Review Article

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

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   ☐ Bone/joint infection   ☐ Implantable device
   ☐ Urinary tract infection   ☐ Wound infection   infection
   ☐ Acute abdominal infection   ☐ Blood stream catheter   ☐ Other infection
   ☐ Meningitis   infection   _____
   ☐ Skin/soft tissue infection   ☐ Endocarditis

                    ___ Yes   ___No

2. **Are any two of 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.**

   ☐ Hyperthermia > 38.3 °C   ☐ Tachypnea > 20 bpm   ☐ Hyperglycemia (plasma
       (101.0 °F)   ☐ Leukocytosis (WBC count   glucose >140 mg/dL) or
   ☐ Hypothermia < 36 °C   >12,000 μL−1)   7.7 mmol/L in the absence
       (96.8°F)   ☐ Leukopenia (WBC count <   of diabetes
   ☐ Altered mental status   4000 μL−1)
   ☐ Tachycardia > 90 bpm

                    ___ Yes   ___No

   If the answer is yes, to both questions 1 and 2, *suspicion of infection* is present:

   ✓ Obtain: **lactic acid, 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 (176.8 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 (18.0 mg/dl)
   ☐ Coagulopathy (INR >1.5 or aPTT >60 secs)
   ☐ 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 *suspicion 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 $\geq$ 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),

Systemic Inflammatory Response Syndrome
Temperature >38.3°C, or <36°C
Heart Rate >90 bmp
Respiratory rate >20 breaths/min
White cell count <4 or >12 g/L
Blood glucose >7.7 mmol/L not diabetic
New altered mental state

Figure 2: Criteria for Systemic Inflammatory Response Syndrome (SIRS). Adapted from McClelland H and Moxon A (2014) [9].

also endorsed by the SSC, as they felt certain elements in the previous bundle required critical-care skills that were not always available. The "Sepsis Six" was shown to improve care delivery in various clinical settings. It involves interventions that should be administered within one hour of identification, and can be started by nursing staff [10].

Certain populations are at a greater risk for sepsis, and need to be closely monitored. Paediatrics [11], the elderly, and those with comorbidities may have decreased capacity to fight infection compared to the general population. These populations may need more specific criteria when assessing for sepsis. By creating an easy to use sepsis screening tool, all nurses and healthcare staff should be adequately equipped to evaluate, diagnose and treat septic patients, decreasing the overall mortality rate of septic shock.

Although changes in protocols for sepsis screening by nurses are sometimes met with resistance [12], nurse driven implementation of sepsis protocols have shown to be highly effective in early identification and treatment of septic patients within the one hour goal [13]. Tromp and colleagues performed a before-and-after intervention study (ED setting) in which compliance with the SSC care bundle improved significantly after the implementation of their nurse-driven program [14]. The completion of four of six individual elements improved significantly. These include measuring serum lactate (improved from 23% to 80%), taking a chest radiograph (from 67% to 83%), taking urine for urinalysis and culture (from 49% to 67%), and starting antibiotics within 3h (from 38% to 56%) [14]. According to Tromp *et al.*, compliance with the SSC recommendations significantly improved after the introduction of a primarily nurse-driven, care bundle based, sepsis protocol followed by training and performance feedback [14]. Since nurses spend a significant amount of time at a patient's bedside, they are most capable of recognizing, identifying and playing a critical role in early management of sepsis patients. Having nurses at the forefront of sepsis protocol implementation, has exponentially decreased sepsis mortality rate as previously discussed. As a result, nurses and physicians are able to collaboratively work together in order to implement effective patient care.

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 has 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

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.
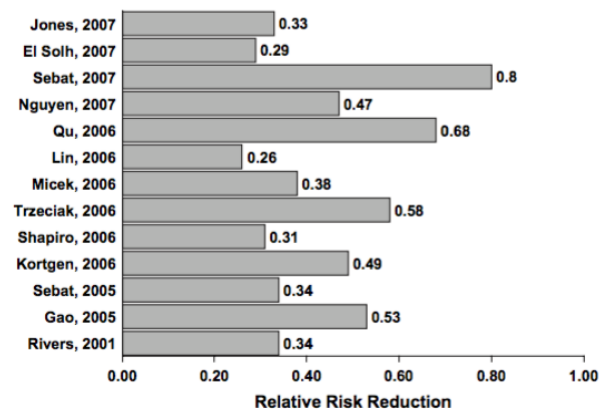

Figure 3: Sepsis protocol implementation reduces mortality risk [18].

Table 1. Determination of the quality of evidence.

Underlying methodology
A (high) RCTs
B (moderate) Downgraded RCTs or upgraded observational studies
C (low) Well-done observational studies with control RCTs
D (very low) Downgraded controlled studies or expert opinion based on other evidence
Factors that may decrease the strength of evidence
1. Poor quality of planning and implementation of available RCTs, suggesting high likelihood of bias
2. Inconsistency of results, including problems with subgroup analyses
3. Indirectness of evidence (differing population, intervention, control, outcomes, comparison)
4. Imprecision of results
5. High likelihood of reporting bias
Main factors that may increase the strength of evidence
1. Large magnitude of effect (direct evidence, relative risk > 2 with no plausible confounders)
2. Very large magnitude of effect with relative risk > 5 and no threats to validity (by two levels)
3. Dose-response gradient
RCT = randomized controlled trial

Table 2. Factors determining strong vs. weak recommendation.

What should be considered	Recommended process
High or moderate evidence	The higher the quality of evidence, the more likely a strong recommendation.
(Is there high or moderate quality evidence?)	
Certainty in or similar values	The more certainty or similarity in values and preferences, the more likely a strong recommendation.
(Is there certainty or similarity?)	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.

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