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Prognostic accuracy of sofa score for prediction of In-hospital mortality in elderly patients with SIRS

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Abstract
Objective: To determine accuracy of SOFA score in predicting in-hospital mortality of elderly patients with SIRS criteria.
Material and Method: A prospective observational study at tertiary care hospital. 102 elderly patients (>60 years) with 2 or more SIRS criteria are included, SOFA score calculated at admission and at 48 hours. Association of SOFA score with mortality was assessed.
Results: Mean age of patients is 69.7 years and mortality is 35.29% (36 out of 102 died). 17(89.47%) patients died out of 19 patients having SOFA score >10. With SOFA 6-10, 14(41.17%) patients died and 5(11.62%) patients died in SOFA group 1-5 and all 6 patients survived with SOFA score 0. Result is statistically significant (p value 0.005). Mean SOFA score is higher in non-survivors (9.81±4.006) than survivors (4.29±3.076) at admission. Mean SOFA score at 48 hours in non-survivors is 11.43±4.64 v/s 2.20±2.366 in survivors and mean DELTA SOFA in non survivors is 2.65±3.892v/s -2.09±2.104 in survivors.
Conclusion: Higher SOFA score at admission and high mean SOFA at admission, 48 hour and high mean DELTA SOFA is associated with increase probability of mortality so we can conclude that SOFA score can predict in-hospital mortality in elderly patients.

Keywords: Sequential organ failure assessment (SOFA), Systemic inflammatory response syndrome (SIRS), Mean SOFA

1. Introduction

Organ dysfunction irrespective of etiology (infectious and noninfectious) due to SIRS (systemic inflammatory response syndrome) is important cause of mortality in elderly patients[1]. SIRS is defined with two or more of following variable-

1. Fever of more than 38°C (100.4°F) or less than 36°C (96.8°F).
2. Heart rate more than 90 per minute.
3. Respiratory rate more than 20 breath per minute or arterial carbon dioxide tension ($PaCO_2$) of less than 32mmHg.
4. Abnormal white blood cell counts (>12000/µL or <4000/µL or >10% immature [band] forms).

Common causes of SIRS are – infection, ischemia, inflammation, trauma, etc. Infection is the most common cause of SIRS. SIRS is caused by inflammatory mediators released by lymphocytes, macrophages, granulocytes, and vascular endothelial cells. In untreated cases SIRS may progress to sepsis, severe sepsis septic shock.
An effective predictor of prognosis is required to assess morbidity and mortality in this condition[2]. This lead to development of scoring systems to quantify the severity of the patient's illness based on the degree of organ dysfunction, serially over time. This enables clinicians to follow the evolving disease process. This may improve prognosis in such patients and prevent mortality to some extent. These scoring systems also guides the efficient utilization of hospital resources, especially in a resource limited setting.
There are several scoring system for evaluation of critically ill patients that predict patient outcome and mortality.

1. APACHE II, III (Acute physiology and chronic health evaluation)
2. SAPS II (Simplified acute physiology score)
3. MPM II (Mortality prediction model)
4. MODS (Multiple organ dysfunction score)
5. SOFA (Sequential organ failure assessment)
6. LODS (Logistic organ dysfunction score)
7. ODIN (organ dysfunction and infection score)
8. TRIOS (Three day Recalibrating ICU outcome score)

These scoring system are effective in predicting hospital mortality and they are comparable in terms of outcome prediction [3]. While many scoring systems are difficult to use, SOFA system is easy to use with comparable accuracy to other scoring system. SOFA score is calculated for 6 organ systems respiratory, neurological, cardiovascular, hepatic, renal and coagulation system. Score ranges 0 to 4 for each organ system and total SOFA score ranges 0 to 24.
There are various studies on SOFA score in different subset to predict outcome in critically ill patients but very few studies has been conducted in elderly patients (>60years) in India as well as abroad. Due to change in demographic profile, Geriatric population is increasing universally with more and more elderly patients requiring intensive care for critical illness. So we decided to utilize SOFA score to predict outcome of hospitalized elderly patients fulfilling SIRS criteria.

2. Material and Method

This is a prospective observational cohort study of 102 patients admitted in NEW HOSPITAL MEDICAL

COLLEGE, Government Medical College, Kota in ward and medical ICU.
Inclusion criteria- 1) - age >60 years.
2) - two or more SIRS Criteria.
Exclusion Criteria- 1)-age<60 years.
2)-need for immediate surgery or postsurgical/post traumatic SIRS.
3)-immunocompromised state (HIV, post-transplant patients, CKD, CLD, patients on oral steroids and immunosuppressive drugs) etc.
The data is collected from 102 eligible patients after taking written consent. A detailed clinical history, complete physical examination, routine investigation and SOFA Score was calculated on admission and at 48 after admission. All 6 variable of SOFA was calculated, for respiratory variable arterial blood gas analysis was done PaO2 and FiO2 ratio was calculated, for CNS variable Glasgow coma scale was calculated. Cardiovascular variable was calculated by measuring blood pressure for mean arterial pressure (MAP) and need for vasopressor for maintaining MAP. Liver, renal and coagulation variables were calculated by laboratory investigation (Liver function test, Kidney function test and complete blood cell count).

3. Results

102 elderly patients fulfilling inclusion and exclusion criteria are recruited for study. Mean age of patients is 69.7 year, 58(56.86%) are male and 44(43.13%) are female. Patients with SIRS criteria 2 or more are included in study. In our study out of 4 SIRS variable, Tachycardia was present in 90(88%) patients followed by Fever, Leukocytosis/Leukopenia and Tachypnea in 75(73.52%), 61(59.8%), 53(51.96%) patients respectively. 2 SIRS criteria were present in 43(42.15%) patients, 3 and 4 SIRS criteria were fulfilled by 43(42.15%) and 16(15.68%) patients respectively.(Table.1)

Table 1: Patients Characteristics

Charachterstics	Subgroups	N	%
Age (Years)	60 -70	59	57.84
	71-80	34	33.33
	>80	9	8.82
Sex	Male	58	56.86
	Female	44	43.13
Clinical Variable	Fever	75	73.52
	Tachypnea	53	51.96
	Tachycardia	90	88.23
	Leukocytosis/ Leucopenia	61	59.80
No. Of SIRS Criteria	2	43	42.15
	3	43	42.15
	4	16	15.68

3.1 SOFA Score at admission- SOFA score was calculated at admission in patients fulfilling 2 or more SIRS criteria. 6 Patients have 0 score, 43 patients scored between 1 to 5, 34 patients scored between 6 to 10 and 19 patients scored >10. (TABLE. 2)

Table 2: SOFA Score at admission

SOFA Score at admission	No. of patients (n=102)
0	6
1 – 5	43
6 – 10	34
>10	19

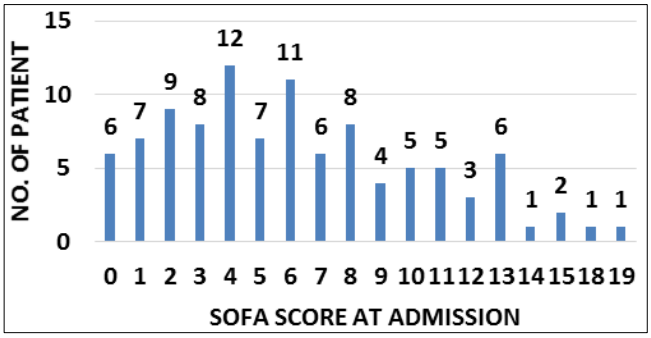

Fig 1: Distribution of SOFA Score

In our study SOFA at admission ranges from 0 – 19 with mean score of 6.27, standard deviation 4.308. Lowest score at admission was 0 in 6 patients and highest score is 19 in 1 patient. (Fig. 1)

3.2 Outcome - Primary outcome was in-hospital death or discharge. Out of 102 patients included in our study 36 patients (35.29%) died in hospital and 66 patients (63.72%) were discharged. Out of 36 non survivors 13(36.11%) patients died within 48 hours, and 23(63.88%) died after 48 hours.

3.3 SOFA score at admission with outcome - In our study highest mortality occurs in SOFA score at admission >10, 17(89.47%) patients died out of 19 patients having SOFA score >10. With SOFA 6-10, 14(41.17%) patients died and 5(11.62%) patients died in SOFA group 1-5 and all 6 patients survived with SOFA score 0. Result is statistically significant (p value 0.005). (Table. 3) Our study shows that probability of death increases as SOFA score at admission increases. Score more than 10 have 89.47% mortality. (Fig. 2)

Table 3: SOFA Score at admission and outcome

SOFA Score at admission		0(n= 6)	1-5 (n=43)	6-10 (n=34)	>10 (n=19)
Outcome (n = 102)	Death	0	5	14	17
	Discharge	6	38	20	2
Significance		P Value – 0.005, Chi^2 – 59.202			

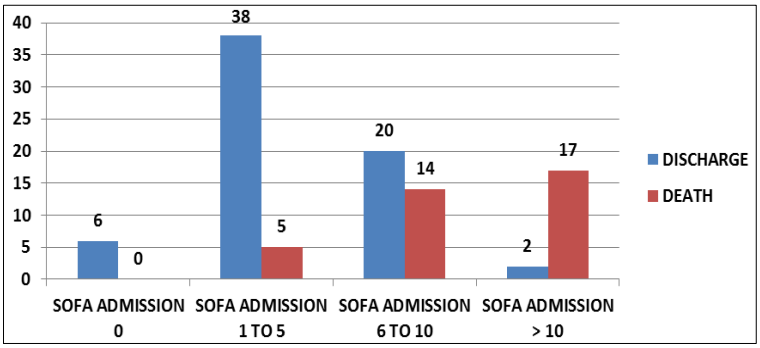

Fig 2: Group wise SOFA Score at admission and outcome

3.4 Relation of outcome with SOFA score – Probability of mortality increases with increment of SOFA score at admission. Patients with 0 SOFA score has no mortality while those have more than 13 SOFA score have 100% mortality and SOFA score between 4 to 13 have intermediate mortality.(Fig. 3)

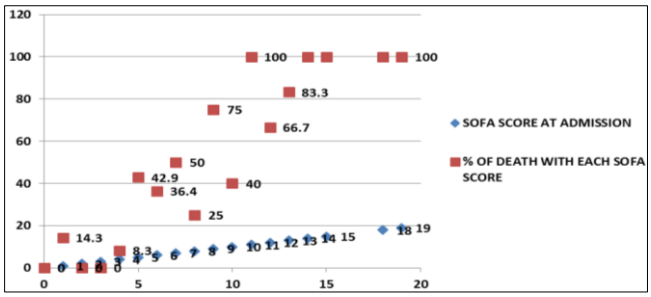

Fig 3: SOFA Score at admission and % of death with each score

Table 4: Mean SOFA Score and outcome

Mean SOFA Score	Non-Survivors	Survivors
At admission	9.81(SD-4.006)	4.29(SD-3.076)
At 48 hours	11.43(SD-4.64)	2.20(SD-2.366)
Mean Delta SOFA	2.65(SD-3.892)	-2.09(SD-2.104)

3.5 Mean SOFA Score and outcome - Mean SOFA score is higher in non survivors than survivors at admission(9.81 in non-survivors v/s 4.29 in survivors), after 48 hour(11.43 in non-survivors v/s 2.20 in survivors) and mean delta sofa is also high(2.65 in non-survivors v/s -2.09 in survivors). (Table. 4). Patients died within 48 hours have higher mean SOFA score (11.53) at admission than other non-survivors (9.81).

4. Discussion

Sepsis and organ dysfunction due to dysregulated host response to infection is responsible for large number of mortality and elderly patients are more susceptible due to various comorbid conditions. In Sepsis 1(1991), 2 or more SIRS criteria were considered for diagnosis. Sepsis 3 is defined as suspected or documented infection and an acute increase of SOFA score by 2 or more points.

SOFA [4] was developed in 1994, initially for sepsis related organ dysfunction but later it was validated in septic as well as non-septic conditions to predict mortality. Previously used scoring system like APACHE, SAPS also predict mortality but are cumbersome and difficult to calculate, as well as these uses physiological variables and previous health status for scoring. While MODS, LODS and SOFA scoring systems are based on organ dysfunction. Among all model of mortality prediction SOFA score is more reliable and easy to use.

All patients with SOFA score 0 were discharged in healthy condition with score 1 to 5; 11.62 % died, score 6 to 10; 41.17% died while score of >10 mortality rate is 89.47%. SOFA score at admission predicts probability of mortality (p value 0.005). Ferreira *et al.* [5] determined the usefulness of repeated measurement of SOFA score for mortality prediction and found that initial score of more than 11 have mortality of more than 80%. Acharya SP *et al.* [6] conducted observational cohort study to evaluate usefulness of SOFA score in predicting the outcome in patients with SIRS and calculated SOFA score at admission, 48 and 96 hour. They also found that initial SOFA score > 11 predicted mortality of 90% (p value-0.004, OR 23.71, 95% CI 2.68-209.78). Alan E. jones *et al.* [7] calculated SOFA score at admission and at 72 hour to determine predictive value of SOFA score. They found that probability of death increases with increment of SOFA score at admission.

Khie Chen Lie *et al.* [8] conducted prospective multicentric study in patients with community acquired infection to analyze sepsis management and mortality prediction using SOFA score. They found low mortality (7%), 8 out of 111 with SOFA score 2 while in our study 1(4.54%) patient died out of 22 with score up to 2.

Mean SOFA score at admission, mean SOFA at 48 hour and mean DELTA SOFA are compared in survivor and non-survivor group. Mean SOFA score at admission is higher in non-survivor (9.81±4.006) than survivor (4.29±3.076). Mean SOFA score at 48 hour in non-survivors is 11.43±4.64 v/s 2.20±2.366 in survivors and mean DELTA SOFA in non survivors is 2.65±3.892 v/s -2.09±2.104 in survivors. These result of our study are similar to Q Qiao *et al.* [9] study for prediction of outcome in critically ill elderly patients using APACHE II and SOFA score, they calculated SOFA score at admission, at 48 hour, at 96 hour, maximum SOFA and DELTA SOFA. They observed higher mean SOFA score at admission;5.15±3.25 in non-survivors v/s 2.99±1.92 in survivors, at 48 hour;7.38±3.51 in non-survivors v/s 2.96±1.98 in survivors, at 96 hour; 9.53±3.83 in non-survivors v/s 2.83±1.75 in survivors and higher mean DELTA SOFA in non-survivors; 8.94±3.64 v/s 1.43±1.36 in survivors. (Table. 5)

Table 5: Comparison with Qiao *et al*. Study

Mean SOFA	Survivors		Non-survivors	
	Qiao *et al.*	Our study	Qiao *et al.*	Our study
Admission	2.99±1.92	4.29±3.076	5.15±3.25	9.81±4.006
48 hour	2.96±1.98	2.20±2.366	7.38±3.51	11.43±4.64
Delta SOFA	1.43±1.36	-2.09±2.104	8.94±3.64	2.65±3.89

Our results of mean SOFA are also in line with Vishal Gupta *et al*. [10] study of SOFA score and critically ill elderly patients, they also found higher mean SOFA score in non-survivors than survivors at admission (7.82±3.74 in non-survivors and 5.30±3.35 in survivors) and at 48 hour (8.64±3.72 in non-survivors and 6.50±3.03 in survivors). (Table. 6)

Table 6: Comparison with Vishal Gupta *et al*. Study

Mean SOFA	Survivors		Non-survivors	
	Vishal Gupta *et al.*	Our study	Vishal Gupta *et al.*	Our study
Admission	5.30±3.35	4.29±3.076	7.82±3.74	9.81±4.006
48 hour	6.50±3.03	2.20±2.366	8.64±3.72	11.43±4.64

Aditi Jain *et al*[11] study of SOFA scoring and prediction of patients outcome in ICU of tertiary care hospital, also showed higher mean SOFA at admission in non-survivors(8.0±2.89) than survivors (3.48±2.23). (Table. 7)

Table 7: Comparison with Aditi Jain *et al*. Study

Mean SOFA	Survivors		Non-survivors	
	Aditi Jain *et al*.	Our study	Aditi Jain *et al*.	Our study
Admission	3.48±2.23	4.29±3.076	8.0±2.89	9.81±4.006

Khie Chen Lie *et al*. [8] also found high mean SOFA score on admission in patients who died (6.7±3.8) compared to survivors (4.6±2.9). (Table. 8)

Table 8: Comparison with Khie Chen lie *et al*. Study

Mean SOFA	Survivors		Non-survivors	
	Khie chen lie *et al.*	Our study	Khie chen lie *et al.*	Our study
Admission	4.6±2.9	4.29±3.076	6.7±3.8	9.81±4.006

Conclusion

SOFA score is a helping tool to predict mortality in elderly patients. High SOFA score on admission increases the probability of mortality. Non-survivors have high Mean SOFA at admission, at 48 hour and high mean delta SOFA in comparison to survivors.

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