

Sequential organ failure assessment score as predictor of outcome in patients with severe sepsis in medical intensive care unit at new civil hospital, Surat

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Abstract

Introduction: Evaluation of patient's status before admission into an intensive care unit (ICU) is essential for predicting the course of the patient in the ICU, ensuring correct interventions and proper management of hospital resources. The present study was planned to assess the ability of SOFA scoring to predict mortality in the ICU setting of a tertiary care centre.

Methods: This was a prospective cohort study, comprising 100 patients, with severe sepsis, admitted in Medical ICU of GMC Surat, a tertiary care centre from March 2016 to September 30th 2017. Patients admitted in the Medical ICU of both sexes with age more than 18 years and fulfilling ACCP/CCM criteria for sepsis were included in the study. The SOFA score was calculated on

admission and at 48 h of presentation to Medical ICU. Daily follow up was maintained till death or discharge from MICU.

Results: The results of the present study showed that the changes in the severity of organ dysfunction were closely related to the outcome of the patients admitted to ICU with diagnosis of severe sepsis. Increasing organ dysfunction scores and cumulative SOFA scores reflected the worsening function in organ systems during the course of severe sepsis mostly in non-surviving patients.

Conclusion: SOFA score on admission has shown a strong correlation with the outcome, and can help triage patients. In this study, SOFA score after 48 hours of admission was a better prognosticator of death ($P < 0.001$) than the score at admittance.

Keywords: Mortality, SOFA Score, MICU.

Introduction

The Intensive Care Unit (ICU) of any hospital deals with patients requiring extreme critical care. Hence, assessment of patient's status prior to admitting into ICU is crucial for safeguarding exact interventions and suitable administration of hospital resources. Critical care predictive scoring systems, viz. Acute Physiologic and Chronic Health Evaluation (APACHE), Simplified Acute Physiologic Score (SAPS), Mortality Prediction Model (MPM), Sequential Organ Failure Assessment (SOFA) derive a arithmetical value or severity score, from a diversity of quantifiable clinical parameters and aid as a supportive instrument at admission in envisaging the course of the patient in the ICU.¹ Though their main goal is prognostication of patient's status, they also help in the assessment of various interventions, quality of care, research, management of hospital resources. However, lot of these scores use several variables which may corroborate both monotonous and troublesome in a setting where calculation needs to be done rapidly to equal the briskly fluctuating medical condition of patients.²

SOFA utilizes modest measurements of key organ function consequential from mundane investigations to compute a severity score. It involves only 6 variables and hence offers fast estimation. The scores are calculated at admission to the ICU and after 48 h of admission. This scoring system has been validated in both medical and surgical ICU's where it has been depicted that the survival rate is directly proportional to the SOFA scores in the ICU. The accurateness of extrapolative models is dynamic and should be from time to time retested, reviewed, and reorganized in diverse clinical settings or they may washout to capture the effects of novel technology, practice arrangements, or standards of care. Thus, the

present study was planned to assess the ability of SOFA scoring to predict mortality in the ICU setting of a tertiary care center.^{2,3}

Methods

This was a prospective cohort study, comprising 100 patients, with severe sepsis, admitted in Medical ICU of GMC Surat, a tertiary care center from March 2016 to September 30th 2017. Patients admitted in the Medical ICU of both sexes with age more than 18 years and fulfilling ACCP/CCM criteria for sepsis were included in the study. Patients on treatment with immunosuppressive agents and/or those shifted to the Medical ICU more than 24 hours after admission were not included in the study.

A written informed consent was obtained from all patients or patient attendant. A detailed history was sought, thorough physical examination done, laboratory data collected and the SOFA score was calculated on admission and at 48 h of presentation to Medical ICU. The delta SOFA (Δ SOFA) was calculated as the difference between the SOFA score at 48 h and the score on the day of admission to the ICU.⁴

Data was analyzed between this two groups; survivor group which include the patients who are successfully discharged after recovery and non-survivor group which include the patients who died. The different SOFA scores were compared to outcome of the patient in ICU with severe Sepsis using independent sample t tests and the paired sample t tests. A Chi square test (with Yates correction when applicable) and Fisher's exact test (when chi square test was not applicable) was used to evaluate statistical significance of categorical variables. Patient outcome was compared also with the Age, Sex, Length of ICU stay, using independent sample t test. $p < 0.05$ being considered statistically significant. Statistical analysis was

done with the computer software SPSS for windows operating system.

Results

Table 1: Survival rate in study

	Survived	Expired	Total
No. of patients	69	31	100

Table 2: Age distribution

Age group	Survived	Expired	Total
15 – 30	23	13	36
30 – 60	40	14	54
>60 years	6	4	10
Total	69	31	100

Table 3: Correlation of Sex with outcome

Gender	Survived	Expired	Total
Male	44	20	64
Female	25	11	36
Total	69	31	100

Table 4: Duration of ICU stay and its relation with outcome

Duration of stay	Survived	Expired	Total
< 3 days	4	12	16
3 – 7 days	34	9	43
7 – 14 days	17	8	25
> 14 days	14	2	16
Total	69	31	100

Table 5: On admission, individual system score and its relation with outcome

SOFA Score (on admission)	Survived	Expired	p value
Respiratory	1.18 ± 1.13	1.74 ± 1.34	0.88
Coagulation	0.74 ± 0.73	0.84 ± 0.77	0.23
Liver	1.28 ± 1.13	0.99 ± 0.54	0.02

Cardiovascular	0.51 ± 0.13	1.05 ± 0.64	0.01
CNS	1.06 ± 0.56	1.20 ± 1.06	0.03
Renal	1.30 ± 1.05	1.19 ± 1.07	0.60

Table 6: Individual system score after 48 hours of admission and its relation with outcome

SOFA Score (on admission)	Survived	Expired	p value
Respiratory	1.18 ± 1.13	2.22 ± 1.11	<0.001
Coagulation	0.74 ± 0.73	0.93 ± 0.85	0.23
Liver	1.28 ± 1.13	1.08 ± 0.83	0.25
Cardiovascular	0.51 ± 0.13	1.32 ± 1.16	<0.001
CNS	1.06 ± 0.56	1.80 ± 1.55	<0.001
Renal	1.30 ± 1.05	1.80 ± 1.10	0.006

Table 7: SOFA Score and its relation to outcome

SOFA Score	Survived		Expired	
	Frequency	Mean ± S.D.	Frequency	Mean ± S.D.
On Admission	69	4.75 ± 1.82	31	5.96 ± 2.6
After 48 hours of admission	69	3.28 ± 1.83	31	8.90 ± 2.66

Table 8: Delta SOFA score and its relation with outcome

Delta SOFA Score	Survived		Expired	
	Frequency	Mean ± S.D.	Frequency	Mean ± S.D.
Score	69	-1.15 ± 1.83	31	2.96 ± 2.16

Discussion

Out of total 100 patients included in study, 69 survived and 31 expired (Table 1). Age distribution of the patients included in the study is given in Table 2. Mean age of the patients was 38.64 + 16.78 years, with maximum patients (54%) being in the age group of 30-60 years of which

35% expired, followed by patients in the age group of 15-30 years (36%) of which 56% expired. As in Table 2, of the 64 males included in the study, 44 (68.8%) survived while 20 (31.2%) expired. Of the 36 females included, 25 (69.4%) survived while 11 (30.6%) expired. (p value =0.56) Thus in our study sex was also not associated with outcome.

Mean length of ICU stay was 6.48 + 4.84 days. Non-survivors had a shorter stay of 4.96 + 4.52 days, but survivors stayed in the ICU for a longer duration of 7.15 + 4.85 days. (p value = 0.03 statistically significant).

The individual system score on admission of the Cardiovascular, Liver and Central Nervous System correlated significantly with mortality, while the scores after 48 hours of admission of the Respiratory, Cardiovascular, Renal and Central Nervous System correlated with mortality significantly. The rest of the individual system scores did not predict survival. The total SOFA score epitomizes the aggregate organ dysfunction of the patient. This demonstrates that how the diverse system scores form an imperative element of SOFA calculation yet discretely they may not be good forecasters. Hence, SOFA should be deliberated in its composite form as a prognostic model.⁵

The Total SOFA score calculated on admission using 6 variables was correlated with mortality, as depicted in Table 5. Mean SOFA score in non-survival group was 5.96 + 2.6 compared to survival group which was 4.75 + 1.82. The study correlated statistically with mortality (P-Value <0.024) as also suggested by Ferreira et al.⁴ The present study depicts strong correlation of mortality with SOFA scores on day 1 which implies that SOFA score at admission can be used to quantify the degree of dysfunction/ failure already present on ICU admission, and can predict the future course. Hence, initial SOFA

score can triage the patients into risk categories for further management and resource planning.⁵

The SOFA score was then calculated 48 hours after admission and was correlated with mortality. Mean SOFA score in non-survival group was 8.90+2.66 compared to survived group which was 3.28+1.83. The study correlated statistically with mortality (P-Value <0.001). Ferreira et al.⁴ also concluded that the mean SOFA score had a better prognostic value than the other SOFA derived variables. Dysfunction in these patients. Vosylius et. al. concluded that cumulative SOFA scores, particularly on day 3, were better in predicting outcome compared to single organ dysfunction score.⁶

The mean Delta score in non-survival group was 2.96+2.16 which was significant in relation to mortality as compared to delta score in survival group which was -1.15+1.83 statistically (P-Value<0.001) which was also concluded in study of Ferreira et al. where Delta SOFA was also significantly associated with outcome and also in Vincent et al, Machado et al and Hiroshi et al.^{5,7}

The results of the present study showed that the changes in the severity of organ dysfunction were closely related to the outcome of the patients admitted to ICU with diagnosis of severe sepsis. Initial and after 48 hours scores outlined the baseline and evolution in the severity of disease. Increasing organ dysfunction scores and cumulative SOFA scores reflected the worsening function in organ systems during the course of severe sepsis mostly in non-surviving patients. The SOFA score on day 3 was better compared with SOFA score on day 1 as the tool for outcome prediction. The discriminative capability of the SOFA score was the highest on day 3. Similarly, Ferreira et al determined that, regardless of the initial score, an increase in SOFA score during the first 48 hours in the ICU predicts a mortality rate of at least 50%.⁶

The results of the present study showed that the changes in the severity of organ dysfunction were closely related to the outcome of the patients admitted to ICU with diagnosis of severe sepsis. Initial and after 48 hours scores outlined the baseline and evolution in the severity of disease. Increasing organ dysfunction scores and cumulative SOFA scores reflected the worsening function in organ systems during the course of severe sepsis mostly in non-surviving patients. The SOFA score on day 3 was better compared with SOFA score on day 1 as the tool for outcome prediction. The discriminative capability of the SOFA score was the highest on day 3. Similarly, Ferreira et al determined that, regardless of the initial score, an increase in SOFA score during the first 48 hours in the ICU predicts a mortality rate of at least 50%.^{4,6}

Summary

Out of 100 patients 69 (69%) survived in the ICU and were transferred out of ICU and then discharged home subsequently, with a good recovery while 31 (31%) expired. In this study, mean age of the patient was 38.64 + 16.78 years, in which maximum patients (51%) were in the age group of (30 - 60 years). In our study, there was no association seen between gender and outcome. In our study, mean length of ICU stay was 6.48 + 4.84 days, non-survivors had a shorter stay, but survivors stayed in the ICU for a longer duration. Cardiovascular, Liver and Central Nervous System correlated significantly on admission. And Respiratory, Cardiovascular, Central Nervous System, and Renal scores after 48 hours of admission were significantly related to mortality. Mean SOFA score on admission in non-survival group was 5.96 + 2.6 compared to survived group which was 4.75 + 1.82 and correlated statistically with mortality (P-Value <0.024). Mean SOFA score in non-survival group was 8.90 + 2.66 compared to survived group which was 3.28 +

1.83 and correlated statistically with mortality (P-Value < 0.001). The mean Delta score in non-survival group was 2.96 + 2.16 which was significant in relation to mortality (P-Value < 0.001).

Conclusion

SOFA score on admission has shown a strong correlation with the outcome, and can help triage patients. In this study, SOFA score after 48 hours of admission was a better predictor of mortality (P < 0.001) than the score at admission. These results reinforce the available evidence and point towards a potential use of the SOFA score predict outcome in ICU patients with severe sepsis. . However, further studies are needed to confirm these findings on a larger scale, and a longer duration and follow-up.

Limitations

In this study, SOFA score was calculated at the time of presentation and after 48 h and Delta SOFA score. Serial and Maximum SOFA score were not measured. A large study sample is ideally required for the statistical significance of the results, their implications, and their validity to extrapolate result and to suggest recommendations on the basis of same. Further studies are needed to be carried out know which is a better predictor of mortality, SOFA score after 48 hours or Delta SOFA score.

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