Original Article

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Comparison of qSOFA Score Versus qSOFA + Serum Lactate Score for Prediction of Mortality in Patients with Intra-Abdominal Sepsis

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Citation

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Abstract

Background: Abdominal sepsis leading to septic shock is a common surgical condition and leading cause of admission in the surgical intensive care unit (ICU). Lactate has been shown to predict adverse outcomes in patients with suspected infection along with quick sequential organ failure assessment (qSOFA) score. The study aimed to compare the predictive accuracy of the quick Sequential Organ Failure Assessment (qSOFA) score and lactate-enhanced qSOFA (LqSOFA) score for in-hospital mortality among patients presenting with intra-abdominal sepsis to the emergency department.

Methods: A prospective comparative study was conducted at Kathmandu Medical College Teaching Hospital, Nepal, from January 1, 2023, to December 31, 2023. Patients with intra-abdominal infection presenting with features of sepsis or septic shock were included. After obtaining ethical clearance (reference number: 0403202006), data on qSOFA and LqSOFA scores were collected using a standardized proforma, and outcomes were recorded. Statistical analysis was performed using SPSS version 26. Continuous variables were compared using the Student's t-test, categorical variables using the Chi-square test, and Receiver Operating Characteristic (ROC) curve analysis was performed to determine discriminative ability. Youden's Index was used to identify the optimal cut-off value for mortality prediction.

Results: A total of 114 patients who were diagnosed with intra-abdominal sepsis meeting the inclusion criteria were analysed. The mortality rate was 22.8% (n=26). The LqSOFA score presented the most significant discrimination with an area under the receiver operating characteristic curve (AUROC) of 0.664 (95% CI: 0.53-0.79) higher than the AUROC of the qSOFA, AUROC 0.575 (95% CI: 0.43-0.71). The addition of lactate threshold identified higher proportion of patients at risk of mortality.

Conclusion: This study suggests that LqSOFA score is a better predictor of mortality than the qSOFA score alone in patients with intra-abdominal sepsis.

Keywords: Lactate; LqSOFA; Mortality; Sepsis; qSOFA

Declarations

Ethics approval and consent to participate: This study was conducted with prior ethical approval from Institutional Review Committee of KMCTH (reference number: 0403202006) and informed consent has been obtained from participants prior to the enrollment.

Consent for publication: Informed consent was obtained from the patient for the publication of identifying features along with the manuscript.

Availability of data and materials: The full data set supporting this research is available with the corresponding author upon request by the readers.

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BACKGROUND

Abdominal sepsis leading to septic shock is a significant surgical condition frequently encountered in clinical practice, often necessitating intensive care unit (ICU) admission [1]. Septic shock arises from a systemic inflammatory response to microbial infection, resulting in hypotension despite fluid resuscitation, potentially leading to multiple organ dysfunction and death [1,2,3]. Despite advancements, a definitive diagnostic test for sepsis remains elusive, posing challenges in clinical practice [4]. Initially sequential organ failure assessment (SOFA) score was developed, but its complexity prompted the introduction of quick SOFA (qSOFA) for rapid assessment [5]. The qSOFA score, though useful, has limitations in sensitivity, particularly for abdominal sepsis where altered mental status is less common [6,7]. Addition of serum lactate to qSOFA score called LqSOFA enhances sensitivity for predicting adverse sepsis outcomes [6,7]. Hence, this study aimed to compare the qSOFA score with LqSOFA to predict the outcome of patients with intra-abdominal sepsis, potentially enhancing diagnostic precision and patient outcomes in in the context of the Nepalese population.

METHODS

A prospective analytical comparative cross sectional study was conducted on patients with intra-abdominal infection with sepsis or septic shock at Department of Surgery, Kathmandu Medical College and Teaching Hospital (KMCTH), Sinamangal, Kathmandu, Nepal between January 1, 2023, to December 31, 2023. Ethical clearance was obtained from the Institutional Review Committee of KMCTH (reference number: 0403202006). All patients with intra-abdominal infection with features of sepsis or septic shock who presented at the emergency and all post-operative patients with similar features were included in the study after obtaining informed consent. The patients who denied consent to participate in the study were excluded. Non-probability convenience sampling method was used. The sample size was calculated using the methods of Buderer et al [8]:

$$TP + FN = Z^2 \times \frac{\text{Sensitivity (1-Sensitivity)}}{W^2}$$

$$TP + FN = Z^2 \times \frac{(3.84)^2 * 0.96 * (1 - 0.96)}{(0.1)^2} = 14$$

$$TN + FP = Z^2 \times \frac{\text{Sensitivity (1-Sensitivity)}}{W^2}$$

$$TN + FP = Z^2 \times \frac{(3.84)^2 * 0.87 * (1 - 0.87)}{(0.1)^2} = 43.43$$

Where,

TP: True positive, TN: True negative, FP: False positive, FN: False negative, W= margin of error= 10%

Z, the normal distribution value, is set to 3.84

Sensitivity and specificity taken from previous study [9].

Sensitivity = 96% = 0.96, 1-Sensitivity = 0.04, Specificity = 87% = 0.87, 1-Specificity = 0.13

Prevalence = 27% = 0.27 (Prevalence of sepsis) [10]

Now, N required for sensitivity and N required for specificity:

- N required for sensitivity

$$\frac{TP + FN}{P} = \frac{14.74}{0.27} = 54.59$$

- N required for specificity

$$\frac{TN + FP}{1-P} = \frac{43.43}{0.73} = 59.49$$

Total required sample size = 54.59 + 59.49 ≈ 114

The qSOFA components (respiratory rate ≥ 22/min, systolic blood pressure ≤ 100 mmHg, and Glasgow Coma Scale < 15) and serum lactate levels were measured at the time of admission to the emergency department, prior to initiation of resuscitation or antibiotic therapy. Patients were subsequently managed according to standard institutional protocols and followed until discharge or death Potential confounding factors, such as comorbidities, ASA grade, abdominal pathology, and type of management, were expected to affect both qSOFA and LqSOFA scores similarly. Therefore, their inclusion or exclusion would not alter the primary comparison between the two scoring systems, and separate adjustment for these variables was not performed in this study. The LqSOFA score was calculated by incorporating serum lactate into the conventional qSOFA score (<2 mmol/L = 0, 2–4 mmol/L = 1, ≥4 mmol/L = 2). Patients were not stratified into mild, moderate, or severe categories based on lactate levels, as this was beyond the scope of the study. This approach allowed consistent use of the scoring system and focused the analysis specifically on comparing the ability of qSOFA and LqSOFA to predict in-hospital mortality.

The data was entered and analyzed in SPSS 26 version. Data were analyzed using IBM SPSS Statistics version26. Continuous variables were expressed as mean ± standard deviation, categorical variables as frequencies and percentages. Inter-group comparisons were performed using the Student's t-test. Diagnostic performance of the qSOFA and LqSOFA scores for mortality prediction was assessed through Receiver Operating Characteristic (ROC) curve analysis, with computation of Area Under the Curve (AUC) and 95% Confidence Intervals (CI). The

Youden Index (J = Sensitivity + Specificity – 1) was used to determine the optimal cut-off providing the best trade-off between sensitivity and specificity.

RESULTS

This study included 114 patients admitted to the surgery department with intra-abdominal sepsis over a duration of one year. Among this cohort, there was a male preponderance, with 60.52% (n=69) compared to 39.47% (n=45) female patients. The mean age of all patients was 47.53±15.57 years (male =. 47.67±16.32 years and female= 47.30±14.62 years). The recorded mortality this study was 22.8% (n =26), out of which 14.03% (n=16) female and 8.77% (n=10) were male. The median post-operative hospital stay was 7 days. The mean lactate was found to be 2.44mmol/L. The other baseline details of the data are listed in **table 1**.

Table 1: Baseline characteristics

Parameters	Mean	Standard deviation
Temperature (°F)	99.46	1.94
Heart rate (bpm)	97.37	23.50
Respiratory rate (bpm)	22.46	7.54
Systolic pressure (mmHg)	110.61	21.21
Diastolic Pressure (mmHg)	69.60	13.36
SPO2 (%)	94.97	4.90
Lactate (mmol/L)	2.44	1.80

The LqSOFA score demonstrated substantial discrimination in predicting mortality, with an Area Under the Receiver Operating Characteristic (AUROC) curve of 0.664 with a standard error of 0.065. The 95% Confidence Interval for this AUROC is between 0.53 and 0.79. The AUROC of qSOFA score was 0.575 with a standard error of 0.072 **(Figure 1)**. The LqSOFA score had a higher AUROC (0.664) compared to the qSOFA score (0.575). This indicates that the LqSOFA score was more effective in predicting mortality in these patients compared to the qSOFA score **(Figure 1, Table 2)**.

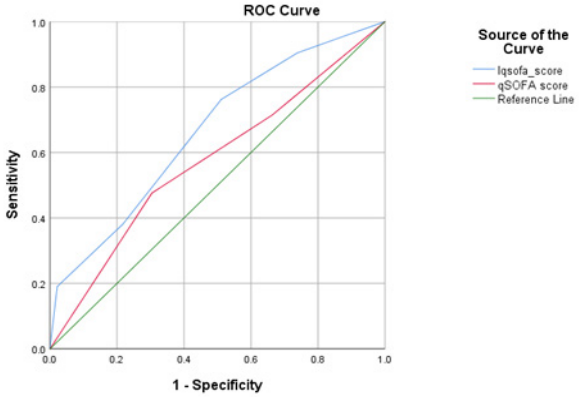

Figure 1: Receiver Operating Characteristic (AUROC) curve for LqSOFA and qSOFA score.

Table 2: Area under the curve values for LqSOFA and qSOFA

Test Result Variable(s)	Area	Asymptotic 95% Confidence Interval	
		Lower Bound	Upper Bound
Lqsofa_score	0.664	0.536	0.793
qSOFA score	0.575	0.433	0.716

The optimal diagnostic threshold, determined using the Youden Index, was LqSOFA ≥ 2 (cut-off 1.5). This point yielded the best balance between sensitivity and specificity, confirming that inclusion of lactate ≥ 2 mmol/L meaningfully enhances predictive performance **(Table 3)**.

Table 3: Youden index of LqSOFA and qSOFA at different

Score	Cut-off Value	Equivalent Score (≥)	Sensitivity (%)	Specificity (%)	Youden Index
LqSOFA	≥ 0.5	1	90.5	26.1	0.166
	≥ 1.5	2	76.2	48.9	0.251
	≥ 2.5	3	38.1	78.3	0.164
	≥ 3.5	4	19.0	97.8	0.168
qSOFA	≥ 0.5	1	71.4	33.7	0.051
	≥ 1.5	2	47.6	69.6	0.172
	≥ 3.0	3	0.0	100.0	0.000

DISCUSSION

According to the Third International Consensus report, sepsis is defined as life-threatening organ dysfunction that develops as a result of an impaired host response to infection [7]. In some studies, the mortality rate associated with sepsis has been documented to reach as high as 24% [11]. In our study, the mortality rate was 22.8%. Septic shock, a subset of sepsis, advances with profound circulatory, cellular, and metabolic abnormalities, heightening the risk of mortality [7]. Severe sepsis is characterized by the presence of sepsis along with sepsis-induced organ dysfunction or tissue hypoperfusion [4]. It ranks as the tenth most frequent cause of death worldwide and stands as the primary cause of death in individuals with infections, particularly when sepsis is not promptly recognized and treated [11].

Sepsis risk factors encompass advanced age, comorbidity (like diabetes, kidney or respiratory disease), infection source, infection location (e.g., hospital-acquired), and the patient's care unit (such as ICU or emergency department) [7]. The prevalence of severe sepsis is notably high among the elderly, with over half of sepsis patients being over 65 years old. Additionally, a majority of sepsis cases involve at least one chronic disease [7]. Esper et al. reported that males and non-white races are at higher risk

of sepsis, other epidemiological studies and randomized controlled trials have also noted a higher occurrence of sepsis among males [12]. In our study, the mean age was 47.53±15.57 years, and 60.52% (n=69) of the patients were male, indicating a preponderance of males over females. A previous retrospective study conducted by Toker et al. reported that the median value of hospital stay was 5.72 days [7]. In contrast, the median hospital stay in our study was 7 days.

Identifying individuals at an elevated risk of mortality in sepsis can lead to a more effective formulation of therapeutic approaches, encompassing investigation, monitoring, and intensive treatments [11]. In recent years, researchers have introduced effective evaluation methods, like the sequential organ failure assessment (SOFA) score, known for its high accuracy and widespread adoption [11]. However, the SOFA score involves time-consuming laboratory testing parameters [12]. To address this, various rapid and straightforward emergency department (ED) scoring systems, such as qSOFA, systemic inflammatory response syndrome (SIRS) criterion, modified early warning score (MEWS), and mortality in emergency department sepsis (MEDS), have been employed to predict mortality in patients admitted to EDs across diverse situations [11, 12]. According to recent studies, the combination of bedside lactate and qSOFA, known as the LqSOFA, is a valuable and swift predictor of mortality in sepsis patients [13]. Lactate has been consistently employed as a dependable indicator for anaerobic metabolism, and consequently, of tissue hypoperfusion in cases of sepsis [13]. A survival analysis was performed to assess the prognostic significance of lactate levels [11]. The findings revealed that patients with lower lactate levels exhibited superior short-term and long-term survival outcomes [11]. Conversely, those with elevated lactate levels demonstrated higher rates of mortality, including 30-day, 90-day, 1-year, and in-hospital mortality [11].

Shetty et al., in a cohort of 12,555 sepsis cases, reported that adding a lactate threshold ≥2 mmol/L to form the LqSOFA score (≥2) increased sensitivity for detecting adverse outcomes to 65.5%. The AUCs for LqSOFA and qSOFA were 0.687 and 0.676, respectively, with LqSOFA demonstrating significantly better predictive performance and suitability for Sepsis-3 screening. [13]. Lopez-Izquierdo et al. reported that the predictive power of the qSOFA scale to discriminate the presence of sepsis was evidenced by an AUC of the ROC curve of 0.757 (95% CI: 0.65–0.81) and LqSOFA reached 0.784 (95% CI: 0.72–0.84) [14]. Seymour et al. reported that as per the Kaiser Permanente Northern California (KPNC) data, incorporating serum lactate levels of 2.0 mmol/L or higher into qSOFA (modified to a 4-point score with an additional point for elevated serum lactate) significantly altered the predictive accuracy of qSOFA [15]. The area under the receiver operating characteristic curve (AUROC) with lactate was 0.80 (95% CI, 0.79-0.81), compared to AUROC without lactate at 0.79 (95% CI, 0.78-0.80), with a statistically significant difference ($P < 0.001$) [15]. Our study revealed comparable results; the LqSOFA score demonstrated notable discrimination with an AUROC of 0.664 (95% CI: 0.53-0.79). Moreover, the AUROC for hospital mortality with the LqSOFA score surpassed that of qSOFA, standing at 0.575 (95% CI: 0.43-0.71).

A drawback of this research is its limited sample size and the fact that it is a single-center study, preventing the generalization of the findings.

CONCLUSIONS

This study demonstrates that the combined qSOFA and serum lactate score (LqSOFA) provides superior predictive accuracy for mortality in patients presenting with intra-abdominal sepsis compared to the qSOFA score alone. Measurement of serum lactate at admission alongside qSOFA enables better risk stratification, facilitating timely identification of patients at higher risk of adverse outcomes. Thus, the LqSOFA score is a valuable, rapid bedside tool that enhances clinical decision-making in emergency surgical settings.

References

1. Antman EM, Loscalzo J. Harrison's Principles of Internal Medicine. Harrison's principles of internal medicine.2015;644457. Available from: https://books.google.com.np/books/about/Harrison_s_Principles_of_Internal_Medici.html?id=7gxjMV8hClsC&redir_esc=y
2. Dellinger RP, Carlet JM, Masur H, Gerlach H, Calandra T, Cohen J, et al. Surviving sepsis campaign guidelines for management of severe sepsis and septic shock. Crit Care Med. 2004;32(3):858–73. DOI: 10.1097/01.ccm.0000117317.18092.e4
3. Dellinger RP, Levy MM, Carlet JM, Bion J, Parker MM, Jaeschke R, et al. Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock: 2008. Crit Care Med. 2008;36(1):296–327. DOI: 10.1097/01.CCM.0000298158.12101.41
4. Dellinger RP, Levy M, Rhodes A, Annane D, Gerlach H, Opal SM, et al. Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock: 2012. Crit Care Med. 2013;41(2):580–637. DOI: 10.1097/CCM.0b013e31827e83af
5. Seymour CW, Liu VX, Iwashyna TJ, Brunkhorst FM, Rea TD, Scherag A, et al. Assessment of clinical criteria for sepsis: for the third international consensus definitions for sepsis and septic shock (Sepsis-3). JAMA. 2016;315(8):762–74. DOI: 10.1001/jama.2016.0288
6. Srzić I, Nesek Adam V, Tunjić Pejak D. Sepsis Defination: What's new in the treatment guidelines. Acta Clin Croat. 2022;61(Suppl 1):67-72. DOI: 10.20471/acc.2022.61.s1.11
7. Kilinc Toker A, Kose S, Turken M. Comparison of SOFA Score, SIRS, qSOFA, and qSOFA + L Criteria in the Diagnosis and Prognosis of Sepsis. Eurasian J Med. 2021;53(1):40-47. DOI: 10.5152/eurasianjmed.2021.20081
8. Buderer NM. Statistical methodology: I. Incorporating the prevalence of disease into the sample size calculation for sensitivity and specificity. Acad Emerg Med. 1996;3(9):895-900. DOI: 10.1111/j.1553-2712.1996.tb03538.x
9. Baig MA, Sheikh S, Hussain E, Bakhtawar S, Subhan Khan M, Mujtaba S, Waheed S. Comparison of qSOFA and SOFA score for predicting mortality in severe sepsis and septic shock patients in the emergency department of a low middle income country. Turk J Emerg Med. 2018;18(4):148-151. DOI: 10.1016/j.tjem.2018.08.002
10. Current evidence, identifying gaps and future directions Global report on the Eppidemiology and Burden of Sepsis. 2020. Available from: https://iris.who.int/bitstream/handle/10665/334216/9789240010789-eng.pdf
11. Liu S, He C, He W, Jiang T. Lactate-enhanced-qSOFA (LqSOFA) score is superior to the other four rapid scoring tools in predicting in-hospital mortality rate of the sepsis patients. Ann Transl Med. 2020;8(16):1013. DOI: 10.21037/atm-20-5410
12. Esper AM, Moss M, Lewis CA, Nisbet R, Mannino DM, Martin GS. The role of infection and comorbidity: Factors that influence disparities in sepsis. Crit Care Med. 2006;34(10):2576-82. DOI: 10.1097/01.CCM.0000239114.50519.0E
13. Shetty A, MacDonald SP, Williams JM, van Bockxmeer J, de Groot B, Esteve Cuevas LM, et al. Lactate ≥2 mmol/L plus qSOFA improves utility over qSOFA alone in emergency department patients presenting with suspected sepsis. Emerg Med Australas. 2017;29(6):626-634. DOI: 10.1111/1742-6723.12894
14. López-Izquierdo R, Sci AM, Martín-Rodríguez F, Castro Villamor MA, Delpozo-Vegas C, Sánchez-Soberón I, et al. Clinical research Head-to-head comparison of pre-hospital qSOFA and lactate-qSOFA for predicting sepsis in patients with and without suspected infection. A multicenter prospective cohort study. 2020. Available from: https://www.archivesofmedicalscience.com/pdf-116676-59682?filename=Head_to_head%20comparison.pdf
15. Seymour CW, Liu VX, Iwashyna TJ, Brunkhorst FM, Rea TD, Scherag A, et al. Assessment of Clinical Criteria for Sepsis: For the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA. 2016;315(8):762-74. DOI: 10.1001/jama.2016.0288