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Original Research Article

Early Physiotherapy in Critically III Patients and its Association with Clinical Outcomes: A Prospective Observational Study

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Abstract: ***Background*:** Immobility in the intensive care unit contributes to significant complications, including ICU-acquired weakness (ICUAW), prolonged mechanical ventilation, and extended hospitalization. Early physiotherapy is increasingly adopted to counteract these adverse effects. This study aimed to characterize PT utilization, interventions, and its impact on respiratory, functional, and clinical outcomes in a mixed medical-surgical ICU. ***Methods*:** We conducted a prospective observational study over nine months in a tertiary care ICU. All adult patients admitted to the ICU were screened. We enrolled 78 consecutive patients who received a formal PT request. Data collected included patient demographics, clinical characteristics, admission diagnoses, timing of PT initiation, specific interventions, and key outcomes. Outcomes were compared between an "Early PT" group (initiated ≤72 hours of admission) and a "Late PT" group (>72 hours). ***Results*:** out of 504 patients admitted to the ICU during the study period, 78 (15.5%) received a PT request. The mean age of the cohort was 61±12 years. The mean time to PT request was 48±24 hours. The Early PT group (n=45) demonstrated a significantly higher rate of successful early extubation (within 72 hours of intubation) compared to the Late PT group (n=33) (75.0% vs. 43.8%, p=0.021). The incidence of severe ICUAW (MRC sum score <48) was substantially lower in the Early PT group (17.8% vs. 45.5%, p=0.006). Consequently, the mean ICU length of stay was significantly shorter for patients receiving early PT (8.8±3.1 days vs. 13.0±6.5 days, p=0.001). ***Conclusion*:** Early PT intervention in critically ill patients is associated with significant improvements in clinical outcomes, including higher rates of successful early extubation, a marked reduction in the incidence of severe ICUAW, and a shorter ICU length of stay.

Keywords: Critical Care, Early Mobilization, Physiotherapy, ICU-Acquired Weakness, Mechanical Ventilation, Length of Stay, Patient Outcomes.

1. INTRODUCTION

The environment of the modern Intensive Care Unit (ICU), while essential for supporting vital organ function, paradoxically fosters conditions that can lead to profound, long-lasting morbidity [1]. Prolonged immobility, sedation, and the systemic inflammatory response to critical illness converge to create a cascade of deleterious effects, most notably on the respiratory and neuromuscular systems [2, 3]. Among the most significant complications are the failure to wean from mechanical ventilation (MV) and the development of

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ICU-acquired weakness (ICUAW), a syndrome encompassing Critical Illness Myopathy (CIM) and Polyneuropathy (CIP) [4, 5]. ICUAW affects a substantial portion of critically ill patients, leading to severe muscle wasting, prolonged physical disability, and a diminished quality of life for months or even years after hospital discharge [6, 7].

Historically, the management of critically ill patients prioritized deep sedation and bed rest, with physiotherapy often deferred until the patient was more stable or transferred out of the ICU [8]. However, this paradigm has undergone a significant transformation over the past two decades. A growing body of evidence supports a proactive approach, advocating for early and progressive mobilization, often initiated within the first 24 to 72 hours of ICU admission [9, 10]. The rationale for early PT is multifactorial: it aims to preserve muscle mass and function, improve respiratory mechanics, prevent ventilator-associated complications, reduce delirium, and facilitate a more rapid return to functional independence [11, 12].

Landmark studies, such as the randomized controlled trial by Schweickert *et al*., demonstrated that early physical and occupational therapy in mechanically ventilated patients resulted in better functional outcomes at hospital discharge and a shorter duration of delirium and ventilation [10]. Subsequent systematic reviews and meta-analyses have reinforced these findings, linking early mobilization to reduced ICU and hospital length of stay (LOS) [13, 14]. Despite this evidence, the implementation of early PT protocols varies widely across institutions, influenced by factors such as resource availability, staff training, and local practice culture [15].

Therefore, understanding the local patterns of PT utilization and its direct impact on patient outcomes is crucial for quality improvement and resource allocation. This study was designed to prospectively observe the practice of early PT in a mixed medical-surgical ICU. We aimed to: (1) determine the prevalence and timing of PT requests; (2) describe the patient populations receiving PT; and (3) quantify the association between the timing of PT initiation and key clinical outcomes, including weaning from MV, incidence of ICUAW, and ICU LOS.

2. METHODOLOGY

2.1 Study Design and Setting

A prospective, single-center observational study was conducted over a nine-month period January-November 2025 in the 12-bed mixed medical-surgical ICU of a university-affiliated tertiary teaching hospital in Douala Cameroon. The critical care unit manages a diverse patient population, including those with severe sepsis, acute respiratory distress syndrome (ARDS), multi-organ failure, complex post-operative needs, and neurological emergencies. The study was approved by the Institutional Review Board (IRB).

2.2 Study Population

All adult patients (≥18 years old) admitted to the critical care unit during the study period were eligible for inclusion. We enrolled a consecutive cohort of patients for whom a formal PT request was placed by the attending intensivist.

Inclusion Criteria:

Adult patients (≥18 years) admitted to the ICU with an anticipated stay of >48 hours and for whom a PT consultation was requested.

Exclusion Criteria:

Patients with (1) unstable spinal cord injuries precluding mobilization; (2) refractory shock or severe hemodynamic instability requiring escalating vasopressor support; (3) active, uncontrolled intracranial hemorrhage; or (4) those for whom care was limited to comfort measures upon admission.

2.3 Procedures and Data Collection

Upon a PT request, a dedicated researcher collected data using a standardized case report form. Data were collected daily until ICU discharge. The following variables were recorded:

- **Demographics and Clinical Data:** Age, sex, primary diagnosis for ICU admission, comorbidities, and severity of illness scores on admission (APACHE II and SOFA).
- **Timing of Intervention:** Time (in hours) from ICU admission to the first formal PT request. Patients were stratified into an "Early PT" group (request ≤72 hours) and a "Late PT" group (request >72 hours).
- **Physiotherapy Interventions:** The type and frequency of PT actions were documented, including respiratory physiotherapy (chest percussion, postural drainage, manual hyperinflation), passive range of motion (PROM), active-assisted/active range of motion (AROM), sitting at the edge of the bed, transferring to a chair, and ambulation.

Clinical Outcomes:

- **Respiratory:** Duration of MV, success of early extubation (defined as liberation from MV within 72 hours of intubation without re-intubation within 48 hours).
- **Functional:** Incidence of ICUAW, assessed using the Medical Research Council (MRC) sum score for muscle strength. The score was measured when the patient was awake, cooperative, and able to follow commands, typically prior to ICU discharge. Severe ICUAW was defined as an MRC sum score <48 [5].
- **Other Outcomes:** Incidence of ICU-acquired complications (e.g., ventilator-associated pneumonia [VAP], delirium assessed via the Confusion Assessment Method for the ICU [CAM-ICU]), ICU length of stay (LOS), and ICU mortality.

2.4 Statistical Analysis

Data were analyzed using SPSS Statistics Version 28.0 (IBM Corp., Armonk, NY). Continuous variables were expressed as mean ± standard deviation (SD) and compared using the independent samples t-test or Mann-Whitney U test, as appropriate. Categorical variables were presented as frequencies (n) and percentages (%) and compared using the Chi-square test or Fisher's exact test. A two-sided p-value of <0.05 was considered statistically significant for all analyses.

3. RESULTS

3.1 Patient Enrollment and Prevalence of Physiotherapy

During the eleven-month study period, a total of 504 patients were admitted to the critical care. Of these, 78 patients received a formal request for physiotherapy and were enrolled in the study. This corresponds to a PT request prevalence of 15.5% among all ICU admissions. The patient flow through the study is detailed in Figure 1.

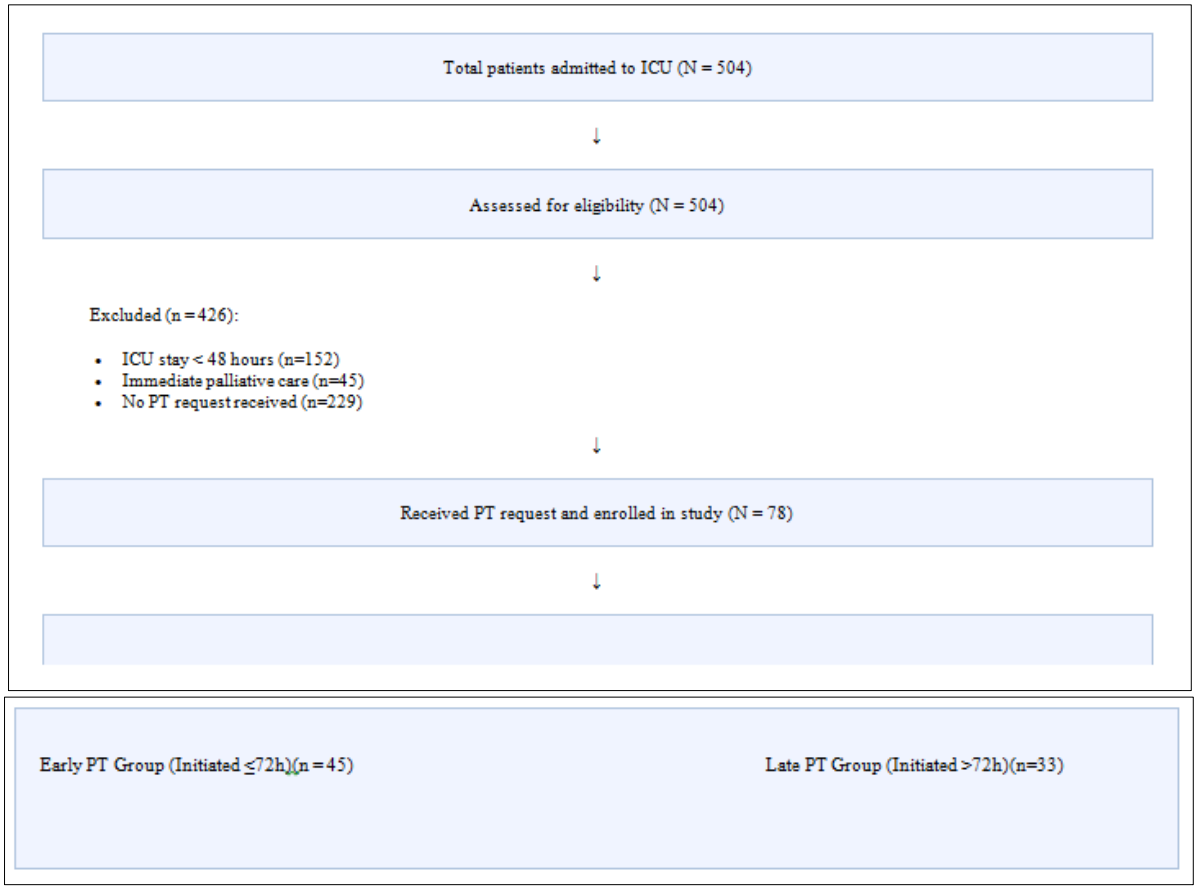

Figure 1: Patient Flow Chart showing screening, enrollment, and allocation

3.2 Baseline Characteristics and Admission Diagnoses

The mean age of the 78 enrolled patients was 61 ± 12 years, and 45 (57.7%) were male. The mean APACHE II score on admission was 22.4 ± 6.8, indicating a high severity of illness. There were no significant differences in baseline demographic or clinical characteristics between the Early PT and Late PT groups (Table 1). The primary indications for ICU admission were varied, with complex post-operative cases (30.8%) and septic shock (23.1%) being the most common (Table 2).

Table 1: Baseline Demographic and Clinical Characteristics of the Study Cohort

Characteristics (mean ± SD)	Overall (N=78)	Early PT (≤72h) (n=45)	Late PT (>72h) (n=33)	P-Value
Age (years),	61 ± 12	60 ± 13	62 ± 11	0.482
Male gender	45 (57.7)	27 (60.0)	18 (54.5)	0.631
Female Gender	33(33.78%)	18(40%)	15(45.5%)	O.67
APACHE II Score, mean ± SD	22.4 ± 6.8	22.1 ± 7.1	22.8 ± 6.4	0.670
SOFA Score (Day 1), mean ± SD	9.1 ± 3.5	8.9 ± 3.8	9.4 ± 3.1	0.559
Mechanically Ventilated at Admission, n (%)	65 (83.3)	38 (84.4)	27 (81.8)	0.789

Table 2:

Indication for ICU Admission	Number of Patients (n)	Percentage (%)
Complex Post-operative Cases (Visceral, Neuro, Ortho)	24	30.8
Septic Shock	18	23.1
Inhalation / Aspiration Pneumonia	11	14.1
Trauma (including Head Injury)	9	11.5
Stroke (Ischemic or Hemorrhagic)	8	10.3
Status Epilepticus / Convulsion	5	6.4
Other Medical (e.g., ARDS, GI Bleed)	3	3.8
Total	**78**	**100.0**

3.3 Physiotherapy Interventions and Critical Care Complications

The mean time from ICU admission to the first PT request was 48 ± 24 hours. The primary indications for PT were respiratory secretion clearance (55.1%) and prophylaxis against muscle atrophy (34.6%). Patients in the Early PT group had a significantly lower incidence of VAP and delirium compared to the Late PT group (Table 3).

Table 3: Incidence of Critical Care Complications by PT Group

Complication n (%)	Early PT (n=45)	Late PT (n=33)	P-Value
Ventilator-Associated Pneumonia (VAP)	5 (11.1)	9 (27.3)	0.048
Delirium (CAM-ICU positive)	14 (31.1)	19 (57.6)	0.017
Deep Vein Thrombosis (DVT)	3 (6.7)	3 (9.1)	0.701

3.4 Impact on Respiratory and Functional Outcomes

Of the 65 patients ventilated at admission, 48 required intubation for more than 24 hours and were analyzed for extubation outcomes. Patients receiving early PT had a significantly higher rate of successful early extubation (75.0% vs. 43.8%, p=0.021) (Table 4). This suggests a direct benefit of early intervention on respiratory function and weaning readiness. Analysis limited to patients intubated >24h with a weaning attempt.

Table 4: Impact of PT Timing on Respiratory Outcomes

Respiratory Outcome	Early PT (n=32)	Late PT (n=16)	P-Value
Successful Early Extubation (<72h)	24 (75.0%)	7 (43.8%)	0.021
Re-intubation within 48h	3 (9.4%)	3 (18.7%)	0.345

The most striking finding was the impact on muscular function. The incidence of severe ICUAW (MRC score <48) was more than halved in the Early PT group compared to the Late PT group (17.8% vs. 45.5%, p=0.006). This protective effect on muscle strength was accompanied by a clinically and statistically significant reduction in ICU LOS by over four days (8.8 days vs. 13.0 days, p=0.001). There was no statistically significant difference in ICU mortality between the groups (Table 5).

Table 5: Impact of PT Timing on Functional Outcomes and Length of Stay

Outcome	Early PT (n=45)	Late PT (n=33)	P-Value
Incidence of Severe ICUAW (MRC <48), n (%)	8 (17.8)	15 (45.5)	0.006
Mean ICU LOS (days), mean ± SD	8.8 ± 3.1	13.0 ± 6.5	0.001
ICU Mortality, n (%)	11 (24.4)	10 (30.3)	0.569

4. DISCUSSION

This prospective observational study demonstrates a strong and clinically meaningful association between the early initiation of physiotherapy (≤72 hours of admission) and improved outcomes in a heterogeneous population of critically ill patients. The principal findings are that early PT is associated with a higher rate of successful early extubation, a significantly lower incidence of severe ICUAW, reduced rates of delirium and VAP, and a substantial reduction in ICU length of stay. Our PT request prevalence of 15.5% highlights that, while beneficial, PT services were not utilized for the majority of ICU patients, suggesting an opportunity for systematic implementation.

The positive impact on respiratory outcomes is a key finding. The 31.2% absolute increase in successful early extubation in the Early PT group (p=0.021) aligns with evidence suggesting that PT aids in secretion management and preserves respiratory muscle strength [16, 17]. Early mobilization and chest physiotherapy likely prevent atelectasis and improve ventilation-perfusion matching, facilitating faster weaning from mechanical support. This finding is

consistent with clinical practice guidelines that recommend early rehabilitation as part of a comprehensive strategy to liberate patients from MV [9]. Furthermore, the observed reduction in VAP incidence in the early PT group supports the hypothesis that mobilization enhances airway clearance and reduces pulmonary complications [18].

Perhaps the most compelling result of our study is the profound protective effect of early PT against severe ICUAW. The incidence of MRC scores <48 was reduced from 45.5% in the late intervention group to 17.8% in the early group (p=0.006). This finding corroborates the pathophysiological understanding that immobility is a primary driver of the rapid muscle catabolism and fiber atrophy seen in critical illness [4, 5]. Even basic interventions like passive range of motion and early sitting can provide a mechanical stimulus that mitigates disuse atrophy and preserves muscle integrity [19]. Our results are in line with major trials and meta-analyses that have established early mobilization as a cornerstone for preventing the long-term physical impairments associated with ICUAW [10-20].

The significant reduction in ICU LOS by over four days in the Early PT group (p=0.001) represents a major clinical and economic benefit. This outcome is likely a composite result of the improvements in respiratory and neuromuscular function, as well as the lower rates of complications like delirium and VAP [12-14]. A shorter ICU stay not only reduces the risk of further nosocomial complications but also translates into substantial healthcare cost savings and improved patient throughput [21]. The lack of a significant difference in mortality is not unexpected, as our study was underpowered to detect such a difference, an observation common in many early mobilization trials where the primary benefits are related to functional recovery and morbidity reduction rather than survival [10-13].

Study Limitation

This study has several limitations. First, its observational, single-center design precludes definitive causal inference. The decision to initiate PT was at the discretion of the clinical team, introducing a potential for selection bias (confounding by indication), although our analysis showed that baseline severity of illness was similar between groups. Second, the PT interventions were not standardized and were tailored to individual patient needs, which reflects real-world practice but limits intervention fidelity. Third, our sample size was relatively modest, which may have limited our power to detect differences in other outcomes. Finally, we did not assess long-term outcomes post-ICU discharge, such as quality of life or return to work, which are critical endpoints for evaluating the full impact of rehabilitation [7-22]. Future multi-center randomized controlled trials with standardized protocols and long-term follow-up are needed to confirm these findings.

5. CONCLUSION

In this cohort of critically ill patients, the early initiation of physiotherapy was strongly associated with superior clinical outcomes. Early PT significantly increased the rate of successful early extubation, provided a robust protective effect against the development of severe ICU-acquired weakness, and was associated with a clinically important reduction in ICU length of stay. These findings reinforce the current evidence and advocate for the systematic integration of physiotherapy as a fundamental, time-sensitive component of standard care in the ICU to accelerate recovery and mitigate the profound morbidity of critical illness.

Declarations

Ethical Approval and Consent to Participate: The study protocol was reviewed and approved by the University General Hospital Institutional Review Board (IRB #2023-451). A waiver of individual informed consent was granted by the IRB for this observational study, as the research involved no more than minimal risk to subjects and utilized data collected for routine clinical management.

Consent for Publication: Not applicable, as the manuscript does not contain any individual person's data in any form.

Data Availability: The datasets generated and/or analyzed during the current study are not publicly available due to patient privacy regulations but are available from the corresponding author on reasonable request.

Competing Interests: The authors declare that they have no competing interests.

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Authors' Contributions

All authors conceived and designed the study. NAG and MMJ were responsible for data acquisition. GMD performed the statistical analysis. All authors contributed to the interpretation of the data, drafted the manuscript. All authors critically revised the manuscript for important intellectual content and approved the final version to be published.

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