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Original Research Article

Utility of sequential organ failure assessment score in prognosticating sick children in pediatric intensive care unit

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ABSTRACT

Background: This study was designed to assess the utility of sequential organ failure assessment score (SOFA) score as a predictor of mortality in pediatric intensive care unit (PICU).
Methods: A prospective hospital based study was carried out in PICU of Gajra Raja medical college, Gwalior, Madhya Pradesh, India. Critically ill patients admitted to PICU were recruited and followed up until they were discharged or deceased. The SOFA score was calculated for all the subjects during first 24 and 72 hours and difference between both i.e. delta SOFA was calculated.
Results: The mean SOFA at 72 hours (T72) was 15.63±2.98 in non-survivors vs. 4.30±2.54 in survivors and was significantly higher (P<0.001). The negative and positive predictive values of SOFA at T 72 were comparable to pediatric logistic organ dysfunction (PELOD) score while these values were less for initial SOFA and delta SOFA score.
Conclusions: Out study showed that SOFA T72 is a better predictor of mortality as compared to initial and delta SOFA score. The SOFA T 72 is comparable to PELOD score and can be used as a reliable predictor of mortality in children.

Keywords: Multiple organ failure, Mortality, Pediatric intensive care unit, PELOD score, SOFA score

INTRODUCTION

The estimation of disease severity and probability of death are important in determining the prognosis of patients in intensive care unit (ICU).[1] It has been a consistent observation that in pediatric intensive care unit (PICU) children usually experience multiple organ dysfunction syndromes (MODS). In ICU mortality correlates with number of failing organ system and degree of dysfunction within any given organ system.[2] About 25% of the children admitted to PICU have MODS and the mortality associated with it is up to 50%. In fact, 97% to 100% of the deaths in PICUs have been related to MODS.[3] MODS, previously known as multiple organ failure (MOF) or multisystem organ failure (MSOF), is the presence of altered organ function in acutely ill patients such that homeostasis cannot be maintained without intervention. It usually involves two or more organ systems.[4]

SOFA and PELOD scoring system are based on MODS and help in predicting outcome in critically ill children.[4,8] Severity of illness scoring systems has been widely used in PICUs to quantify patient outcomes. These scoring systems can be used for internal and external benchmarking to assess severity of illness, appropriate monitoring, proper management and family counseling.

SOFA system was created in a consensus meeting of European Society of Intensive Care Medicine in 1994 and

revised in 1996. SOFA system is a six organ dysfunction/failure score measuring multiple organ dysfunctions daily. Each organ is graded 0 (normal) to 4 (most abnormal) providing a daily total score of 0 - 24 points as shown in Table 1.[4-8] The SOFA score is easy as variables measured are easily available and routinely measured in ICU but the PELOD score which is more cumbersome uses more variables.[4]

Table 1: Sofa score according to European Society of Intensive Care Medicine.

SOFA score	0	1	2	3	4
Respiration					
PaO_2/FIO_2 (mm Hg)	>400	<400	<300	<200	<100
SaO_2/FIO_2		221-301	142-220	67-141	<67
Coagulation					
Platelets $10^3/mm^3$	>150	<150	<100	<50	<20
Liver					
Bilirubin (mg/dL)	<1.2	1.2-1.9	2.0-5.9	6.0-11.9	>12.0
Cardiovascular					
Hypotension	No hypotension	MAP <70	Dopamine </=5 or dobutamine (any)	Dopamine >5 or norepinephrine </=0.1	Dopamine >15 or norepinephrine >0.1
CNS					
Glasgow coma score	15	13-14	10-12	6-9	<6
Renal					
Creatinine (mg/dL) or urine output (mL/d)	<1.2	1.2-1.9	2.0-3.4	3.5-4.9 or <500	>5.0 or <200

METHODS

The study was conducted in PICU of a tertiary care centre of government medical hospital, from August 2013 to August 2014 for a period of one year. Ethical approval for this study was obtained from Institutional Ethical Committee of the hospital. A total of 100 critically ill children were recruited randomly. Subjects excluded from the study were those who stayed in PICU for less than 72 hours, who were less than 1 year and who for any reason did not undergo sufficient diagnostic laboratory tests in accordance with SOFA score and those who were discharged from PICU. Written informed consent was obtained from the parents or legal guardians prior to study.

The SOFA scoring system consists of physical and laboratory variables representing six organ systems namely neurological, cardiovascular, renal, respiratory, hematological and hepatic system (Eg-neurology-Glassgow coma scale C, haematology-WBC, platelet count). After recruitment in the study, patients were followed until they were discharged from PICU or deceased. Initial SOFA score was calculated within 24 hours of admission and then was calculated after 72 hours. Delta SOFA score was calculated as the change in SOFA score over 72 hours (T0 SOFA - T72 SOFA). In each organ system, the highest score in any variable accounted was taken as the score for the organ system. The sum total of the 6 scores for each organ system gives SOFA score (ranging from 0 to 24) which was used to predict risk of mortality in PICU. The Z-test was applied to determine mean SOFA score in survivors and non-survivors and the score were compared by their positive and negative predictive value in predicting mortality.

RESULTS

Table 2: Comparison of mean SOFA scores between survivors and non-survivors.

Features	Final outcome		P Value
	Means±SD		
	Non survivors (27)	Survivors (73)	
Initial SOFA score (T0)	10.48±2.578	8.41±3.390	0.0016
SOFA at 72 hours score (T72)	15.63±2.989	4.30±2.542	<0.001
Delta SOFA (T0-T72)	5.22±2.006	4.29±1.961	0.037

The T0, T72 and delta SOFA value were significantly higher in non survivors as compared to survivors group (Table 2). The p value was significant in all the scores, and was highly significant (p <0.001) in SOFA at 72 hours. The mean T0 SOFA score in Non survivor group was 10.48±2.578 which was significantly higher when compared to survived group i.e. 8.41±3.390 (P=0.016). Also, the mean T72 SOFA score in Non survivor group was 15.63±2.989 as compared to survived group i.e. 4.30±2.542 (P<0.001). The mean Delta SOFA score in Non survivor group was significantly higher (5.22±2.006) when compared to survived group i.e. 4.29±1.961 (P = 0.037).

The comparison of SOFA T0, T72 and delta SOFA in terms of mortality are given in Figure 1, 2 and 3. The Figure 1 shows that mortality was 13.51 % when SOFA T0 score was <7 while it was as high up to 34.92 % when score was greater than 7. The Figure 2 shows mortality was 1.41% when SOFA T72 score was < 10 while it was as high up to 89.66 % when score was greater than 10. The Figure 3 shows mortality was 11.43% when DELTA SOFA score was < 3 while it was as high up to 35.38% when score was greater than 3.

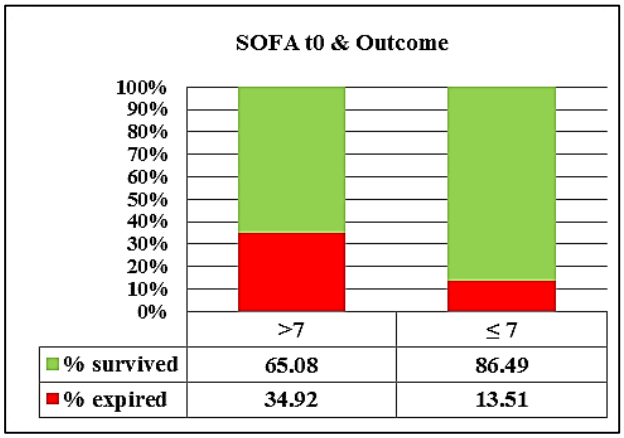

Figure 1: Comparison between survivors and non survivors at mean SOFA T0.

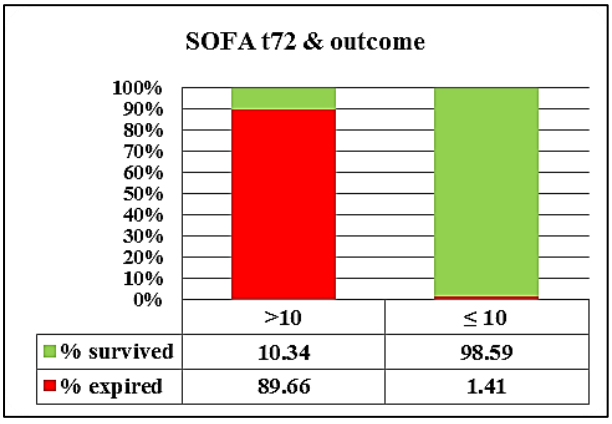

Figure 2: Comparison between survivors and non survivors at mean SOFA T72.

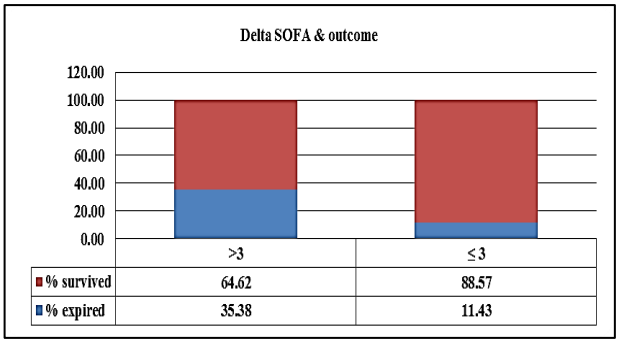

Figure 3: Comparison between survivors and non survivors at mean SOFA T 72.

Finally the comparison of discrimination power through area under curve of receiver operating characteristic (ROC) curve was carried out and results are present in Table 3. Area under ROC curve was higher for SOFA at 72 hours, since the area under the curve was >0.85 thus we can say SOFA at 72 hours was having excellent discrimination power. Furthermore, the system wise comparison of SOFA score was done and the results are given in Table 4 where the P-value was significant in all the systems in SOFA at 72 hours.

Table 3: Comparison of discrimination power through ROC curve.

Scoring system	AUC	Discrimination power
Initial SOFA	0.691	Poor
SOFA at 72 hours	0.997	Excellent
Delta SOFA	0.650	Poor

Table 4: System wise comparison of SOFA scores.

System	Initial SOFA p value	72 hours SOFA p value	Delta SOFA p value
CNS	0.33	<0.001	0.57
CVS	0.48	<0.001	0.99
Respiratory	0.99	<0.001	0.13
Miscellaneous	0.086	<0.001	0.74
Hepatic	0.004	<0.001	0.046

DISCUSSION

Vincent et al, analyzed that SOFA score can reliably describe the prognosis in children as regular and repeated scoring may be more helpful in identifying the categories of patient at major risk of prolonged stay or death.[5] Our study reveals that SOFA at 72 hours score is statistically strong enough to prognosticate risk of mortality in PICU. It can correlate well to mortality as does PELOD score. The SOFA score (T72) can be used as a reliable prognostic predictor of mortality among PICU patients.

Ferreira et al, analyzed the SOFA scores and found that initial SOFA, mean SOFA, SOFA at 48 hours and delta

SOFA values were high in non survivors as compared to survivors (P<0.001) in all scores.[6,7] This is correlated well with this study but correlation of delta and initial SOFA with mortality is not strong (p = 0.037 and p = 0.016, respectively). Furthermore, in the study by Ferreira et al, the authors have calculated the difference between SOFA at 48 hours and SOFA at 0 hours and mentioned this as delta SOFA.[7]

However, Machado et al assigned delta SOFA as the variation of SOFA score day 1 and day 3, as we did in this study.[9] Regardless of the initial SOFA score, early serial evaluation of the SOFA scores during the first 3 days of PICU admission is a better indicator of the prognosis than a single assessment obtained at admission. Similar results were found in this study that sequential SOFA at 72 hours was better predictor in contrast to initial SOFA.

Craig DG et al observed that median SOFA score (±IQR) was significantly higher in patients who died or were transplanted at each of these three time points [admission: 11 (6.75 - 18) versus 5 (3.25-7), P <0.0001; 24-hours: 16 (14.5-18.5) versus 7 (4-9), P < 0.0001; 48-hours: 16 (15 - 18.5) versus 7 (4-10), P = 0.0002].[10] Thus, the present study emphasized on the use of SOFA score as a prognostic indicator in critically ill children as variables measured are easily available and routinely measured in PICU while PELOD score is cumbersome.

CONCLUSION

In conclusion, out study showed that SOFA T72 is a better predictor of mortality as compared to initial and delta SOFA score. The SOFA T72 is comparable to PELOD score and can be used as a reliable predictor of mortality in children. The SOFA score demonstrated fair to good accuracy for predicting in-hospital mortality when applied to patients admitted to pediatric intensive care unit. The SOFA at 72 hours has a significant positive relationship to in-hospital mortality. These data suggest that use of the SOFA score is an acceptable method for risk stratification and prognosis of critically patients in PICU.

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REFERENCES

1. Tan GH, Tan TH, Goh DY, Yap HK. Risk factors for predicting mortality in a pediatric intensive care unit. Ann Acad Med. 1998;27(6):813-8.
2. Proulx F, Fayon M, Farrell CA, Lacorix J, Gauthier M. Epidemiology of sepsis and organ dysfunction in children. Crit Care Med. 1996;109(4):1033-7.
3. Tantalean JA, Leon RJ, Santos AA, Sanchez E. Multiple organ dysfunction syndrome in children. Pediatr Crit Care Med. 2003;4(2):181185.
4. Jones AE, Trzeciak S, Kline JA. The sequential organ failure assessment score for predicting outcome in patients with severe sepsis and evidence of hypoperfusion at the time of emergency department presentation. Crit Care Med. 2009;37(5):1649-54.
5. Vincent JL, De Mendonça A, Cantraine F, Moreno R, Takala J, Suter PM, et al. Use of the SOFA score to assess the incidence of organ dysfunction/failure in intensive care units: results of a multicenter, prospective study. Working group on sepsis-related problems of the European Society Intens Care Med. Crit Care Med. 1998;26(11):1793-800.
6. Vincent JL, Ferreira F, Moreno R. Scoring systems for assessing organ dysfunction and survival. Crit Care Clin. 2000;16(2):353-66.
7. Ferreira FL, Bota DP, Bross A, Melot C, Vincent JL. Serial evaluation of the SOFA scores to predict outcome in critically ill patients. JAMA. 2001;286:1754-8.
8. Khilnani P, Sarma D, Zimmerman J. Epidemiology and outcome of multiple organ dysfunction syndrome in critically ill children from a developing country. Intensive Care Med. 2006;32(11):1856-62.
9. Machado RL, David CM, Oliveira GMM, Godoy PH, Nagatto R, Lemos NGL, et al. Association of the SOFA score and mortality in elderly patients with severe sepsis and septic shock. Critical Care. 2005;9(S2):3593.
10. Craig DG, Reid TW, Martin KG, Davidson JS, Hayes PC, Simpson KJ. The systemic inflammatory response syndrome and sequential organ failure assessment scores are effective triage markers following paracetamol overdose. Aliment Pharmacol Ther. 2011;34:219-28.

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