

The Effects of Post-Resuscitation Sepsis Management on Length of Stay and Total Cost of Care among Patients with Severe Sepsis in the ICU Setting

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ABSTRACT

Background: Although there are many studies that highlight the importance of early resuscitation in severe sepsis, there remains limited or disjointed information about the effect of timely post-resuscitative sepsis management on patient outcomes.

Objective: The goal of this descriptive study was to determine if timely implementation of a post-resuscitation sepsis order set (PRSOs) resulted in a decrease in hospital length of stay (LOS) and hospital cost.

Methods: In this descriptive study, 749 intensive care unit (ICU) patients were reviewed, 494 (66%) patients received the PRSOs compared to 255 patients who did not.

Results: Though not statistically significant, those who received the PRSOs had a decreased hospital length of stay (LOS) by more than one day (9.29 versus 10.33 days) and a decrease in hospital costs (\$22,566.54 versus \$24,155.98).

Conclusion: While the results of this study were not statistically significant, the preliminary results are re-assuring and further study is warranted given the potential implications for future use.

Keywords

Sepsis, Antibiotics, Septic shock.

Introduction

Each year in the United States of America, around 1.7 million people develop sepsis of which nearly 270,000 people die [1]. As a result, sepsis resuscitation has become a Centers for Medicare and Medicaid Services (CMS) core measure which requires immediate

detection and implementation of treatment with empiric antibiotics and adequate intravenous fluids. Evidence shows that early resuscitation is critical to prevent progression to organ dysfunction and ultimately death in patients with severe sepsis [2].

Just as there continues to be strong evidence between bundle administration [3] and survival, there remains limited or disjointed information about what the effect of timely post-resuscitative

sepsis management has on patient outcomes. Patients that have been successfully resuscitated, may be at risk for adverse outcomes related to fluid overload, unnecessary antibiotic therapy, sequelae of post intensive care syndrome (PICS) and readmission. When it comes to fluid resuscitation, the concept of adverse outcomes becomes more evident as multiple studies have shown that excess fluid status is associated with unfavorable outcomes including increased mortality [4]. Although studies have addressed regulation of fluids after the initial resuscitation phase, antibiotic stewardship and interventions to mitigate cognitive, functional and physical effects of PICS, few studies have addressed a bundle of strategies to promote recovery from sepsis while still in the Intensive Care Unit (ICU) [5-9].

The aim of this study was to determine what impact the implementation of a PRSOs (Figure 1) had on hospital length of stay (LOS) and total cost of care of patients in the ICU at St. Joseph’s Medical Center of Stockton CA, an academic community hospital.

Antibiotics	Fluids	Mobility	Nutrition	Discharge Planning
• Deescalation of antibiotic regimen (narrowing or complete cessation)	• Deescalation of total fluid resuscitation to less than 40 ml/hour	• Nurse-initiated order for PT/OT evaluation to encourage early mobility	• Nursing-initiated order for nutrition consult with goal of advancing diet	• Nursing-initiated order of care coordinator consult to accelerate discharge planning

Figure 1: Major Elements of the Post-Resuscitation Order Set (PRSOs).

Methods

Study Design and Setting

Retrospective electronic health record (EHR) data was collected during March 2017 through October 2017. The PRSOs is an innovative nursing-initiated sepsis bundle developed by a multidisciplinary team and implemented in March 2017. After development of the PRSO, education and training for nursing and clinicians was conducted via in-class room education and online modules.

Sample and Selection

The study sample included intensive care unit patients who were: (a) age 18 or older, (b) had a Diagnostic Related Group (DRG) of 870 (Septicemia or Severe Sepsis with mechanical ventilation > 96 Hours), 871 (Septicemia or Severe Sepsis without mechanical ventilation > 96 Hours with Major Complication or Comorbidity) or 872 (Septicemia or Severe Sepsis without mechanical ventilation > 96 Hours without Major Complication or Comorbidity), (c) admitted to the ICU and (d) had an ICU stay of at least 24-hours. Patients with DRG codes of 870, 871 or 872 were identified using initiation of the sepsis order set as documented by clinicians in the EHR. Severe sepsis was defined as suspected or confirmed infection, 2 or more SIRS criteria and 1 or more acute organ dysfunction. Septic shock is defined as criteria for severe sepsis AND either persistent hypotension despite fluid bolus of 30mL/kg/hr or initial lactic acid >4mmol/L.

Intervention

The PRSOs was implemented once certain parameters were met

which was assessed for every 12-hour shift (Figure 2). The PRSOs was piloted from March 2017 through October 2017 in the ICU.

Figure 2

Required Parameters to Initiate Post-Resuscitation Bundle
<ul style="list-style-type: none"> • No vasoactive medications for at least 2 hours • Completed 12 hours of standard ICU protocol for treatment of severe sepsis • Most recent lactic acid value within normal limits, or decreased from previous value

Outcomes and Measures

For this study two patient outcomes were examined; hospital LOS and total cost of care. The outcomes compared were between patients who received the PRSOs and those who did not receive the PRSO during this time period. T-test was used for analysis utilizing SPSS Statistics for Windows, version 20 (SPSS Inc., Armonk, N.Y.).

Results

749 consecutive patients were included in the analysis. Of these 749 patients, 494 (65%) received the PRSOs, and 255 (35%) did not. Though not statistically significant, those who received the PRSOs had a decreased hospital LOS by more than one day and total cost of care. More specifically, for hospital LOS, the average LOS for patients who did not get the PRSO was longer (M = 10.33 days; 95% CI = -0.63-2.7) compared to the LOS of those who received the PRSO (M = 9.29 days; 95% CI = -0.63 - 2.7) p = 0.22. For total cost of care, those who did not get the PRSO had a higher cost (M = \$24,153; 95% CI = -2922.31 - 6117.19) compared to costs of those who did get the PRSO (M = \$22,556; 95%CI = -2616 – 5811.27) p = 0.48. The statistical program SPSS Statistics was used to determine the statistical significance of the differences in hospital length of stay and total cost of care.

Discussion and Conclusion

This descriptive study utilizing retrospective data, is the first to describe the effect of a novel nurse initiated PSROs on hospital length of stay and hospital cost. We examined the implementation of a PSROs aimed at promoting sepsis recovery, on ICU patients demonstrating the parameters for PRSOs implementation (Figure 2). The results of this small descriptive study showed a decrease in hospital length of stay and hospital costs, although not statistically significant, the preliminary results are re-assuring and further study is warranted given the potential implications for future use. For example, readmission within 30 days, total cost of antibiotic therapy during admission, heart failure exacerbations and functional outcomes are all possible measures to be analyzed using the PRSOs.

There are several factors as to why the total cost of care and hospital length of stay were decreased in a non-statistically significant way for patients who received the bundle. The most important factor being that our data set was limited and not large enough to lead to statistical significance. Since total cost of care and hospital length of stay are interconnected, even a non-statistically significant decrease is promising, and may become statistically significant in

future studies with larger data sets. In future studies, it may be beneficial to analyze how other post-resuscitative components of the PRSOs such as early nutritional intervention and early mobility has on long-term recovery of sepsis patients. One of the overlooked complications of sepsis is early massive catabolism, lean body mass loss and escalating hypermetabolism persisting for months to years. Therefore, early enteral nutritional intervention should be considered to correct micronutrient/vitamin deficiencies and deliver adequate protein to facilitate recovery [10].

More studies should explore the long-term outcomes of early nutritional intervention as part of the PRSOs. Additionally, sepsis survivors can also develop long term sequelae such as limitations of activities of daily living including but not limited to the inability to manage money, bathe, or toilet independently [11]. Therefore, it would be prudent to evaluate the impact of early mobilization and physical therapy as part of the PRSOs in future studies.

Although sepsis is a full-spectrum cause of organ dysfunction in acutely ill patients [9], there are many opportunities for early intervention in the recovery phase that could ensure favorable long-term outcomes for patients.

Therefore, there is merit in further exploring the potentially positive applications of a PRSOs in patients with severe sepsis at other facilities and on a larger scale in order to further quantify potential benefits of early recovery.

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