

Selected Topics: Prehospital Care

EARLY DETECTION AND TREATMENT OF PATIENTS WITH SEVERE SEPSIS BY PREHOSPITAL PERSONNEL

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Abstract—Background: Severe sepsis is a condition with a high mortality rate, and the majority of patients are first seen by Emergency Medical Services (EMS) personnel. **Objective:** This research sought to determine the feasibility of EMS providers recognizing a severe sepsis patient, thereby resulting in better patient outcomes if standard EMS treatments for medical shock were initiated. **Methods:** We developed the Sepsis Alert Protocol that incorporates a screening tool using point-of-care venous lactate meters. If severe sepsis was identified by EMS personnel, standard medical shock therapy was initiated. A prospective cohort study was conducted for 1 year to determine if those trained EMS providers were able to identify 112 severe sepsis patients before arrival at the Emergency Department. **Outcomes of the sample of severe sepsis patients were examined with a retrospective case control study. Results:** Trained EMS providers transported 67 severe sepsis patients. They identified 32 of the 67 severe sepsis patients correctly (47.8%). Overall mortality for the sample of 112 severe sepsis patients transported by EMS was 26.7%. Mortality for the sample of severe sepsis patients for whom the Sepsis Alert Protocol was initiated was 13.6% (5 of 37), crude odds ratio for survival until discharge was 3.19 (95% CI 1.14–8.88; $p = 0.040$). **Conclusions:** This pilot study is the first to utilize EMS providers and venous lactate meters to identify patients in severe sepsis. Further research is needed to validate the Sepsis Alert Protocol and the potential associated decrease in mortality. © 2013 Elsevier Inc.

Keywords—prehospital; Emergency Medical Services; sepsis; venous lactate

INTRODUCTION

Severe sepsis and septic shock combined are the 10th leading cause of death, resulting in 215,000 deaths annually and 50.37 deaths per 100,000 people in the United States (US) (1). There are an estimated 751,000 cases of sepsis every year, and age-related, sepsis-associated mortality continues to rise (2,3). The cost of caring for this group of patients is estimated to be \$22,100 per case and \$16 billion annually (2). More than one third of Emergency Department (ED) patients with an infection and patients with severe sepsis and septic shock received their initial care from prehospital personnel (4,5). In addition, patients presenting by Emergency Medical Services (EMS) have higher mortality rates, even after adjusting for demographics and comorbidities (5). Health care providers can decrease patient morbidity and mortality by identifying those with severe sepsis as early as possible and initiating treatment in the most proximal phase of illness (6–8).

Early EMS detection of patients with other severe and critical disorders and advance notification to the receiving

ED has been shown to decrease time to diagnosis and treatment times and potentially improve outcomes. For example, in cases of acute stroke, EMS providers have been trained to identify patients and relay this information to the receiving hospital. These patients have shorter door-to-computed tomography scan times and a modest increase in the use of tissue plasminogen activator (9). Similarly, decreased door-to-balloon times have been demonstrated in ST segment elevation myocardial infarction patients by using prehospital electrocardiograms (10,11). A need for increased awareness and more aggressive treatment in the out-of-hospital setting has been recommended previously, and a prehospital severe sepsis screening tool based on consensus definitions has been developed, but not tested (5,12).

We created this pilot study to investigate the feasibility of a prehospital sepsis screening tool. To that end, we developed a methodology comparable with the cardiac and stroke alert prenotification process to the ED. The Sepsis Alert Protocol (Table 1) contained many familiar components of our longstanding EMS cardiac and stroke alert programs, such as early notification and standardized EMS treatment (13). Our study included two components, identification and treatment. The identification component was executed solely by EMS. The treatment component was initiated by EMS and was to be continued by the ED staff after arrival in the ED. It is important to note that the treatments initiated before hospital arrival were standard EMS interventions for medical shock and contained no new treatment modalities except prompt initiation of treatment. For the ED, treatment was defined as reception of the patient by appropriate staff with the resources necessary for the care of a patient in severe sepsis. Continuation of EMS-initiated treatments was at the discretion of the receiving ED physician.

The primary objective of this study was to determine if EMS providers could identify patients with severe sepsis after having received training in identification of severe sepsis using an evidence-based screening instrument. The secondary objective was to examine differences in

mortality between EMS patients in severe sepsis for whom the Sepsis Alert Protocol was initiated or not initiated. We also attempted to evaluate any factors or interventions identified a priori from past studies that might have affected patient survivability: patient comorbidities, time to antibiotics, amount of intravenous fluid infused, central line placement, and intubation. In addition, we have established a platform for future research studies on prehospital identification and treatment for severe sepsis.

METHODS

Setting

The three participating hospitals are tertiary care centers and collectively care for > 80,000 ED patients annually. Approximately 57% of the 911 EMS transports into the three hospitals are from EMS agencies that function under the medical control of the researching entity. Four board-certified Emergency Physicians provide medical direction for the various agencies, with additional staff responsible for supervision, training, and education for > 950 Emergency Medical Technicians (EMTs) and paramedics. All 911 calls are received and screened by dispatchers and responding units are Advanced Life Support—staffed with two paramedics or one paramedic and an Emergency Medical Technician. The three hospital EDs participating in the study were staffed by physicians from one group who agreed to fully cooperate with the study. This cooperation enabled uniform reception of all study patients across the three hospital EDs.

Study Design and Data Collection

This study used a multi-method, quantitative design in order to evaluate first the feasibility of EMS early identification of severe sepsis before hospital arrival and, second, if there would be any improvement in outcomes for those patients treated early for severe sepsis. The first analysis extended for 1 year and used a prospective cohort study to evaluate if EMS providers trained in sepsis recognition could successfully identify patients in severe sepsis using the Sepsis Alert Protocol screening tool. The independent variable, or exposure, in the cohort study is application of the screening tool by trained EMS providers, and the outcome variable is percent of severe sepsis patients correctly identified. Data were collected prospectively during the study time frame on this cohort of EMS providers on their success in recognition and identification in the prehospital setting of severe sepsis patients. Patient data were collected retrospectively on the number of EMS patients that arrived at the ED in severe sepsis that EMS providers, previously instructed in the Sepsis Alert Protocol, failed to recognize. Identification

Table 1. Prehospital Sepsis Alert Protocol Criteria as Stated on Laminated Cards

18 years and older and not pregnant and At least two systematic inflammatory response syndrome criteria: Temperature > 38°C (100.4°F) or < 36°C (96.8°F) Pulse > 90 beats/min Respiratory rate > 20 breaths/min or mechanically ventilated and Suspected or documented infection and Hypoperfusion as manifested by one of the following: Systolic blood pressure < 90 mm Hg Mean arterial pressure < 65 mm Hg Lactate level \geq 4 mmol/L
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