ORIGINAL ARTICLE

Compliance with the Sepsis Resuscitation Care Bundles in the Emergency Department of a Developing World Tertiary Care Hospital – A Clinical Audit

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Abstract

Background
Severe sepsis and septic shock are catastrophic syndromes resulting in a systemic inflammatory response and dysfunction of one or more end organs. The Surviving Sepsis Campaign is an international collaboration in order to reduce mortality in severe sepsis and septic shock using a standard bundle of care approach.

Method
We conducted a retrospective observational clinical audit in the Department of Emergency Medicine at the Aga Khan University Hospital, Karachi. The compliance rate against each element of the 3 and 6 hour bundle were obtained.

Result
Majority of patients were female with mean age of 64 years. Blood lactate was undertaken 46.5% of the time however majority of patients received timely intravenous fluids and antibiotics. Blood for Culture and sensitivity and blood lactate clearance were measured poorly.

Conclusion
We conclude that compliance to sepsis resuscitation bundles in our setting is inadequate therefore higher training, education and increased awareness is imperative.

Keywords
Sepsis; Surviving Sepsis Campaign; Bundle; Compliance

Introduction

It is estimated, that globally, 5.3 million people die of sepsis on an annual basis.[1] The current burden of sepsis mortality is mostly gestating in developing world- countries which are least able to bear it. At least 50% of septic patients in low-income countries are reported to die, compared to a mortality rate of 15-30% in the United States.[2] Asghar *et al*. demonstrated that there was a high incidence of sepsis in patients admitted to the Intensive care unit of a teaching hospital in Karachi associated with a very high mortality of 51%.[3]

In year 2002, efforts led by the Surviving Sepsis Campaign (SSC) to reduce sepsis-related mortality were intensified.[4] To this end the SSC developed an evidence-based guideline which was distilled into precise bundles of care.[5] The effectiveness of the sepsis bundles lies in the timely achievement of each bundle element. In 2014 Levy *et al* demonstrated that a 10% increase in compliance with the SSC bundles reduced in-hospital mortality by 3-5%. In addition, for every 3 months that a center complied with the SSC bundles, in-hospital mortality declined by 7%.[6] Numerous studies over the past years have clearly demonstrated that improved compliance with the SSC bundles is associated with shorter hospital and ICU length of stay, as well as reduced mortality.[7-10] Ironically, it is the developed world from which most research on sepsis originates. According to a meta-analysis conducted in 2016,[1] population-level epidemiologic data for sepsis are scarce to nonexistent for low-and middle-income countries. Since the advent of the Surviving Sepsis Guidelines in 2004, few studies to assess compliance with the guidelines in the developing world have been conducted. To date, the MOSAICS study (Management of Severe Sepsis in patients admitted to Asian Intensive Care Units, 2011) is the largest multicenter study to prospectively assess compliance to the SSC bundles in the developing world. From the 150 participating ICUs in 16 Asian Countries, compliance rates of 7.6% and 3.5% were observed for the resuscitation and management bundles respectively.[11]

Optimization of Emergency department (ED) management of the septic patient is a priority, as prior studies have shown that two-thirds of septic patients arrive in the ED.[12,13] We are currently lacking studies conducted in our local setting for evaluating the compliance with SSC bundles in ED. Therefore we conducted a clinical audit to determine the compliance to various elements of the 3 and 6 hour SSC bundles for adult patients with severe sepsis and/or septic shock presenting to the ED.

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Methodology

We conducted a retrospective observational clinical audit in the Department of Emergency Medicine at the Aga Khan University Hospital (AKUH), Karachi, Pakistan over a period of 6 months starting from January till June 2017. Due to the retrospective nature of the audit, we were granted exemption from informed consent by the Ethical Review Committee (ERC).

Severe sepsis and septic shock were diagnosed as per the current Society of Critical Care Medicine (SCCM) guidelines.[4] Severe sepsis was defined as sepsis with signs of acute organ dysfunction or hypoperfusion indicated through; sepsis-induced hypotension (systolic blood pressure (SBP) < 90 mm Hg or mean arterial pressure (MAP) < 70 mm Hg or a SBP decrease > 40 mm Hg or less than two standard deviations below normal for age in the absence of other causes of hypotension), blood lactate above upper limits laboratory normal (> 4 mmol/L), urine output < 0.5 mL/kg/hr for more than 2 hours despite adequate fluid resuscitation, 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, serum creatinine > 2.0 mg/dL, total bilirubin > 2 mg/dl, platelet count < 100,000 µL, coagulopathy (international normalized ratio > 1.5). Septic shock was defined as severe sepsis in the presence of hypotension (systolic blood pressure <90 mm Hg) refractory to adequate fluid resuscitation (administration of IV Fluids 30ml/kg over initial 3 hour duration).

In view of a recent study,[3] 99 patients were identified having sepsis with an incidence of severe sepsis and septic shock of 81%. Utilizing existing data and considering confidence intervals at 95 %, sample size was calculated to be of 71 cases.

Prior to data collection, the principal investigator conducted a session to explain the study protocol and to train the data collectors in filling the questionnaire. The data collectors searched the Electronic medical record database for adult patient encounters in ED bearing an ICD9 code diagnosis of 995.92 and 785.52 for severe sepsis and septic shock respectively. We adopted a non-probability sampling strategy for including adult subjects (age ≥18 years) with a diagnosis of severe sepsis/septic shock upon admission to the ED of Aga Khan University Hospital (AKUH). Subjects were excluded if they were unable to survive for 6 hours duration after recruitment (independent of timely institution of the sepsis resuscitation bundle), Do Not Resuscitate (DNR) or Left Against Medical Advice (LAMA) within 6 hours of triage, resuscitated at a different hospital prior to transfer to the ED or had incomplete medical records. The confidential files of these patients were reviewed in order to look for fulfillment of criterion for Severe Sepsis and Septic Shock and the compliance to various elements of the Surviving Sepsis Campaign 3 and 6 hour bundles. The 3 hour bundle tasks included; measuring serum lactate level, obtaining blood cultures (before starting antibiotics), starting broad spectrum antibiotics, and administering a 30 mL/kg crystalloid bolus for patients who are hypotensive or have an elevated serum lactate or signs of organ hypoperfusion. The 6 hour bundle tasks included; starting vasopressors for hypotension that is refractory to volume resuscitation to maintain a mean arterial pressure greater than 65 mm Hg, reassessing intravascular volume status, and remeasuring lactate after 3 hours of resuscitation and if the initial lactate was > 4 mmol/L.

SPSS-version 19 was used for statistical data analysis. In descriptive variables, the continuous variables were displayed using mean and standard deviation while the categorical variables were displayed using percentages (proportions).

Results

A total of 71 patients were included in the study with a mean age of 64 years. Out of these patients, 42 (59%) patients were female and 29 (40%) patients were male. 19 (26.8%) patients were diagnosed as having severe sepsis and 52 (73.2%) patients had septic shock while in the ED. 35 (49%) patients were admitted to the Intensive care unit**.**

When we reviewed compliance with each element of sepsis resuscitation bundles the following results emerged. In the initial 3 hour bundle, 48 (67.6%) patients received antibiotics within 3 hour duration. Only 4 (5.6%) patients had blood drawn for Culture and sensitivity (C/S) prior to antibiotic initiation. Serum lactate testing was performed in 33 (46.5%) patients only. Intravenous fluids administration by 30 ml/kg was done in 60 (84.5%) patients resulting in adequate fluid responsiveness in 43 (60.6%) patients.

In the subsequent 6 hour sepsis resuscitation bundle, Vasopressors were applied to 35 (49.3%) fluid refractory hypotensive patients. Central Venous line insertion was performed and measured in 41 (57.7%) patients. A cutoff CVP pressure of > 8 mmHg was able to be established in 20 (28.1%) patients. The Central Venous Oxygen saturation (ScvO2) was measured in 9 (12.7%) patient and a target ScVO2 of >/= 70% was achieved in 2 patients only. 13 (18.3%) patients had their lactate levels remeasured for successful lactate clearance**.**

Discussion

The Sepsis resuscitation bundles provide a standard operating procedure for early risk stratification and management of a patient with severe infection. Application of the bundle resulting in a clinical and statistically significant decrease in organ failure, mortality, and the utilization of health care resources has been successfully demonstrated.[14,15] However, quality improvement initiatives undertaken in emerging countries have faced various challenges.[16]

Our audit demonstrated that patients received Intravenous fluids and antibiotics in timely manner as emphasized in published guidelines[18]. Nearly 50% of our patients who were hypotensive after fluid administration were started on vasopressors and CVP

line insertion was instituted in 60% of patients. However, post CVP management was lacking in its entirety.

The measurement of lactate levels has been associated with improved outcomes in sepsis, and an elevated lactate value identifies patients at higher risk for poor outcomes.[17] In the first quarter of a multicenter quality improvement program for sepsis care, only 61% of patients had lactate values measured consistent with guidelines.[18] In addition, prior studies have shown that care prompted by measurement of lactate levels in sepsis patients reduces resource utilization and cost and leads to lower likelihood of hospital-acquired conditions.[19] Our audit analysis showed initial lactate testing performed in 46.5% patients. Elevated lactate levels prompt the consideration of specific care practices toward hemodynamic optimization guided by either central venous oxygen saturation[12] or lactate clearance.[20] Performance gaps in ScvO2 measures can be as low as 15% as observed in community EDs to 50% in larger tertiary care centers[21] compared to 13% observed in our setting. International guidelines[14] now strongly recommend that septic patients with elevated lactates have additional therapies until lactate levels are normalized however, only 18 % of our patients were measured for lactate clearance.

Collecting blood cultures has been specifically associated with improved outcomes in sepsis. By obtaining blood cultures, antibiotic regimens can be customized to treat the specific infecting organism. This will result in less unneeded exposure to antibiotics, reducing complications associated with antibiotic use, including drug reactions, allergies and adverse events and the development of drug-resistant organisms.[14] Prior studies have shown only 64.5% of patients had blood cultures collected.[18] In our analysis, only 5.6% patients had blood drawn for cultures prior to antibiotic initiation.

Difficulties in implementing sepsis protocols have already been reported and include a lack of dedicated staff,unavailable resources,[22] shortage of medical and nursing staff,[23] and reduced compliance with the basic principles of quality care, such as continuous training strategies which is associated with a high professional turnover rate,[24] contributing to an inadequate safety culture and low quality of care.[25] These institutional characteristics were not addressed in our study. Also, we did not assess other institutional factors that might be associated with higher sepsis mortality rates, such as the availability of ICU beds or the percentage of patients transferred from other facilities.

Conclusion

The audit has demonstrated that compliance to sepsis resuscitation bundles in our setting is inadequate therefore higher training, education and increased awareness is imperative. Given current and existing evidence, greater compliance with each element of the bundles will result in better patient outcomes compared to what is being observed under present circumstances.

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