SOFA SCORE AND OUTCOME: EXPERIENCE AT A PUBLIC SECTOR HOSPITAL ICU

Abrar Akbar, Sobia Shahzadi, Muhammad Khurram, Hamama Tul Bushra Khar

Holy Family Hospital, Rawalpindi Pakistan

ABSTRACT

Objective: The objective was to find a cut off value of at admission SOFA score that best predicts outcome in critically ill patients admitted to ICU of public sector health care facility.

Study Design: Cross-sectional, descriptive study.

Place and Duration of Study: Medical ICU, Holy Family Hospital, Rawalpindi from February to April 2013.

Material and Methods: One hundred and one patients were included. At admission SOFA score of each patient was noted. Data regarding age, gender, at admission SOFA score and outcome in terms of expired or improved (discharged / shifted from ICU) was sought. Receiver Operator Characteristics Curve (ROC) was drawn for SOFA score and poor outcome. Based on the coordinates of SOFA score and outcome ROC curve, best cut off value of SOFA scores with corresponding highest sensitivity and specificity was calculated. Outcome of patients above and below the cut off value was correlated employing Chi-square test.

Results: Of the 101 patients, 39 (38.6%) improved and 62 (61.3%) expired. Mean initial SOFA score of patients who improved was 5.87 ± 4.17 and who expired was 10.98 ± 4.65. Coordinates of the curve showed that SOFA score cut off value 7.5 had best corresponding sensitivity (0.774) and specificity (0.744). Based on this finding, patients were categorized to Group I (SOFA score ≤7), and Group II (SOFA score ≥8). 32.6% of the Group I and 82.8% of the Group II patients expired (*p*-value 0.0000001).

Conclusion: Higher initial SOFA scores in critically ill patients is associated with higher mortality. Initial SOFA scores (≤7 and >8) are best predictor of outcome in these patients.

Keywords: Critical illness, ICU, Outcome, SOFA scores.

INTRODUCTION

Usage of morbidity and mortality prediction systems is gaining importance now a days[1]. These systems can guide health care providers to categorize patients into group with expected better outcome so that more aggressive management can be done in order to improve survival of critically ill patients especially being treated at health care facilities with limited resources. These systems can also be used as comparative tool for assessment of intensive care unit (ICU) performance[1].

There are many scoring systems which are used in ICUs internationally. Some of these are Acute Physiology and Chronic Health Evaluation (APACHE) II, III, IV; Simplified Acute Physiology Score (SAPS) II, III; Mortality Probability Model (MPM) II, III and Sequential Organ Failure Assessment (SOFA) score[1,2]. In different cohorts of patients population, reliability of these scoring systems has been compared for stratification of mortality risk[2-4]. SOFA scoring system is an established mortality predictor in critically ill patients[3].

In studies, SOFA scoring system has performed comparatively better in predicting mortality and requirement of mechanical ventilation in ICU settings[2-4]. Research focusing SOFA scoring system in Pakistani scenario is deficient. In critically ill patients managed at our public sector hospital, better prognosis has been observed in patients who have at admission SOFA score <6-10. This study was planned to find a cut off value of at admission SOFA score that best

Correspondence: Dr Abrar Akbar, Department of Medicine, Holy Family Hospital, Rawalpindi Pakistan
Email:drabrarakbar@gmail.com
Received: 29 Jul 2013; revised received: 12 Jun 2015; accepted: 23 Jun 2015

predicts outcome in critically ill patients admitted to ICU of our public sector health care facility.

MATERIAL AND METHODS

This cross-sectional, descriptive study was conducted at medical ICU of Holy Family Hospital, Rawalpindi over a period of 3 months from February to April 2013, after approval from Department Ethical Committee. All the patients admitted in medical ICU during the study period regardless of age and genders were included by convenient sampling after informed consent of patient and/or surrogate wherever relevant.

Each patient was managed for respective illness age, gender, diagnosis, at admission SOFA score, outcome and duration of stay were noted for every patient on a specifically designed Performa. SOFA score includes following variables: respiration, circulation, renal, hematological, hepatic and central nervous system related[4]. Maximum SOFA score is 24 and minimum is 0. Details in this regard are given in table-1. Outcome of patients was noted in terms of expired (poor) or discharged/shifted to ward.

Mean ± SD were calculated for age, SOFA sore and duration of stay. Frequency and % were calculated for gender, diagnosis, and outcome. IBM SPSS statistic version 20 was used for data entry and analysis. Outcome based comparison of mean SOFA score, mean age, and duration of ICU stay of all patients was done employing Mann Whitney Test. Receiver Operator

Table-1: SOFA score of all the patients.

Organ system	Score				
	0	1	2	3	4
Respiratory: PaO2/FiO2	>400	≤400	≤300	≤200	≤100
Renal: creatinine (µmol/l)	≤110	110–170	171–299	300–440; urine output ≤500 ml/day	>440; urine output <200 ml/day
Hepatic: ilirubin (µmol/l)	≤20	20–32	33–101	102–204	>204
Cardiovascular: hypotension	No hypotension	MAP <70 mmHg	Dopamine ≤5 dobutamine (any dose)	Dopamine >5 or epinephrine ≤0.1or norepinephrine ≤0.1	Dopamine >15 or epinephrine >0.1 or norepinephrine >0.1
Hematologic: platelet count	>150	≤150	≤100	≤50	≤20
Neurologic: Glasgow Coma Scale score	15	13–14	10–12	6–9	<6

Table-2: SOFA score, age, duration of stay, and outcome in relation with SOFA score groups.

		Sofa score ≤7 (n=43)	Sofa score ≥8 (n=58)	*p*-value
Mean SOFA Score		4.22 ± 2.18	12.55 ± 3.50	0.001
Mean age (years)		31.30 ± 13.98	37.86 ± 17.30	0.03
Gender	Male	24 (55.8%)	26 (44.8%)	0.28
	Female	19 (44.2%)	32 (55.2%)	
Mean duration of stay (days)		3.86 ± 4.31	3.46 ± 3.43	0.417
Alive*		29/43(67.4%)	10/58 (17.2%)	<0.001
Expired		14/43 (32.6%)	48/58 (82.8%)	

* Discharged or shifted to ward

Characteristics Curve (ROC) was drawn for SOFA score and poor outcome. Based on the coordinates of SOFA score and outcome ROC curve, best cut off value of SOFA scores with corresponding highest sensitivity and specificity was calculated. Outcome of patients above and below the cut off value was correlated employing Chi-square test. T-test was similarly used as test of significance to compare means of SOFA score, age, and duration of stay, any mamn-whitney utest for no normal variables.

RESULTS

One hundred and one patients were included in the study. Mean patient age was 35.06 ± 16.23 years. 51 (50.5%) patients were female and 50 (49.5%) male. Mean duration of patient stay in ICU was 3.63 ± 3.82 days. Mean SOFA score of all patients was 9 ± 5.10. 62 (61.4%) patients expired and the rest 39 (38.6%) were discharged from ICU or shifted to respective wards (alive). Fifty one primary diagnoses were noted. 4 out of these; 1] pneumonia (n=13, 12.9%), 2] fulminant hepatic failure (n=8, 7.9%), 3] diabetic ketoacidosis (n=7, 6.9%), and 4] stroke (n=6, 5.9%) were commonest. Majority of pneumonia (n=12, 92.30%), fulminant hepatic failure (n=7, 87.5%, and stroke (n=5, 83.33%) patients expired. Two (28.57%) of diabetic ketoacidosis patients expired.

Mean SOFA score of patients who were discharged / shifted was 5.87 ± 4.17 and who expired was 10.98 ± 4.65 (*p*-value 0.000). Mean age of patients who were discharged / shifted was 31.25 ± 16.07 and who expired was 37.46 ± 15.99 (*p*-value 0.061). 56% (n=28) males and 66.6% (n=34) females expired (*p*-value 0.28). Mean duration of stay of patients who were discharged /shifted was 2.89 ± 3.71 and who expired was 4.09 ± 3.84 (*p*-value 1.25).

ROC curve for SOFA score and outcome are given in fig-1. ROC area under the curve was 0.804. Coordinates of the curve showed that SOFA score cut off value 7.5 had best corresponding sensitivity (0.774) and specificity (0.744). Based on this finding, we categorized the patients in two groups, Group I with SOFA score ≤7, and Group II with SOFA score ≥ 8. 43 patients were included in Group I and 58 in Group II. Patients belonging to the two Groups differed significantly in terms of mean age in addition to mean SOFA score and outcome. Mean duration of stay was not statistically significant with reference to the two Groups. Details in this regard are given in table-2.

DISCUSSION

Our patients with poor outcome had significantly higher at admission SOFA score. Higher initial as well as serial SOFA score are predictors of mortality. In a study conducted by Alsherif et al higher initial SOFA scores in cirrhotic patients correlated with increased mortality[5]. In another study mean initial SOFA score of systemic inflammatory response (SIRS) patients who expired was significantly higher compared to survivors[6]. ICU patients with high initial SOFA scores had high mortality in a Belgian study[7].

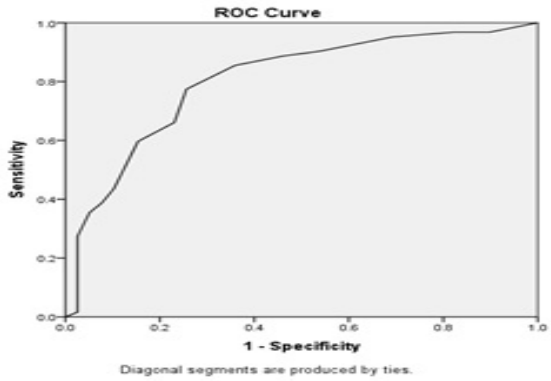

Figure-1: ROC curve for SOFA score and outcome.

We tested correlation of various cut off values of initial SOFA score with outcome. In our patients SOFA scores cut off values ≤7 and >8 had most significant association with outcome. Ferreira FL and colleagues evaluated initial SOFA score as predictor of mortality in ICU patients[7]. They noted that SOFA scores >11 were associated with 80% mortality. Jones AE focused SOFA score as predictor of survival in severe sepsis and hypotensive patients. They noted that at presentation mean SOFA score of patients who

expired was 9.8 and patients who survived was 6.5[8]. Acharya SP and colleagues used SOFA score for mortality prediction in ICU patients managed with diagnosis of systemic inflammatory response. In their study patients with initial SOFA score >11 had 90% mortality[6]. Mean SOFA score of the patients who did not survive, was 6.625 and the mean score of those who survived was 4.5 in a related study focusing critically ill patients admitted in ICU[9].

Mortality in ICU patients depends upon pre morbid status, etiology, severity of the illness and availability of resources[10]. ICU mortality in developed countries is generally less compared to developing countries[6]. In a Pakistani study which focused 4 mortality prediction models in ICU patients with sepsis, 66.6% patients expired[11]. In a study by Shaikh JM et al, 23.71% Pakistani ICU patients with nosocomial infection expired[12]. 14 and 35% mortality was noted in pediatric ICU patients treated by pediatric intensivist and general pediatricians respectively in another Pakistani study[13]. Mortality in our patients was 61%. Although highest and lowest mortality was observed in our pneumonia and diabetic ketoacidosis patient, it is difficult to compare mortality in our patients with other studies as these were most frequent of the 51 primary diagnoses.

Stratification of ICU patients in to different cohorts based on etiology is generally responsible for gender and age based differences noted in various studies. In various international studies variable results have been noted in the same context.[6,7,14] In a Pakistani study, by Bushra Jamil et al which focused ICU patients with sepsis; mean patient age was 52.4 years and 68.75 patients were male[11]. In a related study, Shaikh JM et al, noted that mean age of ICU patients was 30.05 ± 15.81 years and 51.14% patients were male[12]. Mean age of our patients was 35.06 years and 50.5% were male.

Age and gender have been variably associated with outcome in ICU patients. In some studies higher mortality has been noted in ICU patients aged >70-75 years[15-17]. In other studies increasing age however has not been associated with higher mortality[18,19]. Age of our patients with poor outcome was more although statistically insignificant compared to patients who were discharged / shifted. Another important point in this regard is that mean age of our patients is <50% of the studies discussed. Karlovic et al in their study focusing significance of demographic factors on outcome in ICU patients noted findings similar to ours, however average age of patients in their study was 68 years[10].

Females admitted in ICU are considered to have higher mortality[20,21]. In a study by Lipes J and colleagues, female patients managed at ICU had increased mortality compared to males[22]. In studies it has also been noted that females aged less than 50 years have less mortality[23]. Reinikainen et al in their study focusing ICU patients found equal gender based mortality in medical patients, post operative male patients had however higher mortality[18]. Higher number of our female patients expired compared to males.

We noted mean age based correlation between outcome and SOFA score cut off values based groups. Correlation between duration of ICU and SOFA score based outcome prediction has been focus of studies[7]. As has been noted earlier, we did not note association between mean SOFA score, SOFA score Groups and duration of ICU stay[7].

More efficient and aggressive management of patients admitted in ICU who have at admission SOFA score ≥8 may improve the outcome in scenarios like ours. Limitations of study should be kept in mind however that include; not focusing a particular primary diagnosis, not taking care of co morbidities, using only initial rather than serial and modified versions of SOFA scores.

CONCLUSION

Critically ill patients managed in ICU settings with higher initial SOFA scores have significantly higher mortality compared to patients with lower at admission SOFA score. In

our patients SOFA scores ≤7, ≥8 had most significant association with outcome.

CONFLICT OF INTEREST

The authors of this study reported no conflict of interest.

REFERENCES

1 Juneja D, Singh O, Nasa P, Dang R. Comparison of newer scoring systems with the conventional scoring systems in general intensive care population. Minerva Anesthesiologica, 2012; 78 (2): 194-200.

2 Minne L, Abu-Hanna A, de Jonge E. Evaluation of SOFA based models for predicting mortality in the ICU: A systematic review. Critical Care, 2008; 12(6): R161.

3 Halim D, Murni T, Redjeki I. Comparison of APACHE II, SOFA and modified SOFA scores in intensive care unit at Dr. Hasan Sadikin General Hospital. Criti Care & Shock, 2009; 12: 157-169.

4 Hanormand A, Safavi M, Mordi D. The use of infection probability score and sequential organ failure assessment scoring system in predicting mechanical ventilation requirement and duration. Turkish Journal of Trauma and Emergency Surgery, 2009; 15(5): 440-7.

5 Alsherif A, Darwesh H, Badr M, Eldamarawy M, Shawky A, Emam A. SOFA Score as a Predictor of Mortality in Critically Ill Cirrhotic Patients. Life Science Journal, 2013; 10(2): 2384-92.

6 Acharya SP, Pradhan B, Marhatta MN. Application of "the Sequential Organ Failure Assessment (SOFA) scores" in predicting outcome in ICU patients with SIRS. Kathmandu University Medical Journal. 2007; 20(5): 475-83.

7 Ferrerira FL, Boota DP, Bross A, Melot C, Vincet JL. Serial evaluation of the SOFA scores to predict outcome in critically ill patients. JAMA 2007; 286(14): 1754-1758.

8 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.

9 Bale C, Karkrani A, Dabadghao V, Sharma Z. Sequential organ failure assessment score as prognostic marker in critically ill patients in a tertiary care intensive care unit. International Journal of Medical and Public Health, 2013; 3(3): 155-158.

10 Karlović Z, Perić M, Vladić D, Kosjerina A, Majerić-Kogle V. The significance of demographic factors (age, sex, preoperative physiological status) and type of surgery on patients' outcome in ICU. Signa Vitae; 2013 8(2): 42-8.

11 Jamil B, Qureshi K, Khan M, Ujan V. Assessment of Four Mortality Prediction Models in Intensive Care Unit Patients with Sepsis. Infectious Disease Journal of Pakistan, 2004; 13(4): 93-5.

12 Shaikh JM, Devrajani BR, Shah SZA, Akhund T, Bibi I. Frequency, pattern and etiology of nosocomial infection in intensive care unit: an experience at a tertiary care hospital. J Ayub Med Coll Abbottabad, 2008; 20(4): 37-40.

13 Haque A, Bano S. Improving outcome in pediatric intensive care unit in Academic Hospital in Pakistan. Pak J Med Sci, 2009; 25(4): 605-8.

14 Rocker G, Cook D, Sjokvist P, Weaver B, Finfer S, McDonald E, et al. Clinician predictions of intensive care unit mortality. Crit Care Med 2004; 32(5): 1149-1154.

15 Fuchs L, Chronaki CE, Park S, Novack V, Baumfeld Y, Scott D, et al. ICU admission characteristics and mortality rates among elderly and very elderly patients. Intensive Care Med 2012; 38(10): 1654-61.

16 Angus DC, Kelley MA, Schmitz RJ, White A, Popovich J Jr. Caring for the critically ill patient. Current and projected workforce requirements for care of the critically ill patients with pulmonary disease: can we meet the requirements of an aging population? JAMA 2000; 284: 2762-70.

17 Esteban A, Anzueto A, Frutos F, Alia I, Brochard L, Stewart TE, et al. Characteristics and outcome in adult patients receiving mechanical ventilation a 28-day international study. JAMA 2002; 287: 345-55.

18 Boumendil A, Maury E, Reinhard I, Luguel L, Offenstadt G, Guidet B. Prognosis of patients aged 80 years and over admitted in medical intensive care unit. Intensive Care Med 2004; 30: 647-54.

19 Somme D, Maillet JM, Gisselbrecht M, Novara A, Ract C, Fagon JY. Critically ill old and the oldest-old patients in intensive care: short - and long -term outcomes. Intensive Care Med 2003; 29: 2137-43.

20 Nachtigall I, Tafelski S, Rothbart A. Gender-related outcome difference is related to course of sepsis on mixed ICUs: a prospective, observational clinical study. crit care. 2011; 15(3): R151.

21 Pietropaoli AP, Glance LG, Oakes D, Fisher SG. Gender differences in mortality in patients with severe sepsis or septic shock. gend med. 2010; 7(5): 422–437.

22 Lipes J, Mardini L, Jayaraman D. Sex and mortality of hospitalized adults after admission to an intensive care unit. Am J crit care 2013; 22 (4): 314-9.

23 Mahmood K, Eldeirawi K, Wahidi MM. Association of gender with outcomes in critically ill patients. crit care. 2012; 16 (3): R92.