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Research Article

A STUDY OF SEQUENTIAL ORGAN FAILURE ASSESSMENT SCORE AS A PROGNOSTIC MARKER IN PATIENTS WITH SEPSIS IN INTENSIVE CARE UNIT

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ABSTRACT

Objective:

- To study the demographic profile of patients with sepsis and multiple organ dysfunction syndrome in patients with intensive care units.
- To evaluate the use of SOFA Score for predicting the mortality in patients with severe sepsis.
- To evaluate the use of MAX SOFA and DELTA SOFA for assessing the outcome of patients with severe sepsis.

Materials and Methods: A sample of 100 patients who were admitted to intensive care units and fulfilling the inclusion criteria were selected for this study from the tertiary care hospital, Ahmedabad, between September 2020 - September 2021 with suspected/confirmed sepsis. It was a prospective observational study.

Results: SOFA Score at 48 hours, 96 hours, max SOFA, Δ SOFA showed mortality with a P-value <0.001 which is statistically significant. Hence use of SOFA score, Δ SOFA score, and MAX SOFA score are good predictors of outcome in patients of sepsis.

Conclusion: Sequential assessment of organ dysfunction during the first few days of ICU admission is a good indicator of prognosis. SOFA score at 48 hours and MAX SOFA score, as well as Δ SOFA score, are useful predictors of the outcome as compared to SOFA score at admission.

INTRODUCTION

Sepsis is a major worldwide cause of morbidity and mortality and the second leading cause of death worldwide (1). Sepsis leads to multiple organ failures resulting in poor outcomes for such patients. The incidence of sepsis-related mortality is 85% in Indian ICU (2). There are various predictive models which are used in clinical practice. Some widely used among them are chronic health evaluation IV score (3), the simplified acute physiology score III(4), the logistic organ dysfunction score (5) which are widely used in intensive care units which require historical data or data after ICU admission for calculation. According to some investigations done previously most of these scores possess inadequate predictive abilities and are very time-consuming to calculate. The Sequential Organ Failure Assessment (SOFA) score allows the calculation of both the number and severity of organ dysfunction in six organ systems which are respiratory system, coagulatory, liver, cardiovascular system, renal and neurologic, and the score can measure individual or aggregate organ dysfunction (6). The purpose of this study was to determine whether SOFA Score when calculated in patients with severe sepsis with Multiple Organ Dysfunction Syndrome (MODS) would perform with good accuracy for predicting hospital mortality, similarly, MAX SOFA defined as maximum sofa score during the ICU stay and DELTA SOFA defined as the change in subsequent sofa score over a predefined time interval were associated with changes in mortality status. Δ SOFA 48 and ΔSOFA 96 is the difference between admission score and the score at 48 hours and 96 hours respectively.

MATERIALS AND METHODS

A sample of 100 patients who were admitted to intensive care units and fulfilling the inclusion criteria were selected for this study from the tertiary care hospital, Ahmedabad, between September 2019- September 2021 with suspected/confirmed sepsis. It was a prospective observational study.

Inclusion Criteria

All patients admitted to the intensive care unit, medicine department with suspected infection, satisfying two or more criteria of systemic inflammation like;

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

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Exclusion Criteria

- All patients with age less than 12 years.
- All patients who will not give consent for study.
- Patients with HIV positive status.

RESULTS

Of the hundred patients enrolled in the study, SOFA was calculated at admission, at 48 hours, and 96 hours. Δ SOFA and max SOFA were also calculated. Among the 100 patients involved in the study, 45% survived and 55% succumbed to their illness. The minimum age of the person enrolled in the study was 17 and the maximum age was 83. Of the 100 patients, 64% were male and 36% were female. The mean SOFA score on admission was 10.1, at 48 hours was 10.4, and at 96 hours was 10.54. Total 55 patients died out of which mortality in the male population was 57.8% and mortality in the female population was 50.0% suggesting no difference in mortality due to sex. Fluid culture according to the most affected organ was sent, which was positive in 53% of patients. Specimens or materials sent for culture suggested 53% positive reports among which E.coli was seen in 14 patients followed by Pseudomonas in 9 patients and Klebsiella in 7 patients (Table I). The minimum SOFA score of the patients admitted was 3. Hence the data column starts with values of 5 and above. There is a sharp rise in non-survivors as the SOFA score increases (Table II). Of the 40 patients having SOFA scores equal to or more than 12 had 82.50% mortality. The SOFA score was calculated at 24 hours showing high mortality in patients having a high sofa score i.e. 12 or above. At 48 hours the minimum SOFA score observed among the study population is 8. Hence the data column starts with 8 and above. A SOFA score of 12 and above at 48 hours of admission shows an increase in the number of nonsurvivors. The minimum SOFA score of the study population at 48 hours is 8. 3 patients had expired before 48 hours. Among 52 patients who expired after 48 hours, 40 patients had a SOFA score of 12 and above. The survival rate is reduced when the SOFA score increases above 12, at 96 hours of admission. 7 out of 55 patients expired before 96 hours. Out of 48 patients who expired after 96 hours 39 patients had a SOFA score of 12 and above. As the SOFA Score increases from baseline, survival rate is reduced. 33 patients among 55 expired patients had a SOFA score of 12 or above at admission while 39 patients among 55 expired patients had a SOFA score of 12 or above at 96 hours (Table II). Hence high SOFA score suggests high mortality (Table3,). For the Delta SOFA score, the patient data is analysed as those who decreased, unchanged, and increased from the initial score respectively, and the outcome is analysed. The comparison between survivors and nonsurvivors with Δ SOFA at 48 hours and 96 hours was recorded (Table II). Total 44 patients in whom ΔSOFA score increased from baseline at 48 hours there was an increase in mortality around 75%. Similarly, if the total 43 patients in whom Δ SOFA score increased from baseline at 96 hours there was an increase in mortality around 76.7% . As the max sofa score increases the survival rate of the patient decreases. A patient with a max sofa score >14 has an 87.5% mortality rate as compared to a patient with an 8-9 sofa score which has a 6% of mortality rate (Table II). SOFA score at admission, 48 hours, 96 hours, Δ SOFA at 48 hours and 96 hours, max SOFA increases the survival decreases with P-value <0.001, which is statistically significant (Table III,4). Among the 64 patients who required ventilator 48 (75%) expired and among the 36 patients who did not require ventilator support 7 (19%) expired. This shows poor outcomes in the patients requiring ventilator support (Table III).

Table I Demographics of Study Population

Characteristics	Values
No. of Patients	100
Mean Age In Years	54.39±15
Male	64
Female	36
Sofa Score (Mean):-	
T0, T48, T96	10.1 ± 2.54, 10.4 ± 2.66, 10.54 ± 3.23
Total Death, Male, Female	55%, 57.81%, 50.0%
Fluid Culture Status:-	
Positive, Negetive	53%, 47%
Organism:-	NUMBER OF PATIENTS:-
E-Coli	14
Pseudomonas	9
Klebsiella	7
S. Pneumoniea	8
Staph. Aureus	5
Actinobacter Baumanis	5
Candida	5

Table II Comparison of Sofa Score and Its Outcome

Sofa Score On Admission:			
Sofa Score	**Survivors**	**Non-Survivors (% Mortality)**	**Total**
<=5	5	0	5
7-Jun	6	1(14.28%)	7
9-Aug	19	8(29.62%)	27
11-Oct	8	13(61.90%)	21
12 AND ABOVE	7	33(82.50%)	40
TOTAL	45	55	100
Sofa Score On 24 Hours:			
Sofa Score	**Survivors**	**Non-Survivors**	**Total**
<=5	5	0	5
7-Jun	8	1	9
9-Aug	17	5	22
11-Oct	9	15	24
12 AND ABOVE	6	34	40
Sofa Score at 48 hours:			
Sofa Score	**Survivors**	**Non-Survivors**	**Total**
9-Aug	13	5	18
11-Oct	10	7	17
12 AND ABOVE	2	40	42
Sofa score at 96 hours:			
Sofa Score	**Survivors**	**Non-survivors**	**Total**
9-Aug	13	4	17
11-Oct	8	5	13
12 AND ABOVE	2	39	41
Sequential Changes In The Sofa Score Among 55 Expired Patients:			
Sofa Score	**At Admission**	**At 48 Hours**	**At 96 Hours**
<=5	0	0	0
7-Jun	1	0	0
9-Aug	8	5	4
11-Oct	13	7	5
12 AND ABOVE	33	40	39
Max Sofa Score and Relation With Survival:			
Sofa Score	**Survivors**	**Non-Survivors**	**Total**
9-Aug	16	1(5.88%)	17
11-Oct	9	4(30.76%)	13
14-Dec	8	20(71.4%)	28
>14	2	30(93.75)	32

Comparison Between Survivors And Non Survivors With Δsofa At 48 Hours And 96 Hours:						
ΔSOFA	ΔSOFA 48 For Survivors	ΔSOFA 48 For Non Survivors	Total	ΔSOFA 96 For Survivors	ΔSOFA 96 For Non Survivors	Total
Decreased	24	8	32	25	8	33
Unchanged	10	11	21	10	7	17
Increased	11	33	44	10	33	43

Table III Logistic Regression Analysis of Sofa Derived Parameters as Predictors of Mortality

	Died	Survival	Total		
SOFA score	Mean	Mean	Mean	Se Of Mean	P Value (Z Test)
SOFA- 0	11.40 ± 1.811	8.58±2.472	10.13±2.55	0.25	< 0.001
SOFA-24	11.82±1.816	8.53±2.427	10.34±2.67	0.27	< 0.001
SOFA – 48	12.44±1.960	8.11±2.357	10.49±3.04	0.30	< 0.001
SOFA- 96	12.82±1.837	7.76±2.560	10.54±3.34	0.33	< 0.001
SOFA-7 days	14.50±2.029	3.16±2.306	5.85±5.35	0.70	< 0.001
SOFA- MAX	14.45±1.854	9.24±2.723	12.11±3.46	0.35	< 0.001
Δ SOFA 24-0	.42±.762	-.04±.673	0.21±0.76	0.08	< 0.001
Δ SOFA 48-0	1.04±1.290	-.47±1.254	0.36±1.47	0.15	< 0.001
Δ SOFA 96-0	1.42±1.487	-.82±1.813	0.41±1.98	0.20	< 0.001

Δsofa Score In Relation to Outcome In First 48 Hours And 96 Hours				
Sofa Scorechangein First 48 Hour	Died	Survivor	X2	p VALUE
Increased (n=47)	36 (76.6%)	11 (23.4%)	20.55	<0.001
No Change (n=21)	11 (52.4%)	10 (47.6%)	-	-
Decreased (n=32)	8 (25.0%)	24 (75.0%)	-	-
Total	55 (55.0%)	45 (45.0%)	-	-
Sofa score in 96 hour	**Died**	**Survivor**	**X2**	**p VALUE**
Increased (n=20)	16 (80.0%)	4 (20.0%)	**22.34**	**<0.001**
No Change (n=63)	38 (60.3%)	25 (39.7%)		
Decreased (n=17)	1 (5.9%)	16 (94.1%)		
TOTAL	55 (55.0%)	45 (45.0%)		

Outcome For Ventilator Support		
Mechanical ventilation status	Survivors	Non Survivors
Ventilated	**16**	**48**
Non ventilated	**29**	**7**

DISCUSSION

Sepsis is the clinical manifestation of a systemic response of the body to infection or an inflammatory associated acute disease. (9,10) There are many scoring systems to determine and predict the prognosis of sepsis, such as the Glasgow coma scale, SAPS II with SOFA, and APACHE with SOFA. Studies have been performed to compare merits and prognostic abilities of SAPS II score with SOFA score and APACHE score with SOFA score. (11,12) In this study, all patients with suspected/confirmed sepsis admitted to the intensive care unit, medicine department were included in the study. Patients had to fulfil two or more criteria of systemic inflammation. The parameters involved in calculating the SOFA score were collected daily. The score was calculated till discharge from ICU, mortality, or day4 of admission toward whichever was the earliest. The SOFA at admission was labelled T-0 and at day 2 was labelled as T-48 (i.e. at 48 hours) and at day 4 was labelled as T96 (i.e. at 96 hours). The difference is calculated as Delta SOFA. The Maximum SOFA was also calculated and compared with the outcome of the patient. Blood Investigations were taken under strict aseptic conditions with adequate care and sent to the hospital 24 hours laboratories immediately. All the investigations were done in our hospital and no investigations or procedures were 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-analyzer using the method of Malloy and Evelyn. Blood pressure(BP) was measured daily manually. Glasgow Coma Scale(GCS) was calculated daily. Creatinine was measured by the modified Jaffe method using an automatic analyzer at the biochemistry lab. Various culture reports such as ascitic fluid, sputum, urine, blood, cerebrospinal fluid, endotracheal tube were sent under aseptic conditions. ABG was done using an ion-selective electrode in an ABG analyzer. Platelet count was done by using Sysmex KX 21.3 which is an automated cell count analyzer, in the clinical pathology lab. The causative organisms were also studied and SOFA score at admission to ICU was calculated. In the group of patients in whom SOFA was <7 at admission, there were 91% survivors. In patients who had SOFA scores 8-11, there were 43.75% non-survivors and when SOFAscore were 12 or above there were 82.5% non-survivors. These results were comparable to the study results published by F L Ferreira (7) which shows mortality more than 80% when SOFA score on admission is 12 or above. (Table IV). Minne *et al*. study showed that SOFA score at admission had only slightly worse performance than APACHE II/III and was competitive with SAPS II models in predicting mortality in the general medical and surgical ICU. Models with SOFA scores seem to have a comparable performance with other organ failure scores (13). Thereafter SOFA score at 48 hours of admission was calculated, the patient group, which had scores of 8-11, there were 34.28% non-survivors. In the patient group 12 or above there were 95.2% non-survivors. There is a significant increase in mortality rate when the SOFA score is above 12. There is a steep rise in the mortality curve at this value. Admission SOFA, 48 hours SOFA, and 96 hours SOFA are all statistically significant with a p-value < 0.001. In a study by Ferreira *et al*., sequential assessment of organ dysfunction during the first few days of ICU admission was a good indicator of prognosis. Both on admission SOFA score and highest SOFA score are useful predictors of mortality. Mortality, when max SOFA score was more than 14, was 93.75% compared to 5.88% mortality when SOFA score was 8-9 (Table IV).

Table IV Present VS Previous Study

Comparison Between Present Study And F L Ferreira *Et Al* Study:		
Sofa score	Present study	F l Ferreira Study
=<5	0%	11%
6-7	14.28%	21.5%
8-9	29.62%	33.3%
10-11	61.90%	50.0%
=>12	82.50%	95.2%
Comparison Between Max Sofa Score And Mortality Between Present Study And F L Ferreira study:		
Sofa score	Present study	F l ferreira study
8-9	5.88%	26.3%
10-11	30.76%	80.0%
12-14	71.4%	89.7%
>14	93.75%	

Delta SOFA is the difference in values of SOFA score over some time that is also statistically significant in our study. There is strong evidence that patients whose delta SOFA values when increased from the previous value showed higher mortality. Similar findings were also seen in the Vincent Jl (8) study. Similarly in the study by F L Ferreira *et al* (7), the results showed that regardless of the initial score, the mortality rate was at least 50% when the sofa score was increased. In the present study, 75% of patients did not survive whose SOFA scores were increased from baseline in the first 48 hours. Thus,

the results of this study corroborate with the results of the above-mentioned studies. In our study sex of the patient did not play a significant role in influencing mortality. The morbidity and mortality are purely related to the underlying disease state. But, the need for mechanical ventilation predicted mortality outcomes, since the patients who were ventilated showed a higher mortality rate (75%) compared to those who did not require ventilator support (19%), as evidenced by the statistically significant p-value < 0.001. In a study by Rangel-Frausto *et al*, mortality varies from 35% to 70%, depending on factors such as age, comorbidities, presence of acute lung injury or renal failure, whether the infection is nosocomial or polymicrobial, and whether a fungus is a causative agent. (14) In this study DM was associated with 21.8% of alcoholic liver disease and 16.36% of mortality. The most common organism isolated was E.COLI seen in 14% of patients followed by PSEUDOMONAS (9%) and KLEBSIELLA (7%). The fungus was seen in 5% of patients.

CONCLUSION

Sequential assessment of organ dysfunction during the first few days of ICU admission is a good indicator of prognosis. SOFA score at 48 hours and MAX SOFA score, as well as Δ SOFA score, are useful predictors of the outcome as compared to SOFA score at admission. In this study, SOFA Score at 48 hours, 96 hours, max SOFA, Δ SOFA showed mortality with a P-value <0.001 which is statistically significant. Hence use of SOFA score, Δ SOFA score, and MAX SOFA score are good predictors of outcome in patients of sepsis.

Consent

Informed consent was taken as per the standard procedures in the institution.

Financial Support and Sponsorship

Nil.

Conflicts of Interest

There are no conflicts of interest.

Ethical clearance

Obtained from the ethical committee of the institution.

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Reference

1. Linde-Zwirble WT, Angus DC. Severe sepsis epidemiology: sampling, selection and society. Crit care. 2004; 8:222-6.
2. Sharmila Chatterjee, Mahuya Bhattacharya, Subhashkumar. Epidemiology of adult population sepsis in India. Indian j crit care med. 2017 sep; 21(9): 573-577.
3. Zimmerman JE, Kramer A. Acute physiology and chronic health evaluation (APACHE): Hospital mortality assessment for today's critically ill patients. Crit care med. 2006; 34:1297-1310.
4. Moreno RP, Metnitz PG, Almeida E, *et al*. SAPS 3-from evaluation of the patient to evaluation of the intensive care unit. Intensive care med. 2005; 31:1345-1355.
5. Le Gall JR, Klar j, Lemeshow S, *et al*. the logistic organ dysfunction syndrome. A new way to assess organ dysfunction in intensive care unit. ICU scoring group. JAMA. 1996; 276:802-810.
6. Vincent JL, Moreno R, Takala J, *et al*. the sofa score to describe organ dysfunction/failure. Intensive care med. 1996; 22:707-710.
7. Ferreira FL, Bota DP, Bross A, Melot C, VincentJL,. serial evaluation of the sofa score to predict the outcome in critically ill patients. JAMA. 2001 oct 10; 286(14): 1754-8.
8. Vincent JL, de mendonca A, cantrain e F, *et al*. use of the sofa score to assess the incidence of organ dysfunction/failure in intensive care unit.crit care med. 1998;26(11):1793-1800.
9. Beal AL, Cerra FB. Multiple organ failure syndrome in the 199s. Systemic inflammatory response and organ dysfunction. JAMA 1994;271:226-33.
10. Vincent JL, Bihari D. Sepsis, severe sepsis or sepsis syndrome: need for clarification. Intensive care med 1992;18:255-7.
11. Minne L, Abu-Hanna A, De jonge E. Evaluation of SOFA based models for predicting mortality in ICU. A systemic review. Crit care 2008; 12: R161.
12. Halim D, Murni T, Redjeki I. comparison of APACHE II, SOFA and modified SOFA scores in predicting mortality of surgical patients in intensive care unit. Crit care shock 2009;12:157-69.
13. Bota DP Ferreira FL,, Bross A, Melot C, Vincent JL. Serial evaluation of SOFA scores to predict outcome in critically ill patients. JAMA 2001;286:1754-8.
14. Martin GS, Mannino DM, Eaton S,, Moss M. the epidemiology of sepsis in united states from 1979 through 20. N eng J Med 2003;348:1546-54.

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