IMPROVING AN ICU DAILY GOALS CHECKLIST: INTEGRATED AND END-OF-GRADE KNOWLEDGE TRANSLATION

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OBJECTIVES: To understand the perspectives and attitudes of ICU clinicians about use of the DGC, then to improve the checklist by utilizing feedback from front line clinicians.

METHODS: We utilized a mixed-methods design. (1) Field Observations: 2 investigators conducted field observations to understand how the DGC was used for 80 ICU patient rounds over 6 days. (2) Document Analysis: 72 completed DGCs from observed rounds were analyzed. (3) Interviews: We conducted semi-structured interviews of 56 clinicians, analyzing transcripts using a qualitative descriptive approach and content analysis.

RESULTS: Clinicians identified the DGC to be a multipurpose tool impacting on 3 main domains: communication, patient care and education. It enhanced multidisciplinary communication, identified new patient care issues, and prompted teaching opportunities on rounds. The DGC was completed for 93% of our observed rounds, and appeared to foster closed-loop communication between nurses and physicians. Through qualitative analysis of interviews and subsequent member checking, we identified 4 themes related to enhancing the DGC: purpose, content, function and format. Recommendations follow (1) Purpose: expand explicit goal-setting to as many patient domains as possible, and systematic follow-up of progress between rounds. (2) Content: expand the physiotherapy section given the important role of rehabilitation in recovery. (3) Function: utilize the DGC to incorporate recent sedation guidelines. (4) Format: use phrases to facilitate critical thinking, and free text options for further context. Our KT activities led to ongoing collaboration at our own centre, and from other cardiac surgery and oncology ICUs locally.

CONCLUSION: The DGC at St Joseph’s Healthcare Hamilton ICU is a locally developed tool that has helped to enhance communication, patient care and education. Integrated KT as the study was ongoing elicited ways to further enhance its use requiring periodic revision of purpose, content, function and format. End-of-grant KT generated feedback from front line clinicians for further modification before reintroducing the revised DGC into the ICU. Further study will be required to expand the DGC into other ICUs, and to assess its impact on patient-important outcomes.

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APPRAISAL OF A NOVEL MODEL TO IMPROVE PREDICTION OF EXTUBATION FAILURES IN CRITICALLY ILL PATIENTS

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INTRODUCTION: Extubation failure (i.e. urgent re-intubation within 48-hrs) is associated with increased intensive care unit and hospital mortality, length of stay, tracheostomy rate, long term care requirements, and hospital costs. Spontaneous Breathing Trials (SBTs) are standard-of-care means to assess extubation readiness. However, despite passing an SBT with current performance measures, nearly 20% of patients fail extubation. Assessment of performance of SBTs is subjective and variable. SBT performance assessments require a more sensitive and objective model to predict extubation failure.

OBJECTIVES: A novel multivariate predictive model (Weaning And Variability Evaluation (WAVE) Score) derived from respiratory rate variability (RRV) during the SBT prior to extubation, has previously demonstrated improved predictive accuracy of extubation outcomes compared with current standard measures of SBT performance. In this work, we examine the performance of WAVE Score in greater depth in order to better quantify the limitations and strengths of this tool.

METHODS: Data on 446 patients over 12 centers were taken from a prior study of patients utilized to derive the WAVE Score (performed with the Canadian Critical Care Trials Group). Subgroups for analysis were defined a priori based on clinical and physiological descriptors. A sensitivity analysis was performed by increasing and shortening the definition of extubation failure (i.e. varying the period of time before re-intubation), assessing impact on WAVE Score test performance. The evolution of WAVE Score performance during sequential SBTs prior to extubation was evaluated in 74 patients with 2 or more sequential SBTs recorded prior to extubation.

RESULTS: The WAVE Score exhibits improved overall performance in ROC AUC and improved sensitivity for predicting extubation failure in specific subgroups of patients: patients who were less sedated with Richmond Agitation Sedation Scale (RASS) >= -1 (ROC AUC 0.75 vs. 0.58, p=0.15), or who were high risk patients with rapid shallow breathing index (RASSI) > 110 (ROC AUC 0.93 vs. 0.70, p=0.01), or respiratory rate (RR) > 32 (ROC AUC 0.85 vs. 0.65, p=0.02). Despite being derived from RRV, WAVE performance was not significantly altered in groups with a primary respiratory admission diagnosis or respiratory etiology for extubation failure. The WAVE Score demonstrated no significant performance variability when altering the definition of extubation failure (i.e. re-intubation in 12-72 hrs). In this observational study, the sequential WAVE Score over repeated SBTs demonstrated a stable low risk of extubation failure with a low average coefficient of variation of 0.09.
CONCLUSION: The WA VE Score demonstrates improved performance, including sensitivity (ability to correctly detect extubation failure), in patients whom were less sedated (RASS ≥ −1). While sedation is known to reduce RRV in general, these findings suggest sedation may also blunt the capacity of the WA VE score (due to reduced RRV) to detect inability to tolerate an increased workload of breathing during an SBT. The WA VE score performance appears to perform superiorly in patients with a high risk of failure based on elevated RSBI or RR. The WA VE Score demonstrated stable performance when changing the definition of time (12-72 hrs) before re-intubation. The clinical impact of providing the WA VE score to clinicians sequentially up to the time of extubation remains to be determined.

REFERENCES
1. Evidence-based guidelines for weaning and discontinuing ventilatory support: A collective task force facilitated by the American College of Chest Physicians; the American Association for Respiratory Care; and the American College of Critical Care Medicine. Chest 2001;120(6 Suppl):375S.

TABLE 1
Wave score subgroup analysis

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<th>Subgroups</th>
<th>SEN</th>
<th>SPE</th>
<th>PPV</th>
<th>NPV</th>
<th>AUC</th>
<th>P-value (AUC)</th>
<th># Failed extubation</th>
<th># Passed extubation</th>
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<td>0.75</td>
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<td>RASS &lt;−1</td>
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<td>0.27</td>
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FIGURE 1) Sensitivity analysis: Prolonging re-intubation threshold

FIGURE 2) Sensitivity analysis: Reducing re-intubation threshold

FIGURE 3) Longitudinal WAVE score: Can WAVE score predict earlier extubation?
CHARACTERIZATION OF PSYCHOTROPIC DRUG USE SURROUNDING PHYSICAL RERAINT APPLICATION IN MECHANICALLY VENTILATED, CRITICALLY ILL ADULTS

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INTRODUCTION: Chemical restraint with psychotropic medications (e.g. benzodiazepines, non-benzodiazepine sedatives i.e., propofol and ketamine, opioids, and antipsychotics) is preferred over physical restraint (PR) for the management of agitation and for prevention of interference with medical devices. However, limited data exist describing the use of such drugs preceding and during PR application for critically ill adults.

OBJECTIVES: To characterize psychotropic drug use (i.e., alterations to drug regimens) both preceding and during PR application in critically ill, mechanically ventilated adults.

METHODS: Prospective single centre observational study of all patients physically restrained during invasive mechanical ventilation. Drug data were collected for three time intervals: 1) baseline, 120 to 61 minutes prior to PR application, 2) pre-PR, 60 to 0 minutes preceding PR application, and 3) post-PR, up to six hours after PR application. Types of psychotropic drug interventions (e.g. initiation, increase, decrease, and/or cessation) were recorded, as were the total time of PR use and Intensive Care Delirium Screening Checklist (ICDSC) scores.

RESULTS: Fifty-nine patients met inclusion criteria (31 male, 28 female), with a mean age of 59.5 (SD = 18.7) years. Twenty-nine percent of patients screened positive for delirium, either during the nursing shift in which PR was applied, and/or the shift immediately following PR application. All patients were restrained using two-point Posey soft restraints, for a mean duration of 42.2 (SD = 51.3) hours. During the pre-PR period, 16 (27%) patients received no psychotropic drugs, 11 (19%) had no changes to their existing drug regimen, and 32 (54%) had a drug intervention. Twenty-seven (46%) patients had at least one drug initiated and/or increased in dosage during the pre-PR period, representing 41 prescriptions: 11 (27%) opioids, 15 (37%) benzodiazepines, two (5%) antipsychotics, and 13 (32%) non-benzodiazepine sedatives. During the post-PR period, five (8%) patients continued to receive no psychotropic drugs, four (7%) had no changes to their existing regimen, and 50 (85%) had a drug intervention. Forty-two (71%) patients had at least one drug initiated and/or increased in dosage during the post-PR period, representing 71 prescriptions: 29 (41%) opioids, 19 (27%) benzodiazepines, seven (10%) antipsychotics, and 16 (23%) non-benzodiazepine sedatives.

CONCLUSION: These data suggest that most patients receive psychotropic drugs immediately prior to, or early in the application of PR. Most interventions were new drug initiations, and/or increases in existing regimens, suggesting efforts are made to improve chemical restraint.

HUMAN MESENCHYMAL STEM/STROMAL CELLS ENHANCE FCG RECEPTOR MEDIATED PHAGOCYTOSIS OF ESCHERICHIA COLI IN HUMAN MONOCYTE DERIVED MACROPHAGES

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INTRODUCTION: Human Mesenchymal Stem/Stromal Cells (hMSCs) constitute a promising therapeutic strategy for sepsis and the Acute Respiratory Distress Syndrome. MSCs modulate the immune response to reduce lung injury, and enhance the clearance of bacteria, in murine and rodent Escherichia coli pneumonia (Gupta et al, 2012), and in the isolated human lung (Lee et al, 2013). The mechanisms by which MSCs exert beneficial effects are complex, and include their ability to modulate macrophage phenotype and function. A key function of macrophages (Mφ) is to phagocytose and clear invading microorganisms.

OBJECTIVES: To explore if hMSCs are capable of enhancing IgG mediated FcgR Mφ phagocytosis.

METHODS: Bone marrow hMSCs and peripheral blood monocytes were isolated from healthy donors. Monocytes were differentiated to Mφ over 5 days. We assessed the ability of Mφ, co-cultured with hMSCs or fibroblasts, to ingest E. coli using two methods. In the first assay live E. coli was added to Mφ and 15 minutes later extracellular bacteria were washed. Intracellular E. coli, released from Mφ by lysis, were plated and colonies (CFU) counted at 24h. In the second assay we tested Fcg receptor-mediated phagocytosis, by adding opsonized E. coli bioparticles (tagged with green fluorophore) to Mφ. Cells were fixed with 4% PFA, and streptavidin conjugate (tagged with red fluorophore) was added to enable visualization of extracellular bacteria. Images were captured using a confocal microscope. Counting of phagocytosed (green) or non-phagocytosed (red) E. coli was done at 7 randomly chosen field/slide using Image-J software.

RESULTS: In both assays, Mφ co-cultured with hMSCs engulfed significantly more E. coli than Mφ alone (control group) or Mφ co-cultured with fibroblasts. In the first assay (n=3) Mφ co-cultured with hMSCs (on insert or directly) engulfed approximately 2× more live bacteria than Mφ alone (P<0.001). Mφ co-cultured directly in contact with hMSCs did not further enhance phagocytosis. Fibroblast co-culture had no effect on Mφ phagocytosis. Our results, therefore, suggest that factors secreted from hMSCs enhance Fcg receptor mediated Mφ phagocytosis.

CONCLUSION: Our study has shown that hMSCs enhance FcgR Mφ phagocytosis. Further experiments will explore the effects of hMSCs on other phagocytic pathways.

REFERENCES