Original Article

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Sequential Organ Failure Assessment Scoring in Assessing the Incidence and Severity of Organ Dysfunction in Sepsis

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Abstract

Introduction: The Sequential Organ Failure Assessment (SOFA) score is a simple and objective score that allows for calculation of both the number and the severity of organ dysfunction in six organ systems. It is a six-organ dysfunction score measuring multiple organ failure daily. Each organ is graded from 0 (normal) to 4 (the most abnormal). *Methodology:* Patients which are included in the study are perforation peritonitis with Septicemia, Diabetic ulcer foot with gangrene, Necrotizing fascitis of limbs and abdomen, Burns, Mesenteric ischemia with bowel gangrene, Intestinal Obstruction, Carcinoma, Blunt injury abdomen with solid organ injury. *Results:* SOFA score of 12 and above at 48 hours of admission shows an increase in the number of non survivors. The minimum SOFA score of the study population at 48 hours is 8. Among the 47 non survivors, 3 patients had these minimum score. Patients who had a score of 12 and above were 40. *Conclusion:* So using SOFA scoring we can improve the overall prognosis and prevent the mortality to some extent.

Keywords: SOFA; Sepsis; Organ Dysfunction.

Introduction

Multi - organ dysfunction syndrome (MODS) is the leading cause of morbidity and mortality for patients admitted with sepsis, and develops in about 15% of all admissions. Over the past years many scoring models have been developed to describe the severity of illness in patient admitted with sepsis. As an example, the first Sepsis-related Organ Failure Assessment score, later called the Sequential Organ Failure Assessment (SOFA) score, wasintroduced in 1994 [1]. The aim was to quantify the severity of the patient's illness based on the degree of organ dysfunction, serially over time. Although severity of illness scoring systems such as the Acute Physiology and Chronic Health Evaluation (APACHE) II and the Simplified Acute Physiology Score (SAPS) II are based on the first 24hrs of admission, the SOFA scoring system takes into account the time course of a patient's condition during the entire stay in the hospital . This enables surgeons to follow the evolving disease process [1,2].

The Sequential Organ Failure Assessment (SOFA) score is a simple and objective score that allows for calculation of both the number and the severity of organ dysfunction in six organ systems. It is a six-organ dysfunction score measuring multiple organ failure daily. Each organ is graded from 0 (normal) to 4 (the most abnormal) [3].

Although SOFA was developed primarily to describe and quantify organ function, it has been demonstrated in several studies to predict mortality and morbidity of critically ill patients. Early prediction of outcome in surgicalto aid suitable modification of management strategies [2]. This may improve prognosis in such patients and prevent mortality to some extent. This scoring system also guides the efficient utilization of hospital resources, especially in a resource starved setting. This helps in preventing dumping of valuable drugs and treatment modalities in a patient, who may not survive in spite of all efforts. On the contrary they can be utilized for a person, who may improve well with such costly

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intervention. Also, the score can be a useful in clinical research tool to evaluate various therapeutic interventions in early sepsis [4,5].

Methodology

Inclusion Criteria

All patients admitted to the surgical ward with suspected infection, satisfying Two or more criteria of systemic inflammation like

- Heart rate ≥ 90 beats/min
- Respiratory rate ≥ 20/min OR PaCo2<32mmHg
- Temperature ≥ 38°C (100.4oF) or ≤ 36°C (96.8oF
- WBC total count ≥12,000/mL or ≤ 4,000/mL

Patients which are included in the study are perforation peritonitis with Septicemia, Diabetic ulcer foot with gangrene, Necrotizing fascitis of limbs and abdomen, Burns, Mesenteric ischemia with bowel gangrene, Intestinal Obstruction, Carcinoma, Blunt injury abdomen with solid organ injury.

Exclusion Criteria

- All patients with age less than 12 years
- All patients who will not give consent for study
- Patients with HIV and chronic renal failure
- Moribund and terminally ill patients with impending mortality within 48-72 hours.

Sample Size

A total of 100 patients admitted to Coimbatore medical college surgical unit were studied

All patients with suspected/confirmed sepsis admitted in the surgical unit were included in the study. This included operated, non-operated and trauma patients (eg: perforation peritonitis, Diabetic ulcer foot with gangrene Necrotizingfascitis). Patients had to fulfill two or more criteria of systemic inflammation.

The parameters involved in calculating the SOFA score were collected on a daily basis. The score was calculated till discharge from ICU, mortality or day 7 of admission to ward whichever was the earliest. The SOFA at admission was labelled T0 and at day 2 was labelled as T48 (i.e. at 48 hours) and at day 4 was labelled as T96 (i.e. at 96 hours). The difference calculated as Delta SOFA. The Maximum, Mean and total SOFA were also calculated and Compared with outcome of the patient.

Blood Investigations were taken under aseptic conditions with adequate care and sent to the hospital 24 hours laboratory immediately. All the investigations were done in our hospital and no investigations or procedure done outside the hospital. Any experimental or so far unused materials or methods were not used on the patients. Serum bilirubin was calculated using an auto analyser using the method of malloy and evelyn.

ABG was done using ion selective electrode in an ABG analyser. Platelet count was done using sysmex KX21.3 which is an automated cell count analyser, in clinical pathology lab.

Results

Area Under the Curve

The test result variable(s): SOFA Asmission has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

Table. 1: Test Result Variable(s): SOFA Admission

Area	Std. Error	Asymptotic Sig.	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.760	.048	.000	.665	.855

Table. 2: SOFA at 48 hours for non survivors

Sofa Score	No. of Non Survivors
8-9	3
10-11	4
12 and above	40

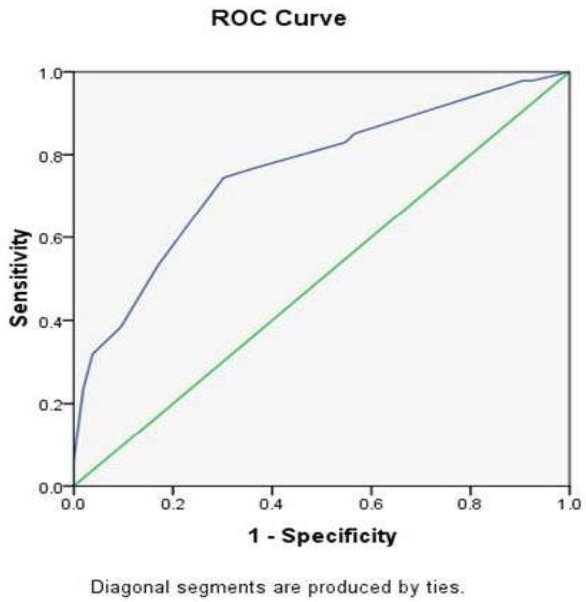

Fig. 1: ROC curve for admission sofa

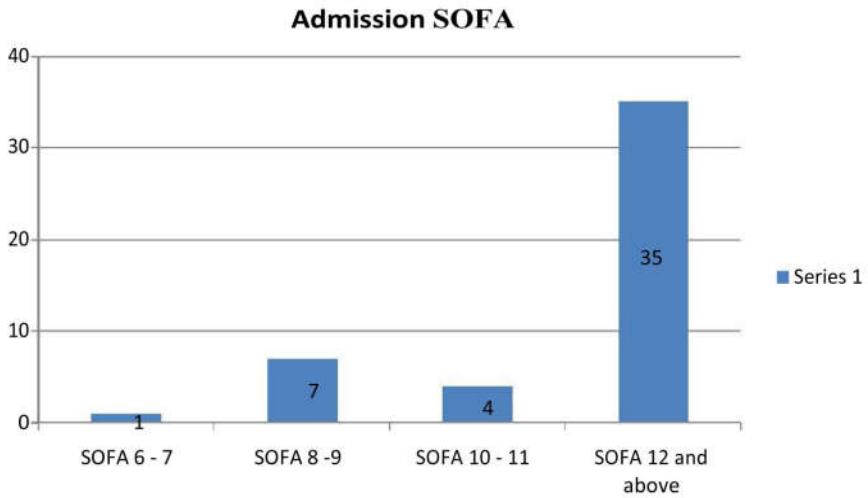

Fig. 2: Comparison between Admission SOFA and No. of Deaths

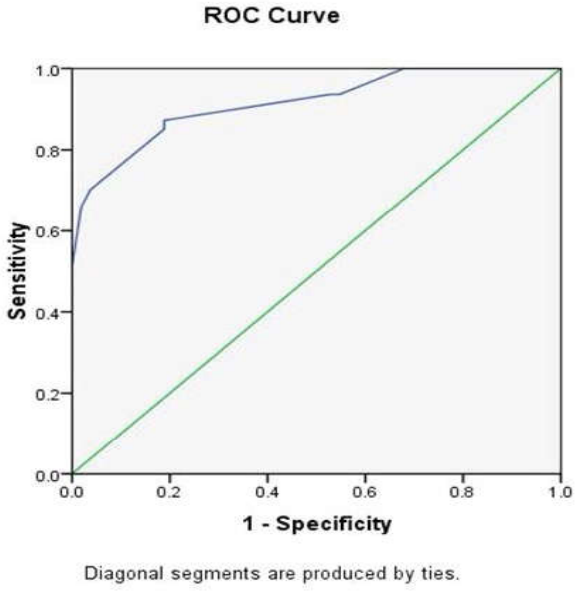

Fig. 3: ROC Curve for SOFA at 48 Hours

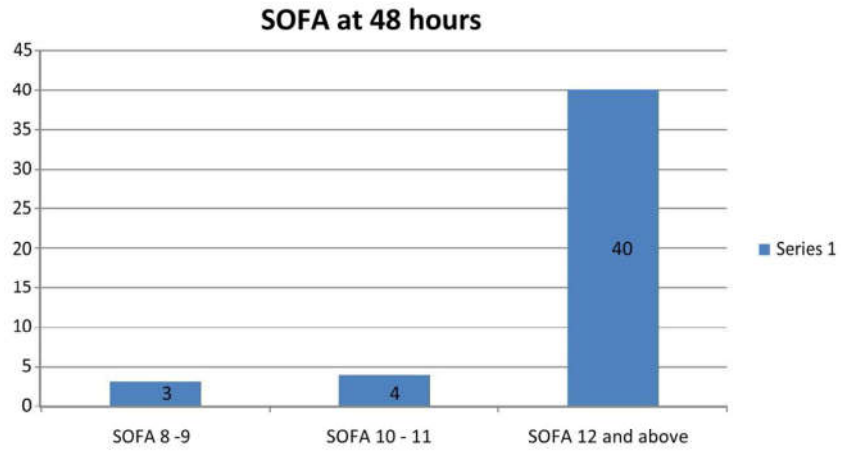

Fig. 4: Comparison between SOFA at 48 Hrs and No of Deaths

Table 3: Test ResultVariable(s): SOFA 48 Hr

Area	Std. Error	Asymptotic Sig.	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.914	.028	.000	.859	.970

Table 4: SOFA Score at 96 hours for Non Survivors

Sofa Score	No. of Non Survivors
8-9	3
10-11	4
12 and above	41

Table 5: Test Result Variable(s): Mean SOFA

Area	Std. Error	Asymptotic Sig.	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.908	.029	.000	.851	.966

Table 6: Test Result Variable(s): Total SOFA

Area	Std. Error	Asymptotic Sig.	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.908	.029	.000	.851	.966

The minimum admission SOFA score of patients in this study is 6. Among the 6 patients who had this score 1 patient expired. That is, the mortality rate is 16.7%. Among the 51 patients who had an admission SOFA score of 12 and above 35 patients expired escalating the mortality rate to 68.6%.

At 48 hours the minimum SOFA score observed among the study population is 8. Hence the data column starts with 8 and above.

The test result variable(s): SOFA 48Hr has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

This picture shows that a SOFA score of 12 and above at 48 hours of admission shows an increase in the number of non survivors. The minimum SOFA score of the study population at 48 hours is 8. Among the 47 non survivors, 3 patients had these minimum score. Patients who had a score of 12 and above were 40.

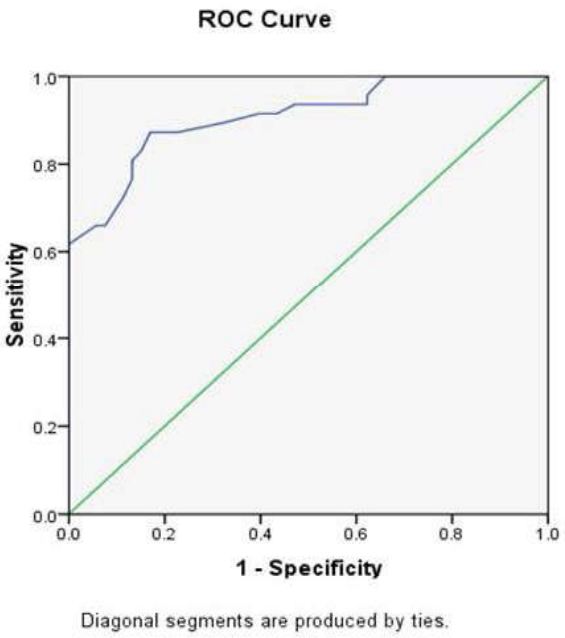

Fig. 5: ROC Curve for Mean SOFA

Discussion

Mean SOFA calculates the average value of the prognostic score duringthe entire hospital stay of the patient.

The test result variable(s): Mean SOFA has at least one tie between the positive actual state group and the negative actual state group.

The smallest cutoff value is the minimum observed test value minus 1, and the largest cutoff value is the maximum observed test value plus 1. All the other cutoff values are the averages of two consecutive ordered observed test values. These data shows that, a mean SOFA score of 11 and above is an excellent predictor of mortality, above which the number of non survivorsincrease.

It is the sum total of all the scores obtained from an individual patient during his hospital stay. It gives information about the severity of the illness since it gives the total worst score of all organs.

The test result variable(s): Total SOFA has at least one tie between the positive actual state group and the negative actual state group.

The smallest cutoff value is the minimum observed test value minus 1, and the largest cutoff value is the maximum observed test value plus 1. All the other cutoff values are the averages of two consecutive ordered observed test values

These data depict that a total SOFA score of 33 and above is an excellent predictor of mortality, above which the number of non survivors increase.

The above results were comparable with other studies [6-9].

Conclusion

- SOFA score is very useful in predicting mortality in critically ill patients, since there is a strong correlation between a rise in the score and mortality in all stages of admission.
- Mechanically ventilated patients have a high risk of mortality compared to non ventilated patients.
- The total SOFA and Mean sofa are better predictors of mortality.
- Delta SOFA score is also a better predictor of mortality.
- Early prediction of outcome in sepsis using SOFA score is useful to aid suitable modification of management strategies.

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