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Brief Reports

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SEPTIC SHOCK AND ADEQUACY OF EARLY EMPIRIC ANTIBIOTICS IN THE EMERGENCY DEPARTMENT

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□ Abstract—Background: Antibiotic resistance is an increasing concern for Emergency Physicians. Objectives: To examine whether empiric antibiotic therapy achieved appropriate antimicrobial coverage in emergency department (ED) septic shock patients and evaluate reasons for inadequate coverage. Methods: Retrospective review was performed of all adult septic shock patients presenting to the ED of a tertiary care center from December 2007 to September 2008. Inclusion criteria were: 1) Suspected or confirmed infection; 2) ≥ 2 Systemic Inflammatory Response Syndrome criteria; 3) Treatment with one antimicrobial agent; 4) Hypotension requiring vasopressors. Patients were dichotomized by presentation from a community or health care setting. Results: Eighty-five patients with septic shock were identified. The average age was 68 ± 15.8 years. Forty-seven (55.3%) patients presented from a health care setting. Pneumonia was the predominant clinically suspected infection (n = 38, 45%), followed by urinary tract (n = 16, 19%), intra-abdominal (n = 13, 15%), and other infections (n = 18, 21%). Thirty-nine patients (46%) had an organism identified by positive culture, of which initial empiric antibiotic therapy administered in the ED adequately covered the infectious organism in 35 (90%). The 4 patients who received inadequate therapy all had urinary tract infections (UTI) and were from a health care setting. Conclusion: In this population of ED patients with septic shock, empiric antibiotic coverage was inadequate in a small group of uroseptic patients with recent health care exposure. Current guidelines for UTI treatment do not consider health care setting exposure. A larger, prospective study is needed to further define this risk category and determine optimal empiric antibiotic therapy for patients. © 2014 Elsevier Inc.

□ Keywords—sepsis; urinary tract infection; antibiotics; nosocomial; critical care

INTRODUCTION

Infections traditionally thought of as nosocomial in origin, such as health care-associated pneumonia, methicillin-resistant *Staphylococcus aureus,* and *Clostridium difficile* have become increasingly more prevalent in the community (1). In an effort to control the development of resistant microbes, the targeted use of antibiotics is recommended (2). This recommendation is supported by a number of clinical practice antimicrobial guidelines and treatment algorithms created by organizations such as the Infectious Diseases Society of America and the Sanford Guide to Antimicrobial Therapy (2). Currently, empiric antibiotic guidelines exist for many conditions such as asymptomatic bacteriuria, cystitis, catheter-related urinary tract infection, and pneumonia (3–8). These guidelines help provide structure for clinicians

when determining the appropriate antibiotics to treat these various infections.

The mortality rate associated with all causes of severe sepsis and septic shock is reported to be 20–50% (9). Mortality is higher in septic patients who receive ineffectual empiric antibiotic therapy, potentially increasing with each additional hour of delay in appropriate antibiotic administration (10–13). Early effective antibiotics could also theoretically help prevent progression of sepsis to septic shock (14).

Beyond the observed high mortality rate, there is a high financial burden associated with sepsis. With approximately 700,000 cases of severe sepsis in the United States annually, costs are estimated to be close to $17 billion per year, representing a huge burden on the health care system (15,16). As such, appropriate antibiotic therapy early in the hospital course represents an opportunity for savings by decreasing both severity of illness and length of stay (12).

Our primary objective was to examine the appropriateness of initial empiric antimicrobial therapy in septic shock patients based on microbial cultures. Secondarily, we sought to identify whether certain disease states or conditions were associated with failure to achieve adequate antibiotic coverage. Finally, we wished to assess whether health care exposure is a risk factor in acquiring virulent forms of urinary tract infection pathogens, similar to what is observed in nosocomial respiratory tract infections (17–20).

MATERIALS AND METHODS

This was a retrospective observational study of patients presenting to the Emergency Department (ED) of an urban tertiary care academic medical center located in Boston, MA between December 2007 and September 2008. The hospital has 631 inpatient beds, and 55,000 ED visits and 750,000 inpatient visits annually. This study was approved by the Institutional Review Board at the facility in which it was conducted and received a waiver of informed consent for medical record review.

A preexisting cohort of septic shock patients presenting to the ED was used to identify patients (21). Inclusion criteria consisted of: 1) Suspected or confirmed infection; 2) Two or more Systemic Inflammatory Response Syndrome criteria; 3) Treatment with at least one antimicrobial agent in the ED; and 4) Hypotension requiring vasopressor use. Immunocompromised patients (human immunodeficiency virus, acquired immunodeficiency syndrome, and patients currently on immunosuppressive therapy) and patients with known active cancer were excluded in an effort to examine health care exposure as an independent risk factor for more virulent pathogens.

A retrospective chart review of eligible patients was performed by trained research assistants and an emergency medicine resident physician. Data collected included demographics, triage vital signs, laboratory data, microbial culture data, and empiric antimicrobial therapies administered in the ED. Patients were divided into four groups based on suspected infection type: 1) pneumonia, 2) urinary tract infection, 3) intra-abdominal infection, and 4) other infection (skin and soft tissue infection, meningitis, and infection of unknown or mixed etiology). In the subset of patients with a positive culture from the site of their suspected infection, initial antimicrobial therapy was classified as appropriate if at least one of the antimicrobial agents administered in the ED displayed in vitro activity against the identified pathogen. For patients with pneumonia, in particular, the hospital's community-acquired pneumonia treatment guidelines were also used to determine if patients received guideline-concordant therapy, regardless of the identification of the cultured pathogen. To eliminate bias in assessing appropriateness, a pharmacy practice resident, an infectious diseases pharmacist, and an emergency physician independently reviewed the data and any disagreements were settled by consensus.

The primary outcome measured was adequacy of empiric antimicrobial choice. Effect of patient origin (health care or community) on the efficacy of antibiotic choice was considered. Patients presenting from a health care setting were defined using the currently accepted definition used for health care-associated pneumonia: a patient who lives in a health care setting (nursing home, rehab center, long-term care facility), is a known dialysis patient, or who was hospitalized in the last 90 days for more than 72 h (8).

Statistical Analysis

Data were entered into an electronic database (Microsoft Office 2011 Access Software; Microsoft Corporation, Redmond, WA) for analysis. Simple descriptive statistics were used to describe the study population. Means and SDs were used to describe continuous variables. Categorical data were expressed as frequency distributions.

RESULTS

One hundred twelve patient records were reviewed for inclusion in the study, of which 85 were considered appropriate for analysis (see Figure 1). The mean age of the cohort was 68 ± 15 years, and 52% were male, with baseline characteristics described in Table 1. The most common infection was pneumonia (45%), and 55% of patients were categorized as presenting from a health care setting. Approximately the same number of patients