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ABSTRACT & COMMENTARY

Post-ICU Stress Symptoms Are Associated with Increased Acute Care Service Utilization for at Least One Year

By Betty Tran MD MSc, Editor

SYNOPSIS: In this prospective, longitudinal study of adult medical-surgical ICU patients, in-hospital substantial acute stress symptoms were associated with a greater risk of rehospitalization within 1 year post-ICU discharge; those with substantial post traumatic stress disorder symptoms at 3 months post-ICU also had a greater risk of future emergency department visits within the year.

SOURCE: Davydow DS, et al. Psychiatric symptoms and acute care service utilization over the course of the year following medical-surgical ICU admission: A longitudinal investigation. *Crit Care Med* 2014;42:2473-2481.

Over the past two decades, advances in critical care have resulted in more patients surviving to hospital discharge, but these successes are attenuated by several sequelae of critical illness, including depression and post-traumatic stress disorder (PTSD).[1] Risk factors for and the health care ramifications of these disorders are poorly understood. Given this, Davydow and colleagues aimed to investigate whether PTSD symptoms in the acute (< 1 month) ICU hospitalization period and PTSD and depressive symptoms at 3 months post-ICU were risk factors for future hospitalizations and emergency department (ED) visits.

Over a 12-month period (2010-2011) at Harborview Medical Center (Seattle, WA), 150 adult patients admitted to medical-surgical ICUs were prospectively recruited. The primary exposure variables were the presence of acute stress symptoms, as assessed by the PTSD Checklist-Civilian version (PCL-C) prior to hospital discharge and at 3 months post-ICU, and depressive symptoms at 3 months post-ICU, as ascertained by the Patient Health Questionnaire-9 (PHQ-9).[2,3] Substantial acute stress symptoms were defined as scoring > 3 on at least one intrusive symptom, three avoidant symptoms, and two arousal symptoms on the PCL-C; substantial depressive symptoms were defined as a PHQ-9 score of > 10.

Financial Disclosure: *Critical Care Alert*'s editor, Betty Tran, MD, MSc, nurse planner Leslie A. Hoffman, PhD, RN, peer reviewer William Thompson, MD, executive editor Leslie Coplin, and managing editor Leslie Hamlin report no financial relationships relevant to this field of study.

[INSIDE]

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Baseline interviews were conducted a median of 8 days (IQR 5–15) after hospital admission. Primary outcomes were number of hospitalizations and ED visits between discharge and 12 months post-ICU.

After adjustment for baseline patient-related (including history of major depression, alcohol/drug use, Charlson comorbidity score among other variables) and hospitalization-related (including mechanical ventilation duration, admission diagnosis, number of surgeries) characteristics, substantial PTSD symptoms in the hospital were associated with a greater risk of rehospitalizations within 1 year of ICU discharge (relative risk [RR], 3.00; 95% confidence interval [CI], 1.80-4.99); there was also a non-significant trend toward increased risk of future ED visits (RR, 1.94; 95% CI, 0.95-3.98). In addition, substantial PTSD symptoms at 3-months post-ICU were associated with a greater risk of ED visits within the year after ICU discharge (RR, 2.29; 95% CI, 1.09-4.84), even after additional adjustment for acute care service utilization in the 3 months post-ICU discharge. Depressive symptoms at 3 month follow-up were not associated with risk of rehospitalization or additional ED visits between 3 and 12 months post-ICU.

[“This study adds to the growing body of literature describing the post-discharge needs of ICU survivors as substantial.”]

■ COMMENTARY

This study adds to the growing body of literature describing the post-discharge needs of ICU survivors as substantial. Inarguably, critical care interventions, such as low tidal volume ventilation for acute respiratory distress syndrome and early antibiotics and fluid resuscitation in sepsis, have saved lives. However, in the same way that heart disease and cancer have replaced infection as the leading causes of death, our achievements are tempered by the generation of a growing population of patients with chronic medical problems as a result of their critical illness: psychiatric disorders, profound neuromuscular weakness, endocrinopathy, malnutrition, increased vulnerability to infection, functional disability, and symptom distress. This study highlights the need for focused attention, follow-up, interventions, and research in the post-ICU period. These efforts should not only help individual patients manage their symptoms and comorbidities, but would hopefully have beneficial effects on both preventing further disability and complications, as well as reducing health care costs through decreasing rates of utilization of acute care services such as recurrent hospitalizations and ED visits. ■

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Nasal Screening for MRSA: The New Basis for De-escalation of Empiric Antibiotics?

By Kathryn Radigan, MD, MSc

Assistant Professor, Pulmonary Medicine, Northwestern University, Feinberg School of Medicine, Chicago

Dr. Radigan reports no financial relationships relevant to this field of study.

SYNOPSIS: The high negative predictive value of a negative nasal screen for methicillin-resistant *Staphylococcus aureus* suggests these patients do not have lower respiratory tract infections caused by the organism.

SOURCE: Tilahun B, et al. Nasal colonization and lower respiratory tract infections with methicillin-resistant *Staphylococcus aureus*. *Am J Crit Care* 2015;24:8-12.

Although nasal screening for methicillin-resistant *Staphylococcus aureus* (MRSA) is a widely accepted method for infection control, the relationship between nasal carriage and development of MRSA lower respiratory tract infection (LRTI) is not well studied. Tilahun and colleagues sought to determine the association between MRSA nasal swab results and MRSA LRTI in a medical ICU. In this single-site, retrospective cohort study, 165 patients were diagnosed with pneumonia and had both nasal swabbing and culturing of respiratory specimens within 24 hours of admission.

Among the 28 patients who had a nasal swab positive for MRSA, eight (4.8%) patients had respiratory specimens positive for MRSA. Of the 165 patients who were involved in the study, only two (1.2%) had negative nasal swabs but positive MRSA respiratory cultures. The sensitivity and specificity for nasal MRSA colonization for subsequent infection were 80% and 87.1% and the positive and negative predictive values were 28.6% and 98.5%, respectively.

■ COMMENTARY

It has long been recognized that treating our critically ill patients with early and appropriate antibiotics is a critical determinant of survival in septic shock.[1] The Surviving Sepsis Campaign suggests that IV antimicrobials should be given within the first hour of recognition of septic shock and severe sepsis without septic shock.[2] The guidelines for the choice of antibiotics are complicated and based on the individual patient and the identity and susceptibility pattern of the bacteria isolated on the individual unit. With good intention, antibiotics are often overprescribed with failure of timely de-escalation, leading to unintended adverse consequences including patient morbidity and mortality, increasing health care costs, and antimicrobial resistance. Prescribing antibiotics to cover MRSA empirically is one of the biggest culprits.[3] This manuscript examined whether a correlation exists between MRSA nasal swab results and MRSA LRTI in a medical ICU. Even though researchers found that positive MRSA nasal swabs were not as helpful in guiding antibiotic therapy, they did conclude that the high predictive value of a negative nasal swab may be helpful with de-escalation of empiric antimicrobial therapy.

Although the overall message of this manuscript may be helpful, a word of caution should be exercised with these recommendations in regards to the type of specimen collected for respiratory tract culture. As described within the manuscript, only 5% of the specimens were collected by bronchoalveolar lavage; 65% of the specimens were tracheal aspirate or sputum collected by suctioning, 13% were from expectorated sputum, and 16% were collected from induced sputum. Since the majority of the specimens were not collected through bronchoalveolar lavage, the ability to differentiate upper respiratory tract colonization from lower tract pathogens is less accurate. Furthermore, the rate of pathogen detection for sputum samples can be quite poor, especially if standards of quality control for sputum culture are not followed. Taking into account these limitations, a negative nasal screen for MRSA should be an additional, but not the only, consideration to be included among a number of other important factors when deciding to de-escalate antibiotic therapy in our critically ill patients. ■

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Multiple Factors Contribute to Recovery of Physical Function After Critical Illness

By Linda Chlan, PhD, RN, FAAN

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Dr. Chlan reports no financial relationships relevant to this field of study.

SYNOPSIS: Physical function after critical illness is influenced by clinical, physiological, and psychological factors that suggest a need for comprehensive interventions to promote recovery and quality of life.

SOURCE: Aitken LM, et al. Physical recovery in intensive care unit survivors: A cohort analysis. *Am J Crit Care* 2015;24:33-40.

As more and more patients survive critical illness or injury, there is increasing evidence that they leave the intensive care unit (ICU) with a number of impediments and impairments. These decrements occur in all of the quality-of-life domains: physical, functional, psychological, and emotional. Many of the decrements in these quality-of-life domains are influenced by factors that are not modifiable, such as age or illness severity. The challenge for researchers and clinicians is to identify modifiable factors that can be used to develop and test interventions to improve functioning and quality of life for patients after they leave the ICU.

The study by Aitken and colleagues aimed to identify physical factors associated with recovery from critical illness that may be modifiable. This cohort study examined a subset of patients enrolled in an Australian multi-site, randomized, controlled trial testing a home-based rehabilitation program of individualized endurance and strength training on physical function and quality of life. Participants in the parent study were recruited from 12 hospitals in three Australian cities that had ICUs stays > 48 hours and length of mechanical ventilator support > 24 hours. Patients (n = 195) were assessed at 1 week, 8 weeks, and again at 26 weeks after ICU discharge on quality of life, psychological well-being, and physical function by the 6-minute walk test. The primary outcome for the cohort sub-analysis (n = 145) reported here was whether the 6-minute walk distance improved from week 1 to the 26-week study endpoint. Participants were divided into three groups by the 6-minute walk results at week 26: those who improved, those who did not improve, and those who did not complete the walk test. Mean age was 56-59 years, with median ICU stays of 5-6 days and median hours mechanically ventilated at 72-92. Overall, 65% of participants increased their 6-minute walk distance by 40% or more. A series of logistic regression models were explored to determine independent relationships to the primary physical function outcome (6-minute walk test), including demographic and clinical variables, illness severity, quality of life, psychological well-being, sleep quality, and engagement in incidental exercise outside of the study rehabilitation protocol. Independent factors contributing to improvement in the 6-minute walk test from week 1 to week 26 were: sleep problems in the first week after ICU discharge, engagement

["The intriguing contributions of sleep quality and exercise outside of the home-based rehabilitation intervention require further investigation."]

in moderate to vigorous exercise, and higher ratings of vitality.

On the other hand, a lack of improvement in physical functioning at the 26-week assessment point was associated with a respiratory ICU admission diagnosis, higher social functioning, and greater 6-minute walk test during the first week after discharge, suggesting that participants in this cohort did not improve physically at the 26-week assessment point. The authors concluded that the meaning of these reported relationships is unclear. However, many complex factors contribute to recovery after critical illness, such as sleep quality, and interventions need to consider multiple influences to improve post-ICU physical function and quality of life.

■ COMMENTARY

The study by Aitken and colleagues reports on factors associated with an objective marker of post-ICU physical function, the 6-minute walk test, in a cohort of ICU survivors. Given that the aims of this study were to determine independent associations with an increase in physical function, no cause-and-effect conclusions can be drawn from the findings. The intriguing contributions of sleep quality and exercise outside of the home-based rehabilitation intervention require further investigation. The inter-relationships among sleep, vitality, exercise, and social functioning in enhancing recovery after ICU stays may be a complicated web to untangle; further investigation with additional cohorts of ICU survivors is needed.

A major limitation of this cohort study is the time lag between the two data collection points (week 1 to week 26 post-ICU discharge) considered in the analysis. There are a number of unknown factors that may have influenced the results, such as hospital readmission or cognitive impairment. Nevertheless, as more and more patients survive critical illness, comprehensive interventions are needed to promote optimal recovery to enhance quality of life. ■

Survival in ARDS Can Be Predicted By Driving Pressure

By Elaine Chen, MD

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Dr. Chen reports no financial relationships relevant to this field of study.

SYNOPSIS: Statistical models were applied to several large trials of ARDS patients undergoing lung protective ventilation strategies and found that decreases in driving pressure, or ΔP, were strongly associated with increased survival.

SOURCE: Amato MBP, et al. Driving pressure and survival in the acute respiratory distress syndrome. *N Engl J Med* 2015;372:747-755.

Lung protective ventilation strategies, such as limiting plateau pressures, lowering tidal volumes, and optimizing positive end-expiratory pressures (PEEP), have been shown through multiple large, randomized clinical trials to have significant mortality benefit in patients with acute respiratory distress syndrome (ARDS). Often, lung protective strategies may optimize one parameter at the expense of another. With a common goal of minimizing ventilator-induced lung injury, trials have not consistently shown which component of the strategies most strongly improves survival.

The authors define driving pressure (ΔP) as the ratio of tidal volume to respiratory system compliance (V_T/C_{RS}) and use this ratio as an index to indicate the "functional" size of the lung. They hypothesize that ΔP better predicts outcome than V_T alone.

Survival prediction models were developed using advanced statistical techniques, including forward and backward stepwise multivariate analysis and multilevel mediation analysis, and were applied to 3562 patients from nine randomized trials of lung protective ventilation strategies. Patients showing significant ventilatory effort (such as those receiving pressure support ventilation or with respiratory rates above set rate) were excluded from the analysis. Models were first developed using four smaller early studies, and refined and

retested with patients from larger, more recent trials.

In early models, ΔP was found to predict survival, as well as critical care tools such as APACHE and SAPS. In follow-up models, higher ΔP consistently predicted lower survival across trials compared with V_T, plateau pressure, and PEEP. The total pooled sample was resampled to match PEEP, ΔP, and plateau pressure. Those with matched PEEP showed increasing mortality with increased plateau pressure (reflecting increasing ΔP); those with matched plateau pressure showed decreasing mortality with increased PEEP (reflecting decreasing ΔP). Those with increasing PEEP and increasing plateau pressure (matched ΔP) had no difference in mortality.

The authors concluded that survival benefits in trials of low tidal volume ventilation and high PEEP ventilation were proportional to reductions in ΔP rather than the target variable and that ΔP was a critical mediator of the benefits conferred. ΔP served as a surrogate for cyclic lung strain on preserved lung units, and ventilator changes that led to decreases in ΔP were associated with improved survival.

■ COMMENTARY

In the years since the advent of low tidal volume ventilation and lung protective ventilation for ARDS, the concepts have been widely studied and nearly universally applied, with varying rates of adherence. As evidence has grown in support of lung protective ventilation, its cited benefits of improving outcomes have broadened beyond ARDS to all critically ill patients as well as surgical populations. We believe that, in general, smaller tidal volumes and decreased lung stretch are associated with less ventilator induced lung injury. However, are there patient populations for whom this does not apply?

This study immediately excludes all patients with spontaneous breathing effort, as measurements of pressure and compliance are difficult to interpret in these patients. Association does not imply causation, and the authors note this. There are no clinical practice implications as a result of this study, since ΔP as defined in this study is measured and not applied, and this study is limited to statistical analysis of pooled data from prior studies.

The results of this study may help providers assess whether ventilator changes might affect their patients' survival. If following lung protective strategies leads to decreases in ΔP, we might surmise that we are improving our patients' chances of survival. Overall, this study reflects that stiffer or smaller lungs belong to sicker patients who are more likely to die. This study challenges strict adherence to lung protective ventilation strategies in patients who do not respond favorably, but prospective trials are needed to further determine benefits of changes in ΔP. ■

A Guide to When and How to Stop CPR

By Betty T. Tran, MD, MSc, Editor

SYNOPSIS: In cardiopulmonary arrest situations, the mnemonic CEASE (Clinical features, Effectiveness, Ask, Stop, Explain), provides a guide for clinicians on how to discontinue resuscitative efforts and effectively communicate with other clinicians and families.

SOURCE: Torke AM, et al. CEASE: A guide for clinicians on how to stop resuscitation efforts. *Ann Am Thorac Soc* 2015;Feb 9 [Epub ahead of print].

Although health care providers undergo hours of training and recertification to provide resuscitative efforts for patients in cardiopulmonary arrest, few are given guidance in terms of when and how to stop it. On the basis of available clinical evidence and ethical principles, Torke and colleagues aimed to provide a framework by which clinicians can organize their thinking about when to discontinue resuscitative efforts, which includes communicating effectively with families. Their proposed guide is summarized by the mnemonic CEASE (clinical features that predict survival):

CLINICAL FEATURES THAT PREDICT SURVIVAL

Knowledge of a patient's clinical history is critical, as pre-arrest factors such as age, metastatic cancer, poor functional status, renal insufficiency, hypotension, and non-cardiac diagnosis are associated with poor neurologic and/or survival outcomes.

EFFECTIVENESS OF RESUSCITATION EFFORTS

There is no standard decision aid to stop in-hospital resuscitation efforts, but the length of resuscitative efforts and the patient's physiological response in real time should be assessed as part of the decision to continue or stop resuscitative efforts. For example, initial ventricular fibrillation or pulseless ventricular tachycardia is associated with better outcomes than asystole or pulseless electrical activity, and survival has been reported to be inversely proportional to resuscitation times.

["Ideally, resuscitative efforts would be avoided in these situations altogether, but this is dependent on various factors during goals of care discussions with patients and families."]

ASK THE OTHER CLINICIANS PRESENT FOR INPUT

Good communication among team members involved in the resuscitative effort is necessary to exchange relevant knowledge in real time; a collaborative, non-hierarchical environment should be the goal.

STOP RESUSCITATION EFFORTS

It is the responsibility of the code leader to decide when to stop resuscitation efforts if the efforts are unsuccessful or the interventions needed to support circulation are unsustainable. Although this is a clinical judgment based on objective as well as subjective information, it is important to note that it is a decision made by the team leader and not within the purview of the patient's family members.

EXPLAIN WHAT HAS HAPPENED TO THE FAMILY

At the end of the resuscitative efforts, the care team is obligated to inform family members what occurred, answer questions, and provide emotional support. This should be done compassionately and involve core skills that can be taught.

■ COMMENTARY

The article by Torke and colleagues provides an organized approach to discontinuing resuscitative efforts in cardiopulmonary arrest situations. For clinicians who work in the critical care environment, the framework presented is intuitive, and done enough times, almost reflexive. In some situations, stopping CPR is not a difficult decision, especially if we know beforehand that it is unlikely to be beneficial (e.g., the patient with terminal illness who is unlikely to survive CPR, the patient admitted with septic shock who is already on maximum vasopressors). Ideally, resuscitative efforts would be avoided in these situations altogether, but this is dependent on various factors during goals of care discussions with patients and families. During the other times, resuscitative efforts may last longer, especially if we believe that the underlying cause can be reversed. Overall, I suspect many of us think through the clinical situation in our heads, view the resuscitative results and discuss with our colleagues in real time, and debrief with family afterwards, all of which occur without having to consciously deliberate the individual steps.

On the other hand, this schema is probably most useful for physicians-in-training and other clinicians who have fewer encounters with critically ill patients and/or cardiopulmonary arrest situations. I have often witnessed residents excitedly lead code resuscitative efforts (with or without referencing their Advanced Cardiovascular Life Support pocket cards, which do not provide an endpoint), only to continue efforts to no end much to the discomfort of nursing and other ancillary staff. This is likely motivated by lack of experience, fear of stopping too soon, and as the authors note, "tremendous momentum to continue [advanced treatment interventions]." Although the CEASE mnemonic is not a decision rule to substitute for clinical judgment, it provides an organized approach to handling resuscitative efforts until more experience is gained. ■

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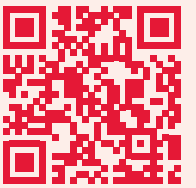

CME QUESTIONS

1. In the study by Davydow et al, substantial PTSD symptoms during ICU hospitalization were associated with:

a. increased risk of future depressive symptoms.

b. increased risk of repeat hospitalization within 1 year of discharge.

c. increased risk of unemployment after hospital discharge.

d. increased usage of psychiatric medication after hospital discharge.

e. increased risk of outpatient visits for sleep disorders.

2. Nasal screening for MRSA may be a helpful tool for which ICU management practices?

a. De-escalation of antibiotic therapy

b. Escalation of antibiotic therapy

c. Minimizing the spread of the pathogen

d. A and C

e. None of the above

3. Which of the following statements is *true* regarding the study's main findings?

a. Patients with higher physical functioning 1 week after ICU discharge continue to make the most gains in improvement over time.

b. Patients with cognitive challenges at ICU discharge cannot engage in post-ICU rehabilitation.

c. Patients with poor sleep quality 1 week after ICU discharge improved their physical functioning over time.

d. Patients with the highest level of social functioning demonstrate the highest levels of physical functioning over time.

e. All of the above

CME OBJECTIVES

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

- identify the particular clinical, legal, or scientific issues related to critical care;
- describe how those issues affect physicians, nurses, health care workers, hospitals, or the health care industry; and
- cite solutions to the problems associated with those issues.

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ARDS