EARLY DETECTION AND TREATMENT OF SEVERE SEPSIS IN THE EMERGENCY DEPARTMENT: IDENTIFYING BARRIERS TO IMPLEMENTATION OF A PROTOCOL-BASED APPROACH

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Introduction: Despite evidence to support efficacy of early goal-directed therapy for resuscitation of patients with severe sepsis and septic shock in the emergency department, implementation remains incomplete. To identify and address specific barriers at our institution and maximize benefits of a planned sepsis treatment initiative, a baseline assessment of knowledge, attitudes, and behaviors regarding detection and treatment of severe sepsis was performed.

Methods: An online survey was offered to nurses and physicians in the emergency department of a major urban academic medical center. The questionnaire was designed to assess (1) baseline knowledge and self-reported confidence in identification of systemic inflammatory response syndrome and sepsis; (2) current practices in treatment; (3) difficulties encountered in managing sepsis cases; (4) perceived barriers to implementation of a clinical pathway based on early quantitative resuscitation goals; and (5) to elicit suggestions for improvement of sepsis treatment within the department.

Results: Respondents (n = 101) identified barriers to a quantitative resuscitation protocol for sepsis. These barriers included the inability to perform central venous pressure/central venous oxygen saturation monitoring, limited physical space in the emergency department, and lack of sufficient nursing staff. Among nurses, the greatest perceived contributor to delays in treatment was a delay in diagnosis by physicians; among physicians, a delay in availability of ICU beds and nursing delays were the greatest barriers. Despite these issues, respondents indicated that a written protocol would be helpful to them.

Discussion: Knowledge gaps and procedural hurdles identified by the survey will inform both educational and process components of an initiative to improve sepsis care in the emergency department.

Key words: Sepsis; Barriers; Survey; Early goal-directed therapy; Emergency department

Severe sepsis is defined as sepsis associated with organ dysfunction, hypotension, or hypoperfusion abnormalities including lactic acidosis (>4 mmol/L), oliguria, or an acute alteration in mental status. It remains a salient problem in critical care and emergency medicine, accounting for more than 500,000 ED visits per year.1

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Sepsis is the tenth leading cause of death in the United States, and the mortality rate for severe sepsis and septic shock is between 40% and 60%.2,3

In 2001 Rivers and colleagues published their seminal work on a severe sepsis and septic shock clinical pathway in adult ED patients.4 In-hospital mortality decreased from 46.5% in the group assigned to standard therapy to 30.5% in the group assigned to the early goal-directed therapy (EGDT) clinical pathway. Subsequent prospective external validation studies have shown that the EGDT pathway can be reliably replicated.5,6 In 2004, The International Sepsis Forum, The European Society of Critical Care Medicine, and the Society of Critical Care Medicine introduced the Surviving Sepsis Campaign (SCC). The SCC is a global initiative to reduce sepsis mortality through a series of recommendations including 6-hour management “bundles” that include a protocolized approach to resuscitation of persons with sepsis-induced shock, obtaining blood cultures before antibiotic therapy is instituted, and early initiation of antibiotics.7,8 The Joint Commission currently is defining core measures based on these studies and other current advances in sepsis care.9

The implementation of clinical pathways such as the EGDT pathway described by Rivers et al4 and the SCC is one available method for standardizing and improving the quality of care in acute settings. Various studies have shown that clinical pathways for sepsis that use a quantitative resuscitation strategy significantly reduce mortality.10,11 Jones and colleagues12 performed a meta-analysis of 9 randomized controlled trials that showed a clear survival benefit if the pathway was initiated at or near the time of recognition of sepsis. Specific components of the hemodynamic optimization bundle varied across the studies, suggesting that the time of initiation, rather than the choice of monitoring modalities, played the biggest role in improving outcomes. The benefit of the bundles appeared to be lost if they were initiated late in the course of the disease.

In an effort to introduce a simple, effective, standardized clinical pathway for sepsis treatment, we have launched a sepsis quality improvement project primarily targeting the emergency department and critical care medicine. The goals of the initiative are to: (1) reduce mortality by at least 10% in patients with severe sepsis and septic shock by developing a clearly defined, standardized clinical pathway to promote early identification of appropriate patients; (2) improve the process of care so that resuscitation will be early and aggressive; and (3) enhance communication and patient flow between the emergency department and other areas of the hospital, particularly the ICUs.

In a recent review in the Journal of Emergency Nursing, Vanzant and Schmelzer13 described the resistance of ED personnel to using severe sepsis care bundles, despite overwhelming evidence that doing so would be beneficial for patient outcomes. Some possible reasons for reluctance proposed by Vanzant and Schmelzer included the difficulty of identifying patients who would benefit from early and aggressive treatment, cost of interventions, and a desire of practitioners to treat conservatively. Carlbom and Rubenfeld14 provide some data on barriers to implementation in busy emergency departments, but their study population was limited to physician and nursing leadership. In an attempt to both describe barriers to implementation as experienced by the rank-and-file clinicians and provide site-specific data to inform the implementation of our initiative, we developed a baseline knowledge, attitudes, and behaviors questionnaire and surveyed active clinical staff in the emergency department.

### Methods

#### DESIGN

A cross-sectional design was used to survey full-time staff nurses and physicians in the emergency department of a major urban academic medical center with approximately 72,000 visits per year. Access to the anonymous, confidential online survey instrument was open from November 1 to December 31, 2010. Institutional Review Board approval with a waiver of the informed consent requirement was obtained from the university affiliated with the medical center prior to distribution of the survey.

#### INSTRUMENT AND DATA ANALYSIS

The questionnaires consisted of 14 items for nurses and 13 items for physicians. Eight general questions were the same as

<table>
<thead>
<tr>
<th>Perceived greatest cause of delay</th>
<th>RN (%)</th>
<th>MD (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delay in diagnosis of sepsis by physicians</td>
<td>28.1</td>
<td>6.8</td>
</tr>
<tr>
<td>Delay in availability of ICU beds</td>
<td>19.3</td>
<td>20.5</td>
</tr>
<tr>
<td>Lack of recognition in triage</td>
<td>15.8</td>
<td>18.2</td>
</tr>
<tr>
<td>Knowledge deficit regarding appropriate management</td>
<td>14.0</td>
<td>2.3</td>
</tr>
<tr>
<td>Nursing delays (eg, time to completion of orders)</td>
<td>7.0</td>
<td>20.5</td>
</tr>
<tr>
<td>Laboratory delays</td>
<td>7.0</td>
<td>2.3</td>
</tr>
<tr>
<td>Other</td>
<td>7.0</td>
<td>18.2</td>
</tr>
<tr>
<td>Pharmacy delays</td>
<td>1.8</td>
<td>2.3</td>
</tr>
<tr>
<td>Lack of necessary equipment</td>
<td>0.0</td>
<td>9.1</td>
</tr>
</tbody>
</table>

MD, Doctor of medicine; RN, registered nurse.
for both professions, with the additional questions being practice specific. Respondents were asked closed-ended and open-ended questions regarding (1) baseline knowledge and self-reported confidence in identification of systemic inflammatory response syndrome (SIRS) and sepsis; (2) current practices in treatment; (3) difficulties encountered in managing sepsis cases; (4) perceived barriers to implementation of a resuscitation protocol; and (5) suggestions for improvement of sepsis treatment within the department. Some demographic data, such as number of years in practice for nurses and faculty/resident designation for physicians, also were collected.

Analyses were conducted with use of PASW/SPSS version 18.0. Descriptive statistics were used to portray the baseline knowledge, attitudes, and behaviors of each group. Differences between groups were detected and reported with Pearson χ² tests of independence. Statistical significance was set at P < .05.

**Results**

The response rate was 43% (n = 57) among all ED staff nurses, 57% (n = 28) among attending physicians, and 38% (n = 16) among resident physicians. Of the nurse respondents, many had been in practice for 10 or more years (36.8%), followed by equal numbers in practice for 0 to 2 or 2 to 5 years (22.8% each); 17.5% had been in practice for 5 to 10 years. All residents polled were participants in the emergency medicine residency program.

**BARRIERS**

Perceived causes of delays in the early identification and treatment of severe sepsis and septic shock are summarized in Table 1. Delay in diagnosis by physicians was considered the most significant cause among registered nurses (RNs), whereas availability of ICU beds and nursing delays were most commonly cited among physicians. When nursing-related delays (time to completion of orders plus lack of recognition in triage) were combined, they were considered the greatest impediments among physician respondents (41%).

When asked to identify the greatest barriers to implementing a protocol-based approach to early sepsis resuscitation, the most salient barriers were lack of access to central venous pressure/central venous oxygen saturation (CVP/ScvO₂) monitoring for physicians (79.5%) and lack of physical space in the emergency department for nurses (64.9%, Fig. 1). The number of nursing staff required to carry out a resuscitation protocol was the second most commonly cited barrier for both groups. Other barriers cited included delays in registration, general overcrowding, the burden of caring for several critically ill patients at once, comorbid conditions, a delay in diagnosis for patients who are afebrile, the heavy task load for these patients (eg, multiple intravenous lines, Foley catheters, and blood cultures), a lack of premixed antibiotics, and delays in assembling the team for transport to the ICU. A majority of staff surveyed (89.5% of nurses and 86.0% of physicians) stated that a

![FIGURE 1: Perceived barriers to implementation of an early goal-directed therapy–based protocol (N = 101). CVP/ScvO₂, Central venous pressure/central venous oxygen saturation; MD, doctor of medicine; RN, registered nurse.](image-url)
written protocol, similar to the ones already in place in the department for the management of acute coronary syndrome and pneumonia, would help them to manage patients with sepsis.

IDENTIFICATION OF SEPSIS

The majority of physicians (72.7%) reported being familiar with SIRS criteria, although familiarity varied widely between resident and attending physicians (Table 2). More than 85% of nurses reported that they were “somewhat” or “not at all” familiar with SIRS criteria. RNs with more than 10 years of experience were more likely than other nurses to be “not at all” familiar (60%), although this result was not statistically significant. Only 15.8% of nurses reported that abnormal vital signs were reported in a timely fashion by support staff. The majority of nurses (68.5%) felt “very confident” in their ability to recognize septic shock in triage, although the proportion was higher for pneumonia (74.5%). (Much educational emphasis has been placed on pneumonia in our department, and a written protocol for this condition is well established.)

LACTATE

Among physicians, 43.2% reported that they “hardly ever” order a venous lactate culture when ordering blood cultures; this percentage corresponded with the proportion of nursing respondents who stated that they “hardly ever” receive orders for venous lactate cultures (43.9%). Among physicians, the mean minimum value of venous lactate that would raise concern for severe sepsis was 3.1 mmol/L (SD 1.8, range 0-10); among RNs, this value was 8.3 mmol/L (SD 14.5, range 0-70). The majority of physician respondents (63.6%) believed that the correlation between arterial and venous lactate, which has been shown to be >95%, was <90%, and 62.5% of RNs were unsure of the association. Nearly all nurses (98.2%) correctly identified the proper specimen tube to use when sending blood for a venous lactate culture.

FLUID RESUSCITATION AND MEDICATIONS

The expected volume of isotonic crystalloid fluid for a patient with sepsis during a 6-hour stay in the emergency department was 5.2 L (SD 1.9, range 0-10) for physicians and 4.8 L (SD ± 2.1, range 1-10) for RNs. When asked to self-assess their competence in performing a dynamic inferior vena cava ultrasound for fluid responsiveness, more than half (59.1%) of physicians felt “somewhat competent” and 29.5% felt “not at all competent.” Attending physicians were significantly more likely than residents to feel “not at all competent” ($\chi^2 = 6.9, P = .03$). Only half of the physicians (50.0%) were “very confident” in choosing appropriate antibiotics for a patient with severe sepsis.

SUGGESTIONS FOR IMPROVEMENT

Respondents from both professional groups were invited to propose methods for improving sepsis care within the emergency department. Some of the most frequently suggested actions were earlier critical care consultation, perhaps with use of a sepsis rapid response team similar to the stroke and myocardial infarction teams currently in place; in-service sessions for nurses on both protocols and physiology (“the how and the why”); greater collaboration between nurses and emergency room technicians (ERTs), both to recognize subtle changes in vital signs and to accomplish the often lengthy workup required, triage protocols to prompt early recognition; technological improvements such as point-of-care lactate testing; and restructuring the caseload of nurses and residents assigned to a patient with sepsis.

Discussion

In a recent survey by Carlbom and Rubenfeld, ED nurse managers and physician directors identified a critical shortage of nurse staffing as one of the largest impediments to implementation of a quantitative resuscitation clinical pathway. Our results are consistent with these findings, in that nurse staffing was the second most commonly cited barrier to implementation of a protocol-based approach to early sepsis resuscitation by both nurses and
physicians. Carblo and Rubenfeld also found that challenges in identifying patients with sepsis were an obstacle to implementation. Similarly, missed opportunities for identification in triage and a delay in diagnosis by physicians were among the most commonly cited barriers in our survey.

In response to the identification issues identified in the survey findings, a multidisciplinary education program that will target nurses, physicians, and ERTs has been developed. Nursing education focuses on the nurse’s role in identifying patients with sepsis and septic shock in triage, as well as screening for occult shock, that is, patients who may present with normal vital signs but who may be in a state of persistent hypoperfusion. Nursing education also will encompass both the physiology and management of sepsis, with a special emphasis on venous lactate measurement, which often is utilized as a screening test for the presence of lactic acidosis and shock.

Among physician staff surveyed, the belief that invasive technologies such as CVP and ScvO2 monitoring are necessary for effective treatment was prevalent. Because the seminal work by Rivers et al included these treatment modalities in their protocol, it is not surprising that the need to use them has become ingrained to some extent. However, Jones et al demonstrated that lactate clearance, a reduction in lactate concentration of at least 10% from two consecutive blood specimens, similarly has been associated with improved outcomes and can be measured non-invasively. It has been shown that it is not inferior to ScvO2, which has been used in many centers as a therapeutic end point but is more invasive. Dynamic inferior vena cava sonography is a noninvasive, bedside imaging modality being used by emergency and critical care physicians to assess fluid responsiveness. Because invasive measurements are not feasible in many emergency departments, our clinical pathway includes empiric fluid loading, lactate clearance, and inferior vena cava ultrasound as an alternative to CVP and ScvO2 monitoring. The survey findings indicate that physician education will need to be conducted to convince staff that this alternative method of measurement is both feasible and effective.

Sexton has described reduced postoperative sepsis rates in the setting of a climate of enhanced teamwork; operating rooms with staff that report having the most teamwork-aligned attitudes also have postoperative sepsis rates half that of the Agency for Healthcare Research and Quality–reported national average. The tendency of survey respondents to place responsibility on other groups for identification and treatment delays (nurses on physicians and vice versa, and emergency personnel on the ICU staff) strongly indicate that any future efforts must emphasize teamwork and must include representatives from all disciplines (emergency and critical care) and professions (nurses, physicians, and ERTs) in order to be successful. To this end, an interdisciplinary committee with representatives from emergency medicine, critical care medicine, clinical pharmacy, patient safety/quality, nursing management, and clinical nursing is charged with implementation of the clinical pathway initiative. One early outcome of this collaboration has been the development of a “sepsis pager” that can be initiated in the emergency department as early as triage and will alert the ICU and other entities such as the laboratory and nursing management to facilitate faster treatment and transfer.

IMPLICATIONS FOR EMERGENCY NURSING

Because the SCC focuses on the crucial first 6 hours after the recognition and diagnosis of sepsis, facilitation of early diagnosis is essential. Because they are the first clinicians to evaluate patients, nurses have both the opportunity and the responsibility to suspect sepsis and initiate the clinical pathway. Tromp et al demonstrated that a nurse-driven protocol initiated at triage improved compliance with bundle elements. Cases that were included by nurses were significantly more compliant with bundle elements than cases that were not included by nurses, illustrating the potential impact of an empowered nursing staff.

Respondents to the survey identified two key areas to be addressed specifically by nursing. First, education regarding the timely identification and treatment of sepsis and septic shock is necessary across all levels of experience. Not only were knowledge deficits and practice issues identified, but a significant number of write-in responses pointed to education as a solution for barriers to clinical pathway implementation. Second, a fair amount of “finger pointing” is done both between professions (nurses and physicians) and units (emergency department and ICU). This finding highlights the need for an interdisciplinary approach to protocol development and implementation, both to address current perceptions and to avoid possible pitfalls. Collaboration between ED and ICU nurses both to facilitate accurate handoff and timely transfer and to nurture a “culture of safety” will be crucial to the success of the pathway.

LIMITATIONS

Because participation in the survey was voluntary, clinicians with a greater interest in and knowledge of the problem may have been more likely to participate, resulting in selection bias. The findings of this survey are reflective only of conditions at our particular institution. Other entities wishing to
implement a protocol-based approach to sepsis should undertake their own needs assessment to identify issues and barriers particular to them. The questionnaire was developed for use only in this context and was not a validated survey tool. As such, results may not be reproducible.

Conclusions

Data on nursing barriers to implementation of a clinical pathway for sepsis in the emergency department are lacking and represent a large area of need within the science of knowledge translation and clinical pathway implementation. Hospitals seeking to improve their treatment of sepsis may benefit from individual unit-level surveys to identify baseline knowledge and possible barriers. Our survey revealed significant knowledge deficits and other barriers to clinical pathway implementation that must be addressed through education and enhanced interdisciplinary and interprofessional collaboration.

REFERENCES