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Admission SOFA Score as a Predictor of Early Mechanical Ventilation Requirement in Critically Ill Patients: A Hospital-based Study

Dr. Shilpa Bhaurao Mupade[1], Dr. Tilka Ghate[2], Dr. Heena Pahuja[3], Dr. Ketaki Marodkar[4]

[1]Junior Resident, Department of Anaesthesiology NKPSIMS & Lata Mangeshkar Hospital Nagpur
[2]Associate Professor, Department of Anaesthesiology NKPSIMS & Lata Mangeshkar Hospital Nagpur
[3]Professor, Department of Anaesthesiology NKPSIMS & Lata Mangeshkar Hospital Nagpur
[4]Professor & Head of the Department, Department of Anaesthesiology NKPSIMS & Lata Mangeshkar Hospital Nagpur

Corresponding Author:

Dr. Shilpa Bhaurao Mupade
Junior Resident, Department of Anaesthesiology NKPSIMS & Lata Mangeshkar Hospital Nagpur
Email: shilpamupade@gmail.com

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ABSTRACT

Background: Early identification of critically ill patients who may require invasive mechanical ventilation is essential for timely intervention and optimal utilization of intensive care resources. The Sequential Organ Failure Assessment (SOFA) score is a widely used clinical tool that evaluates the extent of organ dysfunction and helps predict outcomes in critically ill patients. Assessing the predictive value of the admission SOFA score for early ventilatory requirement may assist clinicians in identifying patients at risk of respiratory deterioration soon after ICU admission.

Objectives: To determine the association between admission SOFA score and the requirement of invasive mechanical ventilation within 48 hours of ICU admission, to estimate the risk of mechanical ventilation across different SOFA score strata, and to evaluate the predictive ability of the SOFA score for early ventilatory support.

Methods: This hospital record-based study was conducted in the Intensive Care Unit of a tertiary care hospital. A total of 30 consecutive adult patients admitted to the ICU during the study period were included. Patients below 18 years of age and those already on mechanical ventilation at the time of admission were excluded. Demographic details and clinical diagnoses were recorded, and SOFA scores were calculated within the first hour of ICU admission using parameters from six organ systems. Patients were categorized into three SOFA strata (0–6, 7–9, and ≥10). The primary outcome was the requirement of invasive mechanical ventilation within 48 hours. Statistical analysis included descriptive statistics and Receiver Operating Characteristic (ROC) curve analysis to assess predictive accuracy.

Results: Out of 30 patients, 10 (33.3%) required invasive mechanical ventilation within 48 hours. Patients requiring ventilation had higher mean SOFA scores (9.9) compared with those who did not require ventilation (7.4). Higher SOFA strata were associated with increased ventilatory requirement, with the greatest incidence observed in patients with SOFA scores ≥10.

Conclusion: Admission SOFA score is a useful predictor of early invasive mechanical ventilation in critically ill patients and may aid in early risk stratification and ICU preparedness.

Keywords: *SOFA Score,Predictor,Mechanical Ventilation.*

INTRODUCTION

The Sequential Organ Failure Assessment (SOFA) score is an objective and widely accepted scoring system used to quantify the degree of organ dysfunction in critically ill patients. The score was originally developed to describe and track organ failure in patients with sepsis but has subsequently evolved into a universal prognostic indicator applicable across diverse intensive care unit (ICU) populations. By providing a structured and standardized evaluation of organ dysfunction,

the SOFA score allows clinicians to assess the severity of illness and estimate the risk of adverse clinical outcomes in critically ill patients[1].

The SOFA scoring system evaluates dysfunction across six vital organ systems: respiratory, cardiovascular, hepatic, coagulation, neurological, and renal. Each organ system is assigned a score ranging from 0 to 4 depending on the degree of dysfunction, and the cumulative total reflects the overall burden of organ failure. This multidimensional approach enables clinicians to capture the dynamic physiological derangements that occur in critically ill patients and provides a reliable method for monitoring disease progression over time[2]Mechanical ventilation (MV) remains one of the most important life-saving interventions in modern critical care practice. It is frequently required in patients presenting with severe respiratory compromise, acute respiratory distress syndrome (ARDS), septic shock, metabolic derangements, or multiorgan dysfunction. The timely initiation of invasive mechanical ventilation is crucial to prevent respiratory failure, reduce the risk of hypoxemia, and maintain adequate oxygen delivery to vital organsHowever, predicting which patients will require early mechanical ventilation remains a major challenge for intensivists and anesthesiologists, particularly at the time of ICU admission. Delayed identification of patients at risk for respiratory deterioration may lead to emergency intubations, increased complications, and worse clinical outcomes. Therefore, identifying reliable clinical tools that can predict the need for early ventilatory support is of considerable importance in critical care medicine[3]Several investigators have demonstrated that higher SOFA scores at ICU admission correlate with increased disease severity, higher mortality rates, and prolonged dependence on organ support therapies including mechanical ventilation. Serial assessment of the SOFA score has also been shown to provide valuable prognostic information and help clinicians track the progression or resolution of organ dysfunction during ICU stay.[2-4]

Previous studies have highlighted those specific components of the SOFA score—particularly respiratory and cardiovascular dysfunction—are strongly associated with subsequent need for ventilatory support. Modified SOFA models have also been explored to improve prediction of outcomes including mortality and ventilator requirement in critically ill patients[5].In emergency and critical care settings, the SOFA score has also demonstrated utility as a rapid bedside triage tool that can assist clinicians in early risk stratification and management planning. By quantifying the degree of organ dysfunction at the time of ICU admission, clinicians may be able to anticipate the need for advanced organ support interventions such as mechanical ventilation and initiate timely management strategies[6].The relevance of such predictive tools becomes even greater in resource-limited healthcare environments where ICU beds, ventilators, and trained personnel may be limited. In many Indian tertiary care and district hospitals, early prediction of ventilatory requirement can significantly improve resource allocation and help prioritize patients who may benefit from early airway management and intensive monitoring.[7]

Despite the widespread clinical use of the SOFA score, relatively limited data are available regarding its ability to predict the early requirement of mechanical ventilation within the first 48 hours of ICU admission. Some studies have suggested that admission SOFA scores may serve as a useful predictor for ventilatory support requirements, with moderate diagnostic accuracy demonstrated through receiver operating characteristic (ROC) curve analysis.[8]

Therefore, evaluating the association between admission SOFA score and early mechanical ventilation requirement may provide valuable insights for improving early clinical decision-making in critically ill patients. Identifying patients with high SOFA scores at admission could help clinicians anticipate respiratory deterioration, optimize ICU preparedness, and improve patient outcomes through timely intervention.[9-11]

Objectives-

1. To determine the association between admission SOFA score and the initiation of invasive mechanical ventilation within 48 hours of ICU admission.
2. To estimate the risk of mechanical ventilation across SOFA score strata (0–6, 7–9, ≥10).
3. To evaluate the diagnostic accuracy of admission SOFA score in predicting the need for invasive mechanical ventilation using ROC analysis.

METHODOLOGY -

This was a hospital record-based study in Intensive Care Unit (ICU) of a tertiary care hospital.

A total of 30 consecutive adult patients admitted to the ICU during the study period were included in the study. Patients aged below 18 years and those already receiving mechanical ventilation at the time of ICU admission were excluded from the study. After obtaining relevant clinical information, demographic data and primary diagnosis were recorded for each patient. Within the first hour of ICU admission, all required clinical and laboratory parameters were collected for calculation of the SOFA score. The SOFA scoring system evaluates dysfunction across six organ systems including respiratory, cardiovascular, hepatic, coagulation, neurological, and renal systems, with each component scored from 0 to 4 depending on the severity of organ dysfunction. The total SOFA score was calculated as the sum of the scores of all six organ systems.The primary outcome variable of the study was the requirement of invasive mechanical ventilation within 48 hours of ICU admission. Secondary parameters included use of non-invasive ventilation, time to intubation, and ICU length of stay. Patients were categorized into three SOFA score strata (0–6, 7–9, and ≥10) based on established severity

intervals to evaluate the relationship between increasing organ dysfunction and ventilatory requirement. Statistical analysis included descriptive statistics for baseline characteristics and comparison of SOFA scores between ventilated and non-ventilated patients. The incidence of mechanical ventilation across different SOFA strata was calculated. Additionally, the diagnostic accuracy of admission SOFA score in predicting the requirement of mechanical ventilation was assessed using Receiver Operating Characteristic (ROC) curve analysis, with estimation of sensitivity, specificity, positive predictive value, and negative predictive value. Data analysis was performed using standard statistical software.

RESULTS

Table 1: Baseline Demographic and Diagnostic Profile (n=30)

Variables	n	%
Male	21	70.0
Female	9	30.0
Pneumonia / ARDS	8	26.7
Sepsis / Septic Shock	7	23.3
Postoperative	5	16.7
DKA / HONK	5	16.7
Acute Exacerbation COPD	4	13.3
Poisoning / Overdose	1	3.3
Total	30	100

Table 2: Mean SOFA Component Scores (n=30)

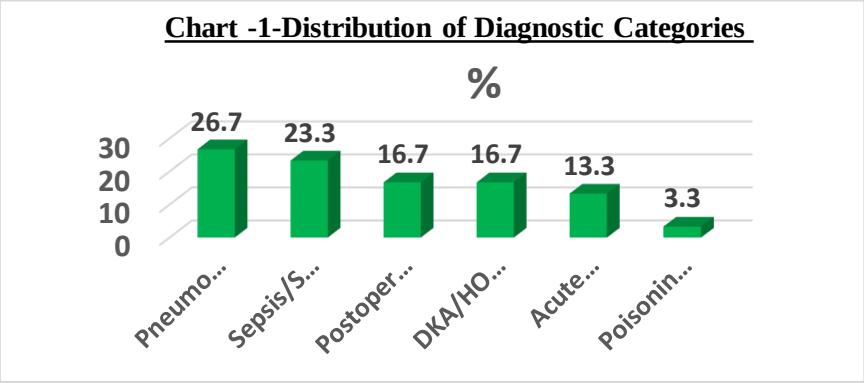
SOFA Component	Mean Score
Respiratory	1.53
Coagulation	1.53
Liver	1.63
Cardiovascular	1.47
CNS	0.90
Renal	1.17
Total SOFA Score	8.23

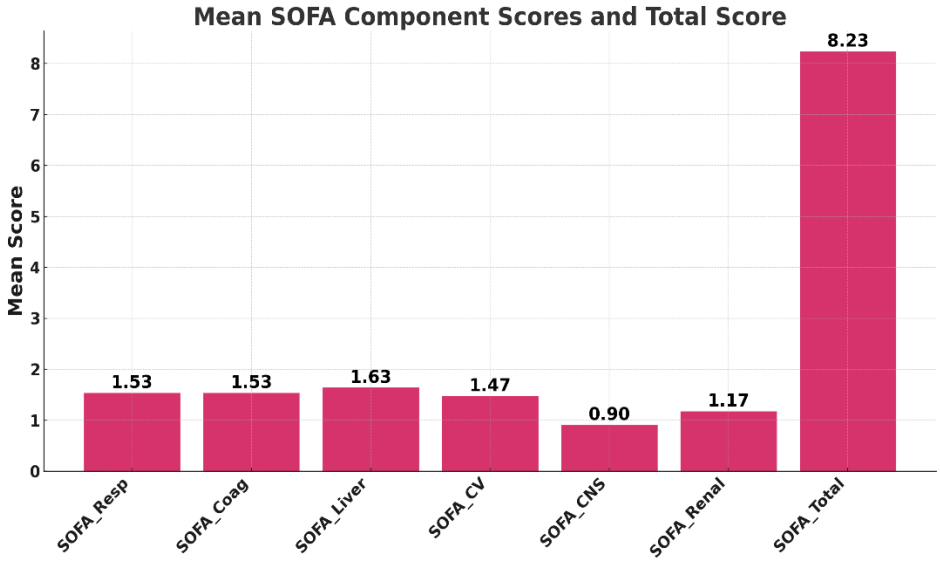
Table 3: SOFA Score vs Invasive Mechanical Ventilation within 48 Hours (n=30)

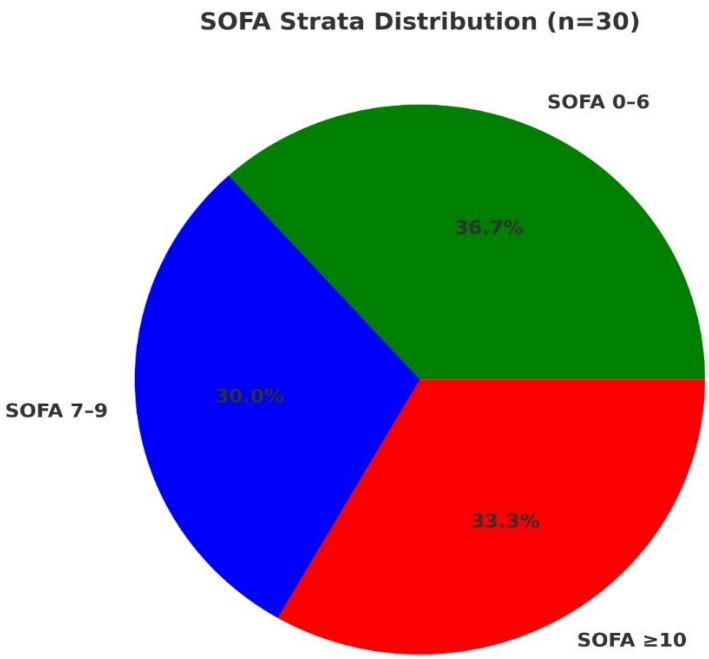
Invasive MV within 48 hours	n	%	Mean SOFA	Median SOFA
No	20	66.7	7.4	7.0
Yes	10	33.3	9.9	10.5
Total	30	100	-	-

Table 4: SOFA Strata and need of Invasive Mechanical Ventilation within 48 Hours (n=30)

SOFA Strata	Total Cases (n)	% of Total	MV within 48h (n)	MV within 48h (%)
0–6	11	36.7	3	10.0
7–9	9	30.0	1	3.3
≥10	10	33.3	6	20.0
Total	30	100	10	33.3







DISCUSSION-

In the present study, the Sequential Organ Failure Assessment (SOFA) score at ICU admission demonstrated a clear association with the need for invasive mechanical ventilation (IMV) within the first 48 hours. Patients who required early mechanical ventilation had significantly higher mean and median SOFA scores compared with those who did not require ventilatory support. This finding suggests that greater organ dysfunction at the time of ICU admission is closely related to subsequent respiratory deterioration and the need for advanced ventilatory support. The ability of the SOFA score to quantify multisystem organ dysfunction makes it a useful bedside tool for identifying critically ill patients at risk of early respiratory failure.

Our findings are consistent with the study conducted by Huang et al.,8 which evaluated the predictive value of admission SOFA score for ventilatory requirement in critically ill patients. The authors reported that higher SOFA scores at admission were associated with an increased likelihood of requiring mechanical ventilation during the ICU stay. Their study highlighted that SOFA-based assessment can help clinicians identify patients who may require early ventilatory support and guide timely airway management strategies11-12. Similarly, Wang et al. developed a predictive model incorporating SOFA score and other clinical variables to estimate the risk of mechanical ventilation within 48 hours of admission. The authors demonstrated that early risk stratification using SOFA-related parameters can improve clinical decision-making and early intervention in critically ill patients11.

Another study by Chang et al. examined the ability of the SOFA score to predict ventilator dependence in patients with severe sepsis and septic shock. The investigators reported that higher admission SOFA scores were significantly associated with prolonged mechanical ventilation and ventilator dependency. Their results indicated that the SOFA score could serve as an early prognostic indicator for respiratory failure and the need for prolonged ventilatory support. These findings support the observations in our study, where patients with higher SOFA scores were more likely to require invasive ventilation within the first 48 hours of ICU admission.13-14

Furthermore, Lu et al. investigated the relationship between SOFA scores and the duration of mechanical ventilation in critically ill patients. Their study demonstrated that patients with higher SOFA scores had a significantly increased risk of prolonged ventilatory support. The authors also reported that a SOFA score threshold of around eight points was associated with a higher probability of extended mechanical ventilation duration, emphasizing the importance of early severity assessment in ICU patients15. This aligns with the results of our study, where the mean SOFA score among ventilated patients was considerably higher than that of non-ventilated patients, suggesting greater severity of illness at admission.

Additionally, Do et al. reported that higher SOFA scores at ICU admission were strongly associated with increased requirement of organ support therapies including mechanical ventilation and vasopressor support. Their study demonstrated that patients with SOFA scores ≥10 had significantly worse outcomes and higher likelihood of requiring intensive organ support interventions14. In the present study, a similar pattern was observed in which patients belonging to higher SOFA strata showed a greater incidence of early mechanical ventilation.

Overall, the findings of the present study reinforce the clinical utility of the SOFA score as a practical and objective tool for early risk stratification in critically ill patients. By identifying patients with higher SOFA scores at ICU admission, clinicians may anticipate the likelihood of respiratory deterioration and prepare for early airway management and ventilatory support. This is particularly relevant in resource-limited settings where timely allocation of ICU resources and ventilators is crucial. Early prediction of ventilatory requirement using a simple scoring system such as SOFA may therefore improve clinical outcomes by enabling prompt intervention and optimized critical care management.11-15

CONCLUSION-

The present study demonstrates a significant association between the Sequential Organ Failure Assessment (SOFA) score at ICU admission and the requirement of invasive mechanical ventilation within the first 48 hours. Patients who required early mechanical ventilation had notably higher mean and median SOFA scores compared with those who did not require ventilatory support, indicating that greater organ dysfunction at admission is closely related to early respiratory deterioration. The findings highlight the usefulness of the SOFA score as a practical bedside tool for early identification of critically ill patients who are at higher risk of requiring advanced respiratory support.

Stratification of patients according to SOFA score categories further emphasized this relationship. Patients with higher SOFA strata, particularly those with scores ≥10, showed a greater incidence of invasive mechanical ventilation within 48 hours of ICU admission. In contrast, patients with lower SOFA scores had comparatively lower ventilatory requirements. This demonstrates that increasing severity of organ dysfunction is directly associated with an increased likelihood of requiring mechanical ventilation in the early course of ICU stay.The SOFA score, being simple, objective, and easily calculable using routinely available clinical and laboratory parameters, can serve as a valuable triage and prognostic tool in critically ill patients.

In conclusion, the admission SOFA score shows promising utility in predicting the early requirement of invasive mechanical ventilation in ICU patients. Incorporating SOFA-based risk stratification into routine ICU assessment may help improve early clinical decision-making, optimize ventilatory preparedness, and potentially enhance patient outcomes in critical care settings.

REFERENCES

1. Vincent JL, de Mendonça A, Cantraine F, et al. Use of the SOFA score to assess the incidence of organ dysfunction/failure in intensive care units. Critical Care. 1998;2(1):1-10.
2. Ferreira FL, Bota DP, Bross A, Melot C, Vincent JL. Serial evaluation of the SOFA score to predict outcome in critically ill patients. Critical Care. 2001;5(2):R67–R72.
3. Zampieri FG, Colombari F. The SOFA score in predicting mechanical ventilation. Revista Brasileira de Terapia Intensiva. 2014;26(4):373-378.
4. Raith EP, Udy AA, Bailey M, et al. Prognostic accuracy of the SOFA score. Journal of Intensive Care. 2017;5:26.
5. Grissom CK, Brown SM, Kuttler KG, et al. A modified SOFA score for predicting ventilator needs. Critical Care. 2010;14:R64.
6. Jones AE, Trzeciak S, Kline JA. The value of the SOFA score in emergency and ICU patients. Critical Care Medicine. 2009;37(5):1649–1654.
7. Sahoo JN, Gurjar M. Critical care in resource-limited settings: Indian perspective. Indian Journal of Critical Care Medicine. 2020;24(Suppl 4):S191–S198.

8. 8Huang YC, Ko WJ, Tsai PR, Wu VC, Chen YM, Wu KD, et al. Admission SOFA score predicting ventilation requirement in critically ill patients. BMC Pulmonary Medicine. 2014;14:14.9.
9. Grissom CK, Brown SM, Kuttler KG, Boltax JP, Jones J, Jephson AR, et al. A modified Sequential Organ Failure Assessment score for predicting mortality and mechanical ventilation in acute respiratory distress syndrome. Critical Care. 2010;14:R640.
10. Raith EP, Udy AA, Bailey M, McGloughlin S, MacIsaac C, Bellomo R, et al. Prognostic accuracy of the Sequential Organ Failure Assessment score for in-hospital mortality among adults with suspected infection admitted to the intensive care unit. Journal of Intensive Care. 2017;5:26.
11. Ferreira FL, Bota DP, Bross A, Melot C, Vincent JL. Serial evaluation of the Sequential Organ Failure Assessment score to predict outcome in critically ill patients. Critical Care. 2001;5(2):R67–R72.
12. Wang B, Li Y, Zhang H, Chen X, Liu Y, Zhao J, et al. A novel nomogram to predict the risk of requiring mechanical ventilation within 48 hours after admission in critically ill patients. PeerJ. 2024;12:e16945.
13. Chang YC, Yu CJ, Chang SC, Lee LN, Yang PC, Luh KT, et al. Ventilator dependence risk score for predicting prolonged mechanical ventilation in patients with severe sepsis. Scientific Reports. 2018;8:5655.
14. Lu F, Wang Y, Zhang H, Chen L, Li Y, Sun W, et al. Correlation between mechanical ventilation duration and pediatric Sequential Organ Failure Assessment score in critically ill patients. Frontiers in Medicine. 2022;9:905123.
15. Do SN, Nguyen TQ, Nguyen HT, Tran TH, Pham DT, Le HT, et al. Sequential Organ Failure Assessment score for predicting outcomes in critically ill patients: a cohort study. BMJ Open. 2023;13:e072349.