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Original Research Article

Evaluation of SOFA score (Sequential Organ Failure Assessment score) in hospitalised patients with sepsis

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ABSTRACT

Introduction: Considering sepsis as a common illness the following study studied the score and extrapolated with survival benefits in medical emergency patients. The score was made to determine population level burden of disease.
Various studies recommended SOFA for screening sepsis and determine prognosis. The score has been used to determine injury to organs in admitted patients with infection.
Materials and Methods: The cross sectional study was conducted at Vivekananda Institute of Medical Sciences, Kolkata over a period of one year (2019 till 2020) on sepsis patients admitted in medical ICU. The study revealed that more the scores on the day of admission, the more is the risk of adverse outcomes and subsequent early mortality (within day 7 of admission). In this study, among 56 cases of total death within the first 7 days of admission, 53 patients (94.64%) had day 0 SOFA score of >9 making it a significant outcome in this study. Baseline SOFA scores ≥ 9 and rising SOFA scores as day progresses can predict mortality in sepsis.
Results: The mean SOFA score on admission to the ICU was 9.2. The 28-day mortality rate was 28%. Patients with a SOFA score of 9 or more on admission to the ICU had a significantly higher mortality rate than those with a score of less than 9 (42% vs. 14%, $p < 0.01$). The SOFA score on day 3 of ICU stay was also significantly associated with mortality ($p < 0.01$).
Conclusion: The SOFA score is a simple and easy-to-use tool that can be used to assess the severity of organ dysfunction in patients with sepsis. It is a good predictor of mortality in patients with sepsis admitted to the ICU.

1. Introduction

Sepsis is a characterised by abnormalities due to malregulated host response to infection. Sepsis can cause derangement of multiple systems and death.[1] Various studies indicate the rate of hospitalizations due to sepsis increased over few years leading to deaths.[2] SIRS (Systemic Inflammatory Response Syndrome) is characterised by fever or hypothermia, increasing pulse, increasing breathing rate and increased or decreased leucocyte count. Sepsis means SIRS plus infection.[3] Severe sepsis is sepsis with poly organ failure (atleast 2 or more organs). Severe sepsis with refractory low blood pressure is referred to as septic shock. Sepsis results from a deficiency of innate immunity of host and pathogen virulence gaining access. Risk factors for sepsis are admission to ICU, nosocomial infection, bacteria proliferation, increasing age, immunoparalysed patients, recent history of hospitalization and community-acquired pneumonia. Genetic aberrations also lead to pathogen invasion.[4] Most commonly infections in US are due to Gram positive bacteria although Gram negative infections are on the rise. Mycotic infection prevalence

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are increasing in context to solid organ and bone marrow transplantation. Culture negative infections comprise 50 % of sepsis cases. Viral aetiologies include flu viruses, corona viruses and the latest pandemic of COVID – 19. Different scoring systems are in place to determine illness grade and thus point to outcomes of patients in the unit admitted for emergency care. The factors taken into consideration include performance in the chosen population, feasibility, ease of use, and availability. The prediction model should be updated periodically to reflect contemporary practice and patient demographics, avoiding deteriorating performance over time. Sepsis is a disease syndrome which should be diagnosed and monitored in a very systematic and well documented way so as to increase the probability of survival of the patient. Since the differential diagnosis of sepsis is enormous including non-infectious causes, malignancy a presumed or definite diagnosis of sepsis has first to be made. Subsequently the patient has to be followed up on day 0 and periodically every 48 hours till clinical recovery. This enhances the chances of survival of the patient. The scoring system helps us to guide in assessing the severity of disease process thereby helps us in instituting aggressive treatment at the very outset. Subsequently monitoring of disease also helps us in escalating or deescalating drugs and also to prognosticate patients and inform their relatives which creates a strong bond between us meaning doctor and patient or patient relatives. The score thus helps in proper communication to both consultants and to relatives. The score was adopted in a meeting in 1994 to determine effectiveness and suitability of evaluation of ill patients admitted with sepsis.[5]

16 countries analysed the scores.[6] Moreno et al.[7] explained effect of score and presented the data between increasing score and death . The score also predicted survival probabilty at ICU discharge. One needs to calculate the maximum score, the change in score, or delta score (total maximum score minus admission total score) as a strong correlation with ICU mortality. SOFA utilises assessment of major organ function to calculate a severity score. The scores are measured after 24 hours of admission to the department. Repeat calculations are done at 48 hours. Rise in scores by 30 percent increases mortality by 50%.[8] The score comprises oxygen partial pressure to inspired oxygen ratios, mean arterial pressures, hepatic function tests, renal function tests, coagulation parameters and glasgow coma scale score. Originally designed as a research tool to certain groups of patients with sepsis. It can be a quite accurate tool in sepsis cases and when applied to correctly chosen groups.

MODS is explained by the 2016 emergency clinicians team as rise of 2 or more points in the score. The effectiveness of the score was extrapolated from sick patients with sepsis by electronic health questionnares from ICUs both inside and outside the US.[9] Other ICU scores were compared. The SOFA scores for death rate in admitted patients were superior to that for the SIRS criteria. The SOFA score is a easy to use tool to predict system dysfunction in sick patients. Timely and justified scoring helps to monitor status of patient and progression of disease. The SOFA score can compare between patients benefitting clinical trials. One important parameter to be kept in mind is in an era of scores one needs to be very meticulous in choosing various scores in select patients to avoid errors and bias. We can institute various protocols like twice daily monitoring, alternate day monitoring and can generate survival data in patients and also compare any statistical difference among patients monitored daily or on alternate days. Because in parallel we need to understand the stress and strain of a medic on duty so as not to overburden them with lots and lots of data. At our institution we do regular monitoring of scores in patients with sepsis proven or suspected and do it on day of admission and subsequently at least once daily and calculate the difference. If we find a significant difference we look into patient charts, clinical vignette and try to intervene appropriately. As we all know meticulous clinical examination is difficult in ICU patients everytime so these scoring system helps us in triaging our patients. We studied the SOFA score and correlated with mortality in patients admitted with infection.

2. Materials and Methods

The cross-sectional study was conducted at Vivekananda Institute of Medical Sciences, Kolkata over a period of one year (January 2019 to January 2020) on all patients admitted with sepsis, septic shock and multiorgan dysfunction in medical ICU. Patients who underwent surgery (general surgery and gynaecological surgery) and admitted in surgical ICU were excluded from this study. The score was calculated on day 0, day 3 and on day7 and outcomes are recorded as death within the 7th day of admission and recovery during this observation period. The research was accepted by the appropriate hospital Committee. The data are entered into an Excel Spreadsheet. The median values and standard deviations are measured with MS Excel software and analysed using GraphPad Instat Software. Statistical significance regarding difference of incidence in symptoms between two groups will be carried out by appropriate statistical tests. Significance is assessed at the level of 5%. (p value cut off 0.05).

3. Results

Among the 100 cases in this study, 61 patients were male and rest 39 were females. (Table 1).

In this study, the minimum age of cases was 17 years and the maximum being 87 years. So, the study population has the median age of 66 years and the mean age is 61.53 years.(Table 2).

Table 1: Showing proportion of patients according to gender

Sex	Frequency	Percent
Female	39	39
Male	61	61
Total	100	100

Table 2: Showing proportion of patients according to age

	Minimum	Maximum	Mean	Median	Standard deviation
Age	17	87	61.53	66.00	14.32

In this study, 76 patients had a score of more than 9 on the day of hospitalisation while 24 patients had score less than 9 on that day (day 0), among 76 cases, 73 patients had a score of more than 11. (Table 3), (Figure 1).

Table 3: Distribution of patients with scores on day 0

SOFA scoring (day 0)	Frequency	Percent
>9	76	76
≤9	24	24
Total	100	100

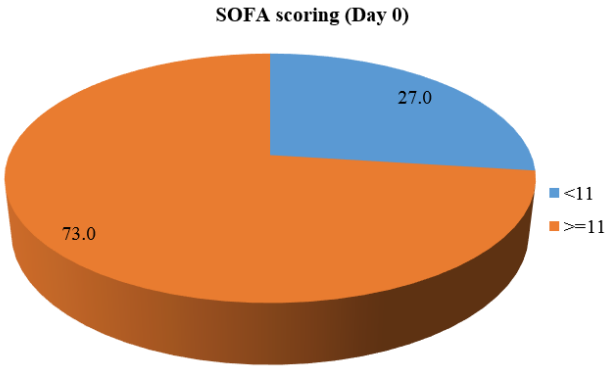

Figure 1: Pie chart showing distribution of score

The more the scores on the day of admission, the higher is the risk of adverse outcomes and subsequent early mortality (within day 7 of admission). In this study, among 56 cases of total death within the first 7 days of admission, 53 patients (94.64%) had day 0 score of >9 making it a significant outcome in this study (probability value of < 0.001).(Figure 2).

Usually serial monitoring of the score is required to predict adverse outcomes and predicting early mortality. Thereby change in the scores in increasing trend on serial measurement more accurately predicts adverse outcomes and mortality risks. In this study, mean score rose from 15.41 to 16.28 on the day of admission (day 0) vs 3rd day (day 3) post admission carries significant p value < 0.001 statistical value in predicting mortality. (Figure 3)

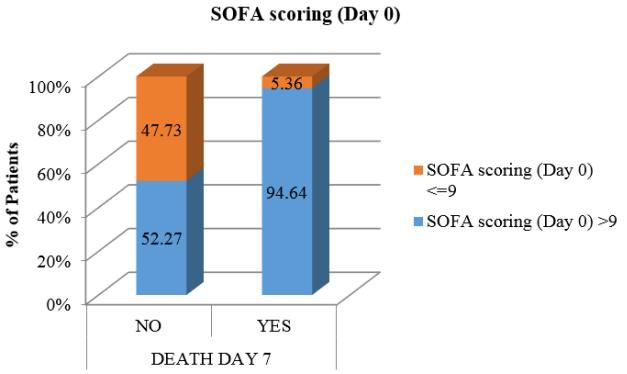

Figure 2: Bar diagram showing day 7 mortality and scoring of more/less than 9 on day of admission

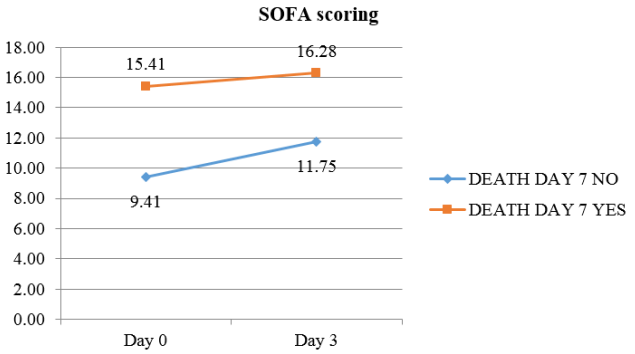

Figure 3: ine diagram showing mean score on day 0 and day 3 and day 7 mortality

4. Discussion

The score was unanimously discussed in 1994 to assess quantitatively the extent of organ failure over time in patients. 6 organ functions were estimated assessing score at presentation and classified from 0 to 4.[10] The score is an integral part into a range of ICU medicine is globally accepted marker of assessing various organ system function in sepsis. The score is now routinely used to track a patient's stay in hospital to assess degree of organ function or speed of failure.

During this study period, 61 male and 39 female patients were admitted, meaning males were admitted more commonly during the study period. A study by Larsson et al[11] in Sweden showed no gender bias. The study showed no difference in admission rate that could be linked to the gender of the patient. Another Indian study by Todi S, Chatterjee S et al[12] showed more male patients present in ICU with sepsis with ratio of male patient to female patient of 1.34:1 to 1.63:1. This fact, though due to admission bias and observation bias during this fixed cross sectional study period but probably due to faulty lifestyle, like smoking, alcohol intake, leading to increased incidence of chronic

liver disease, lung disease and hypertension. Mean age of sepsis in this study is 61.53 years. 64 patients were above the age of 60 years and among them 45 patients (80.36%) died within 7 days of admission, which is a significant (p value < 0.001) association. Means age is an important predisposing factor for severe infection and MODS due to immunocompromisation and associated comorbidities with advancing age. In study by Dr. Todi S et al[12] shows mean age of presentation and worst outcome in sepsis in 65 years.

SOFA scoring on admission (Day 0) also predicts the outcome during hospital stay. An initial score of less than 9 showed mortality of less than 33% while more than 9, specifically, more than 11 predicted mortality risk of more than 95% in a data by Flavio Lopes.[13] In present study also, 5.36% death within day 7 had SOFA score of more than 11 making this 91 study statistically significant in predicting mortality risk (p value > 0.001). A study on SOFA score as a indicator of prognosis in sick patients showed SOFA in ICU at first contact and subsequently at 48 h as a good marker of survival[14] which was similar to a study in Nepal by Acharya et al.[15] Literature in 2001 showed serial evaluation of SOFA score as a survival marker in ill patients and proved SOFA score during the first few days of presentation as a standard marker of prognosis.[8]

This study also matches with the previous study thereby proving the significance of above score in the assessment of death risk. Delayed hospital admission, associated undetected comorbidities and sepsis related initial complications were thought to be the cause of increased SOFA score on admission. Our study substantiates the use of SOFA score on admission and follow up scoring to substantiate mortality outcomes in patients admitted with infection. Increasing the sample size would further help us to validate our findings. Though various scoring systems have been in place we need a score which is simple and bedside friendly to access. Proper utilisation of score and its application helps us in triaging patients and act diligently to institute proper antimicrobials and supportive care so as to optimise patient management which in turn improve ICU care and hence improve patient outcomes. Though seemingly the score seems attractive there is a hinch in that as the measurements are based on clinical tools which may lead to confounding bias. As a consequence clinicians and hospitals need to formulate the proper uses of score in select patients guided by senior physicians so that confounding bias can be eliminated. Similar studies on large scale can help us to formulate a concrete guideline to implement SOFA score routinely to patients admitted with sepsis for proper prognostication and aggressive management.

5. Conclusion

The study was done to find out the correlation of rising SOFA scores in 100 medical people being admitted to critical care unit over a duration of 1 year which showed baseline SOFA scores ≥ 9 and rising SOFA scores as day progresses can predict mortality in sepsis and can help us to adopt aggressive source control measures and appropriate antibiotics to try to save our patients. SOFA score on admission is sensitive and specific and may be analysed to track organ function in sick patients. The score measures the degree of organ dysfunction and guide clinicians to change treatment decisions. SOFA is a good supplement to other scoring systems like SAPS score. The score when measured daily monitors progression of the disease. We should train our junior residents to use the scoring system in every patient suffering from sepsis as far as practicable to generate more robust data. We hereby propose approaches to calculating the SOFA score in all patients of sepsis on admission and follow up scores which can increase the sensitivity of assessments and dismiss the sources of heterogeneity.

6. Conflict of Interest

None.

7. Source of Funding

None.

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