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Sepsis-review of screening for sepsis by nursing, nurse driven sepsis protocols and development of sepsis hospital policy/protocols

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Abstract
Sepsis is one of the leading causes of death in the United States. In order to decrease the morbidity and mortality associated with sepsis in patients, early detection is vital, and so screening protocols have been developed. The Surviving Sepsis Campaign has developed an evidence based screening guideline that has been adapted by various institutions. Having specific criteria in detecting a septic patient is the defining factor in screening for sepsis by nursing staff. In order for the sepsis protocol to be effective, it is necessary that nursing and other front line staff be educated. Institutional barriers regarding implementation of protocol is another factor that still needs to be effectively addressed. This review will explore the benefit of implementing sepsis protocols within hospitals and many of the challenges that have already been faced.

Introduction
Sepsis is a severe and life threatening systemic inflammatory response to an infection that can ultimately progress to severe sepsis and septic shock. The underlying infection can be attributed to many pathogens, but it is most commonly caused by gram-positive bacteria followed by gram-negative in hospitalized patients [1]. Sepsis is among one of the leading causes of admission to the hospital and is associated with significant morbidity and mortality among patients. In the United States alone it affects more than 750,000 patients and accounts for 215,000 deaths annually [2]. When compared to patients hospitalized for various conditions those with sepsis were found to have a 75% longer average length stay [3]. Due to the length of stay and attention that septic patients require it imposes significant financial costs. In 2008, it was estimated $14.6 billion was spent on treating patients who were hospitalized for sepsis [4]. It is the most costly treated condition among hospitalized patients and out of the total combined costs for all hospitalizations in the United States it accounted for 5.2 percent of the spending [5]. Despite recent medical advances the incidence rate of sepsis has been shown to be increasing over the previous twenty years [2]. In order to decrease this trend early identification by nursing and screening is crucial to see a decrease in patient mortality. Management should be focused on early fluid and antibiotic administration. It was shown that for every hour there was a delay in the administration of appropriate antibiotic medications resulting in a decreased survival rate of 7.6% during the 6-hour period following the documentation of hypotension [6]. Even with early intervention, patients who developed severe sepsis and survived are more likely to develop considerable neurocognitive and physical impairments [7].

Screening for sepsis by nursing
The increasing incidence of sepsis makes it an overall concern for hospital staff. As such, screening draws early detection to patients with potential to sepsis. Nurses are in a unique position of constant patient interaction; sepsis screening can be integrated to be a part of a nurse’s daily routine. Nurses need to be adequately educated to identify and effectively treat sepsis. Unfortunately, identifying sepsis still poses big challenges [8]. First line healthcare staff needs to be properly educated on these symptoms and treatment to react effectively. Simple screening tools can be used to identify sepsis in patients. The Surviving Sepsis Campaign (SSC), has created evidence based guidelines to assist hospitals and staff in creating their own screening protocol (Figure 1). The latest update [1], brought together 68 international experts to assess the importance of various symptoms and treatments based on clinical evidence. The first step of the screening test identifies whether the patient has two or more features of Systemic inflammatory response syndrome (SIRS). SIRS is a group of reactions to nonspecific insult (Figure 2). Although SIRS can be due to multiple causes, when combined with an infection, it could indicate sepsis. At this point, patients should be monitored, particularly for signs of organ dysfunction. If at least one of the signs of hypoperfusion or organ dysfunction becomes present, the patient has progressed to severe sepsis. Furthermore, septic shock could occur if severe sepsis is associated with refractory hypotension.

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Key words: sepsis, surviving sepsis campaign, nurses, screening

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"Chart record – use patient label. Do not remove from chart"

Evaluation for Severe Sepsis Screening Tool

Instructions: Use this optional tool to screen patients for severe sepsis in the emergency department, on the medical/surgical floors, or in the ICU.

1. Is the patient’s history suggestive of a new infection?
   - Pneumonia, empyema
   - Urinary tract infection
   - Acute abdominal infection
   - Meningitis
   - Skin/soft tissue infection
   - Bone/joint infection
   - Wound infection
   - Blood stream catheter infection
   - Implanted device infection
   - Other infection

   _Yes_  _No_

2. Are any two of the following signs & symptoms of infection both present and new to the patient? Note: laboratory values may have been obtained for inpatients but may not be available for outpatients.
   - Hypothermia > 38.3 °C (101.0 °F)
   - Hypothermia < 36 °C (96.8 °F)
   - Altered mental status
   - Tachycardia > 90 bpm
   - Tachypnea > 20 bpm
   - Leucocytosis (WBC count >12,000/µL)
   - Leukopenia (WBC count < 4,000/µL)
   - Hyperglycemia (plasma glucose >140 mg/dL or 7.7 mmol/L in the absence of diabetes)

   _Yes_  _No_

If the answer is yes, to both questions 1 and 2, _suspicision of infection_ is present:

- Obtain: lactate, blood cultures, CBC with differential, basic chemistry labs, bilirubin.
- At the physician’s discretion obtain: UA, chest x-ray, amylase, lipase, ABG, CRP, CT scan.

3. Are any of the following organ dysfunction criteria present at a site remote from the site of the infection that are NOT considered to be chronic conditions? Note: in the case of bilateral pulmonary infiltrates the remote site stipulation is waived.
   - SBP < 90 mmHg or MAP < 65 mmHg
   - SBP decrease > 40 mm Hg from baseline
   - Creatinine > 2.0 mg/dL (178.8 mmol/L) or urine output < 0.5 ml/kg/hour for 2 hours
   - Bilirubin > 2 mg/dL (34.2 mmol/L)
   - Platelet count < 100,000 µL
   - Lactate > 2 mmol/L (10.0 mg/dL)
   - Coagulopathy (INR >1.5 or aPTT > 60 sec)
   - Acute lung injury with PaO2/FIO2 < 250 in the absence of pneumonia as infection source
   - Acute lung injury with PaO2/FIO2 < 200 in the presence of pneumonia as infection source

   _Yes_  _No_

If _suspicision of infection_ is present AND _organ dysfunction_ is present, the patient meets the criteria for SEVERE SEPSIS and should be entered into the severe sepsis protocol.

Date: ___/___/___ (circle: dd/mm/yy or mm/dd/yy)  Time: ___: ___ (24 hr. clock)

Version 7.2.13

Figure 1: Evaluation for severe sepsis screening tool online at http://www.survivingsepsis.org/sitecollectiondocuments/screeningtool.pdf

(BP < 90/60) despite adequate fluid resuscitation and/or a serum lactate level ≥ 4.0 mmol/L [1,9].

The goal is to prevent the patient from developing septic shock by immediate intervention of patients determined to have sepsis. Treatment generally involves collection of blood, for lactate, blood count and culture analysis, oxygen administration, fluids to prevent hypotension and antibiotics [1,9]. Two care bundles have been recommended by the SSC for management of severe sepsis, delivered within three hours and six hours of identification [1]. Daniels et al. 2010, created an alternative care bundle (The Sepsis Six Care Bundle),
Development of nurse-driven sepsis protocol

When identifying a patient who fits all criteria of being septic, it is extremely important that nurses have a management plan implemented. As this is an on-going educational process for nurses all over the country, such management plans have been known to improve patient quality of care. According to Schell-Chapel and Lee, on the early detection and management of sepsis, there are two specific care bundles that management and care fall under, the 3 hour and the 6 hour bundle. It is expected that healthcare providers obtain blood lactate levels to identify tissue hypoperfusion, perform appropriate diagnostic tests including blood cultures prior to giving antibiotics in order to obtain an immediate diagnosis and lastly administering broad spectrum antibiotics to the patient within one hour of identifying that the patient is septic. Crystalloid IV fluids are then administered to the patient if the patient is hypotensive or if a persistent lactate level of 4 mmol or higher. The patient makes a quick transition to a more advanced level of care during the 6 hour bundle. If hypotension persists, vasopressors are administered to the patient immediately. SSC guidelines recommend re-measuring lactate levels to evaluate the effects of fluid or vasopressor resuscitation, as well as measuring central venous pressure and central venous oxygen saturation in patients with septic shock to guide further interventions [15]. According to Picard, O’Donoghue et al., a strong initiative toward improving patients quality of care was considered at the Beth Israel Deaconess Medical Center (BIDMC) in Boston, Mass. by implementing a sepsis protocol. The Multiple Urgent Sepsis Therapies Protocol was designed at BIDMC and it consisted of 8 treatment modalities [16].

Education for nursing staff was a vital component to establishing a highly functional protocol. It is extremely important that nursing staff are able to make a definitive sepsis diagnosis of a patient undergoing sepsis in order to decrease mortality. Not making accurate diagnosis posed to be a problem for many facilities as the protocol and educational awareness was being established. Therefore, educational modules and staff development workshops were put into place. Case based, high fidelity, hands on simulation sessions with interprofessional participation also posed as an option for clinicians to become educated on making a proper sepsis diagnosis [15]. Hospitals can have a significant impact on sepsis morbidity and mortality by developing policies and establishing evidence-based protocols as various initiatives have shown. According to the New York State Department Health (NYDOH), for example, since the implementation of Kaiser Permanente’s Northern California sepsis program mortality has been reduced for patients admitted to hospitals with sepsis, by more than 40 percent. It has saved more than 1,400 lives. Similarly, Regions Hospital in Minnesota reports that initiatives launched in 2005 led to more than a 60 percent drop in sepsis mortality by 2011, and Intermountain Health Care reports a reduction in its sepsis mortality rate from 25% to 9%, saving 85 lives and $38 million annually [17].

According to NYDOH, development and implementation of these evidence-based protocols will promote early identification and treatment of sepsis in hospitals by focusing on 5 key areas [17].

1) Recognition of risk factors, signs and symptoms of sepsis.
2) Resuscitation with rapid intravenous fluids and administration of antibiotics upon diagnosis of sepsis.
3) Referral to appropriate clinicians and teams as appropriate.
4) Measurement and evaluation of current practices for purposes of informing future policy.
5) Quality Improvement measures that will permit development

**Systemic Inflammatory Response Syndrome**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature &gt;38.3°C, or &lt;36°C</td>
<td></td>
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<tr>
<td>Heart Rate &gt;90 bmp</td>
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<tr>
<td>Respiratory rate &gt;20 breaths/min</td>
<td></td>
</tr>
<tr>
<td>White cell count &lt;4 or &gt;12 g/L</td>
<td></td>
</tr>
<tr>
<td>Blood glucose &gt;7.7 mmol/L not diabetic</td>
<td></td>
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<tr>
<td>New altered mental state</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 2:** Criteria for Systemic Inflammatory Response Syndrome (SIRS). Adapted from McClelland H and Moxon A (2014) [9].
and dissemination of best practices through clinical and administrative information sharing [17].

In order to successfully decrease mortality in sepsis cases, hospitals need to establish and implement these evidence-based protocols and recommendations. But how are these protocols and recommendations developed? What determines the quality of evidence and the factors determining strong versus weak recommendations? Tables 1 and 2, adapted from the SCC International Guidelines for Management of Severe Sepsis and Septic Shock, highlight these points [1].

The GRADE system was adopted by the SSC in 2008 and is based on sequential determination of evidence quality and recommendation strength according to predetermined criteria [1]. A letter grade, A (high) to D (low), is assigned to designate evidence quality, and management recommendations are graded as strong (1) or weak (2) [1]. The recommendation strength is felt to be more important than the letter grade in the context of adopting a recommendation for clinical practice [1]. Using this methodology, the SSC has developed 3 and 6-hour sepsis care bundles that form the basis of institution-specific sepsis protocols. Using these care bundles has led to decreased mortality risk, as several studies have shown in Figure 2.

Nguyen and colleagues observed hospital mortality rates of 21% for patients who received all treatments specified in the bundles and 40% for those who did not (P ≤ .01) [18]. Gao and colleagues also identified increased hospital mortality in patients who did not receive all sepsis bundle treatments [18] (Figure 3). Although hospitals have seen decreased mortality risk by implementing the SSC care bundles, however, there still remain professional and institutional barriers to sepsis protocol management. A lack of expertise acknowledgement, difficulty providing education regarding protocol components, and staff’s resistance to change constitute some professional barriers [18]. A lack of interdepartmental communication, departmental collaboration, as well as limited staff numbers poses an institutional barrier to proper sepsis protocol management [18].

**Conclusion**

Due to the increasing rate of sepsis amongst hospitalized patients, it was extremely important that proper screening protocols be implemented in hospitals nationwide as early as possible. The focus of the protocols should not only include proper screening and identification, but prevention as well. Educating the nursing staff, interdepartmental communication and collaboration in identifying patients who are septic has been the primary goal of these new protocols. As with any newly implemented protocol, there were initial roadblocks, however there has been significant improvement in the proper diagnosis of septic patients by proper education of all nursing staff which ultimately led to the decrease in patient mortality.

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**Table 1. Determination of the quality of evidence.**

<table>
<thead>
<tr>
<th>Underlying methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (high) RCTs</td>
</tr>
<tr>
<td>B (moderate) Downgraded RCTs or upgraded observational studies</td>
</tr>
<tr>
<td>C (low) Well-done observational studies with control RCTs</td>
</tr>
<tr>
<td>D (very low) Downgraded controlled studies or expert opinion based on other evidence</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Factors that may decrease the strength of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Poor quality of planning and implementation of available RCTs, suggesting high likelihood of bias</td>
</tr>
<tr>
<td>2. Inconsistency of results, including problems with subgroup analyses</td>
</tr>
<tr>
<td>3. Indirectness of evidence (differing population, intervention, control, outcomes, comparison)</td>
</tr>
<tr>
<td>4. Imprecision of results</td>
</tr>
<tr>
<td>5. High likelihood of reporting bias</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Main factors that may increase the strength of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Large magnitude of effect (direct evidence, relative risk &gt; 2 with no plausible confounders)</td>
</tr>
<tr>
<td>2. Very large magnitude of effect with relative risk &gt; 5 and no threats to validity (by two levels)</td>
</tr>
<tr>
<td>3. Dose-response gradient</td>
</tr>
</tbody>
</table>

| RCT = randomized controlled trial |

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<table>
<thead>
<tr>
<th>What should be considered</th>
<th>Recommended process</th>
</tr>
</thead>
<tbody>
<tr>
<td>High or moderate evidence</td>
<td>The higher the quality of evidence, the more likely a strong recommendation.</td>
</tr>
<tr>
<td>(Is there high or moderate quality evidence?)</td>
<td></td>
</tr>
<tr>
<td>Certainty in or similar values</td>
<td>The more certainty or similarity in values and preferences, the more likely a strong recommendation.</td>
</tr>
<tr>
<td>(Is there certainty or similarity?)</td>
<td></td>
</tr>
<tr>
<td>The larger the difference between the desirable and undesirable consequences and the certainty around that difference, the more likely a strong recommendation. The smaller the net bene t and the lower the certainty for that bene t, the more likely a weak recommendation.</td>
<td></td>
</tr>
</tbody>
</table>

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**Figure 3: Sepsis protocol implementation reduces mortality risk [18].**
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References


