MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.59218/makrjms.2024.5.70.75

OPEN ACCESS

**Key Words**
Sepsis, survival sepsis campaign, antibiotic, emergency, screening sepsis

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**Received:** 22 November 2023
**Accepted:** 31 December 2023
**Published:** 8 January 2024

**Citation:** Jeedhu Radhakrishnan, Pavan R. Sagar and Kashyapa, 2024. Profiling of Sepsis Patients in the Emergency Department-A Retrospective Study. Res. J. Med. Sci., 18: 70-75, doi: 10.59218/ makrjms.2024.5.70.75



# Profiling of Sepsis Patients in the Emergency Department: A Retrospective Study

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**ABSTRACT**
Sepsis and septic shock are major healthcare problems, impacting millions of people around the world each year killing between one in three and one in six of those it affects[1]. Infection-prevention efforts, including those targeting both community-acquired and health-care-associated infections, can reduce sepsis incidence. It is treatable and timely implementation of targeted interventions improves outcomes. There are various scoring system like Sequential Organ Failure Assessment (SOFA), Modified Early Warning Score (MEWS), Rapid Emergency Medicine Score, APACHE II in early identification of sepsis. But in a resource limited setting, there is a need of early identification and initiation of treatment. Hence there is a need for clinical bedside scoring system to identify patients at risk for improving the outcomes as early administration of appropriate anti-microbials is one of the most effective interventions to reduce mortality in patients with sepsis. This retrospective study involved total of 305 patients who were admitted to Multi-disciplinary ICU or High Dependence Unit from Emergency room for a period of 6 months. Of which 105 patients were suspected to have sepsis or identified in shock. The most common comorbid medical condition was found to be diabetes mellitus and respiratory symptoms accounted for majority of the cases. Timing of antibiotic in patients with suspected sepsis and patients with septic shock mean time of which was found to be 61 mins and 53 mins respectively which is compliant with the current recommendations.

## INTRODUCTION

Sepsis is life-threatening organ dysfunction caused by a dysregulated host response to infection[2]. It arises when the body's response to infection injures its own tissues and organs and can lead to septic shock, multiple organ failure and death, if not recognized early and managed promptly[3]. The occurrence and frequency of sepsis are determined by a complex interplay of many host, pathogen and health system response factors[4]. The World Health Assembly has urged member states to strengthen efforts to identify, document, prevent and treat sepsis[5]. In the community, sepsis often presents as the clinical deterioration of common and preventable infections such as those of the respiratory, gastrointestinal and urinary tract, or of wounds and skin. In the fight against sepsis, the Surviving Sepsis Campaign (SSC) was initiated in 2002 to promote the adoption of evidence-based performance measures[7], with the latest guidelines published in 2021[8].

Screening tools used to identify sepsis in older in patients with suspected infection include quick Sequential (Sepsis-related) Organ Failure Assessment (qSOFA) and Modified and National Early Warning Scores (NEWS and MEWS). The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) recommends qSOFA criteria be used to prompt clinicians to further investigate for organ dysfunction, to initiate or escalate therapy as appropriate and to consider referral to critical care or increase the frequency of monitoring, if such actions have not already been undertaken.

A study of 49,331 patients treated at 149 New York hospitals, each additional hour of time from ED arrival to administration of antimicrobials was associated with 1.04 increased odds of in-hospital mortality, p<0.001 (1.07 (95% CI, 1.05-1.09) for patients receiving vasopressors vs. 1.01 (95% CI, 0.99-1.04) for patients not on vasopressors)[11]. A study at Kaiser Permanente Northern California[12] involving 35000 patients showed that each additional hour of time from ER arrival to administration of antimicrobials was associated with 1.09 increased odds of in-hospital mortality (1.07 for patients with "severe" sepsis [lactate = 2, at least one episode of hypotension, required non-invasive or invasive mechanical ventilation or has organ dysfunction] and 1.14 for patients with septic shock): which equated to a 0.4% absolute mortality increase for "severe" sepsis and a 1.8% absolute increase for septic shock.

Mortality reduction associated with early antimicrobials appears strongest in patients with septic shock, where studies have reported a strong association between time to antibiotics and death in patients with septic shock. In a study by Kumar *et al*., it was found that each hour of delay in appropriate antibiotic administration reduced survival by 8% in patients with septic shock[14]. This association was found to be weaker associations in patients without septic shock data from resource-limited settings. This suggest that timely administration of antimicrobials in patients with sepsis and septic shock is beneficial and potentially feasible[13]. Study involving 140 patients by Shahsavarinia *et al*, 84 (60%) had positive qSOFA score and 56 (40%) patients had negative qSOFA score Nearly half of patients with positive qSOFA expired during their stay in hospital while this was about 5% for patients with negative qSOFA. ROC curve of study regarding prediction of outcome with qSOFA showed an area under curve of 0.59. (P value: 0.04). This study concluded that qSOFA has acceptable value for risk stratification of severity, multi organ failure and mortality[16].

In another multicentre observational study by George *et al*[17], done to validate qSOFA in emergency department (ED) patients with pneumonia From March to August 2009, 5584 patients were enrolled of which 713 met inclusion criteria. In this study, SIRS criteria had the highest sensitivity for death (89%) and lowest specificity (25%), while CRB had the highest specificity (88%) and lowest sensitivity (31%), followed by qSOFA (80% and 53%, respectively). It was found no significant differences between qSOFA and SIRS for predicting in-hospital death and results was nearly identical pneumonia-specific severity scores performed predicting death and ICU utilization.

In a systemic review of literature by Song *et al*[18], 23 studies with a total of 146,551 patients the in-hospital mortality rate was studied, which showed pooled sensitivities of 0.51 for a positive qSOFA score and 0.86 for positive SIRS criteria, as well as pooled specificities of 0.83 for a positive qSOFA score and 0.29 for positive SIRS criteria. They concluded that A positive qSOFA score had high specificity outside the ICU in early detection of in-hospital mortality, acute organ dysfunction and ICU admission.

**Aims and objective:**

- The aim of the study is to study the management of sepsis in Emergency department of a tertiary care center in Mangalore
- To study the demographic profile of the patients
- To classify the sample into patients likely to have sepsis and patients in septic shock
- To profile the management of sepsis as per the recommended guidelines

## MATERIALS AND METHODS

**Study setting:** Hospital based Retrospective record-based study done at KMC hospital, B R Ambedkar circle, Mangalore for a period of 6 months assessed retrospectively from May 2022 to October 2022. Patients admitted to ICU (Intensive Care Unit) or

Fig. 1: The following illustration describes the approach to diagnosing a patient likely in sepsis and in septic shock

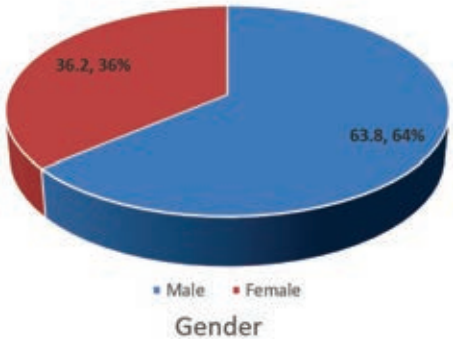


Fig. 2: Gender distribution of patients studied

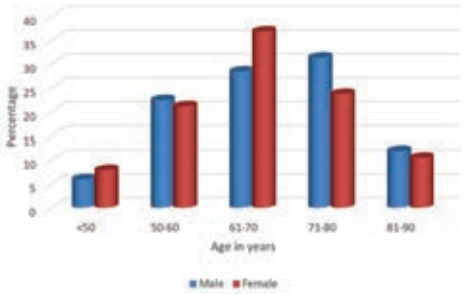


Fig. 3: Age Wise Distribution

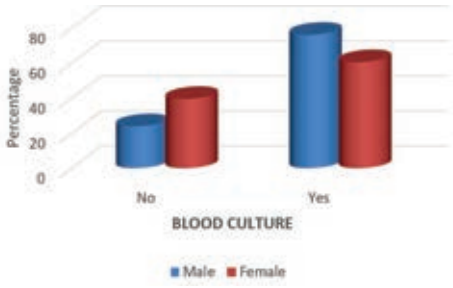


Fig. 4: Indication for Blood culture in Emergency

HDU (High Dependency Unit) from Emergency were included as study sample. Study population included all patients above 18 yrs diagnosed with suspected infection received in the Department of Emergency Medicine at KMC hospital Mangalore.

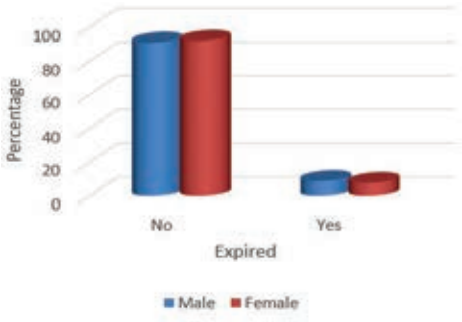


Fig. 5: Box-Whisker chart of Timing of antibiotic

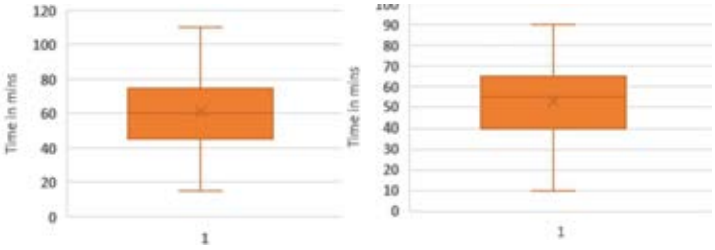


Fig. 6: Mortality

The primary outcome measures were the compliance with the Surviving Sepsis Campaign 2021 guideline. The secondary outcome measure was all cause mortality of the current hospitalization.

**Data collection methodology:** Demographic data, comorbidities, clinical history, vitals on arrival will be collected. According to the Sepsis definition, a life-threatening organ dysfunction caused by a dysregulated host response to infection. The qSOFA score is a simple score consisting of three items: respiratory rate (RR) = 22 breaths per minute, altered mentation (Glasgow Coma Scale [GCS] < 15) and systolic blood pressure (SBP) < 100 mmHg. A qSOFA score =2 was found to be significantly predictive of increased all-cause mortality in patients outside of the ICU[9]. Therefore, the authors of the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) recommended the use of the qSOFA score for the identification of adult septic patients in out-of-hospital, emergency department, or general hospital ward settings[10].

Patients with septic shock can be clinically identified by a vasopressor requirement to maintain a mean arterial pressure of 65 mm Hg or greater and serum lactate level greater than 2 mmol/L (>18 mg/dL) in the absence of hypovolemia[10]. Septic shock is defined as a subset of sepsis in which underlying circulatory and cellular metabolism abnormalities are profound enough to substantially increase mortality up to 40%[10]. The current Surviving Sepsis Campaign

Table 1: Age Distribution of patients studied

| | Gender | | |
|---|---|---|---|
| Age in years | Male | Female | Total |
| <50 | 4(6%) | 3(7.9%) | 7 (6.7%) |
| 50-60 | 15(22.4%) | 8(21.1%) | 23 (21.9%) |
| 61-70 | 19(28.4%) | 14(36.8%) | 33 (31.4%) |
| 71-80 | 21(31.3%) | 9(23.7%) | 30 (28.6%) |
| 81-90 | 8(11.9%) | 4(10.5%) | 12 (11.4%) |
| Total | 67(100%) | 38(100%) | 105 (100%) |

Table 2: Comparison of hemodynamics variables in male and female patients studied

| | Gender | | | |
|---|---|---|---|---|
| Variables | Male | Female | Total | p-value |
| Pulse rate (bpm) | 106.27±24.53 | 110.55±25.51 | 107.82±24.85 | 0.399 |
| SBP (mm Hg) | 138.28±41.68 | 135.21±40.30 | 137.17±41.02 | 0.714 |
| DBP (mm Hg) | 80.00±19.47 | 77.66±19.03 | 79.15±19.26 | 0.552 |
| PP | 19.43±9.81 | 19.18±8.72 | 19.34±9.39 | 0.899 |
| RR | 24.40±7.16 | 24.42±6.77 | 24.41±6.99 | 0.990 |
| Temp | 98.63±1.35 | 98.53±0.93 | 98.60±1.21 | 0.671 |
| MAP (mm Hg) | 86.48±21.09 | 84.05±20.85 | 85.60±20.93 | 0.571 |

Table 3: Expired

| | Gender | | |
|---|---|---|---|
| Expired | Male | Female | Total |
| No | 61(91%) | 35(92.1%) | 96(91.4%) |
| Yes | 6(9%) | 3(7.9%) | 9(8.6%) |
| Total | 67(100%) | 38(100%) | 105(100%) |

Table 4: QSOFA

| QSOFA | Gender | | Total |
|---|---|---|---|
| | Male | Female | |
| <=1 sepsis not suspected | 6(9%) | 4(10.5%) | 10(9.5%) |
| >1 sepsis suspected | 36(53.7%) | 23(60.5%) | 59(56.2%) |
| >2 | 25(37.3%) | 10(26.3%) | 35(33.3%) |
| Total | 67(100%) | 38(100%) | 105(100%) |

Table 5:

| Symptoms | Gender | | | |
|---|---|---|---|---|
| | Male (n=67) | Female (n=38) | Total (n=105) | p-value |
| Respiratory | 47(70.1%) | 22(57.9%) | 60(57.1%) | 0.290 |
| Genitourinary | 6(9%) | 4(10.5%) | 10(9.5%) | 0.920 |
| GastroIntestinal | 5(7.5%) | 4(10.5%) | 9(8.6%) | 0.863 |
| Central nervous system | 18(26.9%) | 7(18.4%) | 25(23.8%) | 0.462 |
| Skin Soft Tissue | 0(0%) | 1(2.6%) | 1(1%) | 0.777 |

Table 6: Antibiotic Indicated

| | Gender | | |
|---|---|---|---|
| Antibiotic Indicated | Male | Female | Total |
| No | 9(13.4%) | 6(15.8%) | 15(14.3%) |
| Yes | 58(86.6%) | 32(84.2%) | 90(85.7%) |
| Total | 67(100%) | 38(100%) | 105(100%) |

P=1.000, Not significant, Chi-Square Test

Table 7: Blood Culture

| Blood Culture | Gender | | Total |
|---|---|---|---|
| | Male | Female | |
| No | 16(23.9%) | 15(39.5%) | 31(29.5%) |
| Yes | 51(76.1%) | 23(60.5%) | 74(70.5%) |
| Total | 67(100%) | 38(100%) | 105(100%) |

guidelines[8] recommends the use of Empirical antibiotic in patients within 1 hour if patient is in shock or within the 3 hrs if a possibility of sepsis is present and shock is absent.

**Data management and analysis:** Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean±SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance.

Cases of the samples should be independent Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters. Leven's test for homogeneity of variance has been performed to assess the homogeneity of variance. A t-test is a statistical test that is used to compare the means of two groups. Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups, Non-parametric setting for Qualitative data analysis.

**Significant figures:**

- + Suggestive significance (p-value: 0.05<p<0.10)
- Moderately significant (p-value:0.01<p£0.05)
- Strongly significant (p-value: p£0.01)

**Statistical software:** The Statistical software namely SPSS 22.0 and R environment ver.3.2.2 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

## DISCUSSIONS

The study involved total of 305 patients who were admitted to Multi-disciplinary ICU or High Dependence Unit from Emergency room for a period of 6 months. Of which 105 patients were suspected to have sepsis or identified in shock accounting for incidence rate of 34.4%. Rest of the patients were excluded from study as they were diagnosed with other conditions. Out of 105 patients in total 67 of the patients were male and 38% are females which comprised of 63.8% and 36.2% respectively. Out of 105 patients majority of them were between the age group 50-80 yrs which accounted for 86% of the admissions.

**Patient demographics:** There were a total of 105 ICU admissions from 1st January, 2022 to 30th June, 2023, of which 105 (32.1%) patients were recruited into the study. In the study, 67 were male (62%) and 41 were female (38%). The youngest age group only accounted for 6.7% of those in the study and the percentage increased to 11.4 % in oldest age group, whereas majority of the patient were found to be between the age group 61-70 yrs.

The most common medical condition was diabetes mellitus (DM) at 57.1%, followed by Chronic Respiratory Failure at 20%. Chronic kidney disease (CKD) made up of 18.1% whilst cerebrovascular accidents made up of 23.8%. The GCS score and

qSOFA score has been calculated and majority of the patients had GCS of >12 accounting for upto 72.4% of the sample size and 89.5% of the patients who had qSOFA score more than or equal to 1.

**Source of infection:** In both male and female Respiratory symptoms accounted for majority of the cases upto 70% in males and 58% in female patients respectively. This is followed by CNS symptoms and Genitourinary symptoms. Among the 105 patients, 85.7% needed a antibiotic to administered as per recommendations of Surviving Sepsis guidelines. Blood culture had been indicated in 74 patients which accounts for 70.5% of the sample size. The timing of antibiotic is calculated from the time of arrival of the patient to emergency and administration of antibiotic. It is categorized into two subgroups-patients with suspected sepsis and patients with septic shock mean time of which was found to be 61 minutes and 53 minutes respectively.

The mortality which is measured as secondary outcome, accounts for 9% of the admissions to the ICU of HDU which is as tabulated below. The following study revealed most common site of infection in patients with sepsis was the lungs (55.5%), similar to the findings observed in Wang et al study which included adults diagnosed with Sepsis or Septic shock in 18 ICU's across China20. Also incidence of sepsis was more common in male than females, which was also comparable as the International cohort study had 61.6% male patients, whilst an Asian cohort study the MOSAICS trial had 61.7% males 20.

68% of the patient had MAP between 70-110mmHg which corelated with qSOFA score indicating in upto 89% of the patients had increased risk of mortality. The mortality which is measured as secondary outcome, accounts for 9% of the admissions which is less than that in MOSAICS22 study which was 44.5% and 26.7% as per Global burden of disease sepsis study published by WHO global report on the epidemiology and burden of disease[21].

**Limitations and strengths:** This study is a retrospective study looking into a highly selected group of critically ill patients admitted to the ICU. As per the inference of data, the goal of timing of antibiotic had been achieved as per the Surviving Sepsis guidelines 2021. The mortality observed also is not significant as it was studied in critically ill patients. But, this audit has shown that compliance to the sepsis resuscitation care bundle did not meet the target of 100%. Training, education and increasing awareness of the care bundle across all disciplines is imperative. Since study patients were restricted to one local hospital, which would not be a true reflection of territory wide practice and therefore the generalizability of study is limited.

## CONCLUSION

Sepsis accounts for high mortality and morbidity, especially in the critically ill. Early recognition is of utmost importance, as it is a highly reversible and treatable condition when treatment is commenced early. Compliance to the Surviving Sepsis Campaign guideline has been shown to improve survival.

This study is the first in Department of Emergency to look at compliance with the Surviving Sepsis Campaign guidelines. Relentless effort should be paid to update our knowledge on sepsis and more needs to be done to improve adherence to latest guidelines, particularly to the prompt administration of antibiotic and source control, so that the mortality and morbidity of patients with sepsis can be reduced.

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