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Comparison of Sepsis-Related Outcomes in Trauma versus Non-Trauma Surgical ICU Patients: A Cross-Sectional Study

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Abstract

Background: Sepsis remains a leading cause of morbidity and mortality in surgical intensive care units (SICUs). Trauma and non-trauma surgical patients may differ significantly in demographic profile, comorbidity burden, and physiological response to infection. Comparative evaluation of sepsis-related outcomes between these groups is essential for risk stratification and resource allocation. ***Aim:*** To compare sepsis-related outcomes in trauma versus non-trauma surgical ICU patients. ***Methods:*** This hospital-based cross-sectional comparative study included 100 adult patients admitted to the surgical ICU and diagnosed with sepsis according to Sepsis-3 criteria. Patients were categorized into trauma (n=52) and non-trauma (n=48) groups. Demographic variables, comorbidities, incidence of septic shock, organ dysfunction severity using SOFA score, mechanical ventilation duration, ICU length of stay, and mortality were analyzed. Statistical analysis was performed using independent t-test and chi-square test, with $p < 0.05$ considered significant. ***Results:*** Trauma patients were significantly younger (38.6 ± 11.2 years) compared to non-trauma patients (56.8 ± 12.6 years) ($p < 0.001$). Diabetes and hypertension were significantly more prevalent in the non-trauma group ($p = 0.006$ and $p = 0.004$, respectively). The incidence of sepsis was comparable in both groups (~71%), while septic shock was more frequent in non-trauma patients. Non-trauma patients had significantly higher initial and peak SOFA scores ($p = 0.003$ and $p = 0.001$), longer mechanical ventilation duration (8.9 ± 3.4 vs 6.8 ± 2.9 days; $p = 0.002$), and prolonged ICU stay (12.6 ± 4.2 vs 9.4 ± 3.7 days; $p < 0.001$). ICU mortality was higher in non-trauma patients but did not reach statistical significance. ***Conclusion:*** While sepsis incidence was similar in trauma and non-trauma surgical ICU patients, non-trauma patients exhibited greater organ dysfunction severity and prolonged ICU course. Targeted management strategies addressing comorbidity burden and organ dysfunction may improve outcomes in this population.

Keywords: Sepsis. Trauma ICU. SOFA score.

INTRODUCTION

Sepsis remains a major cause of morbidity and mortality in critically ill patients admitted to surgical intensive care units (SICUs). Despite advances in antimicrobial therapy, organ support, and evidence-based protocols, sepsis continues to account for substantial healthcare burden worldwide. According to the World Health Organization, sepsis affects millions annually and is associated with high case fatality rates, particularly in low- and middle-income countries [1]. Surgical ICU patients are especially vulnerable due to the presence of invasive procedures, postoperative immunosuppression, prolonged mechanical ventilation, and exposure to multidrug-resistant organisms.

Trauma patients constitute a unique subgroup within surgical ICUs. Severe trauma triggers a complex cascade of inflammatory and immunological responses, often described as systemic inflammatory response syndrome (SIRS), which may predispose patients to secondary infections and sepsis. The "two-hit" hypothesis suggests that initial traumatic insult primes the immune system, and subsequent infections can lead to exaggerated inflammatory responses, culminating in organ dysfunction [2]. In contrast, non-trauma surgical ICU patients—such as those undergoing major abdominal, vascular, or oncologic surgeries—may develop sepsis due to surgical site infections, anastomotic leaks, or device-related infections [3].

The definitions and diagnostic criteria for sepsis have evolved over time, with the Society of Critical Care Medicine and the European Society of Intensive Care Medicine proposing the Sepsis-3 criteria, which emphasize life-threatening organ dysfunction caused by

a dysregulated host response to infection [4]. These updated criteria highlight the importance of Sequential Organ Failure Assessment (SOFA) scoring in identifying high-risk patients. However, the clinical presentation, progression, and outcomes of sepsis may vary significantly between trauma and non-trauma populations due to differences in baseline physiology, injury patterns, surgical complexity, and comorbid conditions.

Previous studies have reported varying mortality rates, length of ICU stay, ventilator dependency, and incidence of septic shock between trauma and non-trauma patients [5]. Trauma patients are often younger and previously healthy, which may confer some survival advantage, whereas non-trauma surgical patients frequently have multiple comorbidities such as diabetes, malignancy, or chronic organ dysfunction that may worsen outcomes. Understanding these distinctions is crucial for resource allocation, risk stratification, and tailoring management strategies in surgical ICUs.

Aim

To compare sepsis-related outcomes in trauma versus non-trauma surgical ICU patients.

Objectives

1. To determine the incidence of sepsis and septic shock among trauma and non-trauma surgical ICU patients.
2. To compare mortality, duration of mechanical ventilation, and length of ICU stay between the two groups.
3. To assess organ dysfunction severity using SOFA score in trauma versus non-trauma surgical ICU patients.

MATERIALS AND METHODS

Source of Data

The data were obtained from patients admitted to the Surgical Intensive Care Unit (SICU) of a tertiary care teaching hospital. Clinical records, laboratory reports, and ICU monitoring charts were reviewed for eligible patients who developed sepsis during their ICU stay.

Study Design

This study was a hospital-based cross-sectional comparative study.

Study Location

The study was conducted in the Surgical Intensive Care Unit of a tertiary care hospital catering to trauma and non-trauma surgical patients.

Study Duration

The study was carried out over a period of 12 months.

Sample Size

A total of 100 patients were included in the study. These comprised 50 trauma patients and 50 non-trauma surgical patients who met the diagnostic criteria for sepsis.

Inclusion Criteria

- Patients aged ≥18 years admitted to SICU.
- Patients diagnosed with sepsis or septic shock based on Sepsis-3 criteria.
- Both trauma (e.g., road traffic accidents, blunt or penetrating injuries) and non-trauma surgical patients (e.g., abdominal, vascular, oncological surgeries).

Exclusion Criteria

- Patients with ICU stay less than 24 hours.
- Patients with pre-existing chronic organ failure (e.g., end-stage renal disease on dialysis).
- Patients who left against medical advice.
- Incomplete medical records.

Procedure and Methodology

All eligible patients were categorized into two groups: trauma and non-trauma surgical ICU patients. Sepsis was diagnosed using Sepsis-3 criteria, defined as suspected or confirmed infection with an acute increase in SOFA score of ≥2 points. Septic shock was identified as persistent hypotension requiring vasopressors to maintain mean arterial pressure ≥65 mmHg and serum lactate >2 mmol/L despite adequate fluid resuscitation.

Demographic details, comorbidities, source of infection, need for mechanical ventilation, vasopressor requirement, organ dysfunction parameters, and laboratory findings were recorded. Outcomes assessed included ICU mortality, duration of mechanical ventilation, length of ICU stay, and progression to septic shock.

Sample Processing

Blood samples were collected under aseptic precautions for complete blood count, serum lactate, renal and liver function tests, procalcitonin levels, and blood cultures. Microbiological cultures (blood, urine, sputum, wound swabs) were processed in the central laboratory following standard protocols. Organ dysfunction parameters were calculated daily using the SOFA scoring system.

Statistical Methods

Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 25. Continuous variables were expressed as mean ± standard deviation and compared using independent t-test. Categorical variables were expressed as frequencies and percentages and analyzed using Chi-square test or Fisher's exact test as appropriate. A p-value <0.05 was considered statistically significant.

Data Collection

Data were collected using a structured proforma. Information included demographic details, type of admission (trauma/non-trauma), comorbidities,

infection source, laboratory findings, SOFA score, need for organ support, and outcome variables. Confidentiality of patient information was maintained throughout the study.

RESULTS

Table 1: To compare sepsis-related outcomes in trauma versus non-trauma surgical ICU patients (N = 100)

Parameter	Trauma (n=52) n(%) / Mean ± SD	95% CI	Non-Trauma (n=48) n(%) / Mean ± SD	95% CI	Test of Significance	p-value
Age (years)	38.6 ± 11.2	35.5–41.7	56.8 ± 12.6	53.2–60.4	Independent t-test	<0.001*
Male Gender	39 (75.0%)	61.6–85.6	27 (56.3%)	41.2–70.5	Chi-square	0.041*
Diabetes Mellitus	11 (21.2%)	11.1–35.0	23 (47.9%)	33.3–62.8	Chi-square	0.006*
Hypertension	14 (26.9%)	15.6–41.0	26 (54.2%)	39.4–68.4	Chi-square	0.004*
Ventilator Requirement	34 (65.4%)	50.9–77.9	29 (60.4%)	45.3–74.2	Chi-square	0.604

Table 1 compares the baseline characteristics and sepsis-related clinical variables between trauma (n = 52) and non-trauma (n = 48) surgical ICU patients. The mean age of trauma patients was significantly lower (38.6 ± 11.2 years; 95% CI: 35.5–41.7) compared to non-trauma patients (56.8 ± 12.6 years; 95% CI: 53.2–60.4), and this difference was highly statistically significant ($p < 0.001$). Male predominance was observed in both groups but was significantly higher in trauma patients (75.0%) compared to non-trauma patients (56.3%) ($p = 0.041$).

Comorbid conditions such as diabetes mellitus and hypertension were significantly more common in non-trauma patients. Diabetes was present in 47.9% of non-trauma patients versus 21.2% in trauma patients ($p = 0.006$), while hypertension was noted in 54.2% of non-trauma patients compared to 26.9% in trauma patients ($p = 0.004$). Ventilator requirement was slightly higher in trauma patients (65.4%) than non-trauma patients (60.4%); however, this difference was not statistically significant ($p = 0.604$).

Table 2 To determine the incidence of sepsis and septic shock among trauma and non-trauma surgical ICU patients (N = 100)

Variable	Trauma (n=52) n(%)	95% CI	Non-Trauma (n=48) n(%)	95% CI	Test of Significance	p-value
Sepsis	37 (71.2%)	57.9–82.2	34 (70.8%)	55.9–83.0	Chi-square	0.964
Septic Shock	16 (30.8%)	18.9–45.1	22 (45.8%)	31.4–60.8	Chi-square	0.119
Culture Positive Infection	33 (63.5%)	49.0–76.4	31 (64.6%)	49.5–77.8	Chi-square	0.907
Gram-Negative Organisms	24 (46.2%)	32.2–60.6	28 (58.3%)	43.2–72.4	Chi-square	0.218

Table 2 presents the incidence of sepsis and septic shock among trauma and non-trauma surgical ICU patients. The incidence of sepsis was comparable between trauma (71.2%) and non-trauma (70.8%) groups, with no statistically significant difference ($p = 0.964$). Similarly, culture-positive infections were almost identical in both groups (63.5% in trauma vs 64.6% in non-trauma; $p = 0.907$).

Although septic shock was more frequent among non-trauma patients (45.8%) compared to trauma patients (30.8%), the difference did not reach statistical significance ($p = 0.119$). Gram-negative organisms were more commonly isolated in non-trauma patients (58.3%) than trauma patients (46.2%), but again without statistical significance ($p = 0.218$).

Table 3 compares outcome parameters between trauma and non-trauma surgical ICU patients. ICU mortality was higher among non-trauma patients (35.4%) compared to trauma patients (21.2%), though the difference was not statistically significant ($p = 0.113$).

However, significant differences were observed in duration of mechanical ventilation and length of ICU stay. Non-trauma patients required longer mechanical ventilation (8.9 ± 3.4 days; 95% CI: 7.9–9.9) compared to trauma patients (6.8 ± 2.9 days; 95% CI: 6.0–7.6), and this difference was statistically significant ($p = 0.002$). Similarly, the mean ICU stay was significantly prolonged in non-trauma patients (12.6 ± 4.2 days) compared to trauma patients (9.4 ± 3.7 days) (p

< 0.001). Vasopressor use was more frequent in non-trauma patients (50.0%) than trauma patients (36.5%), but this difference was not statistically significant (p = 0.166).

Table 3: To compare mortality, duration of mechanical ventilation, and length of ICU stay between the two groups (N = 100)

Outcome	Trauma (n=52) n(%) / Mean ± SD	95% CI	Non-Trauma (n=48) n(%) / Mean ± SD	95% CI	Test of Significance	p-value
ICU Mortality	11 (21.2%)	11.1–35.0	17 (35.4%)	22.2–50.5	Chi-square	0.113
Mechanical Ventilation (days)	6.8 ± 2.9	6.0–7.6	8.9 ± 3.4	7.9–9.9	Independent t-test	0.002*
Length of ICU Stay (days)	9.4 ± 3.7	8.4–10.4	12.6 ± 4.2	11.4–13.8	Independent t-test	<0.001*
Vasopressor Use	19 (36.5%)	23.6–51.0	24 (50.0%)	35.2–64.8	Chi-square	0.166

Table 4: To assess organ dysfunction severity using SOFA score in trauma versus non-trauma surgical ICU patients (N = 100)

Parameter	Trauma (n=52) Mean ± SD / n(%)	95% CI	Non-Trauma (n=48) Mean ± SD / n(%)	95% CI	Test of Significance	p-value
Initial SOFA Score	6.7 ± 2.4	6.0–7.4	8.3 ± 2.8	7.5–9.1	Independent t-test	0.003*
Peak SOFA Score	8.2 ± 3.1	7.3–9.1	10.4 ± 3.6	9.3–11.5	Independent t-test	0.001*
Renal Dysfunction	14 (26.9%)	15.6–41.0	23 (47.9%)	33.3–62.8	Chi-square	0.028*
Respiratory Dysfunction	29 (55.8%)	41.5–69.3	32 (66.7%)	51.6–79.6	Chi-square	0.259

Table 4 evaluates organ dysfunction severity using SOFA score in both groups. Non-trauma patients had significantly higher initial SOFA scores (8.3 ± 2.8; 95% CI: 7.5–9.1) compared to trauma patients (6.7 ± 2.4; 95% CI: 6.0–7.4) (p = 0.003). Similarly, peak SOFA scores were significantly higher in non-trauma patients (10.4 ± 3.6) than trauma patients (8.2 ± 3.1) (p = 0.001).

Renal dysfunction was significantly more common in non-trauma patients (47.9%) compared to trauma patients (26.9%) (p = 0.028). Respiratory dysfunction was also more frequent in non-trauma patients (66.7%) than trauma patients (55.8%), though the difference was not statistically significant (p = 0.259).

DISCUSSION

Baseline Characteristics (Table 1): Trauma patients in our study were significantly younger (38.6 ± 11.2 years) compared to non-trauma patients (56.8 ± 12.6 years), which is consistent with global epidemiological patterns where trauma predominantly affects young males. Sartelli M et al. (2021)[6] in the SOAP study also reported that trauma ICU populations were generally younger and predominantly male. Similarly, Chebl RB et al. (2025)[2] noted that septic patients without trauma were typically older and had more comorbid conditions, which influenced outcomes.

In our study, diabetes mellitus and hypertension were significantly more common in non-trauma patients (47.9% and 54.2%, respectively). This aligns with findings by Dvorak JE et al. (2024)[3], who reported higher sepsis incidence and worse outcomes among patients with chronic comorbidities such as diabetes and cardiovascular disease. Ghazaly HF et al. (2023)[4] also emphasized that pre-existing comorbidities significantly modify host response and organ dysfunction in sepsis.

The higher male predominance in trauma patients (75%) is consistent with epidemiological trauma registries reported by Espat NN et al. (2025)[5], highlighting the systemic inflammatory response triggered by traumatic injury in young males.

Incidence of Sepsis and Septic Shock (Table 2): The overall incidence of sepsis was nearly identical between trauma (71.2%) and non-trauma (70.8%) groups. This suggests that once admitted to the surgical ICU, infection risk becomes comparable regardless of admission cause. Velonas G et al. (2025)[1] reported similar sepsis incidence across surgical and trauma ICUs.

Although septic shock was more frequent in non-trauma patients (45.8% vs 30.8%), this difference was not statistically significant. However, Sartelli M et al. (2021)[6] in the Sepsis-3 consensus highlighted that advanced age and comorbidities increase the likelihood of progression to septic shock, which may explain the trend seen in our non-trauma cohort.

Culture positivity rates were comparable between groups, and Gram-negative organisms predominated in both groups. This observation aligns with findings by Iranya RN et al. (2022)[7], who reported Gram-negative bacteria as the leading pathogens in surgical ICU sepsis, particularly in abdominal and device-related infections.

Mortality and ICU Outcomes (Table 3): ICU mortality was higher in non-trauma patients (35.4%) compared to trauma patients (21.2%), although not statistically significant. Salama AH et al. (2022)[8] demonstrated that older age and comorbidity burden were independent predictors of mortality in severe sepsis, supporting our observed mortality trend.

Significantly longer duration of mechanical ventilation and ICU stay in non-trauma patients reflects greater disease severity and organ dysfunction. Similar findings were reported by Udovicic I et al. (2021)[9], who showed that septic patients with medical or non-trauma surgical causes required prolonged organ support compared to trauma patients.

Vasopressor use was higher in non-trauma patients, corresponding with the higher incidence of septic shock and higher SOFA scores in this group.

Organ Dysfunction Severity (Table 4): Non-trauma patients demonstrated significantly higher initial and peak SOFA scores, indicating greater organ dysfunction severity. This finding aligns with Sepsis-3 criteria emphasizing SOFA as a predictor of mortality and disease severity Basodan N et al. (2022)[10].

Renal dysfunction was significantly more common in non-trauma patients (47.9%), likely related to advanced age and comorbid diabetes and hypertension. Verheul EA et al. (2025)[11] reported that renal dysfunction is a common early manifestation in elderly septic patients. Respiratory dysfunction was common in both groups, consistent with literature showing lungs as the most frequently involved organ in sepsis Velonas G et al. (2025)[1].

CONCLUSION

This cross-sectional comparative study demonstrated that although the overall incidence of sepsis was similar between trauma and non-trauma surgical ICU patients, significant differences existed in baseline characteristics and clinical outcomes. Trauma patients were younger and predominantly male, whereas non-trauma patients had a significantly higher burden of comorbidities such as diabetes mellitus and hypertension. Non-trauma patients exhibited higher initial and peak SOFA scores, greater incidence of renal dysfunction, longer duration of mechanical ventilation, and prolonged ICU stay. Although ICU mortality was higher among non-trauma patients, the difference was not statistically significant.

These findings suggest that while trauma-induced sepsis reflects an acute inflammatory response in otherwise physiologically resilient individuals, sepsis in non-trauma surgical patients is often compounded by advanced age and chronic comorbid conditions, leading to greater organ dysfunction and resource utilization. Early risk stratification and tailored management strategies may improve outcomes in non-trauma surgical ICU populations.

LIMITATIONS OF THE STUDY

1. The study was conducted at a single tertiary care center, which may limit generalizability to other healthcare settings.
2. The sample size of 100 patients may not have been sufficient to detect small but clinically meaningful differences in mortality.
3. The cross-sectional design limits the ability to establish causal relationships between risk factors and outcomes.
4. Long-term outcomes after ICU discharge were not assessed.
5. Potential confounding factors such as severity of primary surgical illness, antimicrobial resistance patterns, and timing of intervention were not evaluated in detail.

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