

The role of early mobilization in ICU patients: Analyzing How early physical therapy and mobilization protocols improve functional outcome, reduce ICU delirium and decrease ventilator dependency in critically ill patients

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ABSTRACT:

Background: Prolonged immobilization in the intensive care unit (ICU) often results in significant functional decline, increased ventilator dependency, and heightened risk of ICU delirium. Early mobilization has been proposed as a potential intervention to counteract these adverse effects and improve patient outcomes.

Aim: The study aimed to evaluate the role of early mobilization and physical therapy protocols in improving functional outcomes, reducing the incidence of ICU delirium, and decreasing ventilator dependency in critically ill patients.

Methods: A prospective cohort study was conducted involving 100 critically ill patients in the ICU. Patients were divided into two groups: the intervention group, which received early mobilization and physical therapy protocols starting within 72 hours of ICU admission, and the control group, which received standard care without early mobilization and physical therapy. Functional outcomes were assessed using the Functional Independence Measure (FIM), ICU delirium was measured using the Confusion Assessment Method for the ICU (CAM-ICU), and ventilator dependency was recorded as the number of ventilator days.

Results: Patients in the intervention group showed significant improvements in functional outcomes (mean FIM score improvement of 23%, $p < 0.01$) compared to the control group. The incidence of ICU delirium was reduced by 28.6 % in the intervention group ($p < 0.03$), and the mean number of ventilator days was reduced by 31.5% compared to the control group ($p < 0.02$).

Conclusion: Early mobilization and physical therapy in ICU patients significantly improved functional outcomes, reduced ICU delirium, and decreased ventilator dependency. These findings support the

implementation of early mobilization protocols in critically ill patients to enhance recovery and reduce ICU-related complications.

Keywords: Early mobilization, ICU delirium, ventilator dependency, functional outcomes, physical therapy, critically ill patients.

INTRODUCTION:

In critical care settings, patients admitted to intensive care units (ICUs) often experienced prolonged immobility due to the severity of their conditions, sedation, and mechanical ventilation. This immobility had significant repercussions on their overall recovery, resulting in physical deconditioning, muscle atrophy, and complications such as ICU-acquired weakness (ICUAW) [1]. ICUAW, characterized by profound weakness in critically ill patients, had been associated with increased morbidity, prolonged hospital stays, and delayed recovery post-discharge. Traditionally, critical care focused on stabilizing physiological parameters with less emphasis on early physical interventions, but growing evidence highlighted the need to reconsider this approach [2].

Early mobilization in critically ill patients emerged as a potential strategy to mitigate the detrimental effects of immobility. It was defined as the initiation of physical activity, including passive range of motion, bed mobility exercises, and even ambulation, as soon as patients' medical conditions allowed. Numerous studies underscored the role of early mobilization in improving functional outcomes, reducing ICU delirium, and decreasing ventilator dependency [3]. This proactive approach shifted the focus from mere survival to long-term quality of life by addressing the musculoskeletal and cognitive decline associated with prolonged ICU stays.

Functional Outcomes and Early Mobilization

Research had shown that critically ill patients who participated in early mobilization protocols demonstrated better physical functioning at hospital discharge and during long-term follow-up compared to those who remained immobile for extended periods [4]. Early physical therapy interventions, which ranged from passive exercises to assisted walking, helped maintain muscle strength and joint flexibility. Patients who engaged in such activities were more likely to regain independence in basic activities of daily living (ADLs), reducing the need for post-discharge rehabilitation [5].

Functional recovery was also closely linked to ICUAW. Studies revealed that early mobilization reduced the incidence and severity of ICUAW, thereby improving patients' long-term mobility and physical endurance. This suggested that early intervention played a critical role in preserving muscle function and preventing long-term disability in critically ill patients [6].

ICU Delirium and Early Mobilization

ICU delirium, a common complication in critically ill patients, was characterized by confusion, inattention, and fluctuating mental status. It had been associated with worse clinical outcomes, including longer ICU and hospital stays, higher mortality rates, and a greater likelihood of long-term cognitive impairment. While the exact mechanisms of delirium remained unclear, immobility and sedation were believed to contribute significantly to its onset [7].

Studies investigating the effects of early mobilization on ICU delirium demonstrated promising results. Early mobilization protocols, in conjunction with reduced sedation practices, were found to lower the incidence of delirium in ICU patients. Patients who were mobilized early showed improved cognitive

function, reduced episodes of confusion, and shorter durations of delirium, compared to those who remained immobile. The physical activity, combined with increased patient interaction and environmental stimulation, was thought to play a protective role against cognitive decline [8].

Ventilator Dependency and Early Mobilization

Ventilator dependency in critically ill patients was another challenge in ICU care, often leading to prolonged mechanical ventilation and associated complications. Prolonged intubation increased the risk of ventilator-associated pneumonia (VAP) and further contributed to muscle atrophy, complicating the weaning process. Early mobilization had been shown to facilitate weaning from mechanical ventilation by improving respiratory muscle strength and endurance [9]. Patients who engaged in physical therapy while still mechanically ventilated demonstrated faster extubation times and decreased ventilator days, reducing the overall ICU stay.

Early mobilization in critically ill patients had proven to be a vital intervention for improving functional outcomes, reducing ICU delirium, and decreasing ventilator dependency. It represented a shift in critical care, moving beyond life-saving measures to enhancing the quality of recovery for ICU patients [10].

METHODOLOGY:

Study Design and Setting

This study employed a prospective cohort design conducted in the intensive care unit (ICU) of Pak Emirates military hospital Rawalpindi. The study spanned from July 2023 to June 2024.

Study Population

The study involved 100 critically ill patients admitted to the ICU who met the inclusion criteria. Inclusion criteria comprised adult patients aged 18 years and older, who required mechanical ventilation and had been in the ICU for more than 48 hours. Patients were excluded if they had contraindications to mobilization, such as prolonged hemodynamics instability, severe neurological deficits, or musculoskeletal injuries.

Sampling Method

Participants were recruited through convenience sampling. The ICU team identified eligible patients during daily rounds, and informed consent was obtained from the patients or their legal representatives prior to enrollment in the study.

Intervention

The intervention consisted of an early mobilization protocol initiated by a trained physical therapist. Mobilization sessions were conducted daily, focusing on gradually increasing physical activity levels based on each patient's tolerance. The protocol included passive range of motion exercises, sitting on the edge of the bed, walking with Aid and eventually ambulation as the patient's condition allowed.

Outcome Measures

The primary outcome measures included functional outcomes, ICU delirium, and ventilator dependency. Functional outcomes were assessed using the Functional Independence Measure (FIM) scale at baseline and at discharge from the ICU. ICU delirium was evaluated using the Confusion Assessment Method for the ICU (CAM-ICU) daily during the intervention period. Ventilator dependency was measured as the number of days patients required mechanical ventilation, recorded from the day of enrollment until extubation.

Data Collection

Data were collected at baseline, during the intervention, and upon ICU discharge. Baseline characteristics such as age, gender, comorbidities, and APACHE II scores were documented. The outcomes were analyzed by a blinded research assistant to minimize bias.

Statistical Analysis

Data were analyzed using SPSS 25 version. Descriptive statistics were calculated for demographic variables. Continuous variables were analyzed using paired t-tests or Wilcoxon signed-rank tests, while categorical variables were assessed using chi-square tests. A p-value of <0.05 was considered statistically significant.

RESULTS:

The study evaluated the impact of early mobilization on functional outcomes, ICU delirium, and ventilator dependency among critically ill patients. A total of 100 patients were enrolled, with 45 patients in the early mobilization group and 55 patients in the standard care group. The analysis revealed significant improvements in functional outcomes, reductions in ICU delirium rates, and decreased ventilator dependency in the early mobilization group compared to the control group.

Table 1: Functional Outcomes Measured by the Barthel Index:

Time Point	Early Mobilization Group (n=45)	Standard Care Group (n=55)	p-value
Day 3	30.2 ± 6.3	26.5 ± 5.9	<0.01
Day 6	42.4 ± 6.2	35.1 ± 6.4	<0.01
Day 9	53.1 ± 5.5	44.3 ± 7.2	<0.01
Day 14	70.2 ± 4.1	57.2 ± 6.9	<0.01

Table 1 presents the functional outcomes of patients measured using the Barthel Index at various time points during their ICU stay. The early mobilization group demonstrated statistically significant improvements in their scores at all assessed time points compared to the standard care group. By Day 14, the early mobilization group had an average Barthel Index score of 70.2 indicating a higher level of functional independence compared to the standard care group, which had a score of 58.5.

Table 2: Incidence of ICU Delirium:

Group	Number of Patients with Delirium	Total Patients (n)	Incidence (%)	p-value
Early Mobilization	10	45	22%	<0.03
Standard Care	17	55	31%	<0.03

Table 2 shows the incidence of ICU delirium among the study groups. The early mobilization group had a significantly lower incidence of delirium (22.2%) compared to the standard care group (31%). This

reduction indicates that implementing early mobilization protocols effectively decreased the risk of developing delirium in critically ill patients.

Table 3: Duration of Ventilator Dependency:

Group	Median Duration of Ventilation (days)	Interquartile Range (days)	p-value
Early Mobilization	5.5	4- 8	<0.02
Standard Care	8	6-12	<0.02

Table 3 summarizes the duration of ventilator dependency between the two groups. The early mobilization group had a median duration of 5.5 days, significantly shorter than the 8 days reported in the standard care group. The interquartile ranges also indicated less variability in the early mobilization group, suggesting that patients in this group were more likely to wean off ventilation sooner than those receiving standard care.

DISCUSSION:

The findings from this study underscored the significant impact of early mobilization on the outcomes of critically ill patients in the intensive care unit (ICU). Throughout the duration of the study, it became evident that early physical therapy and mobilization protocols contributed to improved functional outcomes, reduced the incidence of ICU delirium, and decreased the duration of ventilator dependency [11].

Early mobilization was associated with enhanced physical functioning among patients. Previous research has established that prolonged bed rest can lead to muscle atrophy and physical deconditioning, which are particularly detrimental for ICU patients who often face significant physical limitations upon discharge [12]. In this study, patients who participated in early mobilization protocols demonstrated greater improvements in mobility and strength compared to those who received standard care. These findings align with the growing body of evidence advocating for early mobilization as a critical component of ICU management. By initiating mobility early, healthcare providers not only fostered physical recovery but also contributed to a more positive trajectory toward discharge.

The reduction in ICU delirium observed in this study is another critical finding that emphasizes the importance of early mobilization [13]. Delirium is a common complication in critically ill patients, associated with prolonged hospital stays, increased healthcare costs, and long-term cognitive decline. Early mobilization likely played a role in minimizing the risk factors associated with delirium, including sedation, sleep deprivation, and sensory deprivation. By engaging patients in mobilization activities, caregivers were able to reduce sedation levels and promote more consistent sleep patterns. Moreover, physical activity may have contributed to increased orientation and cognitive engagement, further diminishing the risk of delirium [14]. This is consistent with existing literature that suggests a correlation between physical activity and cognitive function in critically ill patients.

Additionally, the study highlighted a notable decrease in ventilator dependency among patients who underwent early mobilization. Prolonged mechanical ventilation is associated with various complications,

including ventilator-associated pneumonia and prolonged ICU stays. The implementation of mobilization protocols likely facilitated earlier weaning from mechanical ventilation, as patients who were mobilized exhibited improved respiratory function and strength [15]. This not only enhanced patient comfort but also contributed to better resource utilization within the ICU, allowing for more efficient management of bed availability and staffing.

It is crucial to acknowledge the multifaceted nature of early mobilization and its implementation within the ICU setting. The success of mobilization protocols relied heavily on interdisciplinary collaboration among healthcare professionals, including nurses, physical therapists, and respiratory therapists. Effective communication and teamwork were paramount in assessing patient readiness for mobilization and ensuring safety during these activities [16]. As a result, the study underscored the need for healthcare institutions to foster a culture that prioritizes early mobilization and supports staff education and training. Despite the positive outcomes associated with early mobilization, certain limitations were identified. The study sample was relatively small, and the results may not be generalizable to all ICU populations [17]. Additionally, variations in patient conditions, sedation drugs used, their dose and duration and responses to mobilization could introduce bias in the findings.

Future research should aim to include larger, more diverse cohorts to validate these outcomes.

Further the role of sedation and paralytic and their dose and duration on patient outcome and further explore the mechanisms by which early mobilization exerts its beneficial effects [18].

This study reaffirmed the importance of early mobilization in ICU patients, demonstrating its efficacy in enhancing functional outcomes, reducing ICU delirium, and decreasing ventilator dependency [19]. The findings call for the integration of early mobilization protocols into standard ICU care, with a focus on interdisciplinary collaboration and continued research to optimize practices that support critically ill patients on their path to recovery [20].

CONCLUSION:

The study demonstrated that early mobilization in ICU patients significantly improved functional outcomes, reduced the incidence of ICU delirium, and decreased ventilator dependency. Implementing structured physical therapy and mobilization protocols facilitated enhanced recovery among critically ill patients, fostering a more favorable hospital course. These findings underscored the importance of integrating early mobilization into standard ICU practices, highlighting its potential to improve overall patient outcomes. The evidence presented supports further research and implementation of early mobilization strategies to optimize care for critically ill individuals in intensive care settings.

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