

Assessment of SOFA Score and its Relation with Sepsis Outcome in a Tertiary Care Centre

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ABSTRACT

Aim: To study the association of SOFA score with sepsis and its correlation with patient outcome in a tertiary care centre. **Materials and Methods:** A prospective observational cohort study conducted on 320 patients of sepsis in Medicine department and ICU, SRN Hospital, MLN Medical College, Prayagraj, U.P. India. **Results:** In this study, out of 320 patients taken for the study 71 (22.2%) expired and 249 (77.8%) were discharged/referred. In the study, for mortality as an outcome (expired vs discharge), on the day of admission, day 3 and on day 7, the area under the ROC curve (AUROC) for SOFA at admission predicting Expired vs Discharged/Referred was 0.87 (95% CI: 0.819 - 0.921), thus demonstrating good diagnostic performance. It was statistically significant ($p = <0.001$). The relative risk (95% CI) for expired group, when SOFA on admission is ≥ 5 was 7.75 (4.8-12.63). PPV of 50.8% (42-60), NPV 95.0% (91-98) with diagnostic accuracy of 78.4% (74-83). **Conclusion:** In this study, it was seen that higher values of SOFA (at admission) scores was associated with poor outcomes. Higher rate of mortality was seen in all those subjects in whom persistent high values of SOFA scores were seen during the admission.

Key words: Sepsis, SOFA score, Systemic inflammatory response syndrome, septic shock.

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INTRODUCTION

Sepsis is a leading cause of morbidity and mortality in critically ill patients worldwide. Sepsis is not a specific illness but rather a syndrome encompassing a still-uncertain pathobiology.^{1,2} For years this syndrome has alternatively been addressed as septicemia, sepsis syndrome, or simply sepsis. Thus, defining sepsis has been baffling clinicians for very long.

A 1991 consensus conference developed initial definitions that focused on the then-prevailing view that sepsis results from a host's systemic inflammatory response syndrome (SIRS) to infection. Approach to this sepsis definition was based on clinical signs and symptoms as, any patient meeting ≥ 2 systemic inflammatory response syndrome (SIRS) criteria.

SIRS CRITERIA

FEVER	>38°C or <36°C.
TACHYPNEA	>20 breaths/min.
TACHYCARDIA	>90beats/min.
TOTAL LEUCOCYTE COUNT	>12000/ul or <4000/ul or >10% bands

Score ranges from (0-4), with 1 point for each criterion. One major drawback of the SIRS criteria was that none of the parameters are specific for sepsis. To address the above problem, in 2001, task force under international sepsis definition conference introduced a new criterion of sepsis (termed as 'sepsis-2') as:

≥ 2 SIRS criteria plus suspected or documented infection

The definition remained largely unchanged for more than a decade and this situation of diagnostic dilemma remained till 2016, when SOFA scoring was recommended in potentially septic patients after finding predictive validity of SOFA scoring in critically ill septic patients in hospital mortality better than conventional SIRS criteria. It includes -

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SOFA SCORING

ORGAN SYSTEM	0	1	2	3	4
Glasgow Coma Scale	15	14-13	12-10	9-6	less than 6
pO ₂ /fio ₂ mmHg	>400	<400	<300	<200	<100
Platelet Count	>1.5	<1.5	<1	<0.5	<0.2
Serum Bilirubin	<1.2	1.2-1.9	2-5.9	6-11.9	>12
Cardiovascular (vasopressor dosage in ug/kg/min)	>70 mm Hg	MAP<70 mm Hg	Dopamine <5 Or, dobutamine (any dose)	Dopamine 5-5, or, epinephrine ≤0.1, Norepinephrine ≤0.1	Dopamine>15 or, epinephrine >0.1 or, Norepinephrine >0.1
Serum creatinine (mg/dl) Urine output(ml/d)	<1.2	1.2-1.9	2-3.4	3.5-4.9 <500	>5 <200

So, according to new guidelines, (termed sepsis-3) now, new definitions of sepsis and septic shock came out as **SEPSIS: Suspected or documented infection and an increase in greater than or equal to 2 SOFA score point.**³

Sepsis involves magnitude of change in different physiological, haematological and biochemical parameters. SOFA score is one such scoring system that takes into account different parameters to provide a comprehensive score that can be used successfully for prediction of outcome particularly in sepsis patients.

MATERIALS AND METHODS

STUDY DESIGN-The prospective observational cohort study conducted in SRN Hospital, MLN Medical College, Prayagraj, U.P. India.

CASES - Patients were enrolled from medicine emergency, wards and ICU of SRN Hospital, Prayagraj.

INCUSION CRITERIA - Age >18 years and patients if suspected or documented sepsis at the time of admission.

EXCLUSION CRITERIA - Patients with underlying malignancy, on immunosuppressive drugs, patients with aplasia or immunosuppressive disease (HIV), pregnancy and critically ill patients of aetiology other than sepsis. Site specific culture is excluded.

RESULTS

The present study was carried out with an aim to evaluate the efficacy of SOFA scoring system in prediction of outcome of sepsis patients admitted. For this purpose, a total of 320 patients falling in sampling frame were enrolled. In our study mean age of the patients (in years) was 46.30 ± 17.33 and out of which maximum no. 69 (21.6%) of participants belonged to the age group of 51-60 Years. The mean (SD) of Age (Years) in the

Discharged/Referred/Survivor group was 44.66 (17.32) whereas in Expired/Nonsurvivor group was 52.06 (16.23). There was a significant difference between the 2 groups in terms of Age (Years) ($p = 0.001$), with the median Age (Years) being highest in the expired group. Maximum mortality 29.6% was seen in participants of the group 51-60 Years. 196(61.3%) of the participants were Male and 124 (38.8%) of the participants were Females.

The mean (SD) of SOFA (Admission) was 4.03 (3.47). When compared on the day 3 and day 7, we found that the mean (SD) of SOFA (Day 3) was 2.42 (3.00). The median (IQR) of SOFA (Day 3) was 1.00 (0-4), whereas the mean (SD) of SOFA (Day 7) was 0.87 (1.57). The median (IQR) of SOFA (Day 7) was 0.00 (0-1).

In the present study, there were 71 (22.2%) mortalities. The ROC analysis, for mortality as an outcome (expired vs discharge), on the day of admission, the area under the ROC curve (AUROC) for SOFA (Admission) predicting Expired vs Discharged/Referred was 0.87 (95% CI: 0.819 - 0.921), thus demonstrating good diagnostic performance. It was statistically significant ($p = <0.001$). At a cut-off of SOFA (Admission) ≥ 5 , it predicts Expired with a sensitivity of 86%, and a specificity of 76%. The odds ratio (95% CI) for Expired group when SOFA (Admission) is ≥ 5 was 17.1 (8.99-32.55). The relative risk (95% CI) for Expired group, when SOFA (Admission) is ≥ 5 was 7.75 (4.8-12.63). PPV of 50.8% (42-60), NPV 95.0% (91-98) with diagnostic accuracy of 78.4% (74-83).

The area under the ROC curve (AUROC) for SOFA (Day 3 and Day 7) demonstrated poor diagnostic performance in predicting Outcome: Expired vs Discharged/Referred. For Day 3, it was 0.638 (95% CI: 0.552 - 0.725), statistically significant ($p = <0.001$) and at a cutoff of ≥ 6 , it predicted Outcome with a sensitivity of 45%, and a specificity of 92%. The odds ratio (95%

CI) being 12.53 (6.03-26.06) with relative risk (95% CI) 4.57 (3.19-6.39). AUROC for SOFA (Day 7) predicting Outcome was 0.598 (95% CI: 0.537 - 0.659) when cutoff of SOFA (Day 7) was taken as ≤ 0 , it predicts Outcome with a sensitivity of 80%, and a specificity of 42% implying poor diagnostic performance.

Summary of all parameters of study population

All Parameters	Mean \pm SD Median (IQR)
Age (Years)	46.30 \pm 17.33
≤ 20 Years	23 (7.2%)
21-30 Years	45 (14.1%)
31-40 Years	61 (19.1%)
41-50 Years	56 (17.5%)
51-60 Years	69 (21.6%)
61-70 Years	48 (15.0%)
71-80 Years	10 (3.1%)
81-90 Years	6 (1.9%)
> 90 Years	2 (0.6%)
Gender	
Male	196 (61.3%)
Female	124 (38.8%)
TLC (/cu.mm)	20101.31 \pm 8222.39
Neutrophils (%)	85.50 \pm 7.95
Lymphocytes (%)	10.22 \pm 7.90
SGOT (U/L)	85.44 \pm 72.78
SGPT (U/L)	76.39 \pm 77.86
ALP (U/L)	322.55 \pm 287.19
T. Bilirubin (mg/dL)	1.20 \pm 0.97
T. Bilirubin	
< 1.2 mg/dL	213 (66.6%)
1.2-1.9 mg/dL	59 (18.4%)
2-5.9 mg/dL	47 (14.7%)
6-11.9 mg/dL	1 (0.3%)
T. Protein (g/dL)	6.11 \pm 9.10 5.80 (5.20-6.30)
S. Creatinine (mg/dL)	1.67 \pm 1.13
S. Creatinine	
< 1.2 mg/dL	121 (37.8%)
1.2-1.9 mg/dL	123 (38.4%)
2-3.4 mg/dL	58 (18.1%)
3.5-4.9 mg/dL	10 (3.1%)
> 5 mg/dL	8 (2.5%)
Blood Urea (mg/dL)	74.96 \pm 62.13
BUN (mg/dL)	36.74 \pm 29.41
S. Sodium (mEq/L)	138.25 \pm 6.58
S. Potassium (mEq/L)	4.29 \pm 0.63

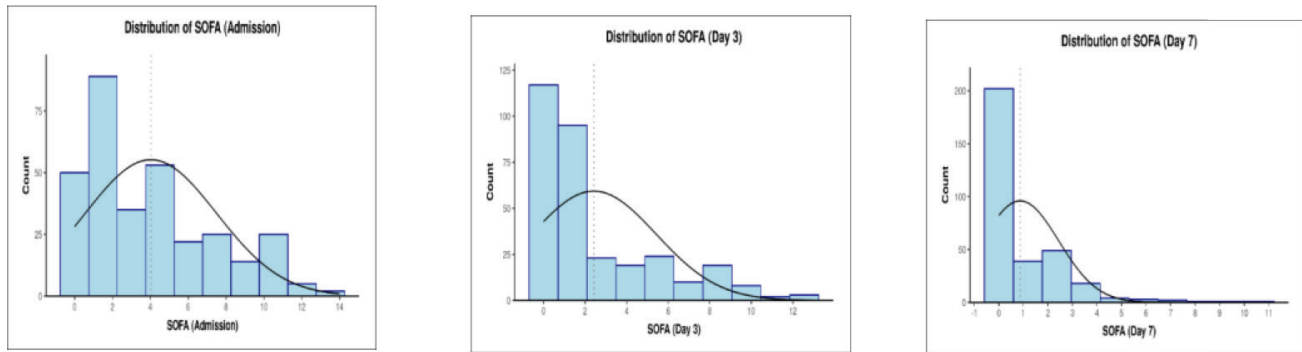
All Parameters	Mean \pm SD Median (IQR)
S. Calcium (mEq/L)	0.97 \pm 0.63
Systolic BP (mmHg)	113.96 \pm 27.73
Diastolic BP (mmHg)	74.47 \pm 17.23
MAP (mmHg)	87.63 \pm 20.42
MAP	
< 70 mmHg	88 (27.5%)
≥ 70 mmHg	232 (72.5%)
Random Plasma Glucose (mg/dL)	149.44 \pm 96.40
paO2/fio2	
100-200	21 (6.6%)
200-300	32 (10.0%)
300-400	267 (83.4%)
Platelet Count (Lacs/cu.mm)	1.67 \pm 0.76
Platelet Count	
0.2-0.5 Lacs/cu.mm	7 (2.2%)
> 1.5 Lacs/cu.mm	158 (49.4%)
GCS	13.18 \pm 2.96
GCS Category	
< 6	10 (3.1%)
6-9	36 (11.2%)
10-12	36 (11.2%)
13-14	53 (16.6%)
15	185 (57.8%)
SOFA (Admission)	4.03 \pm 3.47 3.00 (1.00-6.00)
SOFA (Day 3)	2.42 \pm 3.00 1.00 (0.00-4.00)
SOFA (Day 7)	0.87 \pm 1.57 0.00 (0.00-1.00)
NLR (Admission)	11.56 \pm 6.05 11.00 (8.30-15.00)
NLR (Day 3)	7.09 \pm 5.65 5.70 (3.50-8.60)
NLR (Day 7)	2.36 \pm 2.85 2.00 (0.00-5.00)
Duration Of Hospital Stay (Days)	6.62 \pm 3.71 6.00 (4.00-9.00)
Outcome	
Discharged/Referred	249 (77.8%)
Expired	71 (22.2%)

The mean (SD) of SOFA on admission was 4.03 (3.47). The median (IQR) of SOFA on admission was 3.00 (1-6). The mean (SD) of SOFA on day 3 was 2.42 (3.00). The median (IQR) of SOFA on day 3 was 1.00 (0-4). The mean (SD) of SOFA on day 7 was 0.87 (1.57). The median (IQR) of SOFA on day 7 was 0.00 (0-1).

Mean and Median SOFA for various days of admission

SOFA	Mean \pm SD	Median (IQR)
Admission	4.03 (3.47)	3 (1-6)
Day 3	2.42 (3.00)	1 (0-4)
Day 7	0.87 (1.57)	0 (0-1)

Distribution of participants in terms of SOFA



DISCUSSION

Sepsis is one of the most important and common cause for admission. Sepsis involves magnitude of change in different physiological, haematological and biochemical parameters, thus these can be considered to be useful for prediction of outcome among sepsis patients admitted to an ICU. SOFA score is one such scoring system that takes into account different haematological and biochemical parameters to provide a comprehensive score that can be used successfully for prediction of outcome particularly in ICU patients which can be extended to sepsis patients too.

The usefulness of the score has been previously validated in large cohorts of critically ill patients.^{4,5} The SOFA score has several desirable characteristics for application in the ED, because it is easy to calculate at the bedside and includes clinical and laboratory data that are routinely available in the ED.

F L Ferreira *et al.* studied Serial evaluation of the SOFA score to predict outcome in critically ill patients from April 1 to July 31, 1999, in a 31-bed medico surgical ICU at a university hospital in Belgium on 352 patients. The initial, highest, and mean SOFA scores correlated well with mortality. Initial and highest scores of more than 11 or mean scores of more than 5 corresponded to mortality of more than 80%. The predictive value of the mean score was independent of the length of ICU stay. They concluded Sequential assessment of organ dysfunction during the first few days of ICU admission is a good indicator of prognosis. Likewise a number of studies have been done over a decade the strengthen the association of high SOFA scores in predicting the mortality in patients of sepsis.

To further strengthen the correlation, an observational study was carried out that included a total of 320 patients with sepsis. We calculated the SOFA in the both groups and on the different days of hospitalisa-

tion. The mean (SD) of SOFA (Admission) was 4.03 (3.47). Compared to present study, Akilli *et al.*⁶ in their study had the SOFA score was 4.9 ± 2.2 . When compared on the day 3 and day7, we found that the mean (SD) of SOFA (Day 3) was 2.42 (3.00). The median (IQR) of SOFA (Day 3) was 1.00 (0-4), whereas the mean (SD) of SOFA (Day 7) was 0.87 (1.57). The median (IQR) of SOFA (Day 7) was 0.00 (0-1). In the present study, on ROC analysis, for mortality as an outcome (expired vs discharge), on the day of admission, day 3 and on the day 7th, the area under the ROC curve (AUROC) for SOFA (Admission) predicting Expired vs Discharged/ Referred was 0.87 (95% CI: 0.819 - 0.921), thus demonstrating good diagnostic performance. It was statistically significant ($p < 0.001$).

Likewise a study by Jain *et al.*,⁷ that investigated the SOFA score and ICU mortality relationship, determined that the higher the SOFA score on the 1st, 3rd, and 5th day of ICU stay, the higher the ICU mortality. In the present study, on univariate assessment higher mean TLC values, Lymphocytes, Neutrophil, SGOT, SGPT, ALP, Bilirubin, s. creatinine, platelet counts, GCS were significantly associated with mortality. Patients who expired had significantly higher proportion of organ dysfunction as compared to those who survived. It was also observed that mean GCS scores of patients who expired were significantly lower as compared to those who survived.

CONCLUSION

In this study, it was seen that higher values of SOFA (at admission) scores were found in the non-survivor group. Higher rate of mortality was seen in all those subjects in whom persistent high values of SOFA scores were seen.

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Limitation

Small sample size.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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