Original Article

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Microbiology Section

Implementation of Surviving Sepsis Campaign Guidelines in a Tertiary Care Hospital and its Impact on Patient Outcomes: A Cross-sectional Study

ROOPA BHANDARY[1], AMITHA MARLA[2], SUDESH RAO[3], Y ROHITH[4], AISHWARYA KRISHNA KUMAR[5]

ABSTRACT

Introduction: Sepsis is defined as a life-threatening organ dysfunction caused by a dysregulated host response to infection. Sepsis care bundles, which incorporate key factors such as recognition, diagnosis, and early management, can help standardise the quality of care and have an impact on sepsis-related mortality rates. The Surviving Sepsis Campaign guidelines have formulated recommendations to be incorporated into sepsis care and management.

Aim: To assess the compliance rate with the sepsis care bundle and study its impact on patient outcomes, specifically the mortality rate.

Materials and Methods: This cross-sectional observational study was conducted at the AJ Institute of Hospital Administration in Dakshina Kannada, Karnataka, India, from October 2019 to December 2021. Adult patients in the Emergency Department with signs and symptoms of sepsis were diagnosed and categorised based on the Quick Sequential Organ Failure Assessment (qSOFA) tool. Patients with a qSOFA score >2 were further analysed using the SOFA score. The 2018 Surviving Sepsis care bundle was reviewed, and its utility in sepsis management was analysed. Empirical antibiotics to be administered to sepsis patients, in accordance with the hospital antibiogram, were shortlisted based on the category of sepsis at presentation. All sepsis patients were followed-up to track microbiological reports, appropriate escalation or de-escalation of antibiotics as per the hospital's antibiotic policy, and the condition on discharge to assess patient outcomes. The impact on mortality rate was analysed using the Chi-square test, relative risk, and 95% confidence interval to compare mortality between the compliant and non-compliant groups.

Results: A total of 156 participants took part in the study, of which 109 (69%) were male and 47 (31%) were female. The median age of the study participants was 59.6 years. Patient outcomes were measured using the mortality rate for different SOFA scores. A significant difference in mortality was noted between bundle adherent cases and non-adherent cases for SOFA scores <2 and >2.

Conclusion: The sepsis care bundle helps standardise care and can reduce mortality in sepsis patients.

Keywords: Mortality, Quick sequential organ failure assessment, Sepsis care guidelines, Turnaround time

INTRODUCTION

Sepsis is defined as a life-threatening organ dysfunction caused by a dysregulated host response to infection. Septic shock is associated with underlying circulatory and cellular or metabolic involvement [1]. Sepsis is a predominant cause of mortality, with an estimated number of 31.5 million cases of sepsis and 19.4 million cases of severe sepsis reported every year. The total reported sepsis deaths are 5.3 million, and this number could be higher in developing countries due to inadequate diagnostic support and a higher prevalence of Multidrug-Resistant Organisms (MDRO) [2,3]. The estimated prevalence rate of MDRO-related bloodstream infections ranges from 22.7% to 42.8% [4,5]. If left untreated, the mortality rate of sepsis increases every hour. Early diagnosis and management of sepsis could improve patient outcomes [6].

Bundles are a group of recommendations aimed at providing standardised quality of care for patient management. Sepsis care bundles, incorporating the key factors of recognition, diagnosis, and early management, could help standardise the quality of care and have an impact on sepsis-related mortality rates. The Surviving Sepsis Campaign guidelines have formulated recommendations to be incorporated into sepsis care and management [7]. The hour one bundle, introduced in 2018, includes five key interventions to be completed within the first hour: measuring lactate levels, obtaining blood cultures before antibiotic administration, using broad-spectrum antibiotics, rapidly administering 30 mL/kg crystalloid for hypotension or lactate >4 mmol/L, and using vasopressors to maintain mean arterial pressure >65 mm Hg [8].

However, implementing these guidelines into hospital settings could be challenging and needs to be tailor-made to improve compliance. In India, to the best of the author's knowledge, no study on implementing the 1-hour sepsis care bundle has been published. Hence, the present study aimed to assess the compliance rate with the sepsis care bundle and its impact on patient outcomes, specifically the mortality rate.

MATERIALS AND METHODS

A cross-sectional observational study was conducted in the Emergency Department and Medical Intensive Care Unit of AJ Institute of Hospital Administration, a 450-bed super specialty hospital located in Dakshina Kannada, Karnataka, India. The study was carried out from October 2019 to December 2021. Prior to commencing the study, clearance was obtained from the Institutional Ethics Committee (IEC no: AJEC/REV/126/2023). Informed consent was not obtained from the patients as the study involved documentation of findings from medical records and audit findings.

Inclusion criteria: The study included adult patients presenting to the Emergency Department with signs and symptoms of sepsis or septic shock.

Exclusion criteria: Paediatric patients and patients diagnosed with sepsis after discharge from the Emergency Department were excluded from the study.

Study Procedure

A total of 156 patients were included in the study. Adult patients in the Emergency Department with signs and symptoms of sepsis were diagnosed and categorised based on the qSOFA tool. Patients with a score higher than two were further analysed using the SOFA tool [1]. Meetings were held with the Emergency Department consultants, intensivists, nursing team, and administrators to develop a sepsis care bundle based on the Surviving Sepsis Campaign guidelines of 2018. Sepsis care bundles were prepared to include the Emergency Department checking chart, which consisted of patient demographics, vital signs measurements, urine output, and serum lactate levels. Hypotension and/or elevated lactate were treated with fluids (rapid administration of 30 mL/kg crystalloid for hypotension or lactate >4 mmol/L). Paired blood samples (8-10 mL) were aseptically collected and inoculated in Becton Dickinson and Company (BACTEC) bottles [9]. Antibiotics were administered within one hour of presentation in the Emergency Department. Based on the hospital antibiogram, a broad-spectrum antibiotic (β-lactam + lactamase inhibitor) was selected for empirical antibiotic administration.

All sepsis patients were followed-up until discharge from the hospital to track microbiological reports, proper escalation or de-escalation of antibiotics according to the hospital's antibiotic policy, and the patient's condition on discharge to assess the outcome. Training was provided to the consultants and nursing staff regarding the sepsis care bundles. The implementation of the sepsis care bundle in the Emergency Department was audited monthly. Compliance was measured if all parameters of the sepsis care bundle were executed. However, if any of the parameters were not followed, it was documented as non-compliant. Antibiotic Turnaround Time (TAT) was calculated as the time interval between the time of presentation (t0) to the Emergency Department and the administration of the full dose of antibiotic (t1) [10].

STATISTICAL ANALYSIS

The compliance and non-compliance percentages were calculated. The impact on the mortality rate was analysed using the Chi-square test, relative risk, and 95% confidence interval to compare mortality between the compliant and non-compliant groups. The average antibiotic Turnaround Time (TAT) was calculated.

RESULTS

A total of 156 patients who presented to the emergency department with signs of sepsis or septic shock were included in the study. The median age of the study participants was 59.6 years, of whom 109 (69%) were male and 47 (31%) were female [Table/Fig-1]. The most common underlying etiology for sepsis was pulmonary infection in 46 (25.8%) patients, followed by urosepsis in 43 (23.7%) patients. Cases were classified based on SOFA scoring, with 68 (37.64%) cases having a SOFA score <2 and 112 (61.98%) cases having a SOFA score >2 [Table/Fig-2].

Patient demographics	n (%)
Gender	
Male	109 (69.66)
Female	47 (30.33)
Age in years (mean±SD)	72 {62.0 (81.0)}
Diabetes mellitus	46 (29.72)
Cerebrovascular accident	13 (8.10)
Hypertension	22 (14.05)
Chronic liver failure	13 (8.64)
Chronic renal disease	26 (16.75)
Malignancy	29 (18.37)
Immunosuppressed status	5 (2.97)

[Table/Fig-1]: Patient characteristics and co-morbid conditions.

Parameters	Number (n)	Percentage (%)
Source of infection		
Pneumonia	46	25.8
Urinary Tract Infection (UTI)	43	23.7
Bone/ soft tissue infection	23	12.92
Abdominal/ gynaecologic infections	35	19.2
Multiple sources of infections	33	18.16
Sepsis classification		
SOFA score <2	68	37.64
SOFA score >2 (Septic shock)	112	61.98

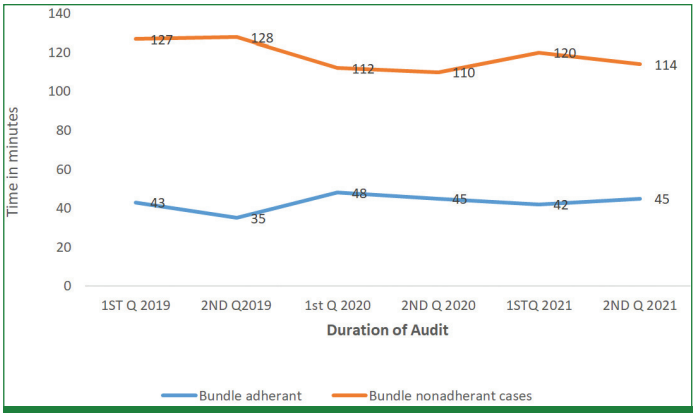
[Table/Fig-2]: Analysis of sepsis cases.

Out of the 156 blood culture samples, 96 samples were positive. The most commonly isolated organism was Staphylococcus aureus in 31 (19.87%) cases, followed by Coagulase-negative Staphylococcus in 24 (15.38%) cases, Klebsiella pneumoniae ssp pneumoniae in 13 (8.33%) cases, Escherichia coli in 11 (7.05%) cases, Pseudomonas aeruginosa in 6 (3.84%) cases, and Burkholderia cepacia in 3 (1.92%) cases [Table/Fig-3].

Organism isolated	n (%)
Staphylococcus aureus	31 (19.87)
Coagulase negative *Staphylococcus*	24 (15.38)
Klebsiella pneumoniae subspecies pneumoniae	13 (8.33)
Escherichia coli	11 (7.05)
Pseudomonas aeruginosa	6 (3.84)
Burkolderia cepacia	3 (1.92)

[Table/Fig-3]: Distribution of organisms isolated from blood cultures of sepsis patients.

Out of the 156 cases, 78% compliance and 22% non-compliance were noted for first-hour antibiotic administration. The average antibiotic administration Turnaround Time (TAT) in the compliant group was 37 minutes, while in the non-compliant group it was 140 minutes [Table/Fig-4].



[Table/Fig-4]: Average antibiotic administration Turnaround Time (TAT) for bundle adherent and non adherent cases.

There was a significant difference in mortality when all the parameters of the sepsis bundle were executed compared to cases where the parameters were not executed [Table/Fig-5].

DISCUSSION

Sepsis is a systemic response and often the final stage leading to death caused by infectious origins. In 2017, sepsis-related mortality was estimated to be 19.7%. There has been a reported 29.7% reduction in sepsis deaths from 1990 to 2017. This reduction can

Parameters	Sepsis score	Mortality (%)	95% Confidence interval	Relative increase in mortality for non adherent cases	p-value
Bundle adherence	SOFA score <2	47.8	49.28-55.06	4.7%	**0.018**
Bundle non adherence		52.17	45.86-49.12		
Bundle adherence	SOFA score >2	53.4	41.12-45.68	6.1%	**0.0021**
Bundle non adherence		56.68	53.43-59.93		

[Table/Fig-5]: Comparison of mortality rates.
The p-value in bold font indicates statistically significant values

be further achieved by implementing evidence-based guidelines in sepsis management [11,12].

Sepsis care bundles play a crucial role in managing patients with septic shock. Early diagnosis and prompt management of sepsis patients are likely to have a positive impact on the outcome. The first sepsis care bundle was introduced in 2004 with the goal of reducing sepsis-related mortality by 25%. Subsequently, the bundle was updated every four years to incorporate the best evidence-based practices in sepsis management [7,13]. In 2018, the one-hour bundle was introduced, which included five parameters to be implemented within the first hour. This was based on the 2016 three-hour sepsis bundle, considering the impact of early diagnosis and management on sepsis survival rates [8].

Studies have emphasised the importance of prompt antibiotic therapy and aggressive hemodynamic resuscitation in sepsis management [14,15]. Early diagnosis of sepsis in the Emergency Department is crucial in the management of sepsis. Various scores, such as the Systemic Inflammatory Response Syndrome (SIRS), SOFA, and qSOFA, have been evaluated for their effectiveness in early identification of sepsis and septic shock. Studies have shown that the SOFA score can better classify patients with septic shock [1]. A study by Umemura Y et al., demonstrated improved outcomes among sepsis patients who received sepsis bundle care within the first hour [14]. Another study by Raymond NJ et al., stated that the mortality rate among compliant patients to the sepsis bundle was significantly lower compared to the non-compliant group [15].

In the current study, a significant reduction in mortality was observed in patients with SOFA scores <2 and >2 who received 1-hour bundle adherent care. This finding is consistent with a study by Kalimouttou A et al., where machine learning-derived sepsis care bundles showed a significant reduction in mortality [16].

In the present study, a broad-spectrum antibiotic was selected at the beginning of therapy. The choice of antibiotic was based on patient categorisation and probable source of infection. The antibiotics were administered within 60 minutes of admission. The cases were followed-up to ensure proper escalation or de-escalation based on culture reports and clinical parameters. Continuous training and awareness among staff on sepsis bundles and teamwork in sepsis management contribute to better prognosis and outcomes for sepsis patients.

Limitation(s)

The presence of comorbidities in the bundle adherent and non-bundle adherent cases could have functioned as a confounding factor.

CONCLUSION(S)

The sepsis care bundle based on the Surviving Sepsis Campaign guidelines is beneficial in providing standardised care to patients with sepsis and septic shock, thereby improving patient outcomes.

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PARTICULARS OF CONTRIBUTORS:
1. Assistant Professor, Department of Microbiology, AJ Institute of Medical Sciences and Research Centre, Mangaluru, Karnataka, India.
2. Professor, Department of Hospital Administration, AJ Institute of Hospital Administration, Mangaluru, Karnataka, India.
3. Cheif Intensivist, Department of Intensive Care Unit, AJ Institute of Hospital Administration, Mangaluru, Karnataka, India.
4. Assistant Professor, Department of Emergency Medicine, AJ Institute of Hospital Administration, Mangaluru, Karnataka, India.
5. Tutor, Department of Microbiology, AJ Institute of Hospital Administration, Mangaluru, Karnataka, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Y Rohith,
Assistant Professor, Department of Emergency Medicine, AJ Institute of Hospital Administration, Dakshina Kannada-575004, Karnataka, India.
E-mail: drroopasmailbox@rediffmail.com

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