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Original Research Article

A study of predictors of outcome in paediatric intensive care unit with special reference to SOFA score

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ABSTRACT

Background: Multi-organ dysfunction syndrome (MODS) is the leading cause of morbidity and mortality for patients admitted in Pediatric Intensive care unit. The Sequential organ failure assessment (SOFA) score is an 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). This scoring system guides the efficient utilization of hospital resources, especially in a resource starved setting and useful to evaluate the prognostication, to counsel the guardians and to decide therapeutic interventions. The score can also be a useful in clinical research tool to evaluate various therapeutic interventions in MODS. The aim of the study was to predict outcome in pediatric intensive care unit with special reference to SOFA score in patients admitted to civil hospital, Ahmedabad.
Methods: We have randomly selected 120 patients who were admitted in pediatric intensive care unit of tertiary care hospital and full-filing inclusion and exclusion criteria included in our study.
Results: There are multiple factors responsible for predicting the outcome in critically ill patients admitted in pediatric intensive care unit. Patients with complete immunization status have better outcome as compared to patients with incomplete immunization and unimmunized status. Patients with higher socioeconomic class have slightly better outcome as compared to patients with lower socioeconomic class.
Conclusions: SOFA score is a good objective score as a predictor of mortality in critically ill patients. But, if SOFA is calculated at the time of admission, then it has poor diagnostic accuracy in prediction of outcome. So, SOFA score at 72 hours of admission (T72) and delta SOFA (T72-T0) are better predictors of poor outcome as compared to SOFA score at admission (T0).

Keywords: SOFA score, MODS, Immunization, Sepsis

INTRODUCTION

Patients admitted in PICU with multi organ dysfunction syndrome having variable outcome, that we can't predict earlier.[1] But some objective scoring systems are available to predict outcome in critically ill patients with multi organ dysfunction syndrome like sequential organ failure assessment score (SOFA), paediatric risk of mortality score (PRISM), paediatrics index of mortality (PIM), paediatrics logistic organ dysfunction score (PELOD).[2-5] Out of which SOFA score is easy to use and can predict outcome in paediatrics age group as compare to other scores. So, we used sofa score in PICU admitted 120 randomly selected patients in tertiary care centre and studied our objective prediction as per scoring system.

Aim and objective

The aim of the study was (a) to predict outcome in paediatric intensive unit (PICU) patients and correlate

clinical profile with outcome in PICU patients; and (b) to evaluate application of SOFA score at admission, at 72 hours of admission and delta SOFA as a predictor of outcome in PICU patients.

METHODS

Type of study

The type of study was prospective observational study.

Duration of study

The duration of the study was from September 2020 to August 2022.

Sample size

We have randomly selected 120 patients who admitted in PICU of tertiary care hospital, Ahmedabad, fulfilling the inclusion and exclusion criteria were enrolled in study. They were investigated as per the proforma and followed up till the outcome.

Inclusion criteria

All children between the age of 1 month to less than 12 years admitted in PICU, tertiary health care hospital, Ahmedabad; PICU stay more than 72 hours; presence of paediatrics MODS (>1 organ system failure) irrespective of the cause; Those who will give informed written consent or assent (as applicable).

Exclusion criteria

All neonates; admission for scheduled procedures normally carried for in a PICU (e. g. haemo-dialysis, IVIG administration); PICU stay less than 72 hours; patients who left as LAMA (leave against medical advice).

A randomized prospective observational study has been conducted at tertiary care hospital, Ahmedabad between September 2020 to August 2022. Where 120 patients who were admitted in PICU randomly selected and enrolled in our study after taking ethical approval from ethical committee. Enrolled patients were critically ill in which predicting outcome was very difficult without any standard scoring system. Here we had tried to apply SOFA score in enrolled patients of pediatric intensive care unit and followed up patients till outcome. SOFA score describes the degree of organ failure in individuals and groups of ICU patients.[6] SOFA score is based on six different scores, one for each of the respiratory, cardiovascular, hepatic, coagulation, renal and neurological systems each scored from 0 to 4 with an increasing score reflecting worsening organ dysfunction. A Study showed that some sub-score and also the total score were associated with survival.[7] In addition to studying the maximum SOFA score, the change in score, or delta SOFA (total maximum SOFA score over the period of illness minus admission total SOFA score) also demonstrated a strong correlation with ICU mortality.

Paediatric SOFA score

One of the major limitations of the SOFA score is that it was developed for adult patients and contains measures that vary significantly with age, which makes it unsuitable for children. The sepsis-3 task force recognised a problem and identified area for further development. Prior studies have not taken into account the age-related variability of the renal sub-score criteria.[8-10] Fortunately, after studies the ratio of peripheral oxygen saturation (SpO_2) to FiO_2 has been validated as an alternative to the PaO_2:FiO_2 ratio in children.[11] We had applied SOFA score at time of admission and 72 hours after admission, filled preformed proforma. There after followed the patient till outcome and recorded all observations. Analysis of SOFA score is done to evaluate utility of these scores and other factors in predicting outcome by various statistical tests like chi squared test, Fisher's exact test, t-test, Wilcoxon-Mann-Whitney U test. P values less than 0.05 will be considered as significant.[12]

RESULTS

In present study, total 120 patients fulfilling the inclusion criteria are included. Out of which, total 74 (61.7% of total) are males and 46 (38.3% of total) are females.

Age wise total 46 patients (38.3% of total) are below 1 year of age, 39 patients (32.5% of total) are aged between 1 to 5 years and 35 patients (29.2% of total) are aged between >5 to 12 years.

In present study, total 120 patients are evaluated for primary cause which leads to multi organ dysfunction. It is observed that all patients are ultimately going to suffer from more than one organ system involvement, but primary causes are different in different patients from which the cascade of MODS starts. Out of 120 patients, 37 have primarily neurological involvement (30.83%), 29 have primarily gastrointestinal and hepatic system involvement (24.17%), 28 (23.33%) have infectious cause primarily, 24 have primarily respiratory system involvement (20%), and 2 have primarily cardiovascular system involvement (1.67%).

In present study, we have calculated mean SOFA score at admission, at 72 hours and mean for delta SOFA score and 2 groups named discharged and expired are compared by using non-parametric test (Wilcoxon-Mann-Whitney U test) to make group comparison.

There was a significant difference between the 2 groups (discharged and expired) in terms of SOFA T0 ($W=965.500$, $p=0.043$), T72 ($W=0.000$, $p\leq0.001$) and Delta SOFA ($W=0.000$, $p\leq0.001$), with the mean SOFA T0, T72 and mean delta SOFA being highest in the expired group. It suggests higher the SOFA, poorer the outcome.

In present study, we have compared outcome in terms of survivors and non survivors with respect to SOFA score at admission (T0). SOFA T0 cut-off is taken as ≥9 according to ROC curve.

In present study, total 36 patients are having SOFA T0 value <9. Out of which, 13 patients (36.11%) are survived and 23 patients (63.89%) are expired. Similarly, total 84 patients are having SOFA T0 value ≥9. Out of which, 15 patients (17.86%) are survived and 69 patients (82.14%) are expired. Mortality is higher in a group of patients having SOFA T0 ≥9 compared to the group of patients having SOFA T0 <9.

In present study, we have compared outcome in terms of survivors and non survivors with respect to delta SOFA score. Delta SOFA cut-off is taken as ≥2 according to ROC curve.

In present study, total 28 patients are having delta SOFA (T72-T0) value <2. Out of which, all 28 patients (100%) are survived and none of the patients are expired. Similarly, total 92 patients are having delta SOFA (T72-T0) value ≥2. Out of which, none of the patients are survived and all 92 patients (100%) are expired. Mortality is 100% in a group of patients having delta SOFA (T72-T0) ≥2.

Table 1: Age and gender wise distribution of data (N=120).

Age (years) /gender	Male	Female	Total N (%)
<1	30	16	46 (38.3)
1 to 5	22	17	39 (32.5)
>5 to 12	22	13	35 (29.2)
Total	74 (61.7%)	46 (38.3%)	120 (100)

Table 2: Primary cause in MODS in patients (N=120).

Primary cause	Respiratory	Cardiovascular	Neurological	Gastrointestinal and hepatic	Infectious
Total N (%)	24 (20)	2 (1.67)	37 (30.83)	29 (24.17)	28 (23.3)

Table 3: Comparison of the 2 subgroups of the variable outcome in terms of mean SOFA score (N=120).

SOFA score	Mean SOFA (SD) in present study	
	Discharged	**Expired**
SOFA at admission (T0)	8.93 (1.88)	9.86 (2.10)
SOFA at 72 hours (T72)	4.11 (1.87)	15.00 (2.53)
SOFA score	-4.82 (1.87)	5.14 (1.48)

Table 4: Comparison between survivors and non-survivors at cut off SOFA T0.

Variables	SOFA T0 ≥9 N (%)	SOFA T0 <9 N (%)	Total
Survivors	15 (17.86)	13 (36.11)	28
Non-survivors	69 (82.14)	23 (63.89)	92
Total	84 (100)	36 (100)	120

Table 5: Comparison between survivors and non-survivors at cut off SOFA at 72 hours (T72).

Variables	SOFA T72≥9 N (%)	SOFA T72<9 N (%)	Total
Survivors	0 (0)	28 (100)	28
Non-survivors	92 (100)	0 (0)	92
Total	92 (100)	28 (100)	120

Table 6: Comparison between survivors and non-survivors at delta SOFA (T72-T0).

Variables	SOFA T72≥9 N (%)	SOFA T72<9 N (%)	Total
Survivors	0 (0)	28 (100)	28
Non-survivors	92 (100)	0 (0)	92
Total	92 (100)	28 (100)	120

DISCUSSION

Patients who were completely immunized had the largest proportion of good outcome and discharged. Patients who were unimmunized had the largest proportion of poor outcome and expired. There was a significant difference between these groups in terms of distribution of outcome. There was a significant difference between these groups in terms of distribution of outcome. Patients of socioeconomic upper middle class had the largest proportion of good outcome and discharged. Patients of socioeconomic upper lower class had the largest proportion of poor outcome and expired. Out of 120 patients, 37 have primarily neurological involvement (30.83%), 29 have primarily gastrointestinal and hepatic system involvement (24.17%), 28 (23.33%) have infectious cause primarily, 24 have primarily respiratory system involvement (20%), and 2 have primarily cardiovascular system involvement (1.67%). In Earan et al study, respiratory system was the most common system affected (40.2 %) followed b\y infectious (19.2%), CNS (16.0%) and GIT disease (9.9%).[13] In present study, mortality is 63.89% when SOFA score at admission (T0) is <9 and mortality is 82.14% when SOFA score at admission(T0) is ≥9. So, in this study, it is found that greater the SOFA score at admission, poorer the outcome but prediction of poor outcome is not good. Sensitivity of SOFA T0 is 75% and specificity is 46% in predicting poor outcome. In present study, mortality is 0% when SOFA score at 72 hours (T72) is <9 and mortality is 100% when SOFA score at 72 hours (T72) is ≥9, which is significantly higher mortality in present study. So, in this study, it is found that more the SOFA score at 72 hours of admission (T72), poorer the outcome and prediction of poor outcome is excellent with sensitivity and specificity 100%. In present study, mortality is 0% when Delta SOFA score is <2 and mortality is 100% when delta SOFA score is ≥2, which is significantly higher mortality in present study. So, in this study, it is found that greater the Delta SOFA, poorer the outcome and prediction of poor outcome is excellent with sensitivity and specificity 100%.We have compared present study result to Gogia P et al study in which Delta SOFA (T72-T0) cut-off was >3. In Gogia et al study, among the group of patients having delta SOFA (T72-T0) >3, 35.38% patients are expired and 64.62% patients are survived. Among the group of patients having delta SOFA (T72-T0) ≤3, 11.43% patients are expired and 88.57% patients are survived. In Gogia et al study, similar results are found that mortality is higher in a group of patients having delta SOFA (T72-T0)>3 compared to the group of patients having delta SOFA (T72-T0)≤3.[14]

Limitations

In present study sample size was 120, which need a further study with large sample size. One of the major limitations of the SOFA score is that it was developed for adult patients and contains measures that vary significantly with age, which makes it unsuitable for children. Study duration was one year in present study for further significant results we need more duration of study.

CONCLUSION

There are multiple factors responsible for predicting the outcome in critically ill patients admitted in PICU. Patients with complete immunization status have better outcome as compared to patients with incomplete immunization and unimmunized status. Patients with higher socioeconomic class have slightly better outcome as compared to patients with lower socioeconomic class. SOFA score is a good objective score as a predictor of mortality in critically ill patients. But, if SOFA is calculated at the time of admission, then it has poor diagnostic accuracy in prediction of outcome. So, SOFA score at 72 hours of admission (T72) and delta SOFA (T72-T0) are better predictors of poor outcome as compared to SOFA score at admission (T0).

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