Original Research Article

The prognostic accuracy of systemic inflammatory response syndrome, quick sequential organ failure assessment and sequential organ failure assessment scores in estimating the 28 day in-hospital mortality

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ABSTRACT

Background: Sepsis is among the leading causes of death in the world. 31.5 million cases of sepsis and 19.4 million cases of septic shock have been the annual global incidence. The collaborative efforts have improved the outcomes, yet the in-hospital mortality rates remain high. This study is undertaken to ascertain the prognostic accuracy of systemic inflammatory response syndrome (SIRS), quick sequential organ failure assessment (qSOFA) and sequential organ failure assessment (SOFA) scores in estimating the in-hospital mortality.
Methods: A prospective observational study was done from the department of general medicine and intensive care units from December 2017 to September 2019. A total of 50 Sepsis patients were selected for the study. The patients have been monitored for 28 days. Data regarding demographics, illness severity, organ dysfunction, length of stay and outcome (for 28 days) of the patients are noted.
Results: The SOFA score with AUROC of 0.82, had the best discrimination in predicting mortality.
Conclusions: SOFA has better prognostic accuracy than SIRS and qSOFA in predicting mortality. As ICU mortality is high in this group and care should be resource-intensive due to increased length of stay.

Keywords: Sepsis, SOFA, qSOFA, SIRS, India

INTRODUCTION

The diseases known to give the physician a difficult management situation are sepsis and septic shock. The mortality rate is 30% due to sepsis, and in the world, it is currently the tenth leading cause of death. Till date, data regarding epidemiology of sepsis is mostly obtained from western literature. Data from India is limited regarding sepsis and most of the literature details about infection rather than sepsis.[1] Sepsis is primarily due to an imbalance of pro-inflammatory and anti-inflammatory responses and results in multi organs dysfunction.[2]

In this study, we have done a comparative study to estimate the prognostic accuracy of SIRS, qSOFA and SOFA in estimating the 28 days in-hospital mortality.

We have done this study to know predictors of morbidity and mortality so that the results from this study will help in the management of sepsis by clinicians so that it can be resource-intensive. The presence of organ dysfunction is a critical part of various scoring systems that rely on clinical and laboratory parameters.

This study is undertaken to ascertain the prognostic accuracy of SIRS, qSOFA and SOFA scores in estimating the in-hospital mortality.

METHODS

This is a prospective observational study with 50 patients in a tertiary care hospital (Narayana medical college and hospital) in the department of general medicine and

intensive care unit. The patients have been followed for 28 days.

Duration of study was from December 2017 to September 2019.

Inclusion criteria

The inclusion croteria for the study included patients who are more than 18 years old should satisfy the SCCM criteria of sepsis.

Exclusion criteria

Exclusion criteria for the study excluded patients with no evidence of infection.

Ethical approval was taken from college ethics committee.

Method of collection of data included 50 patients who were diagnosed with sepsis. They have been diagnosed according to surviving sepsis campaign SOFA criteria by society of critical care medicine (SCCM) and the European society of intensive care medicine (ESICM). Data regarding demographics, severity of sepsis, organ dysfunction have been taken. The variables are compared statistically using chi-square test, area under ROC (AUROC) curves.

RESULTS

Total numbers of patients included in our study are 50 patients. Sepsis has been diagnosed with SCCM SOFA criteria. The following are the observations made in this study.

Duration of stay

Table 1: Duration of stay.

| Duration	No	Min	Max	Mean	SD
No. of days	50	1	18	8.22	4.59

The mean duration of stay in the hospital is 8.22 days.

Organ dysfunction in sepsis

In the present study, renal impairment is seen in as many as 54% of patients, followed by respiratory failure (40%) and cardiovascular involvement (40%).

Hepatic impairment is seen in 22% of the patients.

Almost 22% of the patients had nervous system manifestations like encephalopathy secondary to sepsis, severe acidosis developing post septic shock and brain death etc.

Coagulopathy in the form of thrombocytopenia, bleeding coagulopathies were seen in almost 30% of the patients.

	coagul opathy	CNS	HEPA TIC	RESPI RATO RY	CVS	RENA L
■ Number of cases	15	12	11	20	20	27
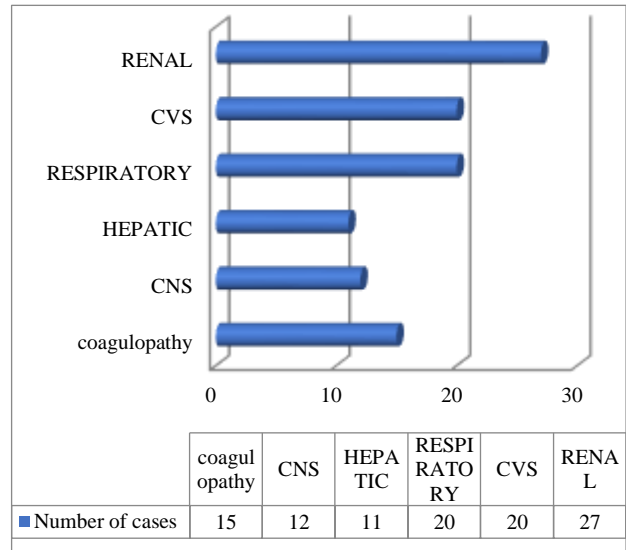
Figure 1: Organ dysfunction in sepsis.

Prognostic accuracy of SIRS, qSOFA and SOFA
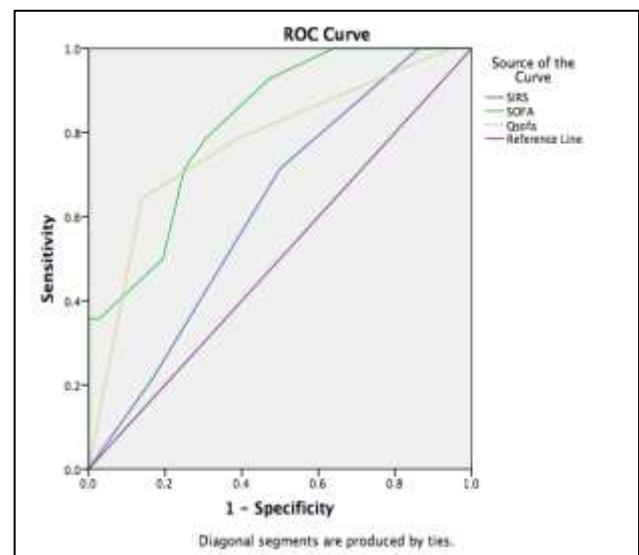
Figure 2: AUROC curve for SIRS, qSOFA and SOFA.

In this present study, the AUROC of SIRS, SOFA and qSOFA are 0.62, 0.82,0.78 respectively, implying SOFA having better prognostic accuracy.

SIRS have more sensitivity and less specificity in predicting in-hospital mortality. While the SOFA has more sensitivity and specificity in predicting in-hospital mortality. qSOFA has less sensitivity and more specificity in predicting in-hospital mortality. The average scores in expired and recovered patients are mentioned in Table 3.

Table 2: AUROC values for SIRS, qSOFA and SOFA.

Variables	Area	Std. error [a]	P value	Asymptotic 95% CI	
				Lower bound	Upper bound
SIRS	0.62	0.08	0.19 (NS)	0.46	0.78
SOFA	0.82	0.06	<0.001*	0.70	0.94
qSOFA	0.78	0.08	0.003*	0.62	0.93

*p<0.05 statistically significant, p>0.05 non-significant, NS

Table 3: Sensitivity and specificity for SIRS, qSOFA and SOFA.

| Variables	Cut off value	Sensitivity	Specificity
SIRS	2.5	0.71	0.5
SOFA	7	0.79	0.69
qSOFA	2.5	0.64	0.86

The mean scores of SIRS, qSOFA and SOFA on expired patients are 3.4, 2.8 and 12, respectively. While the scores in recovered patients are 3.2, 2 and 9 for SIRS, qSOFA and SOFA scores respectively (Table 4).

Final outcome

In the present study with the sample size of 50, the mortality is 28%.

Table 4: Mean scores of SIRS, qSOFA and SOFA.

Scores	Total patients	Recovered	Expired
SIRS (mean ± SD)	3.2±0.8	3.2±0.9	3.4±0.7
qSOFA (mean ± SD)	2±0.7	2±0.7	2.8±0.4
SOFA score	9 (5-12)	6 (4-9)	12 (9-14)
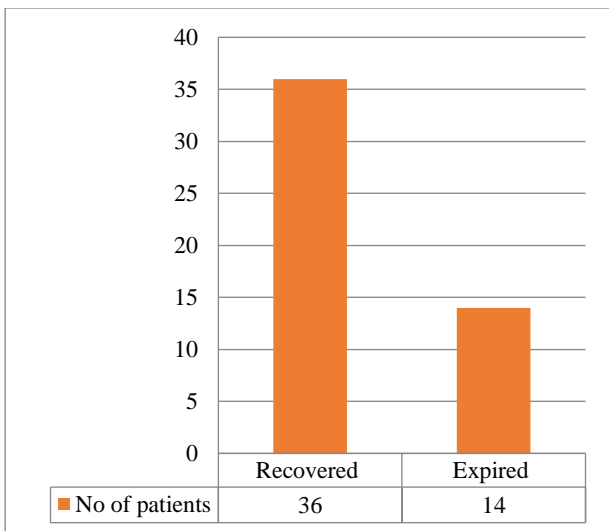
Figure 3: Final outcome.

DISCUSSION

In our study, SIRS have more sensitivity, while the SOFA has more sensitivity and specificity. The AUROC for SIRS, SOFA, qSOFA are 0.62, 0.82, 0.78 respectively. We are implying that SOFA has better prognostic accuracy.

A study done by Malcolm et al on acute hepatobiliary sepsis cases, they found that SIRS lacks specificity and qSOFA lacks sensitivity.[3]

They have done univariate and multivariate analysis for assessing SIRS, qSOFA and SOFA for their accuracy in determining morbidity and mortality. Their observations are shown in Table 5.

On both univariate and multivariate analysis, there was no statistical significance between the comparison of ROC curves for HDU admission, LOS, mortality.[3]

In another retrospective cohort study with over 2000 patients by Khwannimit et al. The SOFA score >2 had the higher sensitivity (99.5%) to predict hospital mortality than qSOFA (98.3%) and SIRS (98.6%).

But, qSOFA had a higher specificity (19.2%) to predict hospital mortality than SIRS (5.3%) and SOFA score (7.5%).[4]

In a study done by Probst et al in hematological cancer patients, sensitivity was 86, 64, and 42% for SIRS, SOFA, and qSOFA, respectively for the diagnosis of sepsis.[4]

Regarding patients with sepsis, mortality was similar in patients with positive and negative SIRS scores. For patients with qSOFA ≥2, mortality was higher than those with qSOFA <2 (p=0.056), and for SOFA 56 vs. 11% (p<0.001), respectively. SOFA allowed significantly better discrimination for in-hospital mortality than qSOFA or SIRS.[4]

In a study done by April et al with 214 patients, estimating the prognostic accuracy of qSOFA, the AUROC values for SIRS and qSOFA were 0.65 and 0.66, respectively. It represents qSOFA having better prognostic value.[5]

In a study done by Askim et al with 1535 patients, the sensitivity to predict 7-day and 30-day mortality was low for risk stratification by qSOFA.[5]

Churpek et al have done a study with 53,849, the AUROC values for SIRS, SOFA and qSOFA were respectively 0.60, 0.62, 0.65 with qSOFA having better prognostic accuracy.[6]

In a multicenter observational study done by De Groot et al with 783 patients, qSOFA had a poor discriminative and prognostic performance.[7]

Table 5: Univariate and multivariate analysis of associations between patient characteristics and factors predictive of study outcomes.

Characteristic	Study outcome, p value					
	Use of vasopressors	HDU admission	SICU admission	Length of hospital stay	Morbidity	Mortality
Univariate analysis						
SIRS criteria	0.135	0.396	0.382	0.577	0.617	0.339
qSOFA score	0.898	0.046	0.792	0.300	0.874	0.928
SOFA score	0.093	0.815	0.223	0.013	0.380	0.394
Multivariate analysis						
SIRS criteria	N. S					
qSOFA score	N. S					
SOFA score	N. S	N. S	N.S	0.002, (OR 6.16, CI 1.99-19.04)	N. S	N. S

Braband et al have studied regarding discriminative and prognostic power of qSOFA alone in around 3600 patients and have found that-sensitivity-32.0% (24.5-40.2); specificity 96.7% (96.1-97.2); positive predictive value 27.8% (21.1-35.2); negative predictive value 97.3% (96.7-97.8).[8]

In a study done by Donelly et al 2593 sepsis patients were considered. Of which 1526 met SIRS, 1080 met SOFA, and 378 met qSOFA criteria. While qSOFA was a better predictor of mortality, SOFA has more specificity for diagnosing sepsis.[9]

In a comparative study done by Finkelstein et al in 152 patients the AUROC values for predicting mortality qSOFA [(AUC), 0.74; 95% confidence intervals (CI), 0.66-0.81]

SIRS criteria (AUC, 0.59; 95% CI, 0.51-0.67; p=0.03). suggesting qSOFA having better discriminative value.[10]

Forward et al in their study with 161 patients, qSOFA was more specific in determining ICU admission, 28-day mortality but SIRS have more sensitivity in diagnosing sepsis.[11]

Freund et al in their study with 879 patients, had a large area under AUROC of 0.80 for predicting mortality by qSOFA.[12]

Giamarellos et al however, saw inadequate sensitivity for early risk assessment for qSOFA. Prediction of an unfavorable outcome and to limit misclassification into lower severity unlike previous scores, SOFA is a better criterion.[13]

Gonzalez et al have studied 1071 elderly patients that are older than 80 years old and observed that qSOFA >2 is the best predictor that gym score and SOFA score in predicting 30-day mortality.[14]

In a study done by Haydar et al they have observed that it would take a longer time in the course of the illness for qSOFA time to be positive. The mean time from arrival to documentation is SIRS-47.1 mins, qSOFA- 84.2 mins.[15]

In a study done by Henning et al to compare the sepsis criteria sepsis 2 and 3, they have seen that SOFA has more specificity than SIRS in diagnosing patients.[16] In two different studies done in different countries by Huson et al qSOFA is a criterion that can be used in limited-resource settings for risk stratification.[17,18]

In a study done by Hwang et al in 1395 patients, the AUROC values were - At arrival in ED-0.53; at 3 hours-0.63; at 6 hours-0.64; at 24 hours-0.57, the values are low concerning the prediction of 28-day mortality.[19]

In a study done by Kim et al with 615 patients, sensitivity (0.14, 0.2, and 0.23) in predicting sepsis, 28-day mortality, and ICU admission. Specificity (0.98, 0.97, and 0.97) in predicting sepsis, 28-day mortality, and ICU admission. qSOFA showed low sensitivity and high specificity.

Limitations

This study is of a relatively small sample size.

CONCLUSION

This study has been done with 50 patients who qualified the SCCM criteria for sepsis. Many studies have been done

comparing SOFA, SIRS and qSOFA in their diagnostic and prognostic accuracy. But in India, data is sparse. This study proves that SOFA has higher prognostic value (higher AUROC) than SIRS, although both scores had higher sensitivity and specificity. Timely management of Sepsis patients would make the management cost-effective and reduce the length of stay.

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