**What is the role of nursing homes in the Surviving Sepsis Campaign?**

**By**

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**Introduction**

 Recently, there have been several publications promoting the role of nursing homes in the Surviving Sepsis Campaign (SSC) [1-3]. There are several factors that appear to be the rationale for this effort. First, there is a high rate of hospital readmissions from patients discharged to nursing homes and efforts to reduce the rate of readmissions [4]. Second, there has been an ongoing effort to reduce “avoidable” hospitalizations of nursing home residents [5]. Third, severe sepsis occurs most often in those age 65 and older and mortality rates with sepsis increase with age [6]. A study of an administrative database of US emergency department visits from 2005-2009 found that nursing home residents accounted for 25% of visits with a diagnosis of severe sepsis and they had a significantly higher ICU admission rate, hospital length of stay, and in-hospital mortality compared to non-nursing home residents after controlling for age [6].

 There are several concerns regarding the promotion of nursing homes as “first responders” in the SSC [3]. Before specifically addressing the role of nursing homes it is important to briefly reflect on the history of the management of sepsis that resulted in the development of the SSC in the early 2000s. In the 1980s and 1990s several drugs were developed and tested for the treatment of sepsis with the goal of reducing mortality. The development of these drugs was based on two assumptions: (1) endotoxin or lipopolysaccharide of gram-negative bacteria is involved in the pathogenesis of sepsis and septic shock resulting in significant morbidity and mortality; and (2) the pathophysiology of sepsis in humans is due in large part to stimulation and overproduction of host mediators (cytokines). Unfortunately, studies of monoclonal IgM antibodies against the lipid A component of liposaccharide were unsuccessful [7,8] as were studies of high dose glucocorticoids to try reduce cytokine overproduction [9]. Studies involved with trying to block specific host cytokines such as IL-1 and tumor necrosis factor were also unsuccessful [10].

 Because of these failures the focus changed to trying to identify patients with bacterial infection who were trending toward sepsis and intervene before organ dysfunction occurs. There was evidence that appropriate antibiotic therapy initiated early reduced mortality in those with sepsis [11, 12]. In addition, early fluid resuscitation was considered important. These findings resulted in the development of “care bundles” discussed below. All of these guidelines pertain to hospitalized patients.

 The remainder of this document provides a brief summary of the SSC, definitions, and sepsis bundles and then discusses the potential role of nursing homes in identifying residents with suspected sepsis and their management.

**History of the Surviving Sepsis Campaign Guidelines, Sepsis Bundles, and Definitions of Sepsis, Severe Sepsis, and Septic Shock**

**Survivng Sepsis Guidelines**

The Surviving Sepsis Campaign (SSC) was initiated in 2002 with the goal to reduce mortality related to severe sepsis and septic shock. The SSC initially had 3 phases:

Phase 1 consisted of the introduction of the campaign at major international critical care conferences in 2002 and 2003. The overall goal of the campaign was to increase clinician and public awareness of the incidence of sepsis, severe sepsis, and septic shock, to develop guidelines for the management of severe sepsis, and to foster a change in the standard of care in sepsis management that would result in a reduction in mortality.

Phase 2 involved development of evidence-based guidelines for the management of severe sepsis and septic shock by an international committee of experts. An executive summary of the guidelines was published in 2004 [13].

Phase 3 of the campaign aimed to operationalize the executive summary recommendations into a set of practical yet valid performance measures. Tool kits were created to allow clinicians to incorporate recommendations into bedside care. These tools included educational programs designed to increase awareness and agreement with the recommendations, checklists or bundles to help ensure patients receive the intervention, and performance measures designed to provide feedback regarding how often patients receive the evidence-based recommendations. Quality indicators were also developed to evaluate a hospital’s performance with respect to sepsis care. In this phase the “sepsis bundle” was introduced which was defined as a package of key elements or goals from the SSC guideline that when introduced into clinical practice have a high likelihood of reducing mortality due to severe sepsis. The aim of the sepsis bundle was two-fold: first, to eliminate the piecemeal application of the guidelines and second, to make it easier for clinicians to bring the guidelines into practice.

**SCC guidelines updates**

 The guidelines were subsequently updated about every 4 years to allow for changes based on research done after the guidelines were released.

 The first update was in 2008 and included a bundle that was recommended to be completed in 6 hours from the identification of severe sepsis [14]. The second update was in 2012. [15].

 In 2016 the SSC guidelines were again updated [16]. This guideline recommended that antibiotic therapy be initiated within 1 hour of the diagnosis of sepsis or septic shock and that at least 30 ml/kg of IV crystalloid be given in the first 3 hours after sepsis-induced hypoperfusion has been identified. This guideline eliminated the severe sepsis category and redefined sepsis [see section on definitions below]. It is important to note that the 2016 SSC guidelines were not endorsed by the Infectious Diseases Society of America [17]. The debate about utilizing the 1-hour bundle has continued [18].

**Sepsis Bundles**

 The major authors of the Sepsis Campaign Guidelines have stressed that the guidelines “must be considered separately from the SCC bundles because they are distinctly different entities” [19]. The authors of the SSC guidelines partnered with the Institute for Healthcare Improvement to develop the initial bundle. Revisions of the bundle have occurred several times since the initial release in 2005.

 The initial bundle consisted of a 6-hour resuscitation bundle and a 24-hour management bundle. With the availability of multiple studies of the application of these bundles they were revised to 3- and 6-hour bundles in 2015.

 In 2018, a revised SSC bundle was released and combined the 3- and 6-hour bundle into a single Hour-1 bundle [20]. According to the authors of the 2018 revision, the hour-1 bundle was “to ensure that continuous improvements in performance were realized and to emphasize that sepsis and septic shock should be viewed as medical emergencies that require rapid diagnosis and immediate intervention. These interventions should be started within the first hour from sepsis recognition. The bundle is intended as a tool to facilitate the prompt diagnosis and treatment rather than a quality indicator to be adopted by national regulatory agencies.” [20].

**Definitions**

 Table 1 provides the history of definitions for sepsis, severe sepsis, and septic shock. These have been referred sequentially as SEP-1, -2, and -3. The initial definitions in 1991 were based on the view at that time that sepsis was a result of the host’s systemic inflammatory response syndrome (SIRS) to infection.

 In 2001 the definitions were reviewed and the list of diagnostic criteria were expanded but the definitions were otherwise unchanged from those published in 1991.

 In 2016, after review by an expert panel, the definition for severe sepsis was dropped. In its place sepsis was defined as life-threatening organ dysfunction caused by a dysregulated host response to infection [formerly severe sepsis]. Organ dysfunction was defined as an acute change in the Sequential Organ Failure Assessment (SOFA) score > 2. Septic shock is a subset of sepsis in which underlying circulatory and cellular/metabolic abnormalities are profound enough to substantially increase mortality [21]

**Summary**

In the past 3 decades there has been an evolution in our understanding about sepsis and its management. Specific drugs or efforts to neutralize the effects of host response have failed to improve outcomes. The focus of efforts has changed to earlier recognition of sepsis and earlier initiation of antibiotic therapy and fluid resuscitation to reduce morbidity and mortality with some success. The SSC developed almost 2 decades ago has evolved as well. However, there has been considerable pushback from critical care [22] and infectious diseases [18] regarding the SSC guidelines and sepsis bundles.

 At the same time over the past 2 decades, there have been parallel efforts ongoing dealing separately with guidelines, sepsis bundles, and sepsis definitions which has added to the confusion when trying to develop an approach to identifying and managing patients with suspected infection. There is no gold standard for the diagnosis of sepsis and, as a result, screening tools with a high diagnostic sensitivity have not been defined. The latest SSC guideline now defines sepsis as life-threatening organ dysfunction due to a dysregulated host response to infection. It is clear that this definition defines a process that has been ongoing for some time. However, what is more important is identifying those who have infection before they develop organ dysfunction which is not addressed by the latest guideline. This is a major concern for emergency medicine physicians, critical care specialists, and infectious diseases specialists.

**Identifying suspected sepsis in nursing home residents**

The findings of age-related increase in mortality with sepsis and that a significant proportion of those admitted to a hospital with sepsis are nursing home residents [6] has stimulated an emphasis on the nursing home for identification of sepsis at an early stage and to initiate treatment in that setting with the goal of reducing hospitalizations as well as mortality [3]. The proponents of this approach have taken the SSC guidelines developed for the hospital setting and applied them to the nursing home setting [2, 3]. However, there is little information about sepsis in the nursing home setting, how to identify residents with infection who may develop sepsis, or the feasibility of nursing homes to evaluate residents in a timely fashion and initiate appropriate management.

As far as can be determined there is only one study that has attempted to look at the management of residents with sepsis in the nursing home [1]. The goal of this study was to determine if various screening methods for sepsis were used in a group of residents transferred to the hospital some of whom were identified with sepsis. The authors evaluated 3 methods to identify sepsis: SIRS, qSOFA, and 100-100-100 criteria or absence of fever to determine which best differentiated “early” sepsis from non-sepsis conditions. There was a total of 236 episodes evaluated of which 59 had a diagnosis of sepsis on return to the nursing home. Retrospectively, the authors applied each of the methods above to determine sensitivity and specificity in identifying sepsis. Noteworthy is that cases transferred to a hospital during the study period (representing 20% of the total transfers) did not return to one of the study nursing homes and the outcome of these cases was not known by the authors. During the study the authors found that documentation of key indicators such as vital signs or cognitive status was limited and a face-to-face provider visit prior to hospital transfer was infrequent. In the analysis of the operating characteristics of each screening tool the number of cases of sepsis decreased to 47 and with non-sepsis to 135. No screening tool had a sensitivity for sepsis greater than 28% 13-72 h prior to hospitalization but specificity was high (84-97%). If the time period analyzed was changed to within 12 h of hospitalization, the most sensitive tool was the 100-100-100 criteria (79%); SIRS criteria had a specificity of 86%.

The study by Sloane and colleagues [1] has several limitations that impact the value of this study. The diagnosis of sepsis was based on discharge records from the hospital and was not verified; the use of this approach to identify sepsis can be questioned. The study population was small with only 59 episodes of sepsis and this was further decreased to 47 because of the lack of vital signs to calculate screening test scores. Twenty percent of the transfers were lost to follow-up and the diagnoses were not known but some probably had sepsis. Although the percentage of residents who were seen in the facility by a provider before transfer was low [which is not surprising], it is highly likely that a provider was contacted with information about the change in status before transfer. An important issue not addressed by the authors is that qSOFA was not developed to be a screening tool for sepsis. On the contrary, it is a risk stratification tool designed to predict the likelihood of ICU admission or hospital mortality in those with a diagnosis of sepsis [23]. The value of the analysis of the operating characteristics for SIRS and 100-100-100 is questionable because of the small sample size with a diagnosis of sepsis. The most important finding of this study is that documentation of vital signs and other parameters of residents transferred to the hospital was poor. This points out the importance of educating staff about the value of collecting appropriate data to identify infection and possible sepsis. The authors suggest, based on their findings, that the 100-100-100 criteria may be a useful screening tool for sepsis risk. If the screen is positive, the authors suggest that these residents should be seen in person or virtual visit by a provider and a protocol should be developed to standardize periodic follow-up along with what they call rapid diagnostic testing [WBC count, serum procalcitonin and lactate levels]. The authors state that such a protocol may reduce hospitalizations and improve treatment of residents with sepsis.

As previously noted, no other studies of sepsis in the nursing home setting were identified on search of the literature. However, efforts in several states to deal with sepsis identification and management in nursing homes were identified. The Ohio Statewide Sepsis Initiative was established as a collaboration of the Ohio Hospital Association and the state QIO and other entities that focused on sepsis in nursing homes [24]. The Seeing Sepsis campaign by the Minnesota Hospital Association developed an algorithm for identification and management of sepsis in the nursing home; the 100-100-100 screening tool was developed by this group [25]. The QIO for New York State developed a similar care pathway for recognizing sepsis in nursing homes. An INTERACT care path for identification of sepsis in the nursing home is available. TMF Health Quality Institute is the QIN-QIO for Arkansas, Missouri, Oklahoma, Texas, and Puerto Rico and has developed an extensive program for the identification and management of sepsis in the nursing home setting with toolkits for download [26].

A Powerpoint presentation in March 2017 by the Ohio Statewide Sepsis Initiative was found online and provides excellent background for developing a sepsis initiative focusing on long-term care. The Ohio Initiative provides a roadmap for a Florida initiative to deal with sepsis identification and management in the nursing home. For example, a steering committee could be formed by representatives from the FHA, FMDA, Florida Department of Health, and HSAG that focuses on hospital readmissions and sepsis in nursing homes as a major target for reducing admissions and readmissions. A PALTC subcommittee could be formed from the steering committee members and charged with focusing on sepsis (capability directory, education, protocols using information already available). It may be necessary to develop a Sepsis Team to carry out much of this activity. There will also be a need to develop metrics for monitoring results of these initiatives.

At the present time recommendations that nursing homes fulfill the role of “first responders” for the SSC is premature for Florida nursing homes. There needs to be a highly organized program to determine nursing home capability, to educate nursing home staff and providers about sepsis, and to develop protocols for staff to use in caring for residents with suspected infection. Following those efforts, monitoring of sepsis metrics [to be developed] will be necessary to determine the effectiveness of education efforts and protocols.

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**Table 1**

**Sepsis-1 definitions [1991]**

*SIRS (systemic inflammatory response syndrome)*

Presence of more than 1 of 4 findings:

* Or a systolic blood pressure decrease > 40 mmHg in adults or < 2 SD below normal for age
* Mixed venous oxygen saturation > 70%
* Cardiac index > 3.5 l min m
* Organ dysfunction parameters

− 1 − 2

* Body temperature > 38.0 or < 36.0 °C
* Heart rate > 90 beats/min
* Tachypnea > 20 breaths/min or hyperventilation with PaCO2 < 32 mmHg
* Arterial hypoxemia (PaO2/FIO2 < 300) – 1
* Acute oliguria (urine output > 0.5 ml/kg
1. M/l for at least 2 h)
* Creatinine increase ≥ 0.5 mg/dlh− 1 or
* White blood cell (WBC) count > 12,000 cells/mm3 or < 4000 cells/mm3

*Sepsis*

SIRS in the presence of a confirmed or suspected infection.

*Severe sepsis*

Sepsis associated with organ dysfunction, hypoperfusion, or hypotension,

*Septic shock*

Sepsis with arterial hypotension despite adequate fluid resuscitation.

**Sepsis-2 definitions [2001]**

*Sepsis*

Infection documented or suspected and some of the following parameters:

General parameters

* Fever (core temperature > 38.3 °C)
* Hypothermia (core temperature < 36 °C)
* Heart rate 90 bpm or > 2 SD above the normal value for age
* Tachypnea: > 30 bpm
* Altered mental status, significant edema or positive fluid balance (> 20 ml/kg over 24 h)
* Hyperglycemia (plasma glucose > 110 mg/dl or

7.7 mM/l) in the absence of diabetes

Inflammatory parameters

* Leukocytosis (white blood cell count > 12,000/μl)
* Leukopenia (white blood cell count < 4000/μl)
* Normal white blood cell count > 10% immature forms
* Plasma C reactive protein > 2 SD above the normal value
* Plasma procalcitonin > 2 SD above the normal value

Hemodynamic parameters

* Arterial hypotension (systolic blood pressure < 9 0 mmHg, mean arterial pressure < 70)
* Coagulation abnormalities (international normalized ratio > 1.5 or activated partial thromboplastin time > 60 s)
* Ileus (absent bowel sounds)
* Thrombocytopenia (platelet count 4 mg/dl or 70 mmol/l)

Tissue perfusion parameters

* Hyperlactatemia (> 3 mmol/l)
* Decreased capillary refill or mottling

**Sepsis-3 definitions [2016]**

*Sepsis*

Life-threatening organ dysfunction due to a dysregulated host response to infection.

Sepsis clinical criteria: organ dysfunction is defined as an increase of 2 points or more in

Sequential Organ Failure Assessment (SOFA) score.

Patients with suspected infection who are likely to have a prolonged ICU stay or to die in

the hospital can be promptly identified at the bedside with qSOFA. Two or more of:

* Hypotension: SBP less than or equal to 100 mmHg
* Altered mental status (any GCS less than 15)
* Tachypnoea: RR greater than or equal to 22

*Septic shock*

Subset of sepsis in which underlying circulatory and cellular/metabolic abnormalities are

profound enough to substantially increase mortality.

Septic shock clinical criteria: Sepsis and (despite adequate volume resuscitation) both of:

Persistent hypotension requiring vasopressors to maintain MAP greater than or equal to

65 mmHg, and lactate greater than or equal to 2 mmol/l.