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Post-Sepsis Syndrome: Long-Term Quality of Life and Organ Recovery Among Survivors of Sepsis – A Prospective Observational Study

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Abstract

Background: Advances in critical care have improved survival following sepsis; however, a substantial proportion of survivors experience post-sepsis syndrome (PSS), characterized by persistent physical, cognitive, psychological, and organ-related impairments. Long-term reduction in quality of life and delayed organ recovery continue to contribute to increased healthcare burden and reduced functional independence among survivors. ***Aim:*** To evaluate long-term quality of life, organ recovery, and functional outcomes among survivors of sepsis over a 6-month follow-up period. ***Materials and Methods:*** A prospective observational study was conducted among 180 adult sepsis survivors admitted to the intensive care unit of a tertiary care hospital between January 2024 and December 2025. Patients were followed for six months after discharge. Clinical characteristics, Sequential Organ Failure Assessment (SOFA) scores, quality-of-life outcomes using the SF-36 questionnaire, psychological symptoms, and organ recovery parameters were assessed. Statistical analysis was performed using SPSS version 26.0. Chi-square test, paired t-test, and multivariate logistic regression were applied. ***Results:*** Among 180 sepsis survivors, 61.1% were males and the mean age was 56.3±14.7 years. Persistent fatigue was observed in 68.3% of participants at 3 months and 42.2% at 6 months. Impaired physical quality-of-life scores were present in 58.9% of survivors at 6 months. Renal dysfunction persisted in 21.7%, pulmonary dysfunction in 18.9%, and cognitive impairment in 27.2% of survivors. Higher baseline SOFA scores were significantly associated with delayed organ recovery ($p<0.001$). ICU stay >10 days and mechanical ventilation were independent predictors of poor quality of life. ***Conclusion:*** Post-sepsis syndrome significantly affects long-term quality of life and organ recovery among survivors. Early rehabilitation, psychological support, and structured follow-up programs are essential for improving long-term outcomes.

Keywords: Post-sepsis syndrome, quality of life, organ recovery, sepsis survivors, SOFA score, intensive care unit

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INTRODUCTION

Sepsis is a life-threatening organ dysfunction resulting from a dysregulated host response to infection and remains one of the leading causes of mortality and morbidity worldwide. Despite major advances in antimicrobial therapy, organ support systems, and critical care management, sepsis continues to impose substantial healthcare and socioeconomic burdens globally. Survivors of sepsis frequently develop prolonged physical, cognitive, and psychological impairments collectively referred to as post-sepsis syndrome (PSS).[1]

The incidence of sepsis has increased globally due to aging populations, increased prevalence of chronic diseases, antimicrobial resistance, and greater utilization of invasive medical procedures. Recent estimates suggest that approximately 49 million cases of sepsis occur annually worldwide, resulting in nearly 11 million deaths.[2] While mortality rates have gradually declined because of improved critical care practices, the number of sepsis survivors living with long-term complications has increased substantially.[3]

Post-sepsis syndrome includes persistent fatigue, muscle weakness, sleep disturbances, anxiety, depression, post-traumatic stress disorder (PTSD), cognitive dysfunction, and persistent organ impairment.[4] These complications significantly reduce quality of life and increase hospital readmissions, healthcare expenditures, and mortality risk even months or years after recovery from acute sepsis.[5]

Persistent inflammation, immune dysregulation, mitochondrial dysfunction, endothelial injury, and microvascular damage have been proposed as mechanisms contributing to long-term organ dysfunction after sepsis.[6] Survivors often exhibit chronic inflammatory states associated with progressive organ damage involving the kidneys, lungs, heart, liver, and nervous system.[7]

Quality of life among sepsis survivors is substantially lower compared to the general population. Physical limitations, decreased mobility, chronic pain, impaired cognition, and emotional distress frequently interfere with daily functioning and occupational productivity.[8] Studies have demonstrated that approximately 30–50% of sepsis survivors experience long-term disability and reduced functional independence.[9]

Renal recovery following sepsis-associated acute kidney injury remains incomplete in many patients, increasing the risk of chronic kidney disease and long-term dialysis dependence.[10] Similarly, pulmonary complications such as reduced lung capacity, fibrosis, and persistent dyspnea contribute to reduced exercise tolerance and poor quality of life.[11] Cardiovascular complications including arrhythmias, heart failure, and increased risk of myocardial infarction have also been documented among survivors.[12]

Neurological and psychological sequelae are major components of post-sepsis syndrome. Survivors frequently report memory impairment, difficulty concentrating, sleep disorders, anxiety, and depressive symptoms.[13] Intensive care unit-related delirium and prolonged mechanical ventilation contribute significantly to cognitive dysfunction and psychiatric illness.[14]

The SF-36 quality-of-life assessment tool has been widely used to evaluate physical and mental health outcomes among survivors of critical illness and sepsis.[15] Reduced physical component scores and mental component scores have been consistently observed during long-term follow-up among sepsis survivors.[16]

Early rehabilitation, multidisciplinary follow-up clinics, nutritional support, physiotherapy, and psychological counseling have demonstrated potential benefits in improving outcomes among survivors of critical illness.[17] However, post-sepsis follow-up services remain poorly established in many low- and middle-income countries.

In India, the burden of sepsis is particularly high due to delayed healthcare access, high rates of infectious diseases, antimicrobial resistance, and limited intensive care resources.[18] Despite increasing awareness regarding sepsis management, limited data are available regarding long-term outcomes and quality of life among Indian sepsis survivors.

Previous studies have mainly focused on acute mortality and ICU outcomes rather than long-term organ recovery and functional rehabilitation.[19] Furthermore, survivors frequently remain under-recognized after discharge and may not receive adequate long-term care.

The present study was therefore conducted to evaluate post-sepsis syndrome, long-term quality of life, organ recovery, and associated predictors among survivors of sepsis admitted to a tertiary care center.

AIM AND OBJECTIVES

Aim

To assess long-term quality of life and organ recovery among survivors of sepsis.

Objectives

1. To evaluate physical and mental quality-of-life outcomes among sepsis survivors.
2. To assess recovery of major organ systems after sepsis.
3. To identify factors associated with poor quality of life after sepsis.

To evaluate predictors of delayed organ recovery among survivors.

MATERIALS AND METHODS

Study Design

Prospective observational study.

Study Setting

Department of General Medicine and Intensive Care Unit of a tertiary care teaching hospital.

Study Duration

January 2024 to December 2025.

Study Population

Adult patients who survived sepsis and were discharged from the ICU.

Sample Size

A total of 180 eligible sepsis survivors were included.

Inclusion Criteria

1. Patients aged ≥18 years.
2. Patients diagnosed with sepsis according to Sepsis-3 criteria.
3. Survivors discharged from ICU.
4. Patients willing to provide informed consent.

Exclusion Criteria

1. Patients with severe pre-existing cognitive impairment.
2. Terminal malignancy.
3. Chronic psychiatric illness.
4. Patients lost to follow-up.

Data Collection

Detailed demographic data, comorbidities, source of infection, SOFA score, ICU stay duration, mechanical ventilation requirement, vasopressor support, and laboratory investigations were recorded.

Patients were followed at 3 months and 6 months post-discharge. Quality of life was assessed using the SF-36

questionnaire. Organ recovery was evaluated clinically and biochemically.

Outcome Measures

1. Physical quality-of-life score.
2. Mental quality-of-life score.
3. Persistent organ dysfunction.
4. Cognitive and psychological impairment.
5. Mortality and readmission.

Statistical Analysis

Data were analyzed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation and categorical variables as percentages. Chi-square test and paired t-test were applied where appropriate. Logistic regression analysis was performed to identify predictors of poor quality of life and delayed organ recovery. Statistical significance was considered at $p<0.05$.

RESULTS

A total of 180 sepsis survivors who fulfilled the inclusion criteria were enrolled and followed for a period of six months after discharge from the intensive care unit. Demographic characteristics, quality-of-life outcomes, persistent symptoms, and organ recovery parameters were analyzed.

Baseline Demographic and Clinical Characteristics

The majority of participants belonged to the 41–60 years age group (48.9%), followed by patients above 60 years (33.3%). Male patients constituted 61.1% of the study population. Diabetes mellitus and hypertension were the most common associated comorbidities. Detailed demographic characteristics are summarized in **Table 1**.

Table 1: Baseline Demographic and Clinical Characteristics of Participants (n=180)

Variable	Frequency (n)	Percentage (%)
Age 18–40 years	32	17.8
Age 41–60 years	88	48.9
Age >60 years	60	33.3
Male	110	61.1
Female	70	38.9
Diabetes mellitus	76	42.2
Hypertension	68	37.8
Chronic kidney disease	24	13.3
Chronic lung disease	20	11.1

The mean age of participants was 56.3 ± 14.7 years.

Distribution of Primary Source of Sepsis

Respiratory tract infection was identified as the most common source of sepsis, accounting for 35.6% of cases, followed by urinary tract infection (24.4%). The distribution of infection sources is illustrated in **Figure 1**.

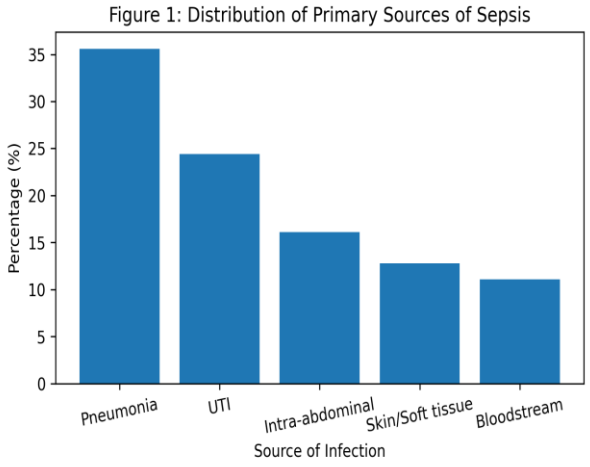

Figure 1: Distribution of Primary Sources of Sepsis

Intensive Care Unit Characteristics

Clinical variables related to ICU stay are presented in **Table 2**. The mean duration of ICU stay was 11.6 ± 5.3 days, while the average baseline SOFA score was 8.4 ± 2.1.

Table 2: ICU-Related Clinical Variables

Variable	Mean ± SD
ICU stay duration (days)	11.6 ± 5.3
Mechanical ventilation duration (days)	6.2 ± 3.8
Vasopressor support duration (days)	4.5 ± 2.7
Baseline SOFA score	8.4 ± 2.1

Quality-of-Life Assessment

Assessment of quality of life using the SF-36 questionnaire demonstrated significant improvement between the third and sixth month follow-up periods. However, several domains remained below expected population standards. The comparison of SF-36 scores is shown in **Table 3**.

Table 3: Comparison of SF-36 Quality-of-Life Scores at Follow-Up

Parameter	3 Months Mean ± SD	6 Months Mean ± SD	p-value
Physical functioning	48.2 ± 11.4	61.7 ± 10.3	<0.001
Role limitation due to physical health	42.1 ± 10.8	56.5 ± 9.6	<0.001
Emotional well-being	50.6 ± 9.4	62.8 ± 8.9	<0.001
Social functioning	46.7 ± 10.1	59.3 ± 9.8	<0.001
General health perception	44.9 ± 11.7	57.1 ± 10.5	<0.001

Statistically significant improvement was observed across all SF-36 domains during follow-up ($p<0.001$).

Persistent Symptoms During Follow-Up

Persistent physical and psychological symptoms were commonly observed among survivors at six months. Fatigue remained the most frequently reported symptom. The prevalence of persistent symptoms is shown in **Figure 2**.

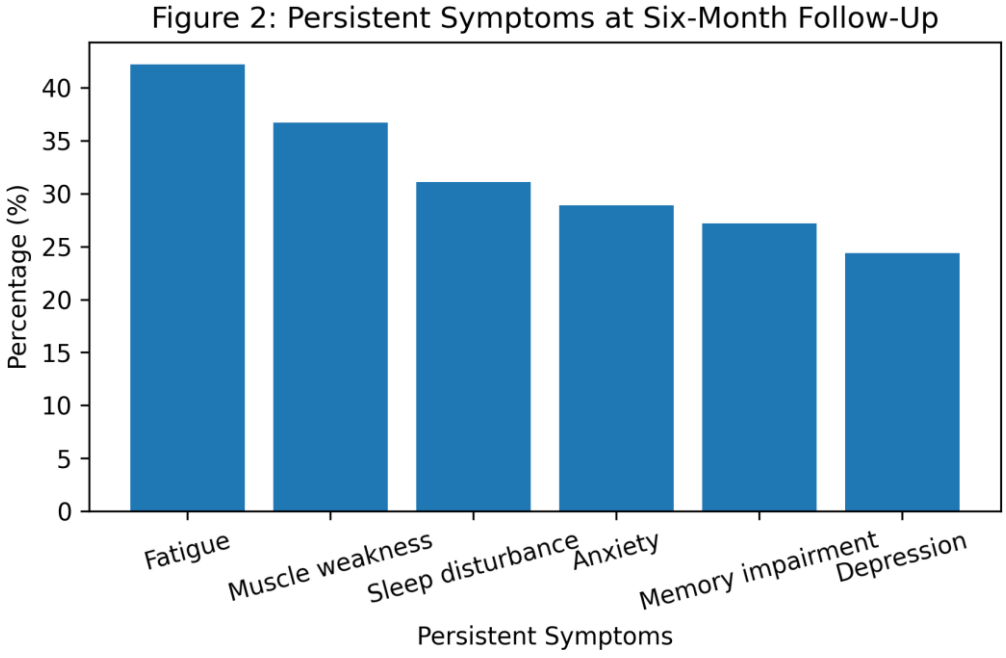

Figure 2: Persistent Symptoms at Six-Month Follow-Up

Persistent Organ Dysfunction

Persistent dysfunction involving major organ systems was documented during follow-up evaluation. Renal dysfunction was the most common persistent organ abnormality, followed by pulmonary impairment. Organ recovery outcomes are summarized in **Table 4**.

Table 4: Persistent Organ Dysfunction at Six Months

Organ System	Frequency (n)	Percentage (%)
Renal dysfunction	39	21.7
Pulmonary dysfunction	34	18.9
Neurological dysfunction	31	17.2
Cardiovascular dysfunction	22	12.2
Hepatic dysfunction	12	6.7

Association Between Baseline SOFA Score and Delayed Organ Recovery

A statistically significant association was observed between higher baseline SOFA scores and delayed organ recovery. Patients with SOFA scores greater than 10 demonstrated poorer recovery outcomes compared to patients with lower scores. Detailed analysis is presented in **Table 5**.

Table 5: Association Between Baseline SOFA Score and Delayed Organ Recovery

Baseline SOFA Score	Delayed Recovery Present	Delayed Recovery Absent	p-value
≤6	18	52	
7–10	44	31	
>10	28	7	<0.001

The association between elevated SOFA score and delayed recovery was statistically significant (Chi-square test, $p<0.001$).

Predictors of Poor Quality of Life

Multivariate logistic regression analysis identified prolonged ICU stay, mechanical ventilation, higher SOFA score, advanced age, and chronic kidney disease as independent predictors of poor long-term quality of life. Regression analysis findings are shown in **Table 6**.

Table 6: Multivariate Logistic Regression Analysis for Poor Quality of Life

Variable	Odds Ratio	95% Confidence Interval	p-value
ICU stay >10 days	2.84	1.52–5.31	0.001
Mechanical ventilation	2.36	1.24–4.49	0.008
SOFA score >10	3.12	1.66–5.89	<0.001
Age >60 years	1.94	1.01–3.73	0.042
Chronic kidney disease	2.11	1.03–4.30	0.037

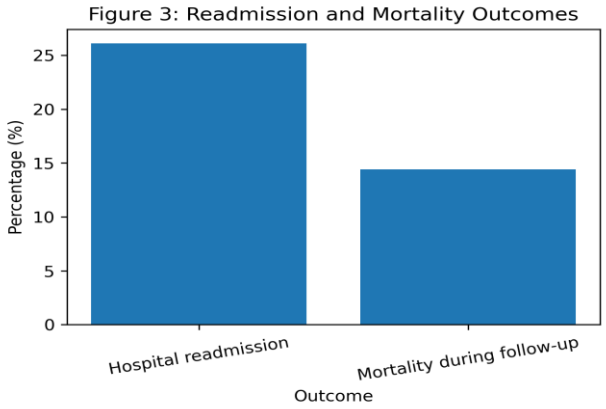

Figure 3: Readmission and Mortality Outcomes During Follow-Up

Readmission and Mortality Outcomes

During the six-month follow-up period, 26.1% of patients required hospital readmission, while mortality was observed in 14.4% of survivors. Follow-up outcomes are summarized in **Figure 3**.

These findings indicate that significant morbidity and healthcare utilization continue even after survival from acute sepsis.

DISCUSSION

The present study evaluated long-term quality of life and organ recovery among survivors of sepsis and demonstrated that post-sepsis syndrome remains a major challenge even after discharge from intensive care. Significant physical, psychological, and organ-related impairments persisted among survivors during the six-month follow-up period.

In the current study, the majority of participants belonged to the middle-aged and elderly population, with a male predominance. Similar demographic findings were reported in previous studies evaluating sepsis survivors.20 Increased age has been associated with poor physiological reserve, immune dysregulation, and delayed recovery following critical illness.

Pneumonia was identified as the most common source of sepsis in the present study. This finding is consistent with previous literature where respiratory infections accounted for the largest proportion of severe sepsis cases requiring ICU admission.21 Pulmonary infections often result in severe inflammatory responses and prolonged respiratory dysfunction, contributing significantly to post-sepsis morbidity.

The current study demonstrated persistent reduction in SF-36 quality-of-life scores among survivors at both 3-month and 6-month follow-up. Although gradual improvement was observed over time, quality-of-life domains remained significantly impaired compared to normal population standards. Similar reductions in physical and mental health outcomes among sepsis survivors have been reported by Winters et al.22

Fatigue, muscle weakness, and sleep disturbances were among the most common persistent symptoms identified in the present study. Persistent fatigue following sepsis may result from chronic inflammation, muscle wasting, mitochondrial dysfunction, and prolonged immobilization during critical illness.23 Muscle weakness is also strongly associated with ICU-acquired weakness and prolonged mechanical ventilation.

Psychological complications including anxiety, depression, and memory impairment were highly prevalent among survivors. These findings are comparable to previous reports demonstrating increased incidence of post-traumatic stress disorder, cognitive dysfunction, and depression after ICU admission.24 Neuroinflammation, cerebral hypoperfusion, and delirium during critical illness are believed to contribute to long-term cognitive dysfunction.

Persistent renal dysfunction was identified in nearly one-fifth of survivors. Sepsis-associated acute kidney injury is a major contributor to chronic kidney disease among ICU survivors.25 Inflammatory injury, microvascular dysfunction, and ischemic tubular damage may persist even after apparent clinical recovery.

Pulmonary dysfunction remained common at follow-up due to prolonged inflammation, fibrosis, ventilator-associated injury, and reduced respiratory muscle strength. Similar findings have been documented among survivors of severe pneumonia and acute respiratory distress syndrome.26

Higher baseline SOFA scores were significantly associated with delayed organ recovery in the present study. SOFA score reflects severity of organ dysfunction during acute illness and has been consistently associated with mortality and long-term complications in critically ill patients.27

Mechanical ventilation and prolonged ICU stay were independent predictors of poor quality of life. These findings support previous studies demonstrating that prolonged immobilization, sedation exposure, delirium, and ICU-acquired weakness contribute significantly to post-intensive care syndrome.28

Hospital readmission was observed in more than one-fourth of survivors during follow-up. Increased susceptibility to recurrent infections, persistent organ dysfunction, and inadequate rehabilitation contribute to recurrent hospitalization after sepsis.29

The mortality rate observed during follow-up highlights that sepsis-related morbidity continues beyond the acute phase of illness. Survivors remain vulnerable to cardiovascular complications, recurrent infections, and progressive organ dysfunction even after discharge.30

The present study emphasizes the importance of multidisciplinary rehabilitation and structured post-sepsis follow-up programs. Early mobilization, nutritional optimization, physiotherapy, pulmonary rehabilitation, renal monitoring, and mental health support may substantially improve long-term outcomes.

Healthcare systems in developing countries often focus primarily on acute survival rather than long-term rehabilitation. Establishment of dedicated post-ICU and post-sepsis clinics may help identify persistent complications early and improve recovery trajectories.

The strengths of the present study include prospective follow-up, comprehensive quality-of-life assessment, and evaluation of multiple organ systems. However, the study was limited by its single-center design and relatively short follow-up duration.

CONCLUSION

Post-sepsis syndrome significantly affects long-term quality of life and organ recovery among survivors of sepsis. Persistent fatigue, cognitive dysfunction, psychological distress, and organ impairment remain common even after six months of recovery.

Higher SOFA scores, prolonged ICU stay, mechanical ventilation, and chronic comorbidities were associated with poor outcomes. Early multidisciplinary rehabilitation, structured follow-up programs, and psychological support are essential for improving long-term recovery and reducing healthcare burden.

Further multicentric studies with longer follow-up durations are required to better understand long-term outcomes among sepsis survivors.

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