

Clinical Profile and Outcome of Sepsis in patients admitted in Medical ICU and its correlation with SOFA Score

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Abstract

Aim: The current study was planned to assess clinical profile of sepsis patients admitted in ICU and to correlate the outcome of patients with the SOFA Score.

Methods: This was a prospective observational study in patients admitted with sepsis of any etiology at Medical Intensive Care Unit (MICU) of tertiary care hospital, Bhopal during the period of 18 Months. SOFA score was assessed and outcome was recorded at intervals of 0,3,7,14 and 28 days in terms of recovery or mortality from the day of admission. Data was analyzed using software IBM SPSS ver. 25 and presented as mean \pm standard deviation & p value of less than 0.05 was considered significant.

Results: A total of 200 patients were enrolled in the study. Mean age was 54 ± 15 years, with male predominance (67.5%). Pneumonia was identified as the

most common cause of sepsis. Presence of one or more co-morbidity was associated with high mortality. High mortality was observed in elderly patients (45%) and males (72%). When SOFA score was correlated with outcome of sepsis in study population it was observed that the patients admitted with lower SOFA score had better outcome compared to those who were admitted with or progressed to higher SOFA score during the hospital stay.

Conclusion: SOFA score is a reliable indicator to predict the outcome in sepsis patients at admission in ICU. Correlation of SOFA score with outcome of sepsis at admission and at frequent intervals should be done to assess clinical recovery of patients.

Keywords: SOFA score, sepsis, outcome.

Introduction

Sepsis remains a leading cause of morbidity and mortality globally, emphasizing the need to identify high-risk patients at the earliest stage possible.^{1,2} Sepsis always remained a pervasive and life-threatening challenge in medical practice with multi organ dysfunction.^{3,4} Due to the high mortality associated with sepsis and its complications rapid diagnosis and treatment of the underlying cause is necessary for favourable outcome.⁵ Various clinical biochemical and haematological parameters in septic patients serve as indicators of organ dysfunction and can be used to assess the prognosis in a patient with sepsis.⁶⁻⁸

The Sequential Organ Failure Assessment (SOFA) score used as a pivotal clinical tool designed to objectively quantify the severity of organ dysfunction in critically ill patients.⁹ SOFA Score assigns points based on degree of dysfunction in six organ system-respiratory, cardiovascular, hepatic, coagulation, renal and neurological. The SOFA score offers a standardized and systematic approach in clinical decision-making and as a valuable prognostic indicator in patients with sepsis. Timely identification of sepsis and early initiation of appropriate interventions have been shown to significantly impact patient outcomes.¹⁰ Furthermore, investigating the outcomes of sepsis in the MICU setting is essential for refining healthcare policies and resource allocation. Hence the current study was planned to study the clinical profile of sepsis patients admitted in ICU of tertiary care center and to correlate the outcome of patients with the SOFA Score.

Materials and Methods

This study was conducted as a prospective observational study in patients admitted with sepsis of various etiology to the Medical Intensive Care Unit (MICU) of Gandhi

Medical College and associated Hamidia Hospital, Bhopal, Madhya Pradesh during the study period of 18 months i.e. from 1st August 2022 to 1st January 2024. All the patients diagnosed with sepsis according to the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3 criteria)¹¹ belonging to age group of more than 18 years admitted to the MICU were included whereas patients with incomplete medical records were excluded from the study.

After obtaining ethical clearance from institute's ethical committee, patients satisfying inclusion criteria were enrolled and written consent was obtained. Detailed history regarding sociodemographic variables along with clinical history was obtained and noted in proforma. All the patients were subjected to thorough examination and findings were documented. Neurological examination was done in detail and consciousness level of patients was assessed using Glasgow coma scale (GCS).¹² Laboratory investigations including Complete Blood Count (CBC), Liver Function Tests (LFT), Renal Function Test (RFT), Serum Electrolytes, ABG analysis were done. SOFA score was recorded on day 0, 3, 7 and then weekly. Outcome was discussed in terms of recovery or mortality upto 30 days from day of admission.

Statistical Analysis

Data was compiled using Ms Excel and analysed using IBM SPSS ver. 25 software (IBM Corp. Illinois Chicago). Categorical variables and continuous variables were presented as frequency (percentage) and mean (standard deviation) respectively. The correlation between SOFA score and clinical outcomes was assessed using Pearson correlation coefficient or Spearman rank correlation coefficient depending on the distribution of data. P value of less than 0.05 was considered significant.

Results

This prospective observational study included a total of 200 patients with sepsis. The baseline characteristics of the patients are shown in Table 1. The majority of patients were male (67.5%) and within the 61-70 years age group (26%). Respiratory etiology ie Pneumonia

was the most common cause, accounting for 48% of cases, followed by Genitourinary cause-urosepsis (30%). Type 2 diabetes mellitus (T2DM) was the most prevalent comorbidity (30%), followed by hypertension (19%) in our study group.

Table 1: Baseline Demographics, Co-morbidities and cause of Sepsis in study population

| Variables | | Number of Patients | Percentage |
|-----------------|------------------------|--------------------|------------|
| Age (Years) | ≤30 | 16 | 8% |
| | 31-40 | 23 | 12% |
| | 41-50 | 39 | 20% |
| | 51-60 | 46 | 23% |
| | 61-70 | 55 | 26% |
| | >70 | 21 | 11% |
| | Total | 200 | 100% |
| Gender | Female | 65 | 32.5% |
| | Male | 135 | 67.5% |
| | Total | 200 | 100% |
| Comorbidity | Respiratory | 12 | 6% |
| | Cardiovascular | 37 | 19% |
| | Diabetes | 59 | 30% |
| | Central Nervous System | 7 | 4% |
| | Renal | 15 | 6% |
| | Rheumatological | 2 | 1% |
| | Unknown | 68 | 34% |
| Total | 200 | 100% | |
| Cause of Sepsis | Respiratory | 96 | 48% |
| | Skin | 36 | 17% |
| | Genitourinary | 59 | 30% |
| | Central Nervous System | 9 | 5% |
| | Total | 200 | 100% |

Overall outcome of sepsis patients upto 28 days from admission is depicted in

Fig 1. Mortality of 56.5% and recovery of 43.5% was noted in the study.

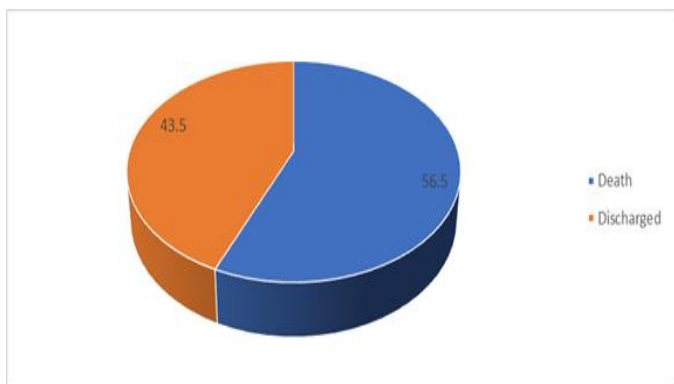


Figure 1: Outcome of patients with Sepsis

The majority initially had a low SOFA score (0-4) (46%). None of the patients had an initial SOFA score of (15-19) or (20-24). Patients with a SOFA score of (0-4) showed 90% recovery (Fig. 2). Among patients with an initial SOFA score of (5-9) or (10-14), a few deteriorated to higher SOFA scores and had high mortality rates reported.

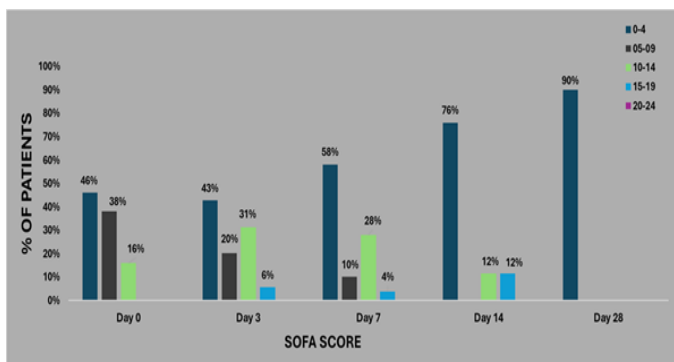


Figure 2: SOFA score on Days 0,3,7,14,28

SOFA score was correlated with the outcome in sepsis patients admitted to the ICU (Fig. 3). It was observed that patients with a SOFA score of (0-4) at admission (Day 0) were discharged from the hospital. Patients with a SOFA score between (5-14) at admission showed poor recovery, with in-hospital mortality up to 90%. Patients who were admitted with a lower SOFA score but progressed to a higher SOFA score on Day 3, 7, or 14 had higher mortality compared to patients who maintained a lower SOFA score.

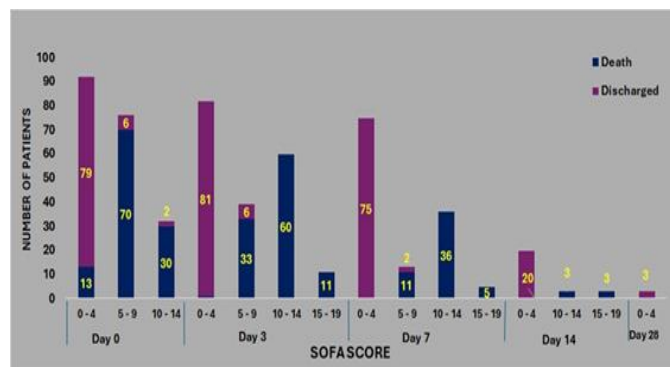


Figure 3: SOFA score and outcome of sepsis on Day 0,3,7,14,28

Overall, we found that elderly patients, with a male predominance and one or more comorbidities, who were admitted with sepsis, are at an increased risk of poor outcomes, as assessed using the SOFA score at admission and at various intervals.

Discussion

Our study observed that the majority were male (67.5%) and the highest number of patients were in the 61-70 years age group (52 patients). This indicates a notable male predominance and highlights that sepsis affects a wide age range. The increased vulnerability of older adults to sepsis is evident in the mortality data, where sepsis increases with advancing age, culminating in a 100% mortality rate for patients over 70 years old. These findings are consistent with the general understanding of sepsis affecting older adults more severely due to age-related decline in immune function and the presence of multiple comorbidities. Similar trends were observed in other studies, including the research by Paary et al.¹³, in which the authors found that 64.2% of these patients were male, and the mean age was 54 years. Additionally, the study by Vallabhajosyula et al.¹⁴ on acute cardiorenal syndrome in sepsis reported a mean age around 71-73 years, with a male predominance of approximately 56-61% across different cohorts. Similarly, Dash et al.¹⁵

highlighted sepsis as a major cause of mortality among hospitalized patients, particularly affecting older adults.

Our study found pneumonia as the most common cause of sepsis, and this highlights the critical role played by respiratory infections in the onset of sepsis. Paary et al.¹³ reported respiratory tract infections in (37.2%) followed by urinary tract (10.3%) and intra-abdominal infections (9.5%). The high incidence of respiratory infections aligns with our findings, emphasizing the global significance of pneumonia as a leading cause of sepsis. Dash et al.¹⁵ found pneumonia to be the most common source of infection (36%) in their study cohort, with the highest mortality rate (55.55%). These findings underscore the critical need for targeted interventions in managing pneumonia-induced sepsis, especially considering the high prevalence and associated mortality.

Our study listed the distribution of patients based on co-morbidities, identifying Type 2 diabetes mellitus (T2DM) as the most prevalent co-morbidity (30%), followed by hypertension (19%) and chronic kidney disease (6%). Additionally, a significant portion of the cohort had no co-morbidities. This highlights the substantial burden of T2DM among sepsis patients, reflecting its impact on disease severity and outcomes. The prominence of hypertension and chronic kidney disease further underscores the importance of managing these conditions to potentially mitigate sepsis complications.

Similarly, Hashmat et al.¹⁶ reported a notable presence of comorbidities among sepsis patients, with 22% having diabetes, 16% chronic kidney disease, 14% hypertension, and 10% chronic liver disease. Their findings align with our study in highlighting the significant role of T2DM and chronic kidney disease as

critical factors in sepsis outcomes. Paary et al.¹³ also found that diabetes was the most common co-morbidity in their sepsis cohort, emphasizing the need for targeted management strategies for diabetic patients to improve sepsis prognosis.

Our study examined the outcomes of patients with different co-morbidities, revealing that patients with chronic kidney disease (CKD) had the highest mortality rate (86.5%), followed by those with hypertension (73%) and chronic obstructive pulmonary disease (COPD) (70%). This data highlights the severe impact of CKD, hypertension, and COPD on sepsis outcomes, underscoring the necessity for intensive management of these conditions in septic patients.

Similarly, Innocenti et al.¹⁷ documented moderate prognostic ability of SOFA score for 28-day mortality. Their findings align with our observations, indicating that underlying conditions like CKD significantly contribute to poor outcomes in sepsis, emphasizing the utility of comprehensive prognostic assessments in managing such high-risk patients. Hwang et al.¹⁸ concluded that qSOFA's strict criteria identified fewer patients as septic but with higher in-hospital mortality rates and highlighted the importance of using robust prognostic tools in conjunction with understanding the impact of comorbidities, similar to our findings on the significant mortality associated with CKD and COPD.

Our study examined the distribution of patients according to their SOFA scores at various time points, revealing critical insights into the progression of sepsis. Initially, the majority of patients had low SOFA scores (0-4), indicating relatively mild organ dysfunction at the onset of sepsis. However, over time, the distribution shifted towards higher SOFA scores, reflecting worsening organ failure in a significant number of

patients. By Day 28, all remaining patients with SOFA scores of 0-4 had survived, and most of these had maintained low SOFA scores (0-4), suggesting that those with lower initial SOFA scores were more likely to survive.

Supporting our findings, Karakike et al.¹⁹ showed that a decrease of less than 25% in SOFA scores by Day 7 was associated with higher mortality. Kamath et al.²⁰ also demonstrated that serial SOFA measurements during the first week predicted outcomes effectively, with higher scores linked to increased mortality. Caramello et al.²¹ reinforced that higher SOFA scores correlate with worse outcomes. Additionally, studies by Rodriguez et al.²² and Lie et al.²³ emphasized the importance of accurate SOFA score assessments, while van der Woude et al.²⁴ confirmed that higher SOFA scores were associated with higher in-hospital mortality rates. These studies collectively underscore the prognostic value of monitoring SOFA scores over time in sepsis management.

Kamath et al.²⁰ concluded that higher SOFA scores were significantly associated with non-survivors, corroborating our observations that increasing SOFA scores over time indicate worsening outcomes. Caramello et al.²¹ found that higher SOFA scores were associated with increased mortality, while patients with lower SOFA scores had better survival rates. This aligns with our findings where patients who maintained low SOFA scores (0-4) by Day 28 had better outcomes.

Collectively, these studies highlight the critical role of SOFA score monitoring in the management of sepsis, reinforcing the necessity of regular and comprehensive assessments to predict and improve patient outcomes.

Our study demonstrated a strong correlation between SOFA scores and patient outcomes at various time

points, underscoring the prognostic value of the SOFA score in sepsis management. On Day 0, patients with SOFA scores of 5-9 and 10-14 exhibited mortality rates exceeding 90%, indicating that higher SOFA scores are strongly predictive of poor outcomes. By Day 28, all remaining patients had SOFA scores of 0-4, suggesting that lower SOFA scores are associated with better survival rates. These findings highlight the utility of the SOFA score as a reliable marker for assessing the severity of organ dysfunction and predicting mortality in septic patients.

Karakike et al.¹⁹ found that a decrease of less than 25% in the admission SOFA score by Day 7 was associated with increased mortality, reinforcing our findings that higher SOFA scores at initial assessment and over time are indicative of poorer outcomes. Similarly, Kamath et al.¹⁹ demonstrated that serial measurements of SOFA scores during the first week of ICU stay were valuable in predicting patient outcomes, with higher SOFA scores correlating with increased mortality rates. These studies collectively validate the importance of SOFA score trends in prognostication and highlight the need for regular monitoring to inform treatment strategies.

Caramello et al.²¹ concluded that higher SOFA scores were consistently associated with increased mortality, aligning with our observations that patients with SOFA scores of 5-9 and 10-14 had exceedingly high mortality rates.

Limitations

One limitation of our study was the observational design, which may have introduced selection bias, as it relied on patients admitted to a single tertiary care centre's medical ICU. This limits the generalizability of the findings to other settings or populations. Additionally, the study did not account for potential

confounding factors such as variations in treatment protocols and the timing of interventions, which could have influenced outcomes. The reliance on SOFA scores alone may have also overlooked other important clinical indicators of sepsis severity and progression. Finally, the data collection over 18 months may not fully capture seasonal variations in sepsis incidence and outcomes.

Conclusion

Mortality rates increased with age, showing that older patients faced higher risks, while younger patients had better outcomes. Pneumonia was identified as the most common cause of sepsis, followed by urosepsis and diabetic foot infections, with varying prognoses based on the underlying cause. The presence of co-morbidities such as Type 2 diabetes mellitus, hypertension, and chronic kidney disease also played a crucial role, with chronic kidney disease associated with the highest mortality. SOFA scores proved to be a reliable predictor of outcomes, with higher scores indicating greater mortality risk and lower scores associated with better survival rates. The dynamic nature of SOFA scores over time further emphasized their importance in assessing and managing sepsis severity.

References

1. Iskander KN, Osuchowski MF, Stearns-Kurosawa DJ, Kurosawa S, Stepien D, Valentine C, Remick DG. Sepsis: multiple abnormalities, heterogeneous responses, and evolving understanding. *Physiological reviews*. 2013 Jul;93(3):1247-88.
2. Kim HI, Park S. Sepsis: early recognition and optimized treatment. *Tuberculosis and respiratory diseases*. 2019 Jan 1;82(1):6-14.
3. Rudd KE, Johnson SC, Agesa KM, Shackelford KA, Tsoi D, Kievlan DR, Colombara DV, Ikuta KS, Kissoon N, Finfer S, Fleischmann-Struzek C. Global, regional, and national sepsis incidence and mortality, 1990–2017: analysis for the Global Burden of Disease Study. *The Lancet*. 2020 Jan 18;395(10219):200-11.
4. Irwin RS, Rippe JM, editors. *Irwin and Rippe's intensive care medicine*. Lippincott Williams & Wilkins; 2008.
5. Agnello L, Giglio RV, Bivona G, Scazzone C, Gambino CM, Iacona A, Ciaccio AM, Lo Sasso B, Ciaccio M. The value of a complete blood count (CBC) for sepsis diagnosis and prognosis. *Diagnostics*. 2021 Oct 12;11(10):1881.
6. Delano MJ, Ward PA. The immune system's role in sepsis progression, resolution, and long-term outcome. *Immunological reviews*. 2016 Nov;274(1):330-53.
7. Hotchkiss RS, Moldawer LL, Opal SM, Reinhart K, Turnbull IR, Vincent JL. Sepsis and septic shock. *Nature reviews Disease primers*. 2016 Jun 30;2(1):1-21.
8. Cohen J, Brun-Buisson C, Torres A, Jorgensen J. Diagnosis of infection in sepsis: an evidence-based review. *Critical care medicine*. 2004 Nov 1;32(11):S466-94.
9. Vosseteig A, Huang T, Jones P. Modified Sequential Organ Failure Assessment score for predicting mortality in emergency department patients with sepsis. *Emergency Medicine Australasia*. 2023 Jun;35(3):504-9.
10. Burrell AR, McLaws ML, Fullick M, Sullivan RB, Sindhusake D. SEPSIS KILLS: early intervention saves lives. *Medical Journal of Australia*. 2016 Feb;204(2):73-.
11. Singer M, Deutschman C, Seymour C, Shankar-Hari M, Annane D, Bauer M. The Third International

- Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). Mervyn. *Jama*. 2016;315(8):801-10.
12. Sternbach GL. The Glasgow coma scale. *The Journal of emergency medicine*. 2000 Jul 1;19(1):67-71.
13. Paary TT, Kalaiselvan MS, Renuka MK, Arunkumar AS. Clinical profile and outcome of patients with severe sepsis treated in an intensive care unit in India. *Ceylon Medical Journal*. 2014 Jun 3;59(2).
14. Vallabhajosyula S, Sakhuja A, Geske JB, Kumar M, Kashyap R, Kashani K, Jentzer JC. Clinical profile and outcomes of acute cardiorenal syndrome type-5 in sepsis: An eight-year cohort study. *PloS one*. 2018 Jan 9;13(1):e0190965.
15. Dash L, Singh LK., Murmu MP, Kerketta A, Hiregoudar MB. Clinical profile and outcome of organ dysfunction in sepsis. *International Journal of Research in Medical Sciences*. 2018 Jun;6(6):1927.
16. Hashmat N, Shabbir I, Rahat T, Ijaz F, Majeed S. Clinical Profile and Disease Outcome of Septic Patients at Public Sector Hospital. *Pakistan Journal of Medical Research*. 2015 Apr 1;54(2).
17. Innocenti F, Tozzi C, Donnini C, De Villa E, Conti A, Zanobetti M, Pini R. SOFA score in septic patients: incremental prognostic value over age, comorbidities, and parameters of sepsis severity. *Internal and Emergency Medicine*. 2018 Apr;13:405-12.
18. Hwang TS, Park HW, Park HY, Park YS. Prognostic value of severity score change for septic shock in the emergency room. *Diagnostics*. 2020 Sep 24;10(10):743.
19. Karakike E, Kyriazopoulou E, Tsangaris I, Routsis C, Vincent JL, Giamarellos-Bourboulis EJ. The early change of SOFA score as a prognostic marker of 28-day sepsis mortality: analysis through a derivation and a validation cohort. *Critical care*. 2019 Dec;23:1-8.
20. Kamath AC, Harsoor S. Study of sofa score for predicting the outcome of patients admitted in ICU at BTGH. *Al Ameen J Med Sci*. 2020;13(2):125–9.
21. Caramello V, Beux V, De Salve AV, Macciotta A, Ricceri F, Boccuzzi A. Comparison of different prognostic scores for risk stratification in septic patients arriving to the Emergency Department. *Ital J Med*. 2020;14(2):79–87.
22. Rodriguez RM, Greenwood JC, Nuckton TJ, Darger B, Shofer FS, Troeger D, Jung SY, Speich KG, Valencia J, Kilgannon JH, Fernandez D. Comparison of qSOFA with current emergency department tools for screening of patients with sepsis for critical illness. *Emergency Medicine Journal*. 2018 Jun 1;35(6):350-6.
23. Lie KC, Lau CY, Van Vinh Chau N, West TE, Limmathurotsakul D. Utility of SOFA score, management and outcomes of sepsis in Southeast Asia: a multinational multicenter prospective observational study. *J Intensive Care*. 2018;6:1–8.
24. Van der Woude SW, Van Doormaal FF, Hutten BA, Nellen FJ, Holleman F. Classifying sepsis patients in the emergency department using SIRS, qSOFA or MEWS. *Neth J Med*. 2018 May 1;76(4):158-66.