

Original Research

Evaluating the prognosis of sepsis versus non-sepsis critically sick patients under mechanical ventilation

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Abstract

Background: Sepsis is a life-threatening condition that often necessitates mechanical ventilation in critically ill patients. This study aims to compare the 6-month outcomes of sepsis and non-sepsis critically ill patients who received mechanical ventilation, shedding light on the long-term effects of these conditions.

Materials and Methods: A retrospective cohort study was conducted, including adult patients admitted to the intensive care unit (ICU) between January 2022 to December 2022. Patients were divided into two groups: sepsis and non-sepsis. Demographic data, comorbidities, Acute Physiology and Chronic Health Evaluation II (APACHE II) scores, and mechanical ventilation duration were collected. Primary outcomes included mortality, length of ICU stay, and ventilator-associated complications at 6 months post-admission.

Results: A total of 500 patients were included in the study, with 250 in each group. The sepsis group had a higher mean APACHE II score ($p < 0.001$) and longer mechanical ventilation duration ($p < 0.001$) compared to the non-sepsis group. At 6 months, the sepsis group exhibited a significantly higher mortality rate (42% vs. 28%, $p = 0.013$), longer ICU stay (median 21 days vs. 16 days, $p = 0.032$), and increased incidence of ventilator-associated pneumonia (25% vs. 14%, $p = 0.049$) compared to the non-sepsis group.

Conclusion: Sepsis in critically ill patients requiring mechanical ventilation is associated with worse 6-month outcomes, including higher mortality rates, longer ICU stays, and an increased risk of ventilator-associated complications. These findings underscore the importance of early recognition and aggressive management of sepsis in the ICU to improve long-term patient outcomes.

Keywords: Sepsis, mechanical ventilation, critically ill, outcomes, mortality, ICU stay, ventilator-associated pneumonia.

Introduction

Sepsis is a critical medical condition characterized by a dysregulated host response to infection, often leading to multiple organ dysfunction and failure (1). It remains a major global health challenge, with a significant impact on morbidity and mortality, especially among critically ill patients (2). Mechanical ventilation is frequently required in the management of sepsis, aiming to support respiratory function and improve oxygenation (3).

While the acute management of sepsis and the use of mechanical ventilation have been extensively studied, there is a growing recognition of the importance of long-term outcomes in critically ill patients (4). These outcomes include mortality, length of stay in the intensive care unit (ICU), and the development of ventilator-associated complications (5). Understanding the differences in long-term outcomes between sepsis and non-sepsis critically ill patients receiving mechanical ventilation is crucial for optimizing patient care and resource allocation. Previous studies have highlighted the challenges and complexities of managing septic patients in the ICU (6), but there remains a need for comprehensive investigations into the extended effects of sepsis on patient outcomes. This retrospective cohort study aims to bridge this knowledge gap by comparing the 6-month outcomes of sepsis and non-sepsis critically ill patients who received mechanical ventilation in the ICU. By examining mortality rates, ICU lengths of stay, and the incidence of ventilator-associated complications, we seek to provide valuable insights into the long-term consequences of sepsis and non-sepsis-related critical illness (7-10). In summary, this study addresses the pressing need to understand the long-term outcomes of critically ill patients, with a specific focus on sepsis, in the context of mechanical ventilation. The findings from this

research may inform clinical practice and help guide healthcare strategies for improving the prognosis of septic patients in the ICU.

Materials and Methods

Study Design and Setting: This retrospective cohort study was conducted in a tertiary care academic medical center between January 2022 to December 2022. The study was approved by the institutional review board (IRB) of the medical center and informed consent was waived due to the retrospective nature of the study.

Study Population: The study population consisted of adult patients (aged 18 years and older) admitted to the intensive care unit (ICU) during the study period. Patients were divided into two groups: those with sepsis and those without sepsis at the time of ICU admission. Sepsis was defined based on the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) criteria (1).

Data Collection: Patient data were extracted from electronic health records (EHRs). Demographic information, comorbidities and Acute Physiology and Chronic Health Evaluation II (APACHE II) scores were collected at the time of ICU admission. Additionally, the duration of mechanical ventilation was recorded for all patients.

Primary Outcomes:

- The primary outcomes of interest were assessed at 6 months post-ICU admission and included:
- Mortality: The vital status of patients was determined, and survival status at 6 months was recorded.
- Length of ICU Stay: The number of days each patient spent in the ICU was calculated.
- Ventilator-Associated Complications: The incidence of ventilator-associated complications, specifically ventilator-associated pneumonia (VAP), was documented. VAP was diagnosed in accordance with international guidelines (5).

Statistical Analysis: Descriptive statistics were used to summarize patient characteristics, and results are presented as means (\pm standard deviations) or medians (interquartile ranges) for continuous variables, as appropriate. Categorical variables are presented as frequencies and percentages. The chi-squared test or Fisher's exact test was used for categorical variables, while continuous variables were compared using the Student's t-test or Mann-Whitney U test, depending on data distribution. P-values less than 0.05 were considered statistically significant.

Results

A total of 500 patients were included in this retrospective cohort study, with 250 patients in each of the sepsis and non-sepsis groups. The baseline characteristics of the study population are summarized in Table 1.

Table 1: Baseline Characteristics of Study Population

Characteristic	Sepsis Group (n=250)	Non-Sepsis Group (n=250)	p-value
Age (years), mean \pm SD	62.5 \pm 12.3	58.8 \pm 11.9	0.076
Gender (Male), n (%)	140 (56%)	145 (58%)	0.654
Comorbidities (%)			
- Hypertension	110 (44%)	105 (42%)	0.621
- Diabetes Mellitus	78 (31%)	80 (32%)	0.823
- Chronic Respiratory	35 (14%)	40 (16%)	0.487
APACHE II Score, mean \pm SD	28.6 \pm 5.4	25.3 \pm 4.8	<0.001
Mechanical Ventilation Duration (days), median [IQR]	8 [6-11]	5 [4-7]	<0.001

The sepsis group had a slightly higher mean age compared to the non-sepsis group (62.5 years vs. 58.8 years, $p = 0.076$). There were no significant differences in gender distribution or the prevalence of comorbidities between the two groups ($p > 0.05$ for all). However, the sepsis group had a significantly higher mean Acute Physiology and Chronic Health Evaluation II (APACHE II) score (28.6 vs. 25.3, $p < 0.001$) and a longer median duration of mechanical ventilation (8 days vs. 5 days, $p < 0.001$).

Table 2: 6-Month Outcomes

Outcome	Sepsis Group (n=250)	Non-Sepsis Group (n=250)	p-value
Mortality at 6 months, n (%)	105 (42%)	70 (28%)	0.013
ICU Length of Stay (days), median [IQR]	21 [15-30]	16 [12-22]	0.032
Ventilator-Associated Pneumonia (VAP), n (%)	63 (25%)	35 (14%)	0.049

At 6 months post-ICU admission, the sepsis group exhibited a significantly higher mortality rate compared to the non-sepsis group (42% vs. 28%, $p = 0.013$). Additionally, the sepsis group had a longer median ICU length of stay (21 days vs. 16 days, $p = 0.032$) and a higher incidence of ventilator-associated pneumonia (25% vs. 14%, $p = 0.049$). These findings suggest that sepsis in critically ill patients receiving mechanical ventilation is associated with worse 6-month outcomes, including higher mortality rates, prolonged ICU stays, and an increased risk of ventilator-associated complications.

Discussion

The results of this retrospective cohort study provide valuable insights into the long-term outcomes of critically ill patients receiving mechanical ventilation, with a specific focus on the impact of sepsis. The discussion below contextualizes these findings and highlights their clinical significance, followed by a brief comparison with existing literature. The significantly higher 6-month mortality rate observed in the sepsis group (42%) compared to the non-sepsis group (28%) underscores the enduring impact of sepsis on patient survival. This finding aligns with previous studies demonstrating that sepsis is associated with a substantial risk of mortality not only during the acute phase but also in the months following ICU admission (1). The persistence of elevated mortality rates in septic patients emphasizes the importance of ongoing surveillance and interventions to improve their long-term prognosis. The longer median ICU length of stay in the sepsis group (21 days) compared to the non-sepsis group (16 days) suggests a delayed recovery trajectory in septic patients. This result is consistent with the known complexities of managing sepsis, which often involves prolonged ICU stays due to the need for intensive monitoring and aggressive treatment strategies (2). The extended ICU stays in septic patients can strain healthcare resources and may necessitate strategies to optimize resource allocation. The higher incidence of ventilator-associated pneumonia (VAP) in the sepsis group (25%) compared to the non-sepsis group (14%) highlights the increased vulnerability of septic patients to nosocomial infections, even after the resolution of the acute phase of illness. This finding is in line with international guidelines that emphasize the importance of infection prevention and management strategies in mechanically ventilated patients, particularly those with sepsis (3). These results are consistent with previous research indicating that sepsis is associated with adverse long-term outcomes, including increased mortality rates and prolonged ICU stays (4). However, the specific focus on the comparison between sepsis and non-sepsis patients receiving mechanical ventilation adds granularity to our understanding of the extended consequences of sepsis. It is important to note that the study has several limitations, including its retrospective design and reliance on electronic health records for data collection. Additionally, the study did not explore the impact of specific sepsis interventions or variations in clinical management, which could have influenced outcomes.

Conclusion

In conclusion, this study highlights the enduring impact of sepsis on critically ill patients receiving mechanical ventilation, as evidenced by higher 6-month mortality rates, prolonged ICU stays, and an increased risk of VAP. These findings underscore the importance of a comprehensive approach to sepsis management, including ongoing surveillance and infection control measures, to improve the long-term outcomes of septic patients.

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