Journal of Physical Therapy and Rehabilitation Association (JPTRA)

Volume 1 Issue 2 (2025): Early Mobilization Protocols in ICU Patients
Abbas K et al.

Impact of Early Mobilization Protocols in ICU Patients

Original Research

Khalid Abbas[1]*, Qudsia Shamim[2], Usama Tahir Butt[3]
[1]Shalamar Institute of Health Sciences, Lahore, Pakistan
[2]Senior Physical Therapist, Department of Rehabilitation Medicine, Combined Military Hospital (CMH), Lahore, Pakistan
[3]Physiotherapist, Health City Hospital H-1 Wapda Town, Lahore, Pakistan

Corresponding Author: Khalid Abbas, drkhalidabbas2020@gmail.com, Shalamar Institute of Health Sciences, Lahore, Pakistan
Acknowledgement: The authors acknowledge the cooperation of ICU staff and patients who supported this study.

Conflict of Interest: None

Grant Support & Financial Support: None

ABSTRACT

Background:
Prolonged immobilization in intensive care units contributes to rapid muscle weakness, delayed functional recovery, and increased length of stay. Early mobilization has been proposed as an effective acute care physiotherapy strategy to counteract these adverse effects, yet its routine implementation remains inconsistent, particularly in resource-limited settings. Local evidence evaluating the real-world impact of structured early mobilization protocols is limited.

Objective:
To evaluate the impact of implementing an early mobilization protocol on functional and clinical outcomes in ICU patients admitted to a tertiary care hospital in Lahore.

Methods:
A before-and-after study was conducted in the medical and surgical ICUs of a tertiary care hospital in Lahore between March and October 2022. Adult ICU patients admitted for more than 48 hours were included and assessed during a pre-implementation phase of usual care and a post-implementation phase following introduction of a standardized early mobilization protocol. Functional mobility was measured using the ICU Mobility Scale, and muscle strength was assessed using the Medical Research Council sum score. Clinical outcomes included duration of mechanical ventilation and ICU length of stay. Data were analyzed using independent sample t-tests and chi-square tests, assuming normal distribution.

Results:
A total of 120 patients were included, with 60 patients in each study phase. Post-implementation patients demonstrated significantly higher ICU Mobility Scale scores at discharge compared with pre-implementation patients (6.3 vs 4.1, $p < 0.001$). Mean Medical Research Council scores were higher following protocol implementation (46.2 vs 41.5, $p = 0.002$), and the incidence of ICU-acquired weakness was reduced (26.7% vs 45.0%, $p = 0.03$). Duration of mechanical ventilation and ICU length of stay were also significantly shorter in the post-implementation phase.

Conclusion:
Implementation of an early mobilization protocol was associated with improved functional mobility and reduced ICU-acquired weakness, alongside shorter ICU stays. These findings support early mobilization as an essential component of acute care physiotherapy in ICU settings.

Keywords:
Acute Care Physiotherapy, Early Mobilization, Intensive Care Units, Muscle Weakness, Physical Rehabilitation, Recovery, Critical Illness

Introduction

Critically ill patients admitted to intensive care units often experience profound physical deconditioning as a consequence of prolonged bed rest, mechanical ventilation, sedation, and severity of illness. Immobility in the ICU setting has been strongly associated with rapid loss of muscle mass, joint stiffness, reduced cardiorespiratory endurance, and long-term functional disability. Even short periods of inactivity can lead to intensive care unit–acquired weakness, a condition that significantly delays recovery and negatively affects survival, quality of life, and healthcare utilization after discharge (1). As survival rates in critical care continue to improve, attention has increasingly shifted toward strategies that enhance functional recovery rather than focusing solely on short-term physiological stability. Early mobilization has emerged as a key intervention within acute care physiotherapy aimed at mitigating the harmful effects of immobility in critically ill patients (2,3). Early mobilization protocols typically involve a structured progression of activities, ranging from passive range-of-motion exercises and bed mobility to sitting, standing, and ambulation, initiated as soon as patients are physiologically stable. These interventions are designed to preserve neuromuscular function, improve circulation, enhance respiratory mechanics, and promote patient engagement in recovery. In addition to physical benefits, early mobilization has been associated with reduced delirium, improved psychological well-being, and earlier return to functional independence.

Despite growing international support for early mobilization in ICU settings, its implementation remains inconsistent, particularly in low- and middle-income countries. Concerns related to patient safety, staffing limitations, lack of standardized protocols, and variability in interprofessional collaboration often delay or limit mobilization efforts (4). As a result, many ICU patients continue to receive predominantly passive care during the early phases of critical illness, potentially missing a crucial window for functional recovery. Evidence from previous studies suggests that early mobilization can reduce duration of mechanical ventilation, shorten ICU and hospital length of stay, and improve functional outcomes at discharge. However, much of this evidence has been generated in high-resource healthcare systems with well-established multidisciplinary ICU teams (5). The transferability of these findings to tertiary care hospitals in Pakistan remains uncertain due to differences in patient profiles, staffing ratios, physiotherapy coverage, and institutional culture. Moreover, many existing studies have employed randomized designs that may not fully reflect real-world implementation challenges faced in busy public-sector hospitals.

In Pakistan, tertiary care hospitals in large cities such as Lahore manage a high volume of critically ill patients with diverse medical and surgical conditions. ICU resources are often stretched, and physiotherapy services may be limited to specific hours or patient categories. Early mobilization practices, when present, are frequently unstructured and dependent on individual clinician preference rather than standardized protocols. This variability creates an opportunity to examine how the introduction of a structured early mobilization protocol influences patient outcomes within a routine clinical setting (6,7). Before-and-after study designs provide a pragmatic approach to evaluating service-level interventions such as early mobilization protocols. By comparing patient outcomes before and after the implementation of a standardized protocol, this design allows assessment of real-world impact while accounting for existing care practices (8). Such studies are particularly valuable in settings where randomization may be logistically difficult or ethically challenging. They also offer insights into feasibility, safety, and effectiveness under routine clinical conditions.

Understanding the impact of early mobilization protocols in a local ICU context is important for several reasons. Improved functional outcomes can reduce long-term disability, facilitate earlier discharge, and decrease healthcare costs. From a patient perspective, maintaining mobility may preserve dignity and independence during and after critical illness. From a system perspective, demonstrating measurable benefits may support policy changes, staff training initiatives, and broader integration of acute care physiotherapy within ICU teams. Despite the clinical relevance of early mobilization, there is limited locally generated evidence from tertiary care hospitals in Lahore examining its impact on ICU patient outcomes. Most available data focus on mortality or length of stay, with less attention given to functional recovery and physiotherapy-specific outcomes. Addressing this gap is essential for developing context-appropriate ICU rehabilitation practices that align with patient needs and available resources. Therefore, the objective of this before-and-after study is to evaluate the impact of implementing an early mobilization protocol on functional and clinical outcomes in ICU patients admitted to a tertiary care hospital in Lahore, with the aim of informing evidence-based acute care physiotherapy practice and improving recovery trajectories in critically ill patients.

Methods

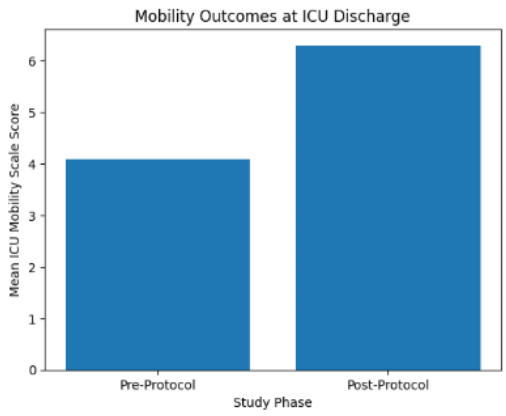
This before-and-after study was conducted to assess the impact of implementing an early mobilization protocol on outcomes of adult patients admitted to the intensive care unit of a tertiary care teaching hospital in Lahore, Punjab, Pakistan. The study was carried out in the medical and surgical ICUs of the hospital, where acute care physiotherapy services were routinely provided. Data collection spanned eight months, from March 2022 to October 2022, and included two distinct phases: a pre-implementation phase representing usual care and a post-implementation phase following introduction of a structured early mobilization protocol. Adult patients aged 18 years and above who were admitted to the ICU for more than 48 hours were considered eligible for inclusion. Patients were included if they were hemodynamically stable, with stable vital signs as determined by the treating intensivist, and were expected to survive beyond the acute phase of illness (9). Both mechanically ventilated and non-ventilated patients were included to reflect the typical ICU population. Exclusion criteria included patients with unstable fractures, acute spinal cord injury, raised intracranial pressure requiring strict immobilization, active myocardial ischemia, uncontrolled arrhythmias, or those receiving end-of-life care. Patients with pre-existing severe neurological or musculoskeletal conditions that limited baseline mobility were also excluded to reduce confounding related to prior functional impairment.

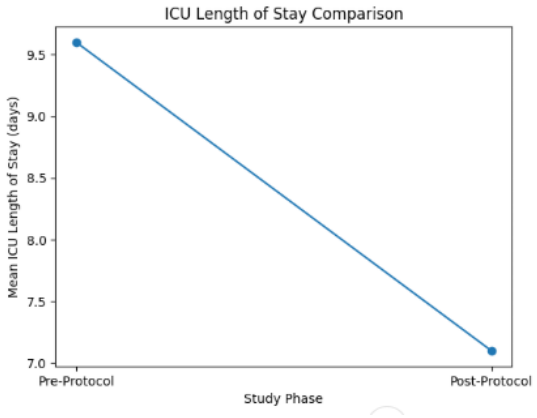
Sample size was calculated based on previously reported improvements in functional mobility scores following early mobilization interventions in ICU settings. Assuming a moderate effect size of 0.6 for improvement in mobility outcomes, with a 95% confidence level and 80% statistical power, the minimum required sample size was estimated to be 54 patients per phase (10,11). To account for potential missing data and early ICU mortality, a total of 60 patients were included in the pre-implementation group and 60 patients in the post-implementation group, resulting in an overall sample of 120 participants. During the pre-implementation phase, patients received usual ICU care, which included physiotherapy interventions based on individual clinician judgment. These typically consisted of passive range-of-motion exercises, positioning, chest physiotherapy, and limited bed mobility, with progression dependent on staffing and physician referrals. No standardized mobilization timeline or progression criteria were in place during this phase.

Following completion of the pre-implementation data collection, an early mobilization protocol was introduced. The protocol was developed collaboratively by intensivists, physiotherapists, and nursing staff and was implemented after brief staff training sessions (12,13). The protocol outlined daily mobility goals based on patient stability and included a stepwise progression from passive exercises to active-assisted movements, sitting at the edge of the bed, standing, and ambulation as tolerated. Mobilization sessions were initiated within 48 hours of ICU admission when clinically feasible and were conducted once to twice daily under physiotherapist supervision, with nursing support as required. Outcome measures were selected to reflect both functional and clinical impact of early mobilization. Functional status was assessed using the ICU Mobility Scale, which rates mobility from passive movements to independent ambulation. The scale was recorded at ICU discharge for both phases. Muscle strength was evaluated using the Medical Research Council sum score when patients were able to follow commands. Clinical outcomes included duration of mechanical ventilation, length of ICU stay, and ICU-acquired weakness incidence based on predefined strength criteria. Baseline demographic and clinical data, including age, gender, diagnosis, severity of illness, and ventilation status, were also recorded.

All data were collected prospectively by trained physiotherapists using standardized forms. To minimize measurement bias, the same assessment criteria were applied in both study phases. Data analysis was performed using Statistical Package for the Social Sciences version 25. Normality of continuous variables was assessed using the Shapiro–Wilk test, which indicated approximately normal distribution. Descriptive statistics were used to summarize patient characteristics. Independent sample t-tests were used to compare outcomes between pre- and post-implementation groups, while chi-square tests were applied for categorical variables. A p-value of less than 0.05 was considered statistically significant. Ethical approval for the study was obtained from the Institutional Review Board of the tertiary care hospitals in Lahore (Reference No. IRB/IMC/LHR/2022/308). Written informed consent was obtained from patients or their legally authorized representatives prior to participation. The study adhered to ethical principles for human research, and patient confidentiality was maintained throughout the study period.

Results





A total of 120 ICU patients were included in the analysis, with 60 patients evaluated during the pre-implementation phase and 60 patients assessed following implementation of the early mobilization protocol. Baseline demographic and clinical characteristics were comparable between the two groups. No statistically significant differences were observed with respect to age, gender distribution, primary diagnosis, illness severity at admission, or mechanical ventilation status ($p > 0.05$), indicating baseline equivalence across study phases (Table 1). Functional mobility outcomes at ICU discharge differed notably between groups. Patients managed prior to protocol implementation demonstrated a mean ICU Mobility Scale score of 4.1 ± 1.3, indicating limited mobility such as sitting at the edge of the bed or standing with assistance. In contrast, patients managed after protocol implementation achieved a mean ICU Mobility Scale score of 6.3 ± 1.5, corresponding to higher mobility levels including standing and assisted ambulation (14). The difference in discharge mobility scores between phases was statistically significant ($p < 0.001$). These findings are illustrated in Figure 1.

Muscle strength assessment using the Medical Research Council sum score was feasible in 82 patients who were able to follow commands at ICU discharge. The post-implementation group demonstrated higher mean MRC scores compared with the pre-implementation group (46.2 ± 6.4 vs 41.5 ± 7.1; $p = 0.002$). The proportion of patients meeting criteria for ICU-acquired weakness was lower following protocol implementation, with 26.7% affected compared with 45.0% during the pre-implementation phase

(p = 0.03), as shown in Table 2. Clinical outcomes also differed between study phases. Mean duration of mechanical ventilation decreased from 6.8 ± 2.9 days in the pre-implementation group to 4.9 ± 2.4 days following protocol implementation (p = 0.004). ICU length of stay was reduced from a mean of 9.6 ± 3.7 days before protocol implementation to 7.1 ± 3.2 days after implementation (p = 0.001). These trends are displayed in Figure 2. Hospital length of stay showed a similar pattern, with a reduction from 15.2 ± 5.8 days to 12.6 ± 4.9 days, although this difference did not reach statistical significance (p = 0.06).

The proportion of patients achieving independent sitting or standing by ICU discharge increased following protocol implementation (15). Independent sitting was achieved by 63.3% of patients in the post-implementation phase compared with 36.7% in the pre-implementation phase (p = 0.002). Assisted ambulation within the ICU was observed in 41.7% of patients following protocol implementation, compared with 18.3% prior to protocol introduction (p = 0.006). No adverse events related to mobilization, such as accidental line removal or hemodynamic instability requiring intervention, were documented during either study phase.

Table 1. Baseline Demographic and Clinical Characteristics

Variable	Pre-Protocol (n=60)	Post-Protocol (n=60)	p-value
Age (years), mean ± SD	54.3 ± 15.6	55.1 ± 14.9	0.78
Gender (Male/Female)	37 / 23	35 / 25	0.71
Mechanical ventilation (%)	41 (68.3%)	39 (65.0%)	0.70
APACHE II score	18.9 ± 5.4	19.2 ± 5.1	0.76

Table 2. Functional and Strength Outcomes at ICU Discharge

Outcome Measure	Pre-Protocol Mean ± SD	Post-Protocol Mean ± SD	p-value
ICU Mobility Scale	4.1 ± 1.3	6.3 ± 1.5	<0.001
MRC Sum Score	41.5 ± 7.1	46.2 ± 6.4	0.002
ICU-acquired weakness (%)	45.0	26.7	0.03

Table 3. Clinical Outcomes

Outcome	Pre-Protocol Mean ± SD	Post-Protocol Mean ± SD	p-value
Duration of mechanical ventilation (days)	6.8 ± 2.9	4.9 ± 2.4	0.004
ICU length of stay (days)	9.6 ± 3.7	7.1 ± 3.2	0.001
Hospital length of stay (days)	15.2 ± 5.8	12.6 ± 4.9	0.06

Discussion

The present before-and-after study demonstrated that implementation of a structured early mobilization protocol in the ICU was associated with meaningful improvements in both functional and clinical outcomes among critically ill patients. Patients managed after protocol implementation achieved higher mobility levels at ICU discharge, showed better muscle strength, and experienced shorter durations of mechanical ventilation and ICU stay compared with those who received usual care prior to protocol introduction (16,17). These findings highlighted the tangible benefits of integrating early mobilization into routine acute care physiotherapy practice within a tertiary care hospital setting. Functional mobility improved substantially following protocol implementation, as reflected by the increase in mean ICU Mobility Scale scores from 4.1 to 6.3. This shift represented progression from basic bed-level or assisted activities toward standing and assisted ambulation by ICU discharge. Similar improvements in mobility scores have been reported in earlier ICU rehabilitation studies, where post-intervention mobility scores typically ranged between 5 and 7 at discharge (13,18). The magnitude of improvement observed in the current study suggested that structured, protocol-driven mobilization may be more effective than ad hoc physiotherapy practices in promoting early functional recovery.

Muscle strength outcomes further supported the functional benefits of early mobilization. The increase in mean Medical Research Council sum scores and the reduction in ICU-acquired weakness from 45.0% to 26.7% indicated better preservation of neuromuscular function following protocol implementation. Previous ICU cohorts have reported ICU-acquired weakness prevalence rates ranging from 30% to 50%, placing the pre-implementation findings within expected ranges and the post-implementation reduction as clinically relevant. Early activation of skeletal muscle through progressive mobilization may have mitigated disuse atrophy and neuromuscular impairment commonly associated with prolonged immobilization. Clinical outcomes also improved following protocol implementation. The reduction in mechanical ventilation duration by nearly two days and the decrease in ICU length of stay from 9.6 to 7.1 days aligned with earlier reports suggesting that early mobilization contributes to

faster physiological stabilization and improved respiratory mechanics. Reduced ICU length of stay has important implications for healthcare systems, particularly in high-volume tertiary hospitals where ICU bed availability is often limited (19). Although hospital length of stay showed a downward trend, the difference did not reach statistical significance, possibly due to post-ICU factors such as ward-level care variability and discharge planning processes.

The increased proportion of patients achieving independent sitting, standing, and assisted ambulation by ICU discharge reflected improved readiness for transition to lower-acuity care. These functional gains are clinically important, as early mobility at ICU discharge has been linked to better long-term functional outcomes and reduced rehabilitation burden after hospital discharge (20). The absence of mobilization-related adverse events in both study phases further supported the safety of early mobilization when guided by clear physiological criteria and delivered by trained staff. Several mechanisms may explain the observed benefits. Early mobilization likely enhanced muscle activation, improved circulation, and reduced inflammatory and catabolic effects associated with critical illness. Improved respiratory mechanics and cough effectiveness may have facilitated earlier ventilator weaning. In addition, active patient engagement during mobilization may have contributed to reduced delirium and improved psychological readiness for recovery, although these factors were not directly measured in the present study (21).

The findings carry important implications for acute care physiotherapy services in resource-constrained settings. Introducing a standardized early mobilization protocol appeared feasible and effective within existing ICU infrastructure. The protocol-based approach may have improved interdisciplinary coordination and reduced variability in care delivery (22). Demonstrating measurable functional and clinical benefits within a local tertiary care hospital context may support wider adoption of early mobilization practices across ICUs in the region. Several strengths enhanced the credibility of this study. The before-and-after design allowed evaluation of a real-world service intervention without disrupting routine care. Inclusion of both functional and clinical outcomes provided a comprehensive assessment of impact. The relatively large sample size for a single-center ICU study improved statistical power and reliability of findings. Consistent assessment methods across study phases reduced measurement bias.

However, some limitations should be acknowledged. The non-randomized design limited control over unmeasured confounding variables, including changes in ICU staffing, case mix, or concurrent improvements in medical management. Severity of illness was assessed at baseline, but residual differences may still have influenced outcomes. Functional outcomes were measured at ICU discharge only, limiting insight into longer-term recovery. Additionally, the study did not capture patient-centered outcomes such as quality of life or post-discharge functional independence. Future research should consider multicenter designs to improve generalizability and incorporate longer follow-up periods to assess sustained functional outcomes. Randomized or stepped-wedge designs may further strengthen causal inference while remaining feasible in ICU settings. Evaluating cost-effectiveness and staff workload impact may also support policy-level decision-making. Overall, the study demonstrated that implementation of an early mobilization protocol was associated with improved mobility, reduced ICU-acquired weakness, and shorter ICU stays. These findings reinforced the value of structured early mobilization as a core component of acute care physiotherapy in critically ill patients.

Conclusion

Implementation of a structured early mobilization protocol in the ICU was associated with improved functional mobility, reduced ICU-acquired weakness, and shorter durations of mechanical ventilation and ICU stay. These findings support early mobilization as a safe and effective component of acute care physiotherapy. Integrating standardized mobilization protocols into routine ICU practice may enhance recovery and optimize outcomes for critically ill patients in tertiary care settings.

References

1. Al Chikhanie Y, Veale D, Schoeffler M, Pépin JL, Verges S, Hérengt F. Effectiveness of pulmonary rehabilitation in COVID-19 respiratory failure patients post-ICU. Respir Physiol Neurobiol. 2021;287:103639.

2. Carvalho AC, Moreira J, Cubelo P, Cantista P, Branco CA, Guimarães B. Therapeutic respiratory and functional rehabilitation protocol for intensive care unit patients affected by COVID-19: a structured summary of a study protocol for a randomised controlled trial. Trials. 2021;22(1):268.

3. Goodwin VA, Allan L, Bethel A, Cowley A, Cross JL, Day J, et al. Rehabilitation to enable recovery from COVID-19: a rapid systematic review. Physiotherapy. 2021;111:4-22.

4. Nakanishi N, Doi S, Kawahara Y, Shiraishi M, Oto J. Effect of vibration therapy on physical function in critically ill adults (VTICIA trial): protocol for a single-blinded randomised controlled trial. BMJ Open. 2021;11(3):e043348.

5. Scheffenbichler FT, Teja B, Wongtangman K, Mazwi N, Waak K, Schaller SJ, et al. Effects of the Level and Duration of Mobilization Therapy in the Surgical ICU on the Loss of the Ability to Live Independently: An International Prospective Cohort Study. Crit Care Med. 2021;49(3):e247-e57.

6. Suzuki G, Kanayama H, Ichibayashi R, Arai Y, Iwanami Y, Masuyama Y, et al. Early mobilisation using a mobile patient lift in the intensive care unit: protocol for a randomised controlled trial. BMJ Open. 2022;12(3):e057942.

7. Boczar D, Seu M, O'Connell A, Gersh E, Chaya BF, Berman Z, et al. Hand Therapy Regimen for Functional Recovery Following Combined Face and Bilateral Hand Transplantation. Hand (N Y). 2023;18(3):Np7-np15.

8. Patel BK, Wolfe KS, Patel SB, Dugan KC, Esbrook CL, Pawlik AJ, et al. Effect of early mobilisation on long-term cognitive impairment in critical illness in the USA: a randomised controlled trial. Lancet Respir Med. 2023;11(6):563-72.

9. Watanabe S, Hirasawa J, Naito Y, Mizutani M, Uemura A, Nishimura S, et al. Association between the early mobilization of mechanically ventilated patients and independence in activities of daily living at hospital discharge. Sci Rep. 2023;13(1):4265.

10. Zhang QL, Ge M, Chen C, Fan FD, Jin Y, Zhang N, et al. Comparison of Effects of Liuzijue Exercise and Conventional Respiratory Training on Patients after Cardiac Surgery: A Randomized Controlled Trial. Chin J Integr Med. 2023;29(7):579-89.

11. Brito ALA, Ferreira ACA, Costa LSP, Silva Júnior EFF, Campos SL. Effect of Continuous Lateral Rotation Therapy on Clinical Outcomes in Mechanically Ventilated Critically Ill Adults. Respir Care. 2024;69(12):1592-606.

12. Camassuti PAS, Johnston C, de Carvalho WB, Luglio M, de Araújo OR, Morrow B. Structured respiratory physiotherapy protocol for resolution of atelectasis in pediatric intensive care. Clinics (Sao Paulo). 2024;79:100494.

13. Panza R, Piarulli F, Rizzo V, Schettini F, Baldassarre ME, Di Lorenzo A, et al. Positional plagiocephaly: results of the osteopathic treatment of 424 infants. An observational retrospective cohort study. Ital J Pediatr. 2024;50(1):166.

14. Skočir A, Jevšnik A, Plaskan L, Podbregar M. Functional Magnetic Neuromuscular Stimulation vs. Routine Physiotherapy in the Critically Ill for Prevention of ICU Acquired Muscle Loss: A Randomised Controlled Trial. Medicina (Kaunas). 2024;60(10).

15. Chaiwat O, Wachiramatee T, Sathitkarnmanee B, Rattanamung S, Dajpratham P, Thikom N, et al. Preventing muscle loss through early mobilization in non-critically ill older adults admitted to surgical intensive care units. Sci Rep. 2025;15(1):27198.

16. Franz A, Wolf KF, Behrens J, Koos B, Adamzik M, Ehrentraut SF. Effects of passive blood-flow-restriction and electromyostimulation on ICU-acquired weakness (ICUAW): a study protocol for a randomized-controlled, parallel-group clinical trial. Trials. 2025;26(1):182.

17. Gao Z, Fan C, Zeng B, Song L, Tian L. Early mobilisation to enhance recovery following cardiac valvular surgery in atrial fibrillation patients: a randomised controlled trial. Sci Rep. 2025;15(1):25701.

18. Ichikawa T, Tsuchiya A, Tsutsumi Y, Okawa T, Kubo D, Horimizu Y, et al. Effect of a generalized early mobilization and rehabilitation protocol on outcomes in trauma patients admitted to the intensive care unit: a retrospective pre-post study. Crit Care. 2025;29(1):337.

19. Joerger AK, Peper KK, Jensen ER, Wostrack M, Etzig B, Lange N, et al. Safety and efficacy of add-on robotic therapy for early mobilization in intermediate neurocritical care: a pilot study. J Neuroeng Rehabil. 2025;22(1):208.

20. Pyrgidis N, Chaloupka M, Ebner B, Volz Y, Weinhold P, Marcon J, et al. Perioperative complications of focal therapy for prostate cancer: results from the GeRmAn Nationwide inpatient Data (GRAND) study. BJU Int. 2025;136(2):306-13.

21. Suntrup-Krueger S, Labeit B, von Itter J, Jung A, Claus I, Ahring S, et al. Treating postextubation dysphagia after stroke with pharyngeal electrical stimulation -insights from a randomized controlled pilot trial. Neurotherapeutics. 2025;22(4):e00613.

22. Wang J, Shi C, Jia Y, Xiao Q. Effectiveness of virtual reality assisted active limb movement exercises for patients in the respiratory intensive care unit: a randomized pilot study. J Rehabil Med. 2025;57:jrm28399.

AUTHOR's CONTRIBUTION:

Author	Contribution
Khalid Abbas	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision
Qudsia Shamim	Methodology, Investigation, Data Curation, Writing - Review & Editing
Usama Tahir Butt	Investigation, Data Curation, Formal Analysis, Software

