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Selected Topics: Critical Care

DOES INITIAL TEMPERATURE IN THE EMERGENCY DEPARTMENT PREDICT OUTCOMES IN PATIENTS ADMITTED FOR SEPSIS?

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Abstract—Background: Sepsis is a leading cause of morbidity and mortality in hospitalized patients. Prompt recognition and early treatment has been shown to improve mortality. Both low and high temperature are among the four elements of systemic inflammatory response required for the diagnosis of sepsis. We hypothesized that initial temperature has an effect on the identification, treatment, and outcomes of septic patients. **Objective:** Our aim was to determine the prognostic and diagnostic utility of the initial recorded body temperature in patients presenting to the emergency department (ED) with sepsis. **Methods:** This retrospective cohort study was conducted in the ED of a single facility during the study period of January 1, 2014 through December 31, 2014. **Inclusion criteria** were adult subjects 18 years of age and older who were admitted to the hospital from the ED with a diagnosis of sepsis. **Results:** Hypothermia on presentation was associated with a longer time to antibiotics treatment of 338.6 min ($p = 0.002$), longer length of stay of 14.5 days ($p < 0.001$), higher rate of intensive care unit (ICU) admission of 32.7% ($p = 0.003$), and higher mortality rate of 30.8% ($p < 0.001$). **Conclusions:** In this study of adult patients diagnosed in the ED with sepsis, hypothermia correlated with increased time to initial antibiotics, length of stay, rate of ICU admission, and mortality. Therefore, hypothermia in the setting of sepsis requires early and aggressive intervention to prevent adverse outcomes and delays in care. © 2018 Elsevier Inc. All rights reserved.

Keywords—sepsis; severe sepsis; septic shock; hypothermia; initial temperature; mortality

INTRODUCTION

Sepsis affects more than 1 million Americans each year, with mortality for patients with severe sepsis and septic shock ranging from 25% to 50% (1). In 2002, the Surviving Sepsis Campaign (SSC) was established to reduce mortality from sepsis by building awareness, improving diagnosis, and increasing use of appropriate treatment. Throughout the years, diagnosis and treatment of sepsis have become more aggressive and timely. In 2012, the SSC released updated guidelines for management of septic patients (2). This guideline recommends completing a sepsis bundle, which includes measuring a lactate level, obtaining blood cultures, fluid resuscitation, and administration of broad-spectrum antibiotics, within 3 h of identification. Despite the existence of these guidelines, adherence to the 3-h bundle continues to be a challenge (3). A large cohort study of patients with septic shock from the SSC registry revealed that only 68% of patients received broad-spectrum antibiotics within the 3-h time frame (2).

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Currently, the established definition of sepsis includes the presence of suspected or confirmed infection and systemic inflammatory response (SIRS) criteria. The SIRS criteria include increased heart rate or respiratory rate, abnormalities in white blood cell count, and a temperature $< 96.8^{\circ}\text{F}$ or $\geq 100.4^{\circ}\text{F}$. Early recognition of sepsis is associated with earlier antibiotic administration and more aggressive fluid administration. When clinicians fail to consider the diagnosis of sepsis in a timely manner, antibiotic and fluid administration is, in turn, delayed, which increases mortality in this cohort of patients (2,4–7).

Early recognition is an important goal in the care of septic patients. The primary goal of this study was to identify whether hypothermic patients in the emergency department (ED), compared with those that were either normothermic or hyperthermic, had delays in identification of sepsis and higher mortality rates.

METHODS

This retrospective cohort study was conducted in the ED of a single academic, urban facility with an annual census of 94,000 patient visits per year. The study period was January 1, 2014 through December 31, 2014. Inclusion criteria were adult subjects 18 years of age and older who were admitted to the hospital from the ED with a diagnosis of sepsis. Exclusion criteria were patients not given a diagnosis of sepsis in the ED, patients who were discharged from the ED, and patients who were not diagnosed with sepsis. Data were obtained from a hospital-based electronic sepsis database, which includes both inpatient and ED patients. The initial documented temperature was utilized because it was postulated that this vital sign would be used by providers for decision-making purposes. Patients were categorized into the following groups; hypothermic, normothermic, or hyperthermic. For the purposes of this study, hypothermia was defined as temperature $< 96.8^{\circ}\text{F}$, normothermia as $96.8\text{--}100.4^{\circ}\text{F}$, and hyperthermia as $> 100.4^{\circ}\text{F}$. Demographic data, medical history, blood pressure on ED presentation, initial white blood cell count, time to treatment with antibiotics (TTA), hospital length of stay (LOS), and final disposition were also collected. TTA was defined as first documented time of patient arrival at the ED to the time of antibiotic administration.

Statistical Analysis

The data were collected and managed using Research Electronic Data Capture, a secure, web-based application designed to support data capture for research studies. Summary statistics were presented for all patients. Categorical variables were summarized as frequency counts

and percentages and continuous variables were summarized as mean and standard deviation or median and interquartile range, as appropriate. All statistical tests were two-sided and conducted at the 0.05 level of significance. Data analyses were conducted using SPSS, version 24 (IBM Corp, Armonk, NY). The data were evaluated using descriptive statistics, Pearson correlation, linear and logistic regression analysis, χ^2 test for independence, and analysis of variance. Significance is defined as $p < 0.05$.

RESULTS

During the study period, a total of 22,310 ED patients were admitted. Among them, 574 patients were diagnosed with sepsis. Of these, 52 patients met exclusion criteria: 33 were diagnosed with sepsis as inpatients, 6 were direct admissions which bypassed the ED, 12 were admitted before January 1, 2014 and 1 patient was already being treated for sepsis at a skilled nursing facility before arrival in the ED. Male to female ratio was approximately 1 (49.6% males vs. 50.4% females). Of the remaining 522 patients included in the analysis, 52 (10%) were hypothermic, 284 were normothermic (54%), and 186 were hyperthermic (36%) (Figure 1).

As seen in Table 1, hypothermic patients were more likely to be older, with a mean age of 69.94 years, when compared to their normothermic (68.9 years) and hyperthermic (64.2 years) counterparts ($p = 0.01$). Hypothermic patients were also more likely to arrive at the hospital via emergency medical services (EMS) (75%) when compared with normothermic (56.3%) and hyperthermic (56.5%) patients ($p = 0.036$).

Upon review of all patients who were diagnosed with sepsis in the ED, mean TTA was 211.6 min. Moreover, there was a 23.9% admission rate to the intensive care unit (ICU), an average LOS of 9.3 days, and a mortality rate of 14.8%. Patients who presented with hypothermia had a longer TTA and were less likely to receive

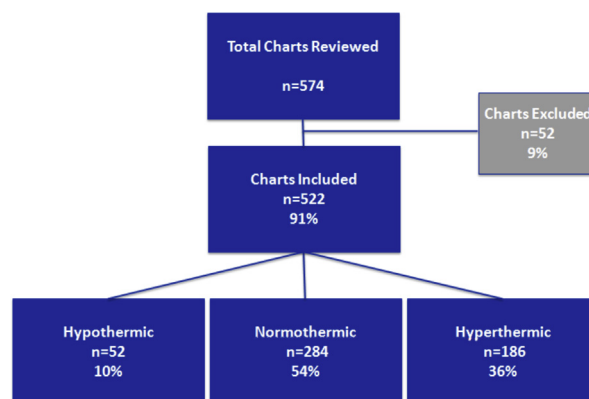


Figure 1. Study cohort.

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