH) to human health is increasingly understood: an American study using national data from 2001 showed that avoidable factors associated with low educational status accounted for almost half of adult deaths.[3] Similarly, the Code Red Project, an initiative to explore the effect of SDoH in Hamilton has demonstrated decade-long inequities in health outcomes between neighbourhoods.[4] Despite this, evidence on the impact of SDoH on sepsis specifically is sparse. To address these disparities and reduce the burden of sepsis to patients and the healthcare system, high-quality and rigorous methods are needed to identify sepsis and collect SDoH data.

OBJECTIVES

The purpose of this study was to explore the effects of clinical and social factors on the development of sepsis. Specifically, we sought (1) to identify whether social determinants of health, including residence in a Code Red zone, affect sepsis development among patients presenting to the emergency department (ED); and (2) to investigate differences in sepsis development and outcomes, based on Code Red residence, among ED admissions relative to the total population in Hamilton.

METHODS

This study was a retrospective case-control study of adults who presented to a large academic tertiary care hospital in Hamilton, Ontario, over a 6-month period. This study is a secondary analysis of a prospectively identified database of consecutive patients admitted to a hospital; however, the current study only included patients admitted to the ED. Population estimates were calculated based on 2016 Canadian census data to reflect clinical data from patient charts. Septic cases, defined as patients presenting with

an infection and 2 of 3 qSOFA criteria or an admitting diagnosis of sepsis, were identified from the prospectively collected dataset. Non-septic controls were collected in a 2-to-1 ratio. Demographic data, presenting symptoms, triage vitals, medical history, and SDoH data, including smoking status, presence of alcohol disorder, and amount of social support, were collected, independently and in duplicate. T-tests and chi-square tests were used to assess continuous and categorical data, respectively. Multivariate logistic regression was used to examine the association between clinical and social factors and sepsis. Lastly, the proportion of patients who presented to the ED from within and outside the code red zone was compared to census population data. All analyses were performed in SAS version 9.4 (SAS Institute).

RESULTS

Of the 7156 patients in the initial dataset, 100 randomly selected septic patients and 200 non-septic patients were included. On average, the septic group had fewer females (45% vs 55%) and were older (median: 75 vs 72). Multivariate logistic regression demonstrated that sepsis was associated with arrival by ambulance (85.00% vs 68.50%, p=0.0021), and inversely correlated with having a family physician (92.93% vs 98.49%, p=0.0120), and dyslipidemia (42.42% vs 56.50%, p=0.0219). As the regression analysis only compares the relative likelihood of sepsis compared to another ED diagnosis, population-level analyses were performed. Patients living in Code Red neighborhoods were 1.81 times more likely to be an ED patient (32.33% vs 17.90%) **(Figure 1),** 1.79 times more likely to have sepsis (32.0% vs 17.9%), and 2.23 times more likely to die of sepsis. Despite these findings, there were several inconsistencies, in the reporting and availability of SDoH data in patient medical charts.

CONCLUSION

In this secondary analysis of patients presenting to an ED, we demonstrated that a disproportionate number of Hamilton residents living in the Code Red zone presented to the ED and had an increased burden of sepsis and other conditions overall. The negative associations between having a family doctor and developing sepsis suggest that access to primary care may mediate the risk of developing sepsis. Given the high mortality rate of sepsis, there is an urgent need to collect SDOH data and use this information to reassess current practices and improve sepsis management.

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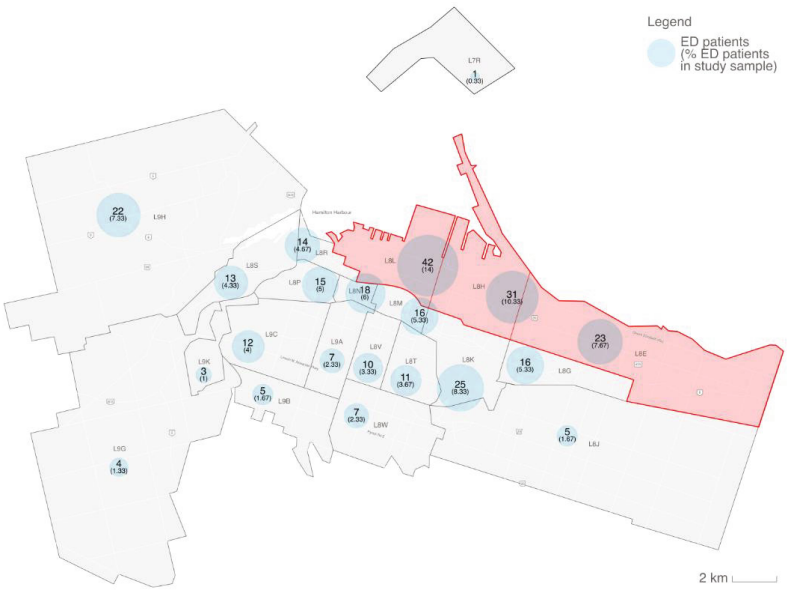

Figure 1

Sociodemographic Disparities in Paediatric Out-of-Hospital Cardiac Arrest - A Systematic Review

Submission ID

72

AUTHORS

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INTRODUCTION

Paediatric out-of-hospital cardiac arrest (POHCA) has an estimated incidence of 8 per 100,000 person-years, and only 6-10% of children are expected to survive to hospital discharge. Shorter emergency medical service (EMS) response times, bystander automated external defibrillator (AED) use and bystander cardiopulmonary resuscitation (CPR) can increase the likelihood of survival with neurologically favourable outcomes, yet recent evidence suggests that the provision of these services is not equitable in all communities.

OBJECTIVES

We conducted a systematic review of the available evidence on sociodemographic factors associated with POHCA incidence, bystander CPR provision, bystander AED administration, survival and neurological outcome.

METHODS

This review was completed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. We systematically searched MEDLINE, EMBASE and Web of Science from database inception to October 2022. The data abstraction process was completed independently by a pair of reviewers. The risk of bias assessment was completed using the National Heart, Lung, and Blood Institute (NHLBI) tool for observational cohort and cross-sectional studies.

RESULTS

The search retrieved 11,763 articles of which 19 met the eligibility criteria. All included studies were ranked as having low to moderate risk of bias. The sociodemographic variables reported include individual or neighborhood-level race, ethnicity and socioeconomic status (SES). The majority of included studies were conducted in the United States (12 out of 19). There were 4 studies on POHCA incidence, 4 on bystander

CPR provision, 3 on bystander AED administration, 14 on survival, and 6 on neurological outcome. In all studies on POHCA incidence, significant differences were found across racial groups with minority populations being disproportionately impacted. Evidence on the association between POHCA incidence and SES was lacking. Bystander CPR provision was consistently associated with individual race and ethnicity, as Black and Hispanic children had a significantly lower likelihood of receiving CPR as compared to white children. The association between bystander CPR provision and SES was variable. There was little evidence of socioeconomic or racial disparities in studies on bystander AED administration, POHCA survival and neurological outcome.

CONCLUSION

Race and ethnicity may be associated with bystander CPR provision and POHCA incidence, however further research is needed to ascertain these findings. The limited literature supports the need for increased inquiry and standardization of outcome reporting to identify high-risk subgroups to target for prevention and public health intervention.

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N/A

TabNet Classifier: A new Neural Network Model for Identifying Acute Kidney Rejection for Deceased Donors

Submission ID

125

AUTHORS

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INTRODUCTION

Recently numerous studies show the superior performance of Deep neural networks (DNN) over decision tree based models for predicting patient clinical outcomes such as predicting time of death in intensive care units (ICU). While decision tree based models can rank the importance of observed covariates per population,Tabnet can rank observed covariates per individual. 1 The reported rank of observed covariates can make trust bonds as well as improving the quality of healthcare services by attending the reported covariates. In this study, we seek to use Tabnet, a new class in DNN models proposed by Google to identify acute kidney rejections in the first 6 month for deceased donors.

OBJECTIVES

We aim to show that TabNet not only has a higher prediction performance than other models but also can rank observed covariates per individual as well as a studied population.

METHODS

Our aim was to use Tabnet to identify the most important deceased covariates related to acute kidney rejection in the first 6 months. We used 269,136 matched deceased kidney donors with recipients from the United Network for Organ Sharing (UNOS) dataset between 1987 and 2022. Using 80% patients for training and 20% for testing, the Tabnet classification model was trained and tested to identify if a graft failed up to 6 months as an early rejection or after 6 months. There were 27024 patients whose kidneys failed before 6 months. We selected 110 different covariates from both organ donors and recipients. The goal was to let models freely select the most important covariates from donors and recipients which maximise their estimation performance regarding graft

failure prediction. As Tabnet ranks importance of covariates per individual, we aggregate the reported covariate importance for all patients to form the rank of covariate importance for early kidney rejection donated by deceased donors. We used the XGBoost model, a decision tree based model, to compare the performance Tabnet classification prediction. The same dataset with same training and testing splits used to train the XGBoost model.

RESULTS

We used accuracy, precision, and recall as reference metrics for comparing the prediction performance of Tabnet and XGBoost models. Tabnet performance metrics were recall=0.99, precision=0.83, and accuracy=0.83 whereas XGBoost performance metrics were recall=0.86, precision=0.80, and accuracy=0.70. The performance of two other famous decision based models, namely LightGBM and CatBoost, were almost identical to XGBoost. The trained Tabnet model showed superior performance over the trained XGBoost model. Comparing the top 30 percentile of ranked covariates showed that 7 out of 9 covariates identified by Tabnet are exclusively related to donors whereas only 1 out of 7 covariates identified by XGBoost.

CONCLUSION

Tabnet shows a superior performance over decision tree models for identifying acute kidney rejection in the first 6 months. Once deployed as a medical tool, Tabnet also can identify the rank of observed covariates per individual as a priceless insight for healthcare professionals.

In our study, Tabnet identifies that the top 30 percentile of ranked covariates are mostly related to deceased donors. Among the most important donor covariates identified by Tabnet are various donor infections and donor cancer history. The 2 other nonexclusive donor covariates were recipient ethnicity and A2A2B eligibility identified by XGBoost as well.

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The Effect of Dehydration, Hyperchloremia and Volume of Fluid Resuscitation on Acute Kidney Injury in Children Admitted to Hospital with Diabetic Ketoacidosis.

Submission ID

35

AUTHORS

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INTRODUCTION

Acute kidney injury (AKI) is an increasingly recognized comorbidity in pediatric diabetic ketoacidosis (DKA). The unique physiology of DKA makes dehydration assessments challenging, and these patients potentially receive excessive intravenous fluids (IVF). However, no study has previously examined the impact of true dehydration and fluids on the etiology and severity of AKI.

OBJECTIVES

To determine the effect of true dehydration, IVF over-resuscitation and hyperchloremia on AKI in DKA.

METHODS

Design, Setting, Participants: Retrospective cohort of all DKA inpatients at a tertiary pediatric hospital from 2014-2019. 145 children were included; reasons for exclusion were pre-existing kidney disease or incomplete medical records. Data collection occurred January 2019–December 2021, data analysis December 2021–March 2022.

Main Outcomes and Measures: AKI was determined by change in creatinine during admission, and comparison to a calculated baseline value. Linear regression multivariable analysis was used to identify factors associated with AKI. True dehydration was calculated from patients' change in weight, previously validated in this population. Fluid over-resuscitation was defined as total fluids given above their true dehydration level.

RESULTS

19% of patients met KDIGO serum creatinine criteria for AKI on admission. Only 2.4% had AKI on hospital discharge. True dehydration and high urea levels were significantly associated with high creatinine levels on admission ($F=4.23$, $p=0.042$; $F=88.29$, $p<0.001$

respectively). IVF over-resuscitation and hyperchloremia were significantly associated with delayed renal recovery (F=13.284, p <0.001). Severity of initial AKI was significantly associated with development of cerebral edema (F=5.735, p=0.018).

CONCLUSION

This study is the first to report specific clinical risk factors for the development of AKI in DKA. AKI on admission was associated with the degree of dehydration and impaired level of consciousness. Delay to recovery was associated with excessive IVF treatments and hyperchloremia, identifying potential modifiable clinical variable for earlier AKI recovery and reduction in long-term morbidity. This highlights the need to readdress fluid protocols in children admitted with DKA.

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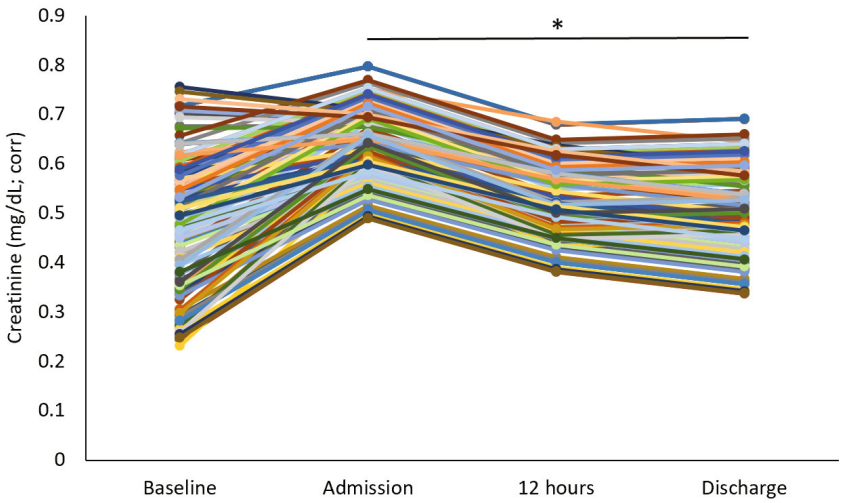

Figure 1

The Experiences of Healthcare Professionals in Providing Care to Unvaccinated Covid-19 Critically-Ill Patients: A Qualitative Study.

Submission ID

54

AUTHORS

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INTRODUCTION

The Covid-19 pandemic has placed immense pressure on healthcare systems and resulted in unprecedented challenges for practitioners[1,2]. Operating with limited resources, working in understaffed environments due to high healthcare worker attrition rates, being redeployed to new areas of medicine, and striving to treat critically ill patients with respiratory failure has left many practitioners with burnout, compassion fatigue and moral distress[1-3]. Certainly, vaccines against Sars-CoV-2 introduced a sense of hope for an end to the pandemic for many working in healthcare environments, and while vaccination has been instrumental in reducing viral transmission, it has simultaneously been accompanied by public resistance against vaccination mandates[4]. This resistance has subsequently placed additional pressure on frontline healthcare workers[4]. Providers have faced new challenges providing care to unvaccinated patients with severe, yet potentially preventable, respiratory failure. Our study explores the experiences of clinicians caring for unvaccinated patients admitted with Covid-19 infections in the intensive care unit.

OBJECTIVES

The objective of our study was to qualitatively explore the experiences of healthcare providers caring for unvaccinated patients with moderate to severe Covid-19 infection in the intensive care setting. Through semi-structured interviews, we aimed to examine the attitudes, emotional responses and perceived obligations of trainees and healthcare professionals, and to explore how managing severe, potentially preventable illness impacts the healthcare team personally and professionally. The data collected may provide insight into unique moral or ethical challenges faced by healthcare workers in their duty to provide high quality care to patients, and may help to inform the

professional navigation of similar situations. This may lead to the development of future educational and continuing professional development initiatives that focus on moral distress, compassion fatigue and burnout in relation to providing care for patients with preventable illness, potentially identifying opportunities to better support healthcare practitioners and trainees during future healthcare crises.

METHODS

This constructivist grounded theory[5] study used semi-structured interviews to develop a theoretical framework for how healthcare workers experience and navigate the provision of care for severely ill unvaccinated patients with Covid-19. We used purposive and convenience sampling of nurses, physicians, fellows, residents, respiratory therapists, and allied health practitioners in the intensive care units at Mount Sinai, Sunnybrook, and North York General Hospitals in Toronto, ON. Interviews were transcribed and coded, and data was analyzed using grounded theory methods. Constant comparisons within/between individual interviews, and within/between institutions assisted in identifying predominant themes that informed the development of the overarching theoretical framework. Research Ethics Board approval was obtained through participating institutions. Our research team consisted of seven co-investigators with expertise in qualitative methodology, research examining moral distress in healthcare, medical education, bioethics and anthropology. Research meetings between team members were conducted regularly to analyze data, modify the semi-structured interview guide to explore emerging themes, and develop the theoretical framework. Reflexivity was employed at each stage of project development and execution to maintain rigor.

RESULTS

At the time of submission, twenty one interviews were conducted. Participants consisted of attending physicians, registered nurses, critical care fellows, respiratory therapists, residents, social workers and physiotherapists. Unanimously, respondents upheld a strict ethical responsibility to provide standard of care for all Covid-19 patients, regardless of vaccination status. While the vaccination status was often included in case presentations and handovers, providers believed it was most relevant in understanding the likely trajectory of illness. Emotional responses towards patients ranged from anger and frustration due to the preventable nature of illness to sadness and hopelessness due to the severity of respiratory failure. Often social media misinformation and public health handling of vaccination campaigns was blamed for the vaccination status. Many recognized their own biases towards unvaccinated patients, which was driven by patients' resistance to other therapeutics and mistrust in healthcare, burnout, personnel shortages, and feeling underappreciated by the public. Biases were actively suppressed and compartmentalized during patient and family interactions to preserve therapeutic relationships.

CONCLUSION

Intensive care practitioners experience a range of emotions providing care to unvaccinated Covid-19 patients, manage their own biases during patient and family interactions to preserve therapeutic relationships, navigate resistance towards vaccination and other Covid-19 therapeutics proposed to treat illness, and have noted a shift in public appreciation towards healthcare workers during the pandemic. Despite these challenges, the perceived ethical and moral obligations of providers remained constant regardless of vaccination status. While coping with burnout, emotional exhaustion and fatigue, ICU providers maintain strict and proactive adherence to the highest standard of care while navigating complex interactions with unvaccinated Covid-19 patients and their families.

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The Impact of Donor Heavy Smoking History on Their Vascular Events Occurrence and Acute Rejection of Graft After Transplant in Recipients.

Submission ID

126

AUTHORS

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INTRODUCTION

Chronic kidney disease (CKD)is aggravated by active smoking due to vascular production of reactive oxygen species, which results in endothelial dysfunction or a decrease in the glomerular filtration rate. CKD patients who are active smokers have a higher incidence rate in dialysis units, which, after a while, may end up waiting on the waiting list for a kidney transplant.(1-2) Many studies have shown that cigarette smoking can negatively impact the outcome of a kidney transplant. It is shown that there exists a strong correlation between post-kidney transplant cardiovascular disease and cigarette smoking. Therefore, smoking cessation prior to a kidney transplant is strongly recommended among recipients and donors. (3)Moreover, numerous other risk factors may contribute to kidney transplant outcomes. To explore the most effective clinical variables affecting transplant outcomes, humans can benefit from Deep Neural Network (DNN) models, which enable them to find a complex interaction among clinical variables with high precision.

OBJECTIVES

The first objective of the present study is to determine the most significant clinical measurements impacting organ failure among heavy smoker and non-heavy smoker organ donor groups. Our second objective is to take advantage of DNN models to observe if there are meaningful differences among the most significant measurements that affect early and late organ failure.

METHODS

TabNet is a DNN model designed for performing classification and regression tasks on tabular data. It takes advantage of the transformer architecture, and, similar to decision

trees, comprises a few sub-networks that perform a hierarchical decision-making process. The feature transformer network of TabNet allows the model to single out and rank the most important measurements per each individual prediction. Therefore, this model offers some levels of individualized interpretability that cannot be obtained from tree-based models like XGBoost and many DNN models. In addition, a DNN model like TabNet can learn complex relationships between covariates that shallow tree-based models cannot. We trained three TabNet classifiers for predicting organ failure before six month, one year and three year time horizons on the United Network for Organ Sharing (UNOS) dataset with a subset of 49841 matched deceased kidney donors with recipients. We then tested the trained binary classifiers on two groups of 2043 heavy smoker donors and 2789 non-heavy smoker donors and observed the significant measurements indicated by the models for each group and each classification horizon.

RESULTS

The average time of organ failure for the heavy smoker donor group is above 63 months, while it is up to 71 for non-heavy smoker donors. CARDARREST_NEURO and DIURETICS_DON are the two most important covariates TabNet pays attention to for its decision-making for 6-month, 1-year and 3-year organ failure classifications for the heavy smoker donor group. However, the first two covariates for the non-heavy smoker group are CONTIN_CIG_DON and CARDARREST_NEURO, respectively. CONTIG_CIG_DON does not appear among the top covariates of the heavy smoker group in any classification horizon. However, CONTIN_COCAINE_DON is present among the most crucial list for this group. This could show that the model has learned a relationship between the recent smoking history of donors and their substance usage history. While HIST_CIG_DON maintains its position among the important covariates of the non-heavy smoker group across all classification horizons, its importance is diminished in the heavy smoker group for 1-year and 3-year classification horizons.

CONCLUSION

This study highlights the importance of recent smoking history in occurrence of different vascular disease such as Cardiovascular causing death or cerebrovascular events causing brain death, in non- heavy smokers over heavy smokers. In the light of their underlying vasculopathy, they are more prone to cocaine-induced vascular events. Overall, the heavy smoker group has an overall higher risk of atherosclerotic and hypertensive vascular disease rates. Rate acute rejection is much higher in the first six months in the heavy smoker group.

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The Role of Hemodialysis Prior to Operation in Reducing Peri-Operative Hypertensive Urgencies in Chronic Kidney Disease and End Stage Renal Disease (CKD/ESRD) Patients at University Health Network (UHN) Hospitals

Submission ID

124

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INTRODUCTION

There has been an increase in the number of patients suffering from Chronic Kidney Disease or End-Stage Renal Disease (CKD/ESRD) during perioperative periods in recent decades. Subgroups of CKD/ESRD patients undergoing surgery have a substantial risk of perioperative hypertension (HTN). The most common etiologies of perioperative hypertension in ESRD and CKD patients include: preexisting uncontrolled hypertension and volume overload, medication withdrawal, generous intraoperative IV fluid therapy (IVF), renovascular compromise, or the use of vasoactive medications. (1-4)

OBJECTIVES

The purpose of this study was to evaluate the effect of hemodialysis prior to surgery on perioperative hypertensive urgency. We compared the rates of hypertensive urgency in patients who received hemodialysis preoperatively with those who did not receive hemodialysis.

METHODS

A retrospective observational study using data between 2015 and 2019, found 295 patients who had noncardiac surgery with perioperative hypertensive urgency. Among those patients, 109 (37%) patients had CKD/ESRD. Their charts were reviewed to analyze the etiology of peri-operative hypertension urgency.

RESULTS

Our preliminary results are suggestive of signs of postoperative hypertension in 64% of CKD/ESRD patients. Pre-operative dialysis within one day of surgery was arranged only in

11% of ESRD patients. Acute coronary events preceded HTN in 13% of cases. Pre-op uncontrolled HTN was found in 67% of cases.

1- percentage of CKD/ESRD received hemodialysis one day prior to surgery (group 1)

2- Overall rate of pre-operation HTN in group 1 vs group 2

3- Prevalence of pre op HTN, intra op HTN, post op HTN estimation:

(group 1= 11.9% , 15.4% , 20.2%)

(group 2= 24.8% , 9.9% , 39.8%)

Those who did not receive dialysis one day prior to surgery, can have volume overload.

CONCLUSION

Peri-operative Hypertension in CKD/ESRD patients associated with hypertensive urgency and vascular event was seen in a relatively significant number of patients. Adequate hemodialysis and hypervolemia prior to surgery is critical in preventing HTN crises and perhaps its complications. More frequent and prolonged sessions of hemodialysis in terminal CKD and ESRD individuals preoperatively could optimize the volume status and stringent fluid management during surgery for such patients.

This abstract is based on preliminary data.

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Therapeutic Drug Monitoring to Personalize Liposomal Amphotericin B Treatment in a Pediatric Patient on Extracorporeal Membrane Oxygenation: A Case Report

Submission ID

104

AUTHORS

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INTRODUCTION

Amphotericin B is first line treatment for pulmonary blastomycosis.[1,2] Previous reports found inadequate exposure to liposomal amphotericin B due to potential sequestration in extracorporeal membrane oxygenation (ECMO) circuits.[3-10] There is a lack of evidence to support routine use of therapeutic drug monitoring (TDM) of amphotericin B.

OBJECTIVES

We report the use of TDM of liposomal amphotericin B in an adolescent with pulmonary blastomycosis cannulated to veno-venous ECMO in order to assess drug sequestration to the circuit and evaluate treatment efficacy.

METHODS

Six days following liposomal amphotericin B dose increase from 5 to 7.5 mg/kg/dose IV daily and on Day 11 of ECMO, plasma amphotericin B concentrations were collected pre- and post-ECMO membrane at Hours 0 (prior to start of drug infusion), 2 (at end of infusion), 3, 8, 14 and 24 and assayed using high-performance liquid chromatography. Pharmacokinetic and pharmacodynamic parameters were estimated by a classical compartment model and non-compartment analysis.

RESULTS

The maximum amphotericin B concentrations (C_{max}) (96.24 mcg/mL and 90.03 mcg/mL) and 24-hour area-under-the-concentration-time curve (AUC) (625 mcg*hr/mL and 616

mcg*hr/mL) were similar pre and post-membrane, respectively, and within the relative variability of the assay. The estimated volume of distribution (V-$_d$), clearance and terminal half-life can be found in Table 1. The V_d was larger and terminal half-life was longer post-membrane, suggesting some drug sequestration but not significant enough to impact the C_{max} or AUC values. The dose of liposomal amphotericin B was later reduced to 5 mg/kg/dose IV daily, which was predicted to achieve a C_{max} of 66 mcg/mL and which met the pharmacodynamic target of C_{max} over minimum inhibitory concentration (MIC) above 40 assuming a literature-reported MIC for *Blastomyces* up to 1 mcg/mL (Figure 1). [9,11-12] After 43 days, the patient was successfully decannulated off ECMO and transitioned to oral itraconazole to complete a 12-month treatment course as an outpatient.

CONCLUSION

TDM concluded that liposomal amphotericin B was an effective treatment for this patient while on veno-venous ECMO both at a dose of 7.5 mg/kg/day and when the dose was reduced to 5 mg/kg/day. Drug sequestration within ECMO components was not evident, but amphotericin B may have saturated the circuit over time. TDM of amphotericin B may be beneficial in pediatric patients supported on ECMO, especially near start of therapy or after a new circuit is placed. Further studies are warranted to evaluate the relationship between C_{max} or AUC and efficacy and safety outcomes.

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Table 1: Estimated amphotericin B pharmacokinetic parameters

Estimated PK parameters	Pre-membrane	Post-membrane	Absolute difference/error	Percent difference/error
C_{max} (mcg/mL)	96.24	90.03	-6.21	-6.45
C_{min} (mcg/mL)	5.76	7.67	1.91	33.16
AUC (mcg*hr/mL)	625	616	-9	-1.44
CL (L/kg/hr)	0.012	0.012	0	0.00
V_z (L/kg) (apparent)	0.23	0.69	0.46	200.00
V_{ss} (L/kg) (steady state)	0.12	0.28	0.16	133.33
k_e (hr^{-1})	0.053	0.0177	-0.0353	-66.60
$t_{½}$ terminal (hr)	13	39	26	200.00

AUC=24-hour area-under-the-concentration-time curve; CL=clearance; C_{max}=maximum concentration; C_{min}=minimum concentration; K_e=elimination constant; PK=pharmacokinetic; $t_{1/2}$=half-life; V=volume of distribution

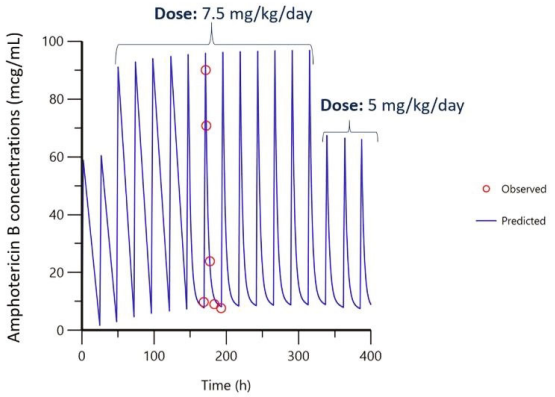

Figure 1: Predicted amphotericin B concentration-time curve based on final pharmacokinetic model in a patient using liposomal amphotericin B

Thrombosis and Bleeding Risks in Critically Ill Patients with Hematologic Malignancies

Submission ID

90

AUTHORS

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INTRODUCTION

Venous thromboembolism (VTE) is a frequent and potentially life-threatening complication in patients with cancer. Thromboprophylaxis is indicated for critically ill patients since they are at increased risk for VTE.[1] Patients with hematologic malignancy (HM) or hematopoietic cell transplantation (HCT) are at risk for both thrombosis and coagulopathy which may be increased in the setting of critical illness. Thus, balancing the risks and benefits of administering pharmacologic thromboprophylaxis is particularly challenging in this population. With an increasing number of HM/HCT patients requiring ICU admission[2]; describing the incidence and risk factors for VTE is the initial step to inform future studies assessing the efficacy and safety of thromboprophylaxis in this population.

OBJECTIVES

To describe, in critically ill patients with HM and HCT, the incidence of VTE and bleeding. As a secondary objective, to describe the frequency of use and type (mechanical or pharmacological) of thromboprophylaxis.

METHODS

We conducted a retrospective cohort study of adult patients with a diagnosis of HM or HCT admitted to the Mount Sinai Hospital (MSH) ICU between January 1st, 2014, and January 31st, 2022. For patients with more than one ICU admission, we considered each individual episode as a separate unit. Patients were followed until hospital discharge. Two investigators collected information on baseline characteristics, incidence of VTE, bleeding and study outcomes. We recorded the use of thromboprophylaxis with low molecular weigh heparin (LMWH), unfractionated heparin (UFH), or sequential compression devices (SCD). Bleeding was classified as minor or major, following international guidelines[3]. Major bleeding was defined as fatal bleeding, symptomatic

bleeding in a critical area or organ, or bleeding causing a significant fall in hemoglobin or leading to transfusion of two or more units of blood. We classified moderate thrombocytopenia as platelets < 50×10^9/L, and performed a sensitivity analysis with a stricter definition for thrombocytopenia of < 20×10^9/L.

RESULTS

We included 862 ICU admissions (813 patients, **Table 1**) During or following ICU admission, 5% (N=44) developed incident VTE (29 DVT, 11 PE, 4 DVT and PE). 70% and 80% patients with incident DVT and PE respectively had thrombocytopenia (21% moderate, 52% severe). Median platelet count at DVT/PE diagnosis was 54 (IQR 22-133). Overall, 7% and 14% had minor and major bleeding respectively. Bleeding site was CNS 30%, abdomen/GI 26%, and pulmonary 19% (**Table 2**).
Thromboprophylaxis was administered in 65% admissions: LMWH 14%, UFH 8% and SCD 43%. Thromboprophylaxis was not given in 21% admissions because of thrombocytopenia; there was no mention of prophylaxis in 14% of cases, of those 62% had severe thrombocytopenia.
The incidence of thrombosis with pharmacological prophylaxis was 9%, 4% with SCD, 4% in those not receiving prophylaxis, and 3% in those with no mention of prophylaxis (Table 2).

CONCLUSION

In this cohort, 80% patients had thrombocytopenia on ICU admission, VTE incidence was 5.1%, and major bleeding occurred in 14%. Approximately 35% did not receive any VTE prophylaxis or there was no mention of it. In 43% the preferred VTE prophylaxis was SCD, 93% of whom had moderate or severe thrombocytopenia.

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Table 1. Demographics and ICU interventions

Patient characteristics	**N=813**
Age (years), median (IQR)	61 (50-69)
Male sex	62%
ECOG* status ≥2	28%
ICU admission diagnosis and organ support N=862	
Septic shock	37%
Acute respiratory failure	31%
Multi-organ failure	9%
Bleeding	7%
Other	16%
Invasive mechanical ventilation	54%
Vasopressors	55%
Dialysis	12%
SOFA (Median, IQR)	8 (6-10)
APACHE II (Median, IQR)	22 (17-27)
Hematologic Malignancy diagnosis (N=813)	
Acute lymphocytic leukemia	15%
Acute myeloid leukemia	49%
Acute promyelocytic leukemia (APML)	3%
Chronic myeloid leukemia (CML)	3%
Lymphoma (Hodgkins and non-Hodgkins)	15%
Multiple myeloma (MM)	5%
Other	10%
HM diagnosis < 1 year	69%
HCT	35%
Thrombocytopenia: moderate/severe	81%/73%

*** Eastern Cooperative Oncology Group (ECOG) Performance status**

Tracking Atrial Fibrillation aFter Intensive Care: The TrAFFIC Study

Submission ID

84

AUTHORS

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INTRODUCTION

New-onset atrial fibrillation (NOAF) is a common complication of critical illness. It is associated with significant risks of mortality and morbidity due to events such as stroke or cardiovascular instability. In non-ICU patients, high quality evidence-based guidelines guide diagnosis, follow-up and prevention of complications. However, the optimal management and follow-up of NOAF acquired during critical illness remains unclear. This is partly due to a lack of knowledge about the natural history of NOAF acquired on the ICU and its recurrence and complications post-ICU discharge.
We present a methodology for a study investigating the feasibility of monitoring patients for atrial fibrillation (AF) post-ICU admission on the hospital ward and after hospital discharge. We use continuous ECG monitoring to ensure greater accuracy in identifying asymptomatic episodes of atrial fibrillation, as well as individual patient follow up to identify complications after ICU and after hospital discharge, including episodes of AF in the community.

OBJECTIVES

1 To assess the feasibility of post-ICU ECG monitoring for AF detection
2 To develop and validate a deep learning algorithm for detection of AF
3 To investigate the recurrence of AF in post-ICU patients who develop NOAF during their ICU admission

METHODS

In this prospective feasibility study, we identified patients who developed NOAF during an ICU admission. We confirmed AF with a 12-lead ECG reviewed by both a member of the treating team, and a clinician member of the study team.
On the ward after ICU discharge, we attached a continuous ECG monitoring patch to

recruited patients for 2 weeks, or until death or discharge. We used VitalPatch® (VitalConnect, CE marked) chest-patches to record single lead ECG. Data from the patch was uploaded in real time to a tablet device via Bluetooth and to a secure NHS server. We recorded patient compliance and satisfaction with the devices.
At 3 months post-hospital discharge, we conducted a further 1 week of monitoring, either applying patches during ICU follow-up clinic, or delivering patches and tablets to patients via courier (Figure 1).
We determined presence of AF in ECG recordings using a flag-and-confirm approach: segments of ECG recordings were initially highlighted by two algorithms, the patch manufacturer's , and a locally-developed deep learning method. Periods of potential AF were then confirmed or refuted by a trained clinician member of the study team using a custom user interface (Figure 2).

RESULTS

Of 15 eligible patients to date, 13 (87%) agreed to participate in the study. Of these, all completed inpatient monitoring, and 2 of 2 patients have completed home monitoring with good data capture. Patient satisfaction to date is good. Initial discomfort at patch removal has been mitigated through the use of the Appeel® sterile medical adhesive remover.

CONCLUSION

This proof-of-concept study has demonstrated the feasibility of post-ICU ECG monitoring in hospital and in patients' homes to elucidate the incidence of post-ICU AF recurrence. Recruitment proportion is high, and ECG patch monitoring is well-tolerated by patients.

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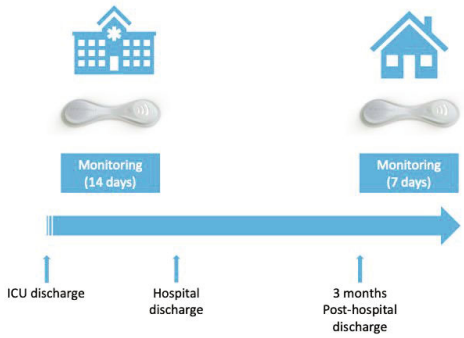

Figure 1

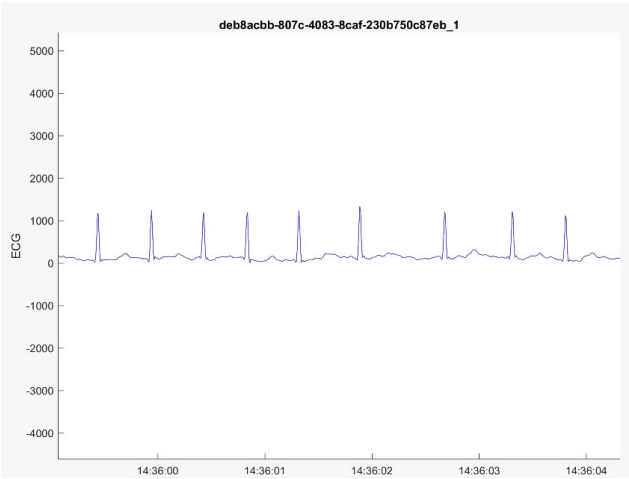

Figure 2

Training in Neurological Emergencies in North American Emergency Medicine Residency Programs: A Survey of Program Directors and Residents

Submission ID

33

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INTRODUCTION

Neurological emergencies carry a high mortality rate of up to 50% (1). Delays in diagnosis and treatment may significantly impact a patient's care trajectory resulting in an overall worse outcome. Studies have shown that up to one third of neurological emergencies are misdiagnosed by the attending emergency medicine (EM) team (1). Given the time sensitive nature of neurological emergency management, and the pivotal role of the emergency medicine physicians and residents in managing these patients, it is important to train emergency medicine residents to diagnose and manage this patient population in the emergency department using standardized teaching methods and evidence-based content.

OBJECTIVES

Given the risk of worse outcomes secondary to delays in treatment and misdiagnosis, and lack of evidence surrounding training in neurological emergencies in EM residency programs in North America, our objective was to assess core competencies, evaluate teaching and assessment practices, and identify barriers surrounding neurological emergency training in North American EM Residency Programs. As well, we aimed to compare program directors' responses to residents' response to identify gaps in training and perceived competencies.

METHODS

We conducted a self-administered cross-sectional survey of EM Program Directors (PDs) and EM residents in North America. We conducted a literature search using MEDLINE to evaluate training in neurological emergencies for EM Residency Programs. We then developed a questionnaire tool using a development stage (item generation and reduction, questionnaire formatting and pretesting) and a testing stage (pilot testing, clinical sensibility, reliability, and validity). We used semi-structured conducted cognitive

interviews with EM faculty (purposive sampling) to ensure clarity of the questionnaire, and a clinical sensibility survey to rate the survey's face validity, redundancy, and comprehensiveness (content validity). The online survey was created using LimeSurvey. We distributed the survey to PDs and residents via e-mail, and to resident members of Canadian Association of Emergency Medicine (CAEP) and Emergency Medicine Residents Association (EMRA).

RESULTS

Thirty-six PDs completed the survey across North America (56% American and 44% Canadian). 97% of respondents consider the management of neurological emergencies a necessary and important part of EM training. 64% of programs spend less than 10% of total lecture time dedicated to neurological emergency topics, and 69% of programs spend 11-20% of total simulation time on neurological emergencies; topics are not standardized across programs. Commonly covered topics include acute ischemic stroke and traumatic brain injury. Topics not commonly covered include spinal cord emergencies and intracranial hypertension. 38 North American residents completed the survey (28% American and 72% Canadian). 50% of residents felt fairly or completely confident managing neurological emergencies, while 50% felt somewhat, slightly, or not confident. 61% of PDs, and 72% of residents, believe residents would benefit from a structured course on the management of neurological emergencies to attain competencies in this domain, but no programs offer such courses.

CONCLUSION

Management of neurological emergencies is an essential skill for EM physicians, however, there is no standardization of priority topics, methods of delivery or evaluation for training residents in these domains. Our next steps include developing and piloting a curriculum using a blended model of simulation and lecture based teaching for EM residents in neurological emergencies.

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Understanding Communication Moments and Relationship Milestones Along an ICU Journey for Patients, Loved Ones, and Healthcare Providers.

Submission ID

101

AUTHORS

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INTRODUCTION

Communication is vital to facilitate patient and family-centered care (PFCC) and build trusting relationships between ICU healthcare providers, the patient, and their loved ones in the ICU (1). Yet, the complexity of care, number of healthcare providers involved, nature and pace of the decisions, and the emotional and physical toll of having a loved one in critical condition are significant barriers to effective communication in the ICU (2). ICU clinicians must attempt to overcome these barriers and create space for collaborative communication with patients and their loved ones (3). Ineffective communication in the ICU may hinder relationship development by creating bias, distrust, and social distance (2). Communication strategies, such as the routine use of family conferences and mneumonics to ensure empathetic approaches to families have been desribed in the literature (1). However, there is paucity of literature on relationship development and the identification of key opportunities for communication in the ICU.

OBJECTIVES

As part of a larger Design Thinking project, the focus of this investigation was to identify, define, and refine key moments of communication, connection, and relationship building in the ICU journey from the perspectives of patients, their loved ones, and ICU healthcare professionals. We sought to define these communication moments and

relationship milestones, and understand unique experiences, positive facilitators, and negative barriers at each moment and milestone.

METHODS

We first engaged our multidisciplinary research team, including patient partners and community-based Indigenous health leaders, to ensure our methods are culturally safe and adhere to principles of ethically engaged research and Indigenous research methodologies (4). In the first phase of this study, the study team of knowledge users, including patient partners, healthcare providers, and community-based Indigenous health leaders collaborated to identify key steps in the journey of a patient through the ICU (e.g., admission, crises, stabilization, discharge). These key steps were defined as either communication moments (i.e. an opportunity when information was given or received) or relationship milestones (i.e. a time when there was a shift or change in trust or bond).
In the second phase of this study, we completed semi-structured journey mapping interviews with ICU healthcare professionals and patients and/or patient loved ones. Participants were asked to describe their ICU journey and choose five key communication moments or relationship milestones, as defined in the first phase of this project, that resonated with their journey. Two investigators (SS, JO) utilized a directed content analysis to identify communication moments or relationship milestones within each interview, while also looking for new themes that were not represented in the framework (5).

RESULTS

We defined sixteen *communication moments* and *relationship milestones* throughout the ICU journey in the first phase of this project, which were validated by 10 journey mapping interviews with ICU healthcare professionals (physicians, nurses, pharmacists, physiotherapists, dieticians, social workers) and 6 patients and/or patient loved ones. Along with each *communication moment* or *relationship milestone,* we identified pains (negative experiences), pain relievers (mitigating factors or actions), gains (positive experiences) and/or gain creators (enhancing factors or actions).

CONCLUSION

Within the ICU journey, there are multiple opportunities for communication and relationship building, which leave a positive or negative impact on patients and their loved ones. This work highlights where ICU healthcare professionals have the ability to positively or negatively influence the ICU journey through communication and relationship building with patients and their loved ones.

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Understanding the Problem(s): Employing a Design Thinking Framework to Improve Open Sternotomy Chest Compression Performance in a Pediatric Cardiac Critical Care Unit

Submission ID

85

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INTRODUCTION

Widely recognized as the most complex system in the world, problems within healthcare are increasingly difficult to understand and solve with traditional methods. Internal review processes in our critical care unit identified an evolving key performance gap in delivery of high-quality chest compressions in patients with an open sternum following cardiac surgery, further elevating the risk of poor outcomes in this vulnerable cohort of patients[1-2]. Recognizing the inherent complexity of this problem and the need to further understand the drivers of poor performance, we utilized design thinking and translational simulation to develop a deep understanding of the problems and provider needs. Design thinking, also known as human-centered design (HCD), generates creative solutions to complex problems by conducting research to understand the underlying needs of end-users in order to identify the correct problem(s) and inform ideation, prototyping and testing of potential solutions[3].

OBJECTIVES

Develop a fulsome understanding of problems underlying inadequate compression performance in a high-risk cohort of patients with an open sternum following cardiac surgery in the Pediatric Cardiac Critical Care Unit at the Hospital for Sick Children in order to develop effective interventions.

METHODS

Interprofessional providers were identified through existing cardiac critical care education days and consisted of registered nurses (RN), respiratory therapists (RT), medical doctor trainees (MD) and nurse practitioners (NP). A questionnaire accessing knowledge of open sternotomy compression procedures and self-reported preferences and emotional responses to performing open sternotomy CPR was created and

administered to a convenience sample of interprofessional providers participating in the education days. Participants also performed open sternotomy chest compressions in a simulated scenario, and video recordings were obtained to capture hand positioning on the chest. Modified group empathy interviews were conducted during the scenario debriefing. Demographics pertaining to work experience were collected. Analyses were descriptive.

RESULTS

Sixty-one surveys were completed by a variety of participants (RNs 77%, RT 11%, MD 11%, NP 1%). Most respondents (59%) indicated they would place their hands over the sternal patch to deliver compressions, with one quarter (26%) preferring to place their hands lateral to the patch and some providers being unsure. Direct observation revealed participants defaulted to the hand placement of the initial compressor. Twenty-seven (44%) of respondents reported they were never taught how to correctly perform open chest compressions. Thirty-six (59%) reported "performing open chest compressions scares me." Thirty-two (52%) reported they feel unconfident in their ability to provide effective open sternotomy chest compressions, and 44 (73%) indicated they would not start compressions prior to a physician being present. Forty (65%) indicated they would volunteer to perform open sternotomy chest compressions during an ongoing prolonged resuscitation. These responses were mirrored by those in modified empathy debriefings conducted following simulations.

CONCLUSION

Using modified HCD methodology and translational simulation, we identified underappreciated key drivers underlying poor compression performance in a high-risk cohort of ICU patients. This data will be used to inform the generation of solutions beyond educational initiatives to enhance performance improvement and sustainable change.

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Worth a Try or a Last resort: Healthcare Professionals' Experiences of Above Cuff Vocalisation

Submission ID

94

AUTHORS

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INTRODUCTION

Above Cuff Vocalisation (ACV) involves the application of an external flow of air via the subglottic port of a tracheostomy (Figure 1). This airflow can facilitate vocalisation and improve quality of life for patients with a tracheostomy[1]. It has also been shown to improve swallowing function and saliva management, likely as a result of restored laryngo-pharyngeal sensation[2]. A recent systematic review highlighted that there is limited evidence available for the acceptability, effectiveness, safety, or optimal implementation of ACV[3]. There is also variation in ACV uptake internationally and no standardised approach to ACV implementation or application[4].

OBJECTIVES

To explore the experience of healthcare professionals using ACV, their perceptions of best practice, and the impact of COVID-19 on ACV use.

METHODS

A qualitative interview design was employed. Purposive sampling was used to identify healthcare professionals from a range of different professional groups with a range of experiences of ACV. Twenty-four participants from seven countries and five professional groups were interviewed. Semi-structured online interviews were conducted with participants exploring the following topics: experiences with ACV, management of ACV, opinions of ACV, impact on length of stay, future directions for ACV, and impact of COVID-19. Data were analysed using reflexive thematic analysis[5].

RESULTS

Five interconnected themes and three sub-themes were generated from the analysis (Figure 2). The moral distress experienced by healthcare professionals amplifies their need to fix patients (Theme 1). There is substantial uncertainty and subjectivity surrounding ACV, which leads to considerable variation in the purpose for which ACV is used and its application (Theme 2). As knowledge of and experience with ACV increases, most participants felt an increasing need for control and caution with ACV to protect patients and staff (Theme 3). General opinions of ACV vary from those who think that ACV is worth a try, to those who believe that it is a last resort, only to be used when all else has failed (Theme 4). The COVID-19 pandemic has had a considerable impact on the use of ACV in some services; as ACV use resumed, many participants felt as though they were starting from scratch (Theme 5).

CONCLUSION

Healthcare professionals rely heavily on their direct experiences when forming opinions about ACV because of the underlying uncertainties and subjectivities. These experiences, which are likely to be impacted by the purpose for which ACV is used and the approach to application taken, influence their opinions of ACV and its uptake and use. As knowledge and experience with ACV increased, most healthcare professionals developed a more cautious approach to ACV. COVID-19 had a substantial impact on ACV use in services that were severely impacted. Future research should focus on establishing the cost-effectiveness of ACV to support decision-making regarding its use.

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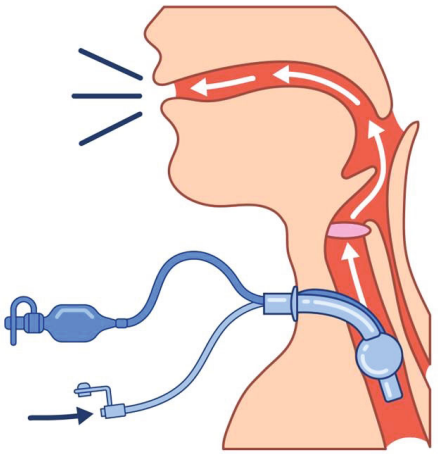

Figure 1 Application of an external airflow to the subglottic port of a tracheostomy tube.

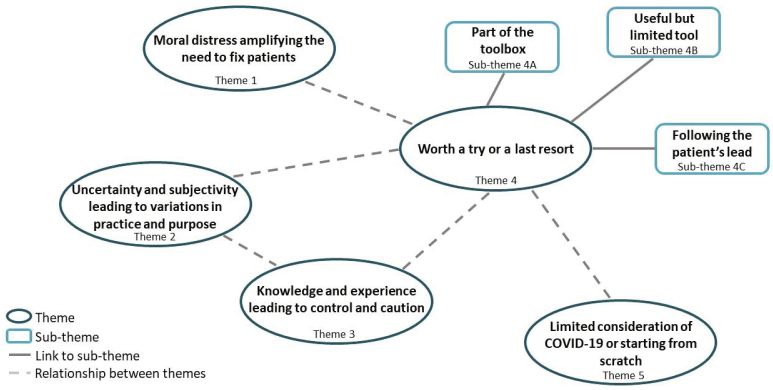

Figure 2 Thematic map outlining the five interconnected themes and three sub-themes