



STUDY OF USEFULNESS OF SOFA SCORE IN PATIENTS WITH MULTIPLE ORGAN DYSFUNCTION IN ICU

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ABSTRACT

Background: Multiple Organ Dysfunction Syndrome (MODS) is a common cause of Intensive Care Unit (ICU) mortality and morbidity. The aim of the study was to determine morbidity and mortality of patients with multiple organ dysfunction in ICU & to prognostic the patients by using SOFA Score. **Methodology:** The study was done on 50 adult patients admitted to the medical & surgical ICU. The detailed history, clinical examination and laboratory investigations were done. Various profiles between two groups; survivor group and non-survivor, were done by the use of SOFA Score. The SOFA score of 6 variables, each representing an organ System. The worst physiological variables were collected serially every 24 hours of patients ICU admission. The worst measurement was defined as the measure that correlates to the highest number of points. **Results:** In our study, 36 patients died and 14 patients survived. The extensive study of SOFA score was done from day 1 to the last day. The SOFA score on day 1 was high among non-survivors than survivors but the SOFA score on day 3 was better compared with SOFA score on day 1 as the tool for outcome prediction. SOFA score was significantly low especially on day 3 (6.84±2.96) in survivor group as compared to non-survivor group whose mean day 3 value being (13.42±4.060). Total SOFA Score and Mean SOFA Score were effective in predicting the outcome patients with Sensitivity of 77.8% and 97.2% respectively and Specificity of 78.6% and 100% respectively. **Conclusion:** SOFA score has been validated extensively for prognostication so serial measurement of SOFA score during first week is a very useful tool in predicting the outcome.

KEYWORDS : Sequential Organ Failure Assessment (SOFA), Intensive Care Unit (ICU)

INTRODUCTION:

Patients in intensive care do not constitute a homogeneous sample. Patients have different diagnoses, time courses, ages, chronic illness, different sites of infection and different degrees of physiological dysfunction, resulting in a large dispersion of mortality risks⁽¹⁾. Additionally, the presence & impact of other confounding events such as antimicrobial therapy, medical/surgical management and forgoing life sustaining therapies also change the outcome of ICU patients⁽²⁾. Considering these factors working group of the European society of intensive care medicine (ESICM) created organ failure assessment score (SOFA), since it is not restricted to sepsis⁽³⁾. So early ICU support in the golden hour with high index of clinical suspicion reduces mortality in sizable number of cases of MOD (Multiorgan Dysfunction)⁽⁴⁾.

Multiple organ dysfunction (MOD) is the presence of altered organ function in acutely ill patients⁽⁵⁾. Multiple scoring systems are available for assessment of severity of illness These scoring systems such as APACHE (Acute Physiology And Chronic Health Evaluation)⁽⁶⁾, SAPS (Simplified Acute Physiology Score)⁽⁷⁾ & MPM (Mortality Probability Models)⁽⁸⁾. These scoring systems calculate a prediction on values taken within the first 24 hours of an ICU stay. But these scores ignore many factors that can influence patient outcome during the course of an ICU stay.

One of them, which is most commonly encountered score in ICU is SOFA SCORE. These scores describe individual organ dysfunction/failure in a continuous form, from mild dysfunction to severe failure. The SOFA is a six-organ dysfunction/failure score used to track the critically ill patient's status in ICU. The retrospective evaluation of the application of this score to the first 24 hours in the ICU on an international database demonstrated a good correlation to mortality and an acceptable distribution of the patients among the several groups⁽⁹⁾.

Organ failure is a continuum of alterations in organ function from normal function, though varying degrees of dysfunction, to organ failure⁽¹⁰⁾. The description of organ dysfunction needs to be based on simple, easily repeatable variables specific to the organ & readily available in all institutions. Organ dysfunction is not static⁽¹¹⁾. It will alter over time & scoring systems needs to be able to take this time factor into account⁽¹²⁾. So the SOFA SCORE is used to evaluate MOD and it's correlation with survival. Our research was aimed to determine mortality and morbidity of patients with multiple organ dysfunction in ICU and to study usefulness of SOFA Score with multiorgan dysfunction in such patients.

MATERIALS AND METHODS:

The present study was started after getting permission from Institutional Ethics Committee. Study was conducted in dept. of General Medicine on 50 patients more than 18 years of age with evidence of Multiple Organ Dysfunction admitted to the medical & surgical ICU were included. Pregnant patients, patient with any Road traffic accident, with single system involvement or length of ICU stay < 1 (less than 1 day) were excluded.

The detailed history, clinical examination and all laboratory investigations were done in this study. In the present study the conditions were defined according to standard practice and based on relevant literature. In this analysis of various profiles between two groups; survivor group which include the patients who were successfully discharged after recovery and non-survivor group which includes the patients who died was done. The SOFA score of 6 variables, each representing an organ System. Each organ system was assigned a point value from 0 (Normal) to 4 (high degree of dysfunction/failure).

The worst physiological Variables were collected serially every 24 hours of patients ICU admission. The worst measurement was defined as the measure that correlates to the highest number of points.

To assess sequential involvement of organ we calculated SOFA Score on every day. This gave us idea whether involvement of number of organs was increasing or decreasing and if the severity of particular organ was increasing. The minimum SOFA Score was 0 and maximum was 24.

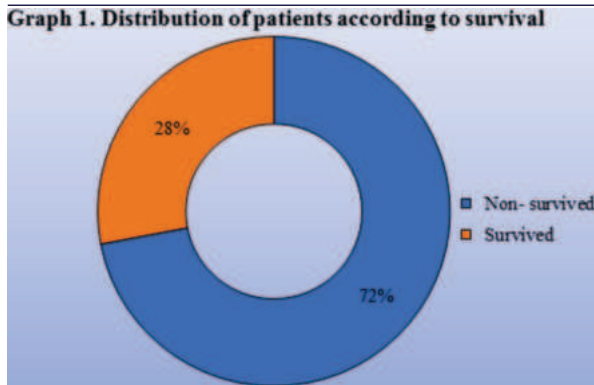
Statistical Analysis:

Descriptive and inferential statistical analysis has been carried out in the present study. Two types of tests were used and they were 1) Student t-test and 2) Chi-square test. Student 't' test (two tailed, independent) has been used for Quantitative data and to find out the significance of study parameters on continuous scale between two groups and Chi-square test has been used for Qualitative data and also to find out the significance of study parameters on categorical scale between two or more groups.

RESULTS:**Demographic And Clinical Profile Of Patients Studied:**

The clinical profile of 50 patients with MODS were studied. There were 34 males and 16 females in this study. The age of patients varied from 18 to 90 years. The mean age was 53.16 years.

Distribution Of Survived Patients Studied:



In the present study, 14 (28%) patients survived and 36 (72%) patients died.

Table 1. Comparison Of Co-morbidities And System Involved Among Survivors And Non-survivors:

Variables		Non survived (n=36)		Survived (n=14)		P value
		Number	%	Number	%	
Co-morbidities	Nil	5	13.9	0	0.0	0.34
	DM	16	44.4	14	100.0	0.001
	HTN	17	47.2	6	42.9	0.97
	Other (RVD/ALD/ Stroke etc)	23	63.9	11	71.4	0.51
System involved	Renal	36	100.0	14	100.0	1.00
	Hepatobiliary	34	94.44	14	100.0	0.92
	RS	26	72.22	14	100.0	0.07
	CVS	24	66.66	9	64.28	0.86
	CNS	25	69.44	3	21.42	0.006

Comorbidities were present in 45 patients with diabetes mellitus and hypertension being present in 16 non-survived with 14 survived and 17 non-survived with 6 survived patients respectively. Involvement of CNS was significantly more in non-survived patients (table 1).

Table 2. Comparison Of Emergency Supports Among Survivors And Non-survivors:

Variables		Non survived (n=36)		Survived (n=14)		P value
		Number	%	Number	%	
Emergency supports	Ventilator	36	100.00	3	21.42	0.000
	Dialysis	15	41.66	4	28.57	0.59
	Inotropic support	17	47.22	12	85.71	0.03
	ICU stay < 7 days	33	91.66	14	100.00	0.65
	ICU stay ≥ 7 days	3	8.33	0	0.00	0.65
Major Diagnosis	Dengue	8	22.24	3	21.42	0.951
	Leptospirosis	2	5.56	0	0.0	0.184
	Carcinoma	6	16.67	0	0.0	0.253

In our study, 36 non-survived and 3 survived patients required ventilator support, 15 non-survived and 4 survived patients required dialysis and 17 non-survived with 12 survived patients required inotropic support. This again suggest significant organ dysfunction (table 2).

However, 8 non-survived and 3 survived cases of dengue with 2 non-survived cases of leptospirosis were identified. There was not a single case of malaria in this study. Also 6 non-survived cases of carcinoma gall bladder with distant metastasis were also identified (table 2).

Table 3. Comparison Calinical Variables Of Survivors And Non-survivors:

Variables	Non-Survived (n=36)	Survived (n=14)	“t” value	P value
	Mean ± SD	Mean ± SD		
Age in years	52.56 ± 12.96	54.71 ± 3.20	0.61	0.545
Temperature	100.57 ± 1.47	102.04 ± 1.21	3.32	0.002
Pulse rate	114 ± 13.12	123.93 ± 9.66	2.56	0.013
Respiratory rate	27.9 ± 4.33	26.93 ± 2.56	0.78	0.437

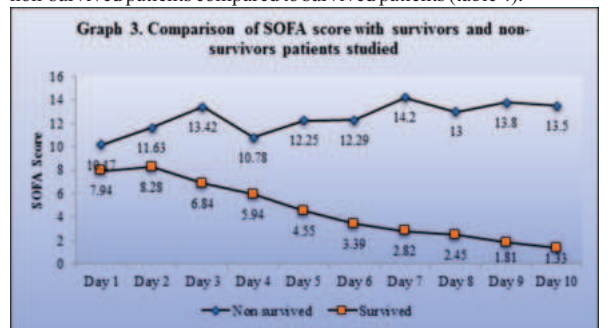
Systolic BP	104.39 ± 18.88	90.71 ± 4.75	2.66	0.011
Diastolic BP	68.44 ± 11.12	64.29 ± 6.46	1.31	0.197
MAP	80.58 ± 12.67	73.71 ± 6.07	1.94	0.059
Hemoglobin	8.23 ± 2.14	9.09 ± 0.56	1.47	0.147
Total count	28541.67 ± 17127.54	17921.43 ± 1542.81	2.30	0.026
Platelet count	105111.11 ± 41569.07	89000 ± 6872.46	1.43	0.158
Serum sodium	132.28 ± 5.95	136.79 ± 0.80	2.81	0.007
Serum potassium	4.53 ± 0.77	3.81 ± 0.20	3.43	0.001
Blood urea	125.13 ± 41.81	64.61 ± 13.5	5.28	0.000
Serum creatinine	4.28 ± 1.76	2.33 ± 0.28	4.10	0.000
Total Sr. bilirubin	7.79 ± 4.28	2.14 ± 0.52	4.89	0.000
Direct Sr. bilirubin	4.7 ± 2.74	1.18 ± 0.21	4.77	0.000

Body temperature, SBP, Total Leucocyte count, Sr. Sodium, Sr. Potassium, Blood Urea, Sr. Creatinine, Sr. Bilirubin (total) and Sr. Bilirubin (direct) were significantly high in non-survived patients compared to survived patients (table 3).

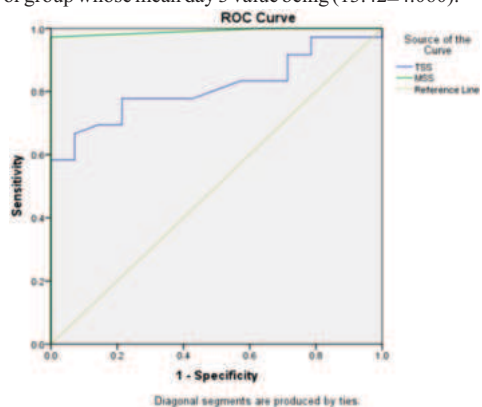
Table 4. Evaluation Of SOFA Scores With Survivors And Non-survivors Of Patients Studied:

SOFA score	Non-Survived (n=36)		Survived (n=14)		“t” value	P value
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD		
< 24 hrs	11.61 ± 2.22	9.5 ± 0.85	3.44	0.001		
>24 hrs	62.28 ± 71.46	29.14 ± 8.63	1.82	0.092		
Total SOFA	73.89 ± 71.73	38.64 ± 9.20	1.82	0.075		
Mean SOFA	13.75 ± 2.23	7.64 ± 0.50	10.09	0.000		

SOFA score at <24 hrs and mean SOFA score were significantly high in non-survived patients compared to survived patients (table 4).



Comparison Of SOFA Score With Survivors And Non-survivors: Out of 50 patients studied, SOFA score was significantly low especially on day 3 (6.84±2.96) in survivor group as compared to non-survivor group whose mean day 3 value being (13.42±4.060).



Graph 2. ROC Curve For Prediction Of Outcome (survivor Or Non-survivor) With The Help Of SOFA Score (assessing Usefulness Of SOFA Score):

Table 5. Area Under The Curve

Variable(s)	Area	Std. Error	P value	Asymptotic 95% CI	
				Lower Bound	Upper Bound
TSS	0.814	0.059	0.001	0.699	0.930
MSS	0.991	0.011	0.000	0.970	1.000

Table 6. Sensitivity, Specificity And Cut Off Values Of Total And

Mean SOFA Score:

Variable(s)	Cut off	Sensitivity	Specificity
Total SOFA Score	43.50	77.8%	78.6%
Mean SOFA Score	8.50	97.2%	100%

Above graph and tables shows that total SOFA Score as well as Mean SOFA Score were effective in predicting the outcome of critical patients admitted in ICU with Sensitivity of 77.8% and 97.2% respectively and Specificity of 78.6% and 100% respectively.

DISCUSSION:

The clinical profile of 50 patients with MODS were studied. There were 34 males and 16 females in this study. The age of patients varied from 18 to 90 years. The mean age was 53.16 years. Similar studies in India by **Diekema DJ et al⁽¹³⁾** have shown male preponderance with most patients in the 5th to 6th decade. Even in our study the most patients were in 5th to 6th decade. Comorbidities were present in 45 patients with diabetes mellitus and hypertension being present in 16 non-survived with 14 survived and 17 non-survived with 6 survived patients respectively.

All patients had fever with breathlessness being the next predominant symptom observed in 36 non-survived and 14 survived with 15 non-survived and 12 survived patients respectively. Even pain in abdomen was observed in 17 non-survived and 8 survived patients. Among the several disorders encountered in MODS, acute kidney injury is one of the most important because it is a life-threatening condition, increases the complexity and cost of care, and is an independent risk factor for mortality mentioned in a study by **Ronco C et al⁽¹⁴⁾**.

The mean SOFA score on the day of admission was 8.74 suggesting there was significant organ dysfunction in all patients. In our study, 36 non-survived and 3 survived patients required ventilator support, 15 non-survived and 4 survived patients required dialysis and 17 non-survived with 12 survived patients required inotropic support. This again suggest significant organ dysfunction. In a large clinical trial by **Sprung CL et al⁽¹⁵⁾** the mortality associated with severe sepsis and septic shock ranges between 13% and 50%.

8 non-survived and 3 survived cases of dengue with 2 non-survived cases of leptospirosis were identified. There was not a single case of malaria in this study. Also 6 non-survived cases of carcinoma gall bladder with distant metastasis were also identified.

Clinical Predictors Of Mortality:

In our study, 36 patients died and 14 patients survived. The mean age among non-survivors was little high compared to survivors (51.7% vs 46.84%) which was not statistically significant ($p=0.411$). 15 patients among non-survivors and 12 patients among survivors had breathlessness which was statistically similar ($p=0.01$). Even comorbidity like diabetes mellitus was statistically similar in two groups ($p=0.001$).

SOFA score has been validated extensively for prognostication. In our study, extensive study of SOFA score was done from day 1 to the last day. The SOFA score on day 1 was high among non-survivors than survivors which was statistically significant (10.17 vs 7.94, $p=0.014$). However, the most significant difference was observed on day 3. The SOFA score was very high among non-survivors than survivors which was statistically very significant (13.42 vs 6.84, $p<0.001$). This was similar to many studies that contain been done. **Saulius Vosylius et al⁽¹⁶⁾** in their study on 117 ICU patients with MODS showed that the changes in the severity of organ dysfunction were closely related to the outcome of patients admitted to ICU. The SOFA score on day 3 was better compared with SOFA score on day 1 as the tool for outcome prediction. **Vincent J et al⁽¹⁷⁾** in their study in 40 ICU's in 16 countries showed that the total SOFA score increased in 44% of the non-survivors but in only 20% survivors. **Saulius Vosylius et al⁽¹⁶⁾** in Vilnius, Lithuania observed that SOFA score on day 1 and day 3 was significantly higher in non-survivors than survivors. **Ferraira FL et al⁽¹⁸⁾** in Belgium found initial SOFA score up to 9, predicted mortality of less than 33% while an initial SOFA score of greater than 11 predicted a mortality rate of 95%.

Studies by **Vincent J et al⁽¹⁷⁾** have shown that in the SOFA scores: cardiovascular, neurological and respiratory, renal, hepatological and haematological dysfunctions were independent risk factors for mortality. In our study the same have been observed as described above for respiratory, cardiovascular and neurological variables. However

renal and hepatic parameters did not vary much among no-survivors and survivors.

CONCLUSION:

Serial measurement of SOFA score during first week is a very useful tool in predicting the outcome. The trend of SOFA score was progressively declining in survivors while non survivors had stable higher score during the first week. Most of the patients have infectious etiology in having MODS and SOFA Score is a very best system in predicting mortality in them. SOFA Score is a very useful tool in MODS patients not only restricted to infection but also with other etiologies. SOFA Score is best than other organ failure assessment scores in patients with MODS, because of having less variables.

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