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Original Research Article

Sepsis induced sequential organ failure assessment score as a prognostic marker in surgical sepsis: a study of 30 cases in 02 years

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ABSTRACT

Background: For the last few decades critical care medicine has been reinventing and fine-tuning organ dysfunction grading to establish a survival scoring system to accurately predict survivality and organ salvageability of critically ill patient in intensive care unit (ICU). The sequential organ failure assessment (SOFA) score assesses the performance of several organ systems in the body and assigns a score, where higher the SOFA score, higher the likelihood of mortality and morbidity. Early prediction of outcome in surgical sepsis is very likely to aid suitable modification of management strategies 13. This may improve prognosis in such patients and prevent mortality to some extent.
Methods: Observational and prospective study of 30 cases, aged>18 years & patients admitted to post-operative ward and surgical intensive care unit (SICU) with suspected surgical infection, and with two or more criteria of SIRS.
Results: In this study out of total 30 patients 63.3% patients survived and 36.6% succumbed to their illness. Our study depicted significant increase in mortality rate when the SOFA score was above 12. Ventilated patient showed a higher mortality rate. Delta, mean, total SOFA Score were statistically significant in our study.
Conclusions: SOFA score is useful in predicting mortality and morbidity in critically ill patients, because has a strong correlation between a rise in the score and mortality in all stages of admission. In our study, out of 09 patients whose T0 SOFA score was very high (above 12) out of which 03 patients only survived.

Keywords: Sepsis, SOFA score, Surgical intensive care unit, Postoperative, SIRS

INTRODUCTION

In critically ill patient's multiple organ failure (MOF) is leading cause of grave morbidity and high mortality. For the last few decades critical care medicine has been reinventing and fine-tuning organ dysfunction grading to establish a survival scoring system to accurately predict survivality and organ salvageability of very sick patients admitted in intensive care unit (ICU).

The sequential organ failure assessment (SOFA) score is a scoring system that assesses the performance of several organ systems in the body (neurologic, blood, kidney, and hemodynamics) and assigns a score based on the data obtained in each category. Higher the SOFA score, higher the likelihood of mortality and lower the score, lower the mortality. It is important to realize that SOFA Score was designed in 1990's by Vincent et al not to predict outcome, but to describe a sequence of complications in critically ill patients.[1]

Among the many intensive care unit (ICU) scoring systems, the SOFA is relatively simple and convenient and shows comparable performance to the traditional admission-based models, such as the "acute physiology and chronic health evaluation" (APACHE) and "simplified acute physiology score (SAPS)".[2-6] To improve the SOFA score, several clinico-statistical

modifications and manipulations have been attempted, and some derivatives have been proposed as additional potential prognosticators. Among these derived parameters, the most significant prognostic indicators are the total SOFA, delta SOFA, and mean SOFA scores in pre-specified time intervals.[6-11]

Objectives

Application of sepsis induced sequential organ failure (SOFA) score as a prognostic marker in surgical sepsis for predicting the outcome as morbidity, mortality and referral to advance centre as and when indicated by the SOFA score.

METHODS

Observational and prospective study was conducted in informed consented 30 cases who were admitted in post-operative ward and in Surgical intensive care unit (SICU) in SGT Medical College and research centre and Hospital, Budhera, Gurugram, 122505, Haryana, India.

Inclusion criteria

Inclusion criteria were age>18 years & patients admitted to post-operative ward and SICU with suspected surgical infection, having two or more criteria of SIRS. This study was conducted between from December 2018 to October 2020.

Exclusion criteria

Exclusion criteria were post-operative patients of Orthopaedics, ENT, Ophthalmology, Obs., Gynae and those not giving consent for the study

Methodology

In this study patient were selected on the basis of fulfilling the criteria of two or more variable of SIRS such as (1) fever (oral temperature>38ºC or hypothermia <36^{0}C) (2) tachypnoea (>24 breaths/min); (3) tachycardia (heart rate>90 beats/min) (4) leucocytosis (>12000/cumm), leukopenia (<4000/cumm), or>10% bands}.

All the patients were subjected to complete physical as well as systemic examination at admission and before surgery. Routine investigations such as complete hemogram (CBC-complete blood count), PT(INR), LFT, KFT, ECG, chest X-ray, blood sugar (random), HBsAg, Anti HCV, ELISA HIV, and Urine examination were done. Cases after month of March 2020 underwent RT-PCR for COVID-19. Any other specific investigations were done as and when required. Adequate medical management of associated comorbid conditions like diabetes mellitus, hypertension and heart diseases were initialized and conditions optimized, more so for patients undergoing surgeries. The score was calculated till the 'event' which included, discharge from ICU, death, referred to higher centre. The SOFA at the onset of sepsis was labelled as T0, at 48hours labelled as T48 and at 72 hours labelled as T72. Delta SOFA, Mean and total SOFA were also calculated and compared with outcome of the patient. Outcome was also calculated on the basis of age, gender, ventilatory support, operated and non-operated patients.

Statistical methods

This is a prospective non-interventional study. Data analysed using SPSS Software Version 26. Descriptive statistics were reported using mean, median and SD for continuous variables, number and percentages for categorical variables. Logistic regression was used to find the predictors for mortality. Probability value/asymptotic significance less than 0.05 was considered statistically significant.

RESULTS

SOFA Score at onset hours for survivor & non-survivors

In this study out of total 30 patients 63.3% patients survived and 36.6% succumbed to their illness. The minimum SOFA score of the admitted patient was 04. Hence the data column starts with values of 04 and above. In this table we can clearly see that there is a sharp rise in non-survivors at a SOFA score above 12.

The minimum onset SOFA score of patients in this study is 04. Among the 02 patients who had these score 01 patients expired. That is, the mortality rate is 50%. Among the 09 patients who had an admission SOFA score of 12, Total 6 patients expired escalating the mortality rate to 66.6%. In this case the sensitivity occurs 54.5% and the specificity was 89.5%.

Table 1: SOFA score at onset hours for survivor and non- survivors.

SOFA score	Survivors	Non-survivors	Total
4-6	1	1	2
6-8	5	1	6
8-10	3	1	4
10-12	7	2	9
12 above	3	6	9
Total	19	11	30

SOFA at 48 hours for non- survivors

At 48 hours minimum SOFA score observed was 04, therefore data starts from 04. In this case the sensitivity occurs 63.6% and having specificity was 94.7%. SOFA score of 12 and above at 48 hours of admission shows an increase in the number of non-survivors. The minimum SOFA score at 48 hours is 04. Among the 13 non-survivors, 01 patient had these minimum scores. Patients who had a score of 12 and above were 10.

Table 2: SOFA at 48 hours for non- survivors.

SOFA Score	Non-survivors
4-6	1
6-8	1
8-10	1
10-12	0
12 Above	10

SOFA at 72 hours for non- survivors

In that case the sensitivity occurs 81.8% and having specificity was 94.7%. This graph depicts that survival rate is reduced when the SOFA score increases above 12, at 72 hours of admission. At 72 hours 10 out of the 11 patients expired, who had a score of 12 and above.

Table 3: SOFA at 72 hours for non- survivors.

SOFA Score	Non-survivors
4-6	0
6-8	1
8-10	0
10-12	0
12 Above	10

Gender

Out of total 20 male patients 06 (30%) did not survive and out of total 10 female patients 05 did not survived (50%).

Table 4: Gender.

Gender	Age (Mean±SD)	Survivor	Non-survivor	Total
Male	48.4 ±19.12	14	6	20
Female	49.1±10.80	5	5	10
Total	48.63±16.61	19	11	30

Outcome of ventilator support

Among the 12 patients ventilated 11 (91.66%) expired and among the 18 patients who did not require ventilator support, all of them survived.

Table 5: Outcome of ventilator support.

	Survivors	Non-survivors
Ventilated	1	11
Non-ventilated	18	0

Table 6: Operated and non-operated cases.

	Survivors	Non-survivors
Operated	18	8
Non-operated	1	3

Delta SOFA

Difference between the subsequent SOFA scores

Δ SOFA 48 is the difference between admission score and the score at 48 hours. ΔSOFA 72 is the difference between the score at admission and 72 hours. The patient data is analysed as those who decreased, unchanged and increased from the initial score respectively, and the outcome is analysed.

Table 6: SOFA at 48 hours changes.

Δ Score 48 hours	Survivors	Non-survivors
Decreased	5	0
Unchanged	7	2
Increased	0	4

Table 7: SOFA at 72 hours changes.

Δ Score72 Hours	Survivors	Non-survivors
Decreased	13	0
Unchanged	4	0
Increased	2	10

Total SOFA

Identify the critical time point when a patient developed the most severe organ dysfunction a total SOFA score of more than 30 is associated with increased mortality.

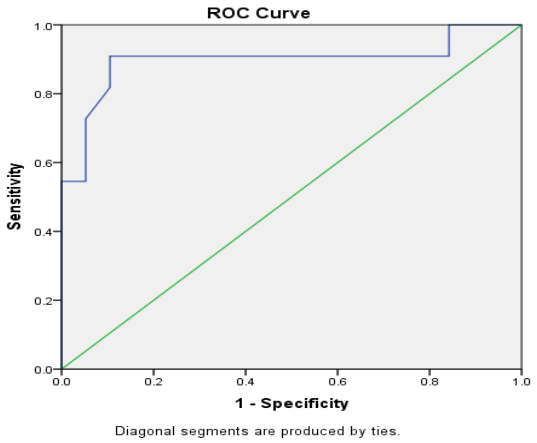

Figure 1: ROC (receiver operative characteristic) curve of total SOFA.

Mean SOFA

Mean SOFA calculates the average value of the prognostic during the entire hospital stay of the patient.

A value of more than 23 showed a sharp rise in mortality

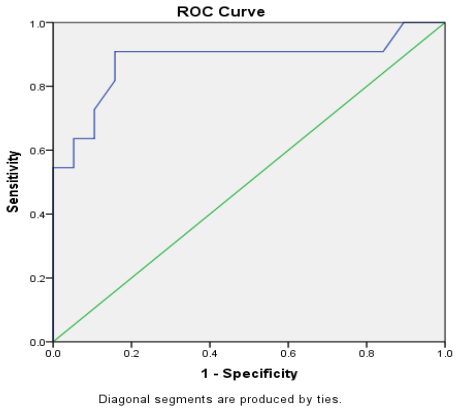

Figure 2: ROC curve of mean SOFA.

DISCUSSION

In the realm of medicine, a surgeon is perhaps the only specialist, who seems to be a unique creation of nature and his personality is shaped by the demand of this work environment. He is often seen as a boisterous, fearless and a straight forward man, who is rocksure of his diagnosis, proud of his surgical skills and arrogantly self-assured of the outcome of almost all surgeries that he performs yes almost all! Except the one that have complicated as infection! Be it the infection of the wound he created or infection of the vital organ deep inside the body of the patient, which may be threatening the patient's life. Like his gentler brethren the physician, the surgeon fears infection! especially the runaway infection, that cannot be tamed and contained by the top of the line antibiotics and threatens the patient and the surgeon to spirals out of control leading to sepsis and septic shock. Very soon this uncontrolled infection which plummet the patient through the "FCP" (final common pathway) into MODS, MOFS and Death!

In critically ill patient's Multiple Organ Failure (MOF) is leading cause of grave morbidity and high mortality. For the last few decades critical care medicine has been reinventing and fine-tuning organ dysfunction grading to establish a survival scoring system to accurately predict survivality and organ salvageability of critically ill patient in Intensive Care Unit (ICU).

The Sequential Organ Failure Assessment (SOFA) score is a scoring system that assesses the performance of several organ systems in the body (neurologic, blood, kidney, and blood pressure/hemodynamic) and assigns a score based on the data obtained in each category, where higher the sofa score, higher the likelihood of mortality. The SOFA score was designed as a research tool so that the groups of patients (e.g. those with sepsis and infection in the blood stream which can lead to shock and death) could be categorized based on their risk of death. It is important to realize that SOFA Score was designed not to predict outcome but to describe a sequence of complications in critically ill.[1]

Assessment of patient's prognosis is vital during the treatment course, to locate problem issues and neutralize them appropriately and in time with revised treatment methodology. Scoring systems have been used assess patient's status, to predict the outcome and spell out the prognosis of the patient in this regard. SOFA scoring system is simple, easily applicable and used widely in many ICU's around the world and is found to be a useful tool of critical care.

In our study sex of the patient did not play a significant role in influencing mortality. The morbidity and mortality are purely related to the underlying disease state.

We have observed the need for mechanical ventilation clearly predicted mortality outcome, since the patients who were ventilated showed a higher mortality rate compared to those who did not require ventilator support, as evidenced by the statistically significant p value <0.001.

It is interesting to note that our study depicted significant increase in mortality rate when the SOFA score was above 12. There is a steep rise in the mortality curve at this value. Admission SOFA, 48 hours SOFA and 72 hours SOFA are all statistically significant with a p value<0.001

Our study showed Delta SOFA which is the difference in values over a period of time is also statistically significant in our study. There is strong evidence that, patients whose delta SOFA values when increased from the previous value, there is a greater chance that the patient may succumb to his illness.

A Study by Jones, Trzeciak, Kline concluded that Delta SOFA over 72 hours has a significant positive relationship to in-hospital mortality.[12]

Again, we have seen Mean SOFA value also proved to be an independent predictor of mortality. A value of more than 23 showed a sharp rise in mortality.

Total SOFA score is also statistically significant in predicting mortality, irrespective of the disease state. A total SOFA score of more than 30 is associated with increased mortality.

Anami et al conducted the study regarding serial evaluation of SOFA scoring in Brazilian teaching hospital which concluded that Mean SOFA reflects organ dysfunction during the ICU stay and can be a useful tool to stratify patients in clinical trials. SOFA Max can identify the critical time point when a patient developed the most severe organ dysfunction during their ICU stay. They also concluded that higher SOFA score had a positive association with mortality. The sequential organ failure assessment (SOFA) is so designed to evaluate the function of six major organ system i.e. cardiovascular, respiratory, renal, hepatic, central nervous system and

coagulation over time. The score is obtained at the day of admission and each of the following days- ICU. Because the SOFA score monitors daily changes in organ function, it can evaluate patient's response to treatment and sequential changes in the SOFA score e.g. increasing or decreasing can predict the eventual outcome of the ICU stay. In many ways SOFA score is far superior than APACHE II score in evaluating day to day progression or regression of the patient and thereby predict the clinical outcome of the patient.[13]

We would like to mention here a very interesting observation that we made along the side of our study, as to how different human beings are genetically geared to react and behave to the assault of disease on them caused by Microbial pathology or trauma! This idiosyncratic reaction of human body to the microbial intruders or to the ill-effect of "enemies within" (anaphylactic reaction, allergic reaction or effects of trauma), ultimately decides who will survive and who will die!

We observed that some patients are genetically "stoic" in their display of "immune-defence reaction". They do not mount an overwhelming and an embarrassing immune reaction to the effect of an insignificant offender. These patients we like to call the "non-juicers"! They do not overwhelm and hopelessly "juice-up" to a microbial challenge or the challenges of the "enemies within". While other patients come out in the open in overwhelming and self-defeating response to the effects of the same offendes, firing all at once, a salvo of all their heavy guns, in form of an unnecessary and excessive secretion of the humoral factors (complement cascade, antibodies, cytokine storm), and unleash their humoral and cellular immunity, so much so that this immune reaction comes across as more threat to the life of the host than the invading pathogens! These patients we call the "juicers"- who unnecessarily, over enthusiastically and dangerously juice up to a insignificant stimulus and bring about the hosts annihilation!

May be a future study we may design a tool incorporating the SOFA scoring system with an analysis of the genetic makeup of the host. This may help us to diagnose a life-threatening situation, neutralize or contain the same in time and at the same time predict an outcome spelling out the prognosis of the patient.

There was some limitation in our study which includes, a smaller number of cases in this study. This would have given us clearer picture regarding correlation between different time period.

CONCLUSION

Observational and prospective study of 30 patients were done at SGT Medical College & Research Centre, Budhera, Gurugram, India, 122505, from November 2018 to October 2020 and were reviewed accordingly.

In our study we found that: 1) SOFA score is useful in predicting mortality and morbidity in critically ill patients, because there is a strong correlation between a rise in the score and mortality in all stages of admission 2) Ventilated patients have a more risk of mortality compared to non-ventilated patients 3) The total SOFA and mean SOFA are better predictors of mortality 4) delta SOFA score is good predictor of mortality and morbidity 5) Early prediction of outcome (mortality and morbidity) in sepsis using SOFA score is useful to aid suitable changes of management strategies and to re-arrange and economically utilize limited resources 6) In our study, out of 09 patients whose T0 SOFA score was very high (above 12), 03 patients have survived. This data depicts that, with early prediction of outcome using SOFA score and suitable therapeutic intervention, critically ill patients can be salvaged. 03 critically ill patients survived in our study 7) Same way out of 08 patients whose SOFA score on admission was low (less than 8), 02 patients died and 06 walked home This data depicts, even with low SOFA score on admission, few patients succumbed to their critical condition, because so many other factors were contributing to their death e.g. septic shock with MODS and "HAC"- (hypothermia, acidosis and coagulopathy) 8) So, using SOFA scoring we can improve the overall prognosis and prevent the morbidity and mortality to some extent and may predict their outcome in the early phase of their admission in SICU.

Since the dawn of humanity, Man has been closely shadowed by diseases and sufferings. He followed himself in the garb of witch doctors, shamans, sorcerer and later on doctors, to cure the disease and the dying. Millennium later Man perfected the art of healing and created Critical Care Warriors- especially skilled surgeons, physician and anaesthesiologists armed with modern life saving gadgets and intelligent use of diagnostic, predictive and prognostic tools like modified upgraded SOFA scoring system. Now handful of these dedicated medical vanguards make all the difference between life and death, for the very sick and the dying of the society at large!

"Never before than now, so much is owed by so many of the sufferings, sick and dying of the society, to so few dedicated lots of doctors!"

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