Annals of Medicine and Surgery 74 (2022) 103265

Contents lists available at ScienceDirect

Annals of Medicine and Surgery

journal homepage: www.elsevier.com/locate/amsu

Case Series

Predictive value of quick sequential organ failure assessment (qSOFA) score in risk assessment and outcome prediction in blunt trauma patients: A prospective observational study

Nidhisha Sadhwani *, Vinaya Ambore, Girish Bakhshi

Department of General Surgery, Grant Government Medical College & Sir JJ Group of Hospitals, Mumbai, India

ARTICLE INFO

Keywords:
Wounds and injuries
Trauma severity indices
Mortality
Quick sequential organ failure assessment

ABSTRACT

Background: There is a plethora of trauma scoring systems currently in place. A lot of these scoring systems, however, are complex and thus have a limited utility in the emergency department. The present study was conducted to evaluate the relatively easy to calculate quick Sequential Organ Failure Assessment (qSOFA) Score in blunt trauma victims. We ought to study its utility in predicting outcomes in blunt trauma patients and its usefulness to guide resource allocation in the emergency department.

Methods: A prospective observational study was performed on blunt trauma patients who had presented to the emergency department of our tertiary care center, over a period of 6 months. Their qSOFA scores were calculated and these patients were observed for their course in the hospital. The predictive validity of this score was then studied for the outcome prediction in these patients.

Results: A total of 246 patients were enrolled. Maximum 36.4% of patients had a qSOFA score of 0 and 10.1% were with a score of 3. Higher qSOFA scores were associated with higher in-hospital mortality, higher needs for an ICU admission, higher needs for mechanical ventilation. However, it did not reliably predict the need for an emergency surgery in these patients.

Conclusions: qSOFA score serves as a reliable tool to predict adverse outcomes in blunt trauma victims. It helps with the quick allocation of resources in the emergency department.

1. Introduction

Trauma is an ever-increasing health problem worldwide. It is a major cause of mortality in the general population and especially in young individuals. The reported mortality rates of severely injured patients range from 7 to 45% [1]. Although many severity scales have been published to classify trauma patients in an emergency, the utility of a lot of these scores is far greater for research and surveillance purposes than their clinical utility.

The quick sequential organ failure assessment (qSOFA) score, a surrogate for the SOFA score, was initially derived and validated by a panel of experts to screen for patients likely to have sepsis [2–5]. It was recently studied for its association with outcomes following blunt trauma, and was found to be a good predictor of in-hospital mortality following blunt trauma [6,14–16]. It is calculated by assigning 1 point each for a respiratory rate greater than or equal to 22 breaths/min, systolic blood pressure less than or equal to 100 mm Hg, and any alteration in mental status Glasgow coma scale (GCS) $<$ 13) [6]. The total score was then calculated by adding the individual scores for the 3 elements.

qSOFA uses only three clinical variables. It serves as a simple, generic tool that can be rapidly calculated in all emergency department (ED) patients on their arrival, without the need for any laboratory or advanced testing. It would be of great help to the ED practitioners and would serve as an excellent tool for resource allocation, to inform triage decisions, to predict clinically important outcomes regardless of whether infection is suspected.

It was found that overall prognosis of patients admitted to Intensive care unit (ICU) directly from the ED is better than the prognosis for those admitted to the ICU from general wards [7,8]. Given its help with resource allocation, patients with higher qSOFA scores could be directly shifted to the ICU from the ED. There are other better scores with better sensitivities but they seldom can be easily calculated during the early ED phase. The advantage of the qSOFA score is its simplicity and lack of

* Corresponding author. Department of General Surgery, 6th floor, Hospital Building, Sir JJ Hospital Campus, Sir JJ Marg, Byculla, Mumbai, 400008. India.
E-mail addresses: sadhwani.nidhisha@gmail.com (N. Sadhwani), vinaya.ambore@gmail.com (V. Ambore), gdbakhshi@gmail.com (G. Bakhshi).

https://doi.org/10.1016/j.amsu.2022.103265
Received 4 January 2022; Received in revised form 11 January 2022; Accepted 13 January 2022
Available online 17 January 2022

Table 1
Comparison of hospitalization outcomes with qSOFA.

Outcomes	qSOFA				P value
	0	1	2	3	
RTS	7.80 (7.80–7.80)	6.90 (6.90–7.80)	7.10 (5.90–7.80)	5.20 (4.20–5.35)	<0.001
TRISS	0.45 (0.40–1.00)	1.90 (0.70–4.60)	3.05 (1.08–9.20)	59.70 (19.35–92.30)	<0.001
ICU					
Yes	1 (1.1%)	10 (20%)	29 (35.4%)	21 (84%)	<0.001
No	89 (98.9%)	40 (80%)	53 (64.6%)	4 (16%)	
ICU LOS (hours)	–	48 (24–108)	48 (24–120)	2 (1–24)	<0.001
Surgery					
Yes	5 (5.6%)	22 (44%)	31 (37.8%)	9 (36%)	<0.001
No	85 (94.4%)	28 (56%)	51 (62.2%)	16 (64%)	
Mechanical ventilation					
Yes	0 (0%)	9 (18%)	31 (37.8%)	21 (84%)	<0.001
No	90 (100%)	41 (82%)	51 (62.2%)	4 (16%)	
Intubation					
Yes	1 (1.1%)	9 (18%)	32 (39%)	21 (84%)	<0.001
No	89 (98.9%)	41 (82%)	50 (61%)	4 (16%)	
Hospital LOS (days)	3 (2–7)	11.50 (7–18)	7 (5–10)	7 (6–12.25)	<0.001
Death					
Yes	0 (0%)	5 (10%)	17 (21%)	21 (84%)	<0.001
No	90 (100%)	45 (90%)	64 (79%)	4 (16%)	
Complications					
Yes	3 (3.3%)	8 (16%)	13 (15.9%)	2 (9.1%)	0.030
No	87 (96.7%)	42 (84%)	69 (84.1%)	20 (90.9%)	

Table 1 legend: RTS - Revised Trauma Score, TRISS - Trauma Revised Injury Scoring System, ICU - Intensive care unit, LOS - Length Of Stay.

Table 2
Multivariate logistic Regression analysis showing impact of qsofa score on the three outcome variables.

	Surgery		Mortality		ICU stay	
Factor	Odds ratio	P value	Odds ratio	P value	Odds ratio	P value
Qsofa						
0	0.000	0.999	0.000	1.000	0.603	0.850
1	0.000	0.999	0.000	0.998	0.288	0.648
2	0.000	0.999	0.000	0.998	0.144	0.447
RTS	0.999	0.998	1.819	0.327	0.697	0.609
TRISS	0.990	0.762	1.104	0.149	0.939	0.298

Table 3
AUROC curves for outcomes.

Score	ICU	Surgery	Mortality
Yes	Area (95% CI)	Area (95% CI)	Area (95% CI)
qSOFA	0.838 (0.785, 0.891)	0.683 (0.615, 0.750)	0.873 (0.812, 0.925)
RTS	0.448 (0.144, 0.814)	0.466 (0.395, 0.536)	0.459 (0.239, 0.759)
TRISS	0.939 (0.903, 0.976)	0.777 (0.721, 0.833)	0.969 (0.951, 0.988)

Table 3 legend: qSOFA - quick Sequential Organ Failure Assesment, RTS - Revised Trauma Score, TRISS - Trauma Revised Injury Scoring System.

dependence on laboratory testing. The current study has assessed the role of this score in risk assessment and outcome prediction in blunt trauma patients. Aims of present study were to asses: a) The relationship of post blunt trauma in-hospital mortality with qSOFA scores (primary outcome); b) The correlation between need for ICU admission, need for surgery, need for mechanical ventilation, need for intubation, ICU length of stay (LOS), hospital length of stay (LOS), complications, with qSOFA scores (secondary outcome); c) To compare the predictive results of qSOFA with The Revised Trauma Score (RTS) and Trauma Injury Severity Score (TRISS) for in hospital mortality, need for ICU admissions, need for surgery.

2. Methods

A prospective observational study of 246 blunt trauma patients at a tertiary care center was carried out over a period of 6 months from June 1, 2019 to November 30, 2019. The study was approved by the Institutional review board at Grant Medical College and Sir J.J. group of hospitals, Mumbai on March 28, 2018 (IRB number- IEC/PG/162/MAR/2018). This study has been registered with the Research Registry UIN: researchregistry7535. Written informed consent was obtained from the patients; in case of incapacity, surrogate consent was obtained.

Inclusion Criteria: All the adult blunt trauma patients above or equal to 18 years of age who visited the emergency department during the study period including patients referred from some other hospital.

Exclusion Criteria: Age <18 years, pregnant women, burns patients, prisoners/patients under custody, disabled patients, patients with Respiratory rate (RR) = 0 at the time of visit, patients with systolic Blood Pressure (SBP) = 0 at the time of visit, patients with Glasgow Comma Score (GCS) = 3 at the time of visit, attrition (Discharge Against Medical Advice), Referred patients missing the variables needed for the calculation of the scores.

The RR, SBP and GCS were measured and the patient was managed as per 10th Advanced Trauma Life Support guidelines given by the American college of Surgeons. These measurements were taken immediately after the patient was brought to the emergency department by a trained medical professional as per the hospital protocol. If the patient was referred from another hospital/medical centre, the data from the first center was taken for the study. If the data required for the calculation of the scores was inadequate on the referral sheet, such patients were excluded from the study. The history about the prevailing co-morbidities, the mechanism of injury, anatomical sites of the injuries was obtained. The definitions used for co-morbidities, need for surgery, and complications were in line with the National Trauma Data Standard definitions used by the American College of Surgeons, Committee on Trauma [9]. The patient was then followed up for: Need for an ICU admission; ICU LOS, if any; Need for mechanical ventilation; Need for intubation; Need for surgery; Complications, if any; Death or discharge; hospital LOS.

The need for surgery, intubation, mechanical ventilation, ICU admission, discharge was as per the treating medical professional's discretion, based on what the patients clinical condition warranted. The need for ICU admission was defined as, direct ICU admissions from the ED or the transfer to the ICU within 24 h of surgery. These data entries were made by a resident doctor who was well aware of the objectives of the study being conducted (non-blinded). The qSOFA, TRISS and the

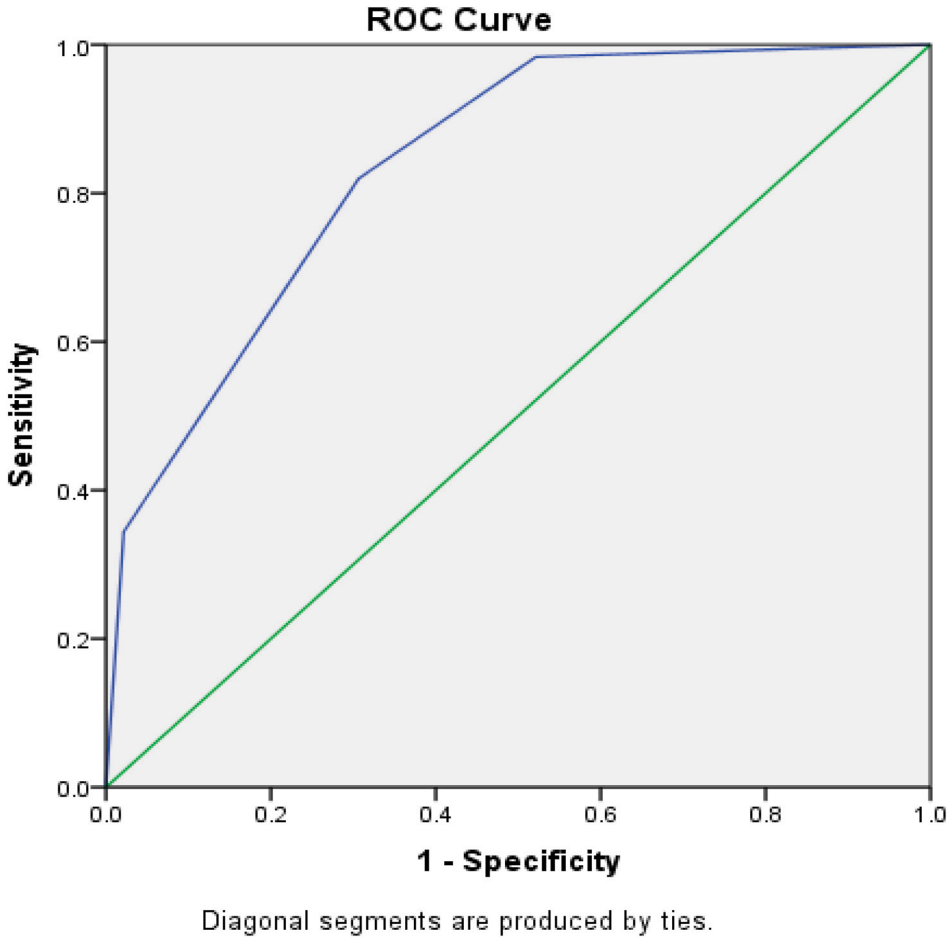

Fig. 1. Predictive validity of qSOFA score in predicting ICU admission.

RTS scores were then calculated and the 'first' scores were considered for the evaluation. The data was abstracted using paper charts.

The qSOFA score calculation: binary qSOFA variables are- GCS- 13 (yes/no), SBP- 100 mmHg (yes/no), and RR- 22 (yes/no).

One point is assigned for each variable if the criterion is met and zero points if the criterion is not met. The qSOFA score (range 0–3) is the unweighted sum of the binary values for each of these 3 variables.

RTS calculation: RTS (range 0–7.84) is the weighted sum of coded values (range 0–4) for three variables: $RTS = 0.9368 \times GCS_c + 0.7326 \times SBP_c + 0.2908 \times RR_c$ (c- coded).

TRISS calculation: It incorporates the RTS, the Injury Severity Score (ISS), and a dichotomous age (55 years) index to calculate the probability of survival (Ps). Specifically, $Ps = 1/(1 - e^b)$, where $b = b0 + (b1*RTS) + (b2*ISS) + (b3*Age)$. (b0, b1, b2, and b3 are constants for blunt or penetrating trauma.) In our study, the TRISS score is expressed as the probability of death.

2.1. Statistical methods

2.1.1. Descriptive analysis

Carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. All Quantitative variables were checked for normal distribution within each category of explanatory variables by using visual inspection of histograms and normality Q-Q plots. Shapiro-Wilk test was also applied to assess normal distribution. Shapiro-Wilk test, p value of >0.05 was considered as normal distribution. For non-normally distributed quantitative parameters, medians and interquartile range (IQR) were compared between study groups using Mann Whitney u test (2 groups)/ Kruskal Wallis test (>2 groups).

2.1.2. Inferential statistics

2.1.2.1. Quantitative outcomes. The association between categorical qSOFA, mortality, need for ICU admission, need for surgery, age, TRISS, RTS, ICU and hospital LOS were assessed by comparing the median values. Mann Whitney u test (2 groups)/Kruskal Wallis test (>2 groups) were used to assess statistical significance.

2.1.3. Categorical outcomes

The association between gender, referrals, co-morbidities, need for mechanical ventilation, intubation, complications, mortality, need for surgery and ICU admission and qSOFA were assessed by cross tabulation and comparison of percentages. Chi square test was used to test statistical significance.

Univariate binary logistic regression analysis was performed to test the association between the co-morbidities, mortality, need for surgery and ICU admission and qSOFA, mechanical ventilation, intubation, TRISS, RTS and hospital stay. Unadjusted Odds ratio along with 95% CI is presented. Variables with statistical significance in univariate analysis were used to compute multivariate regression analysis. Adjusted odds ratio along with their 95% CI is presented.

2.1.4. ROC analysis

The utility of RISS and TRISS in predicting mortality, need for surgery and ICU admission were assessed by Receiver Operative curve (ROC) analysis. Area under the ROC curve along with it's 95% CI and p value are presented. Based on the ROC analysis, it was decided to

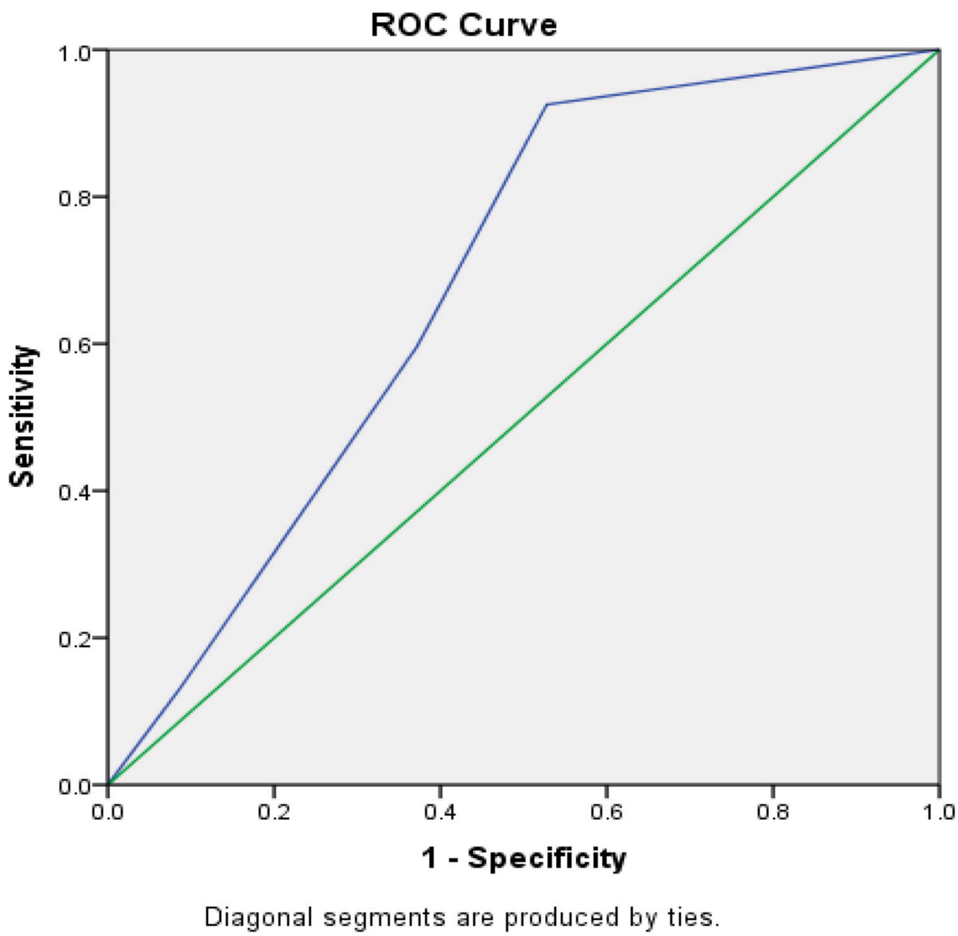

Fig. 2. Predictive validity of qSOFA score in predicting need for Surgery.

consider x, y, z as the cut off values. The sensitivity, specificity, predictive values and diagnostic accuracy of the screening test with the decided cut off values along with their 95% CI were presented. Reliability of the test was assessed by kappa statistic along with it's 95% CI and p Value. P value < 0.05 was considered statistically significant. IBM SPSS® version 21 (IBM Corp., Armonk, USA) was used for statistical analysis.

3. Results

Two-hundred ninety-one patients were screened. Forty-five patients were excluded from the study. Thirty patients were excluded from the study, as they were missing the variables needed for qSOFA calculation, due to improper documentation from the center they were referred from. Fifteen patients who had a RR of 0, SBP of 0 mmHg, or GCS of 3 were also excluded. Two-hundred and forty-six patients were included (n = 246). Out of the 246 patients included, 90 (36.4%) had a qSOFA score of 0, 50 patients (20.2%) had a qSOFA score of 1, 82 patients (33.2%) had a score of 2 and 25 patients (10.1%) had a qSOFA score of 3. 69.7% patients had suffered a Road Traffic Accident.

As seen in Table 1, patients with higher qSOFA scores were more likely to have suffered major injuries. Higher qSOFA scores were more likely to undergo major surgery. Patients with higher qSOFA scores were more frequently admitted to the ICU (P value < 0.001). They also received mechanical ventilation more frequently as compared to qSOFA 0 (P value < 0.001). Patients with a higher qSOFA more frequently needed intubation (P value < 0.001). The in-hospital mortality rate was higher with higher qSOFA scores (P value < 0.001). Patients with a higher qSOFA score developed a complication more frequently than qSOFA 0.

On multivariate analysis, the qSOFA score was not found to be an independent predictor of mortality, need for intubation or the need for surgery, probably due to the small sample size (Table 2).

qSOFA scores were positively associated with RTS and TRISS. There was fair agreement between qSOFA, RTS, TRISS for mortality, need for ICU admission, need for surgery.

As per the Area Under the Curve Receiver Operating Characteristic (AUCROC) values in Table 3, the observed mortality rate with TRISS was higher than that predicted by qSOFA and RTS. While examining the discriminative ability of all 3 scores for ICU admission, the AUCROC of qSOFA and RTS was lower than that of the TRISS score. Evaluation of discriminative ability of these scores for need for surgery, indicated poor discriminative capacity for all 3 for surgery (Table 3).

The qSOFA score had good predictive validity in predicting ICU admission, as indicated by area under the curve of 0.838 (95% CI 0.785 to 0.891, P value < 0.001) (Fig. 1). The qSOFA score relatively had a poor predictive validity in predicting the need for surgery, as indicated by area under the curve of 0.683 (95% CI 0.615 to 0.750, P value < 0.001) (Fig. 2). The qSOFA score had good predictive validity in predicting mortality, as indicated by area under the curve of 0.873 (95% CI 0.821 to 0.925, P value < 0.001) (Fig. 3).

4. Discussion

The categorization of injury has been of interest to the military since record keeping began[10]. The ideal scoring system should promise an accurate, reliable and reproducible description of the injuries, which would subsequently be used as a basis for calculating trauma scores.

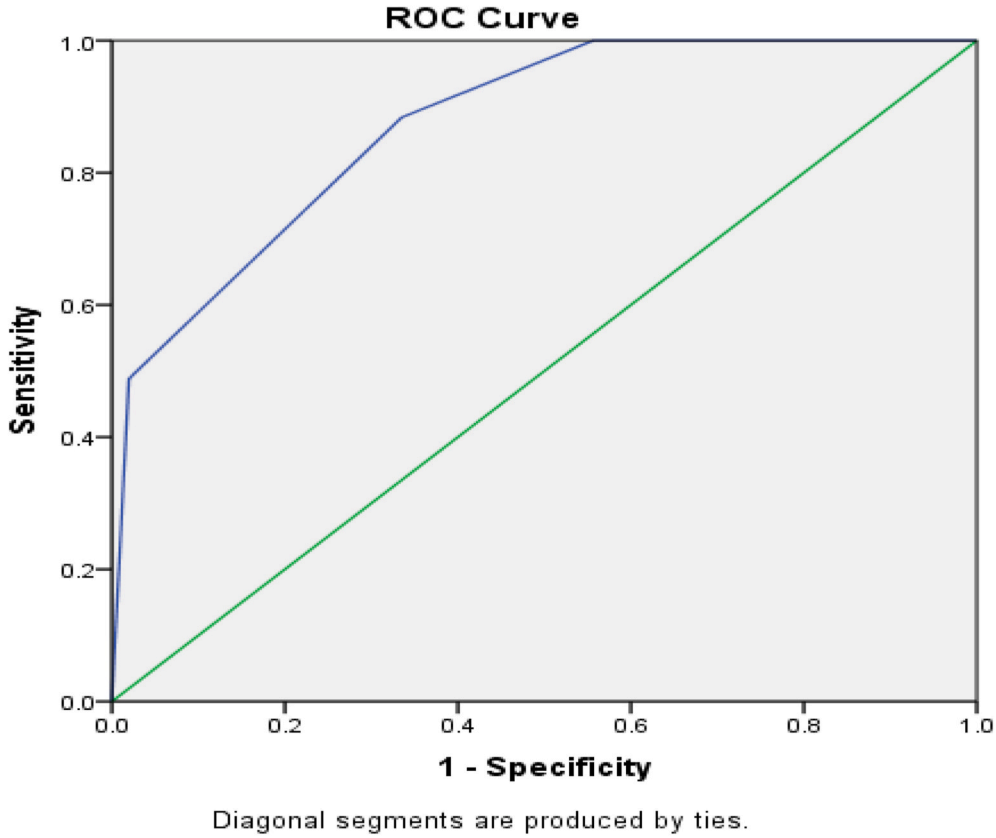

Fig. 3. Predictive validity of qSOFA score in predicting mortality.

The SOFA score was developed in 1994 during a consensus conference. It was initially validated in a mixed, medical surgical ICU population and has since been validated and applied in various patient groups. In a prospective analysis of 1449 patients, a maximum total SOFA score greater than 15 correlated with a mortality rate of 90% [11, 12].

The qSOFA score, a surrogate for SOFA, in settings in which all components of SOFA are not routinely measured, was recently derived and validated by a panel of experts to screen for patients likely to have sepsis. The qSOFA and SOFA scores had acceptable agreement in the majority of studies performed.

A study conducted by Freund et. Al [4]. concluded that this score should be used for risk stratification and consideration for sepsis in emergency department (ED) patients with infection. A study conducted by Singer M et al. [5] among ICU encounters with suspected infection, also supported its use as a prompt tool to consider possible sepsis. It also concluded that qSOFA scores were significantly associated with inpatient mortality, hospital admission, ICU admission, and overall hospital LOS in patients both with and without a suspected infection and thus, the qSOFA score, can potentially be used as a good tool to predict clinically important outcomes for ED patients, regardless of whether infection is suspected.

A retrospective study of 7064 adult blunt trauma admissions was conducted by Jawa et al. [6] In the present study, 246 blunt trauma victims were studied, prospectively. The primary outcome for both these studies was the in-hospital mortality rate. The common secondary outcomes included ICU admission rates, ICU LOS, mechanical ventilation rates, need for major surgery, hospital LOS. In Jawa et al. study, patients with higher qSOFA scores were found to undergo major surgery, were more frequently admitted to the ICU and received mechanical ventilation more frequently as compared to qSOFA 0 and the in-hospital mortality rate was higher with higher qSOFA scores. Present study results were similar to the ones obtained in this study. On multivariate analysis, Jawa et al. found that the qSOFA score was found to be an independent predictor of mortality. However, on multivariate analyses, qSOFA scores were found to not be independently associated with mortality, need for an ICU admission, or a need for surgery, in the present study. This difference on multivariate analysis was probably due to small sample size.

In the current study, there was fair agreement between the qSOFA, TRISS and the RTS scores for prediction of in hospital mortality, need for ICU admission and the need for surgery. The predicted mortality rate by TRISS was higher than that of qSOFA. Similar results were obtained in Jawa et al. study. In the current study, qSOFA performed fairly for predicting the need for an ICU admission as seen on the AUCROC curves. However, the performance of qSOFA in predicting the need for surgery was not as good. It was seen that none of the scores (qSOFA, RTS, and TRISS) were adequate discriminators of the need for surgical intervention. It may be because it is not the initial vital signs and neurologic status, but rather the sequential change in physiology that determines the need for an intervention.

A study by K. Miyamoto et al. [13] concluded that the qSOFA score can be applied to patients with trauma, as well as patients with suspected infection, in the pre-hospital setting. Most of these studies performed, lacked prospective validation and were subject to selection bias and to the errors of documentation and data entry, given their retrospective nature.

This current study however, isn't without limitations. Though it is a prospective study, the data and results are limited to a single institution and may not be representative of other institutional settings. qSOFA seems much more appropriate in the ED as just an early detection tool because the qSOFA can vary in a short time frame. Experts were not blinded to the value of the components of the scores, and this could be a source of incorporation bias. Mental status is assessed variably in different settings and can change along the course of hospitalization which may affect the performance of the qSOFA and affect its validity. The small sample size does not allow us to standardize. More multicentric prospective studies with a larger sample size, may help us validate this score better.

5. Conclusion

The qSOFA score serves as an extremely easy to calculate and an excellent tool to predict the mortality, in patients with blunt trauma. It also tells us about the need for an ICU admission, and the need for surgery in blunt trauma victims. Early recognition of an initial or perhaps serially abnormal qSOFA score could help guide earlier allocation of intensive resources to those patients at higher risk of death. Patients with higher qSOFA score could thus be directly shifted to the Intensive care unit from the emergency department. With further multicentric studies, this score can be used to independently predict adverse outcomes easily.

Research quality and ethics statement

The authors of this manuscript declare that this scientific work complies with reporting quality, formatting and reproducibility guidelines, as per the PROCESS 2020 guidelines [17]. The study was declared exempt by the Institutional review board at Grant Medical College and Sir J.J. group of hospitals, Mumbai on March 28, 2018 (reference number- IEC/PG/162/MAR/2018). This study is not funded.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Ethical approval

Research studies involving patients require ethical approval. Please state whether approval or exemption has been given, name the relevant ethics committee and the state the reference number for their judgement. Please give a statement regarding ethnical approval that will be included in the publication of your article, if the study is exempt from ethnical approval in your institution please state this.

Funding

No funding received.

CRediT authorship contribution statement

Nidhisha Sadhwani: Conceptualization, Data curation, Formal analysis, Writing – original draft. **Vinaya Ambore:** Conceptualization, Writing – original draft. **Girish Bakhshi:** Conceptualization, Formal analysis, Writing – original draft.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.amsu.2022.103265.

References

[1] M. Kahloul, W. Bouida, H. Boubaker, S. Toumi, M.H. Grissa, A. Jaafar, et al., Value of anatomic and physiologic scoring systems in outcome prediction of trauma patients, Eur. J. Emerg. Med. 21 (2014) 125–129.

[2] M. Singer, C.S. Deutschman, C.W. Seymour, M.S. Hari, D. Annan, M. Bauer, et al., The third international consensus definitions for sepsis and septic shock (Sepsis-3), JAMA 315 (2016) 801–810.

[3] C.W. Seymour, V.X. Liu, T.J. Iwashyna, F.M. Brunkhorst, T.D. Rea, A. Scherag, et al., Assessment of clinical criteria for sepsis: for the third international consensus definitions for sepsis and septic shock (Sepsis-3), JAMA 315 (2016) 762–774.

[4] Y. Freund, N. Lemachatti, E. Krastinova, M.V. Laer, Y.E. Claessens, A. Avondo, et al., Prognostic accuracy of Sepsis-3 criteria for in-hospital mortality among patients with suspected infection presenting to the emergency department, JAMA 317 (2017) 301–308.

[5] A.J. Singer, J. Ng, H.C. Thode Jr., R. Spiegel, S. Weingart, Quick SOFA scores predict mortality in adult ED patients with and without suspected infection, Ann. Emerg. Med. (2017) 475–479.

[6] R.S. Jawa, J.A. Vosswinkel, J.E. McCormack, E.C. Huang, H.C. Thode Jr., M. J. Shapiro, et al., Risk assessment of the blunt trauma victim: the role of the quick Sequential Organ Failure Assessment Score (qSOFA), Am. J. Surg. 214 (2017) 397–401.

[7] D.R. Goldhill, A. Sumner, Outcomes of intensive care patients in a group of British intensive care units, Crit. Care Med. 26 (1998) 1337–1345.

[8] C.P. Subbe, Validation of physiological scoring systems in the accident and emergency department, Emerg. Med. J. 23 (2006) 841–845.

[9] 'Outcome information', National Trauma Data Standard (NTDS) Data Dictionary, American College of Surgeons National Trauma Data Bank, 2018, pp. 155–162.

[10] M.N. Chawda, F. Hildebrand, H.C. Pape, P.V. Giannoudis, Injury 35 (2004) 347–358.

[11] J.L. Vincent, A. de Mendonça, F. Cantraine, R. Moreno, J. Takala, P. Suter, et al., Use of the SOFA score to assess the incidence of organ dysfunction/failure in intensive care units: results of a multicentric, prospective study, Crit. Care Med. 26 (1998) 1793–1800.

[12] J.L. Vincent, R. Moreno, Clinical review: scoring systems in the critically ill, Crit. Care 14 (2010) 207.

[13] Kyohei Miyamoto, Naoaki Shibata, Atsuhiro Ogawa, Tsuyoshi Nakashima, Seiya Kato, Prehospital quick sequential organ failure assessment score to predict in-hospital mortality among patients with trauma, AJEM (Am. J. Emerg. Med.) 37 (2019) 2165–2170.

[14] M.W. Kang, S.Y. Ko, S.W. Song, W.J. Kim, Y.J. Kang, et al., Prognostic accuracy of the quick sequential organ failure assessment for outcomes among patients with trauma in the emergency department: a comparison with the modified early warning score, revised trauma score, and injury severity score, J Trauma Inj 34 (1) (2021) 3–12.

[15] W. Huang, P. Yang, F. Xu, et al., Predictive value of qSOFA score for death in emergency department resuscitation room among adult trauma patients:a retrospective study, BMC Emerg Med 21 (103) (2021). https://doi.org/10.1186/s12873-021-00498-0.

[16] W. Huang, P. Yang, F. Xu, D. Chen, Predictive value of qSOFA score for death in emergency department resuscitation room among adult trauma patients: a retrospective study, BMC Emerg. Med. 1 (2021 Jan) (under review).

[17] R.A. Agha, C. Sohrabi, G. Mathew, T. Franchi, A. Kerwan, O'Neill N for the PROCESS Group, The PROCESS 2020 guideline: updating consensus preferred reporting of CasE series in surgery (PROCESS) guidelines, Int. J. Surg. (2020) 60 (article in press).