A Nurse-Driven Early Mobility Protocol: Its Effect on Intensive Care Unit Acquired Weakness

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Abstract

Hospitalized critically ill patients are at high risk for functional decline due to their lack of mobility. This lack of physical activity contributes to adverse effects such as muscle deconditioning, an increased risk of complications, hospital acquired injuries, and increased length of stay. Early mobilization is a necessary intervention to prevent muscle deterioration and aid in enhanced recovery of patients. **Aim of the study:** To evaluate the effect of implementing a nurse-driven early mobility protocol on intensive care unit acquired weakness among critically ill patients. **Research design:** A quasi-experimental design was utilized to achieve the aim of this study. **Setting:** this study was conducted at critical care unit at AL Kasr AL Ainy hospital affiliated to Cairo University hospital**. Methods:** A purposive sample of 140 adult patients, recruited randomly into two equal groups (70 patients in each). **Tools**: three tools were used included, structured interview questionnaire, medical research council scale, intensive care unit mobility scale. **Results:** Post ICU mobility protocol implementation there was a statistically significant difference between the studied groups regarding passively moving to chair with (p value=0.002). **Conclusion:** Nurse-driven early mobility protocol is a safe and feasible intervention; it has a positive effect on the ICU acquired weakness. **Recommendations:** Early mobilization protocol should be incorporated into daily clinical practice of ICU.

Key words: Early mobility, Intensive care unit acquired weakness, Nurse driven

Introduction

Intensive care unit-acquired muscle weakness (ICUAW) is prevalent in a majority of intensive care unit patients. The only identified reason for ICUAW is the critical illness itself **(Gama Lordello et al., 2020).** The major risk factors include immobility or bed rest, which is common in the ICU setting for a patient battling a critical illness **(Vanhorebeek et al., 2020)**. Patients with a critical illness show a decrease in muscle mass within as short as 72 hours after mechanical ventilation and by discharge may experience as much as 18% weight loss. the rate of skeletal muscle strength decreases ranges from 1%-1.5%

each day While a critically ill patient on bedrest, **(Key, 2023).**

The pathophysiologic characteristics of ICU-AW are understood incompletely and likely are multifactorial. Immobilization and disuse are important contributors to the development of ICU-AW, but are not the sole causative factors. ICU-AW encompasses critical illness neuropathy, critical illness myopathy or a combination of both which is labelled as critical illness poly neuromyopathy **(Rawal & Bakhru, 2023).**

The high-intensity early mobility in patients with invasive mechanical ventilation (IMV) is safe and feasible, this can include active and passive activities which should be carried out as early as possible to improve the patient's functional status and increase the number of patients with functional independence at 3-month post-ICU discharge. Meanwhile, it improves the capacity of mobility and muscle strength and decreases the incidence of ICUAW, delirium, disability and mortality during ICU stay **(Zhang et al., 2024).**

Early mobilization or physical-therapy practices as passive limb mobilization, limb and respiratory muscle training, and bed cycling conducted by the critical care nurses are effective and safe method to avoid physical complications of immobilization for critically ill patients. On the other hand, utilizing of sedatives or disturbance of conscious level doesn't allow all patients at intensive care units to actively participate in early mobilization **(Mahran et al., 2023).**

Implementing a nurse driven early mobility protocol needs to be improved by

staffing and resource limitations, which present formidable challenges. Studies have pinpointed restricted staffing levels, time constraints, and inadequate equipment availability as primary barriers to early mobilization implementation **(Paton et al., 2023).** The effectiveness of early mobilization at the ICU has been corroborated by research. In addition to, a reduction in the incidence of ICUAW, it can lead to reduction in mechanical ventilation duration, improvement in patient's ability to stand and increased rates of ICU discharge **(Singam, 2024).**

Critical care nurses are the key to successful implementation of early mobility protocol for ICU patients. Early mobilization consists of various activities ranging from passive range of motion activities to walking with or without assistance. Nurses should also plan for physical and occupational therapies to improve functional outcomes. Daily exercises, especially targeted at the diaphragm and respiratory muscles, help greatly in the process of weaning from mechanical ventilation **(El saman et al., 2022).**

Significance of the study:

Intensive care unit acquired weakness is a major cause of ICU morbidity and mortality. There is no specific treatment for ICUAW, avoiding or limiting triggering events such as hyperglycemia is crucial to improve the recovery of affected critically ill patients **(Lopes et al., 2020).** Worldwide, around 13-20 million patients receive treatment at intensive care units, annually the incidence of ICUAW is rising from 25 to 31% worldwide, with 3.25–6.2 million new patients annually **(El saman et al., 2022).**

Intensive care unit acquired weakness is a known complication in critically ill patients, especially in those with severe underlying diseases with a prevalence range from 26 to 56 percent. Some contributing risk factors include sepsis, use of vasopressors, and hyperglycemia. The prevalence of ICU-AW varies considerably depending on the study population, risk factors, time of assessment, diagnostic methods, pre-hospital muscle function, and overall functional status. A systematic review that included 31 studies reported that a median prevalence of ICU-AW was 43% , with a higher incidence among patients with sepsis **(Chen & Huang, 2024).**

Nurses play a particularly vital role as they are the experts who work most closely with patients to facilitate early mobilization. Owing to their constant presence at the patient's bedside, they are pivotal in initiating and implementing early mobilization. Their role involves screening and classifying the overall feasibility of the intervention based on patient's hemodynamic stability and physical function. Additionally, they are responsible for analysing and assessing patient safety and potential risk factors during the early mobilization to prevent the occurrence of risks. ICU nurses serve as essential coordinators between patients and the medical team. Moreover, they actively participate in training patients to carry out early mobilization **(Lee et al., 2025).** Therefore, this study focused on nurse-driven early mobilization interventions.

Aim of the Study

The aim of the present study was to evaluate the effect of implementing a nurse-driven early mobility protocol on intensive care unit acquired weakness among critically ill patients through the following objectives:

1- Assess the incidence of intensive care unit acquired weakness and functional mobility among critically ill patients.
2- Implement a nurse-driven early mobility protocol among critically ill patients
3- Evaluate the effect of nurse-driven early mobility protocol on incidence of intensive care unit acquired weakness and functional mobility among critically ill patients.

Research Hypothesis

The current study hypothesized that:

H1. Critically ill patients who exposed to nurse-driven early mobility protocol will have a significant decreased incidence of intensive care unit acquired weakness post implementation.

H2. Critically ill patients who exposed to a nurse-driven early mobility protocol will have a significant improvement of functional mobility post implementation.

Operational definition:

Intensive care unit acquired weakness (ICU- AW):

Decreased muscle strength two weeks after ICU admission in which the total score

of simplified medical research council scale ranges from 60-0.

Subject and Methods

Research Design:

A Quasi-experimental design was utilized to achieve the aim of the study. A Quasi-experimental design identify a comparison group that is as similar as possible to the treatment group in terms of baseline (pre-intervention) characteristics. The comparison group captures what would have been the outcomes if the program/policy had not been implemented. Hence, the program or policy can be said to have caused any difference in outcomes between the treatment and comparison groups **(Handley, et al., 2018).**

Setting:

This study was conducted at critical care unit at AL Kasr AL Ainy hospital affiliated to Cairo University hospital. This unit locates on the second floor and includes two sections, the first section had fourteen beds, and the second section had nine beds.

Subject:

A purposive sample of 140 adult patients from previous mentioned setting. The study subject was distributed randomly into two equal groups, the early mobility group (n=70) and the control group (n=70).

Inclusion criteria:

- Adult patients from both genders.
- Admitted to ICU within two weeks without pervious history of neuromuscular disorder.

Tools of data collection:

Data was collected using the following tools

Tool I: Structured interview questionnaire:

This questionnaire developed by researchers based on the current literature **(Key, Zhou et al., Zhang et al., 2023, 2022, 2024)** and was divided into two parts:

Part 1: Personal data of the patients:

It included age, gender, marital status, occupation and educational level.

Part 2: Current and past history of patients:

This part used to assess patients' current history that included duration of current admission, patients' consciousness level on admission and medical diagnosis.

Past history of patients included pervious ICU admission, history of comorbid disease and duration of comorbid disease.

Tool II: - Medical research council scale:

This scale was adopted from **(Latronico & Gosselink, 2015).** It was used to assess strength of muscle, from six muscles in the upper and lower limbs on both sides.

Scoring system of Medical research council scale; Muscle strength was scored according to the 6-point medical research counseling system, which are; no visible contraction which was given grade zero, visible contraction without movements of the limbs equal grade 1, movements of the limbs but not against the gravity equal grade 2, movement against gravity over (almost) the full range was given grade 3, active movement against gravity and resistance was given grade 4 and grade 5 was scored for presence of normal muscle power.

- Patient had ICU- AMW if muscle strength score was < 48.
- Absence of ICU- AMW if muscle strength ranged from 48 to 60.

Tool III: ICU Mobility Scale (IMS):

This scale was adopted from **(Tipping et al., 2016).** It`s an eleven-item categorical scale that measures the highest level of functional mobility of patients within the ICU setting. There is a total of eleven categories on this scale and the maximum score obtained is 10.

Scoring system of ICU Mobility Scale:

The scoring is given based on the mobility stage achieved by the patient. the classified mobility stages include the following:

Classification	Score
- No activity, lying in bed	0
- Sitting in bed, exercises in bed	1
- Passively moved to chair (no standing)	2
- Sitting over edge of bed	3
- Standing	4
- Transfer to chair	5
- Marching in place (at bedside)	6
- Walking with assistance of 2 or more people	7
- Walking with assistance of 1 person	8
- Walking independently with gait aid	9
- Walking independently without a gait aid	10

Validity:

Face validity aimed to inspecting the items to determine whether the tools measure what were supposed to measure. Content validity was conducted to determine whether the tools covered the aim, test its appropriateness, comprehensiveness, accuracy, correction, clearance, and relevance through a jury of 5 experts (assistant professors of medical surgical nursing) from the Faculty of Nursing-Helwan University. Their opinions were elicited regarding tools consistency, rephrasing for some statements and scoring system.

Reliability:

Reliability of the tool was tested to determine the extent to which the questionnaire items are related to each other. The Cronbach's alpha model, which is a model of internal consistency, was used in the analysis. Statistical equation of Cronbach's alpha reliability coefficient normally ranges between 0 and 1. Higher values of Cronbach's alpha (more than 0.7) denote acceptable reliability. The tool showed high reliability, 0.79 for patients` structured interview questionnaire, 0.78 for medical research council scale and it was 0.90 for The ICU mobility scale.

Ethical consideration:

An official permission to conduct the proposed study was obtained from the Scientific Research, Ethical Committee of the faculty of Nursing, Helwan University no (41) 19/5/2024. An official permission was obtained from the administrative authority of the selected setting for the current study.

The researchers obtained consent from the studied patients, explaining the purpose and nature of the study, stating the possibility to withdraw at any time, confidentiality of data assured by the researcher by using codes to identify participants instead of names or any other personal identifiers. Ethics, values, culture, and beliefs were respected.

Pilot study:

The pilot study was done on 10% (14 patients) of the sample to examine the clarity of questions and time needed to complete the study tools. Subjects included in the pilot study were included from the study sample because no modification in the tools were done.

Field Work:

Data collection was started and completed within 6 months in the period from the beginning of July until the end of December .The aim of the study was clarified to patients who accepted to participate in the study before data collection.

Data collection was done by the researchers using the same tools for the same patient who fulfilled inclusion criteria; before and after implementation of a nurse-driven early mobility protocol. The nurse-driven early mobility protocol was adapted from **(Schallom et al., 2020).** it was constructed in three phases as follows:

I- Assessment phase: this phase was done using a pretest tool to assess the incidence of intensive care unit acquired weakness among critically ill patients. patients` physical condition was assessed by:

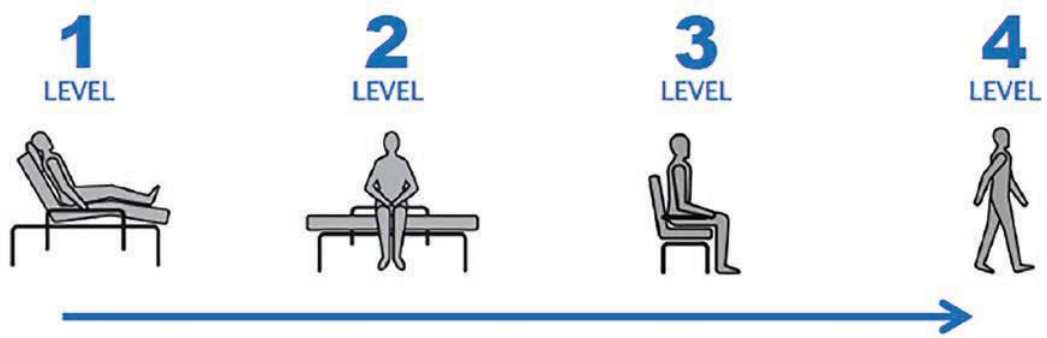
1- Screening for safety

The researchers evaluated myocardial stability, oxygenation stability, vasopressor use, engages to voice and neuro stability.

2- Assessment of risk: Patient's tolerance and risk were evaluated before each mobilization and the doctor chose passive mobilization or active exercise based on patient's disease type, conscious status and muscle strength.

Patients in control group received the routine therapy and management of ICU. Patients in early mobility group received early mobility protocol combined with the routine intervention.

II- Implementation phase: the researchers implemented early progressive mobility protocol by following the levels:



Goal: Clinical stability and able to move arm against gravity

Passive ROM 3 times per day.

Turn every 2 hours

Active-resistance

Sitting position 20 min 3 times per day.

Goal: Sitting upright and able to move leg against gravity

Passive ROM 3 times per day.

Turn every 2 Hours

Active-resistance

Sitting position 20 min 3 times per day.

Sitting on edge of bed

Goal: Increased strength and stands with minimal to moderate assist

Turn every 2 Hours

putting on or taking off clothes in the bed

doing resistance exercises from gently to hard 3 times per day.

Sitting position 20 min 3 times per day.

Sitting on edge of bed

Active transfer to chair ≥20 min 2 times per day

Goal: Strength and distance walk

Self or assisted turn every 2 Hours

Active-resistance

Active transfer to chair ≥20 min 3 times per day

Ambulation (marching in place, walking in halls)

The early mobility protocol was paused or terminated if the patient had:

- A heart rate above 130 b/min or below 60 b/min.
- A heart rate decreasing by more than 20% while resting, with irregular rhythm.
- A systolic blood pressure above 180 mmHg or below 90 b/min, or mean arterial pressure above 100 mmHg or below 60 mmHg.
- A blood oxygen saturation below 88%.
- A respiratory rate below 5 breaths/min or above 40 breaths/min.
- Received mechanical ventilator, and the oxygen concentration was above 60%; or the positive end expiratory pressure (PEEP) was above 10 cmH2O, and the patient was ventilated by control mode (CMV).
- Disorders of consciousness, such as disobeying instructions, irritability; new-onset arrhythmia requiring vasoactive drug maintenance, chest pain with myocardial ischemia, falling, bleeding, medical device removal or failure, respiratory distress

III- Evaluation phase:

This phase was done for both early mobility and control groups through using the same tools of pretest. After completing early mobility protocol, a posttest was used to evaluate the effect of a nurse-driven early mobility protocol on intensive care unit acquired weakness among critically ill patient.

Results

Table (1): shows that 70.0% of the early mobility group and 65.8% of the control group aged 50 ≤ 60 years with mean age of 50.43 + 9.70 & 49.71 ± 8.80 respectively. 57.1% and 60.0% of the studied groups were female respectively, and 68.5% & 64.3% of them were married. Concerning occupation, 62.9% and 58.6% of the both groups didn't work, additionally, 40% and 42.8% of them had primary education. There were no statistically significant differences between the studied groups regarding their personal data.

Table (2): shows that 68.6% &71.4% of the studied groups were admitted to the ICU since 1 to 3 days. 54.3% and 52.8% of them were fully conscious. Regarding their previous ICU admission**,** 75.7% & 71.4% of the both groups had a history of previous ICU admission. In terms of history of comorbid diseases, 60% and 57.1% of the studied patients had hypertension with a duration of comorbid diseases of more than 10 years among 70.0% and 67.1% of them respectively. There were no statistically significant differences between the studied groups regarding their current and past medical history.

Figure (1): illustrates that 38.6% of the early mobility group and 34.3% of the control group were diagnosed with cardiovascular diseases, followed by respiratory diseases among 32.8% of both groups. While only 5.7% and 8.6% of the studied groups had renal disease.

Figure (2): reveals that 87.1% of the early mobility group had muscle weakness compared to 21.4% of them pre to post early mobility protocol implementation, while, 85.7% and 81.4% of the control group had muscle weakness pre and post early mobility protocol implementation respectively.

Table (3): shows that 31.5% and 30% of the early mobility and control groups respectively were inactive and were lying in bed pre-ICU mobility protocol implementation, while, 61.4% and 4.3% of both groups were walking independently without a gait aid post early mobility protocol implementation.

Additionally, there were high statistically significant differences between the studied groups regarding some items of their functional mobility as being inactive and lying in bed, sitting in bed and exercises in bed, sitting over edge of bed and walking independently without a gait aid with (p value=0.000). There was a statistically significant difference between both groups regarding passively moving to chair with (p value=0.002)

Table (4): shows that there was a statistically significant negative correlation between the incidence of muscle weakness of the studied patients and their functional mobility post early mobility protocol implementation at (P= 0.004).

Table 1: Frequency and percentage distribution of the studied patients according to their personal data (n=140).

Personal data	Early mobility group (n=70)		Control group (n=70)		Chi square	P value
	N	%	N	%		
Age (years)						
• 20 - 29	4	5.7	5	7.1	3.256	0.196
• 30 – 39	5	7.1	8	11.4		
• 40 - 49	12	17.2	11	15.7		
• 50 ≤ 60	49	**70.0**	46	**65.8**		
Mean ($\bar{x}$) ± SD	**50.43 ± 9.70**		**49.71 ± 8.80**			
Gender						
• Male	30	42.9	28	40.0	2.239	0.534
• Female	40	**57.1**	42	**60.0**		
Marital Status						
• Married	48	**68.5**	45	**64.3**	0.467	0.494
• Single	2	2.9	4	5.7		
• Divorced	4	5.7	11	15.7		
• Widow	16	22.9	10	14.3		
Occupation						
• Working	26	37.1	29	41.4	1.507	0.105
• Not working	44	**62.9**	41	**58.6**		
Educational level						
• Primary education	28	**40.0**	30	**42.8**	4.083	0.253
• Secondary education	10	14.3	6	8.6		
• Diploma Education	24	34.3	27	38.6		
• Bachelor’s degree	4	5.7	3	4.3		
• Postgraduate education	4	5.7	4	5.7		

Table 2: Frequency and percentage distribution of the studied patients according to their current and past medical history (n=140).

	Early mobility group (n=70)		Control group (n=70)		Chi square	P value
	N	%	N	%		
Current history						
Duration of current admission						
• 1 – 3days	48	**68.6**	50	**71.4**	3.263	0.353
• 4 – 6 days	21	30.0	17	24.3		
• More than 7 days	1	1.4	3	4.3		
Patient's level of consciousness on admission						
• Fully conscious	38	**54.3**	37	**52.8**	2.981	0.395
• Semi-conscious	20	28.6	23	32.9		
• Unconscious	12	17.1	10	14.3		
Past history						
Previous ICU Admission						
• Yes	53	**75.7**	50	**71.4**	2.820	0.121
• No	17	24.3	20	28.6		
History of comorbid disease *						
• Myocardial infarction	5	7.1	7	10.0	0.273	0.601
• Hypertension	42	**60.0**	40	**57.1**		
• Diabetes Mellitus	15	21.4	19	27.1		
• Liver diseases	14	20.0	11	15.8		
Duration of comorbid disease						
• 1 – 5 years	13	18.6	15	21.5	1.286	0.296
• 6 – 10 years	8	11.4	8	11.4		
• More than 10 years	49	**70.0**	49	**67.1**		

*** This variable isn't mutually exclusive**

Figure (1): Percentage distribution of the studied patients according to their medical diagnosis (n=140).

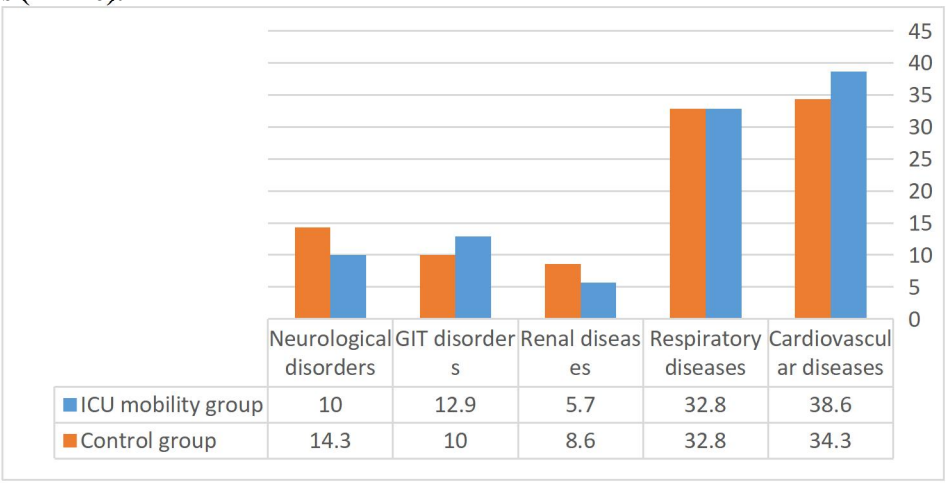


Figure (2): Comparison between the studied groups according to the incidence of ICU acquired weakness pre and post ICU mobility protocol implementation (n=140).

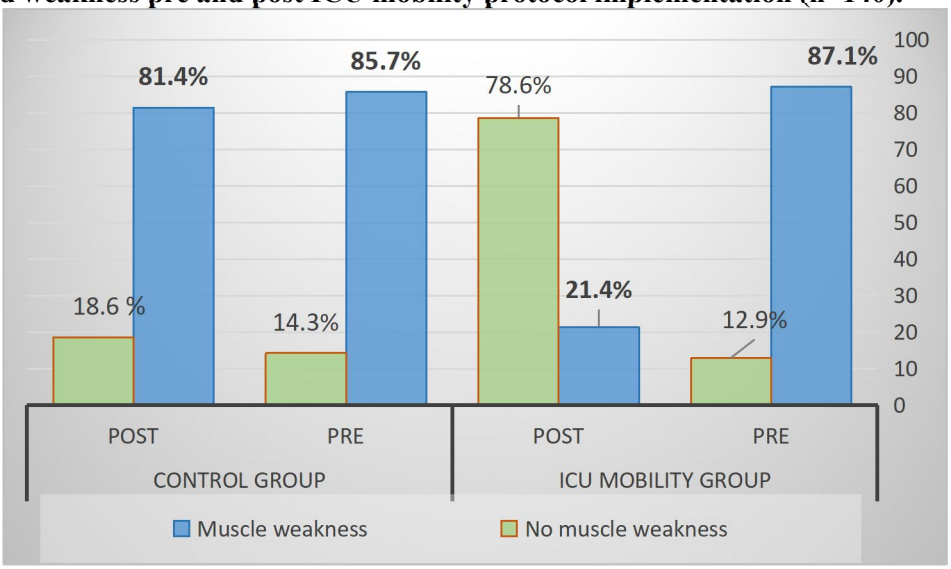


Table (3): Comparison between the studied groups according to their functional mobility pre and post early mobility protocol implementation (n=140).

Items	Early mobility group				Control group				Chi-square	P-Value
	Pre		Post		Pre		Post			
	N	%	N	%	N	%	N	%		
▪ No activity, lying in bed	22	**31.5**	1	1.4	21	**30.0**	19	27.2	9.015	0.000**
▪ Sitting and exercising in bed	8	11.4	1	1.4	10	14.3	12	17.1	5.712	0.000**
▪ Passively moved to chair (no standing)	5	7.1	2	2.9	5	7.1	6	8.6	2.835	0.002*
▪ Sitting over edge of bed	7	10.0	1	1.4	6	8.6	7	10.0	7.362	0.000**
▪ Standing	5	7.1	2	2.9	3	4.3	4	5.7	1.097	0.457
▪ Transfer to chair	3	4.3	2	2.9	4	5.7	3	4.3	2.096	0.525
▪ Marching in place (at bedside)	6	8.6	3	4.3	4	5.7	4	5.7	1.002	0.703
▪ Walking with assistance of 2 or more people	4	5.7	5	7.1	5	7.1	4	5.7	0.830	0.901
▪ Walking with assistance of 1 person	5	7.1	4	5.7	7	10.0	2	2.9	1.096	0.296
▪ Walking independently with gait aid	3	4.3	6	8.6	4	5.7	6	8.6	2.602	0.578
▪ Walking independently without a gait aid	2	2.9	43	**61.4**	1	1.4	3	4.3	4.780	0.000**

*** Significant P ≤ 0.05 ** Highly significant P ≤ 0.001 Not significant ≥ 0.05**

Table (4): Correlation between incidence of muscle weakness of the studied patients and their functional mobility post early mobility protocol implementation (n=140).

Items	Muscle weakness	
	Correlation coefficient (r)	P-Value
Functional mobility	- 0.947	0.004*

Discussion

The study findings revealed that about two thirds of the studied ICU mobility and the control groups aged 50 ≤ 60 years. More than half of the studied groups were female, and about two thirds of them didn't work, additionally, less than half of them had primary education. There were no statistically significant differences between the studied groups regarding their personal data. These findings indicate the homogeneity between both groups of critically ill patients who were selected by good randomization.

These findings agree with **El-Raghi Mostafa, A. (2023).,** who conducted a study about "Risk factors for acquired muscle weakness among critically ill patients" showed that about half of the studied patients had age of 50 years old, and about one third of them were housewives. As well, the study results are consistent with the randomized controlled trial study conducted in China by **Zhang et al., (2024),** entitled, "Effects of the High-intensity early mobilization on long-term functional status of patients with mechanical ventilation in the intensive care unit" and reported that there was no statistical difference between the two groups regarding their general information.

However, this study findings are dissimilar to the findings of a Sweden study carried out by **Söderberg et al, (2025),** who explored The patients' experience of early mobilisation in intensive care and stated that the age of the participants ranged from 21–80 years and more than half of them were male. Additionally, **Atkins-Whyte, (2025),** who conducted a study in Arizona, titled, **"**Implementation of Johns Hopkins highest level of mobility scale to reduce length of stay" and mentioned that the mean age of the patients in both comparative and implementation groups was 73.95+12.5 and more than two thirds were male gender. Theses discrepancies ay e owed to different study setting and characteristics of the studied participants.

Considering current and past medical history, more than two thirds of the studied groups were admitted to the ICU since 1 to 3 days. More than half of them were fully conscious. Regarding their previous ICU admission**,** the majority of both groups had a history of previous ICU admission .In terms of history of comorbid diseases, more than half of the studied patients had hypertension with a duration of more than 10 years among the majority of them. These findings may be related to the diagnosis of cardiovascular and respiratory diseases among more than two thirds of them.

This current study is in agreement with the findings of **Hodgson et al., (2022),** in their study inducted in Australia, titled, "Early active mobilization during mechanical ventilation in the intensive ntensive care unit" and found that the median interval of ICU admission of the patients was 1-4 days. On the contrary, this study disagrees with **Higuchi etal., (2025),** whose Japanese prospective study aimed to investigate clinical characteristics of intensive care unit-acquired weakness in patients with cardiogenic shock requiring mechanical circulatory support and revealed that only one quarter of the study population had hypertension.

Regarding the studied patients' diagnosis, the study findings illustrated that more than one third of the ICU mobility and control groups were diagnosed with cardiovascular diseases, followed by respiratory diseases among less than third of both groups. This current study is in disagreement with the findings of **Hodgson et al., (2022),** whose findings revealed that about two thirds of the studied patients had sepsis.

When assessing the incidence of ICU-AW using medical research council scale, the study findings revealed that the majority of the ICU mobility group had muscle weakness compared to less than quarter of them pre to post ICU mobility protocol implementation, while the majority of the control group had muscle weakness pre and post protocol implementation. These results may be related to the effect of early mobility protocol on improving muscle

strength and help decreasing the incidence of ICU-AW.

This researchers' interpretation is supported by **Sepúlveda et al., (2025),** in their study, titled, "Protocolized strategies to encourage early mobilization of critical care patients: challenges and success", they mentioned that early functional mobilization has been shown to reduce the number of days in bed, shorten the ICU stay, and decrease functional deterioration. Moreover, the study findings are congruent with the Chinese study carried out by **Zhou et al., (2025**), titled, "Meta-analysis of the effects of bundle interventions on ICU-acquired weakness intervention" and reported that the bundle care including early mobilization had lower incidence than control group.

Contrawise, the findings of the systematic review and meta-analysis conducted in Korea by **Lee et al., (2025),** aimed to assess the effects of nurse-involved early mobilization programme on muscle strength and in the intensive care unit length of stay and found that MRC sum scores in the intervention group ranged from 8 to 60, and in the control group ranged from 26 to 58 and early mobilization did not result in a statistically significant enhancement in muscle strength.

By comparing the functional mobility of the studied groups pre and post early mobility protocol implementation, it was revealed that less than one third of both groups were inactive and were lying in bed pre implementation, while about two thirds and the minority of the early mobility and control groups were walking independently without a gait aid post implementation. Additionally, there were high statistically significant differences between the studied groups regarding some items of their functional mobility. These results could be explained by mobilization exercises reduce immobility-related complications, preserve muscle function and helps counterbalance the muscle loss that occurs during extended ICU stays **(Petrucci et al., 2025).**

The study findings are consistent with the results found by **Formenti et a., (2025),** in their narrative review done in Italy, titled, "Combined Effects of Early Mobilization and Nutrition on ICU-Acquired Weakness" , they stated that patients who participate in early mobilization during their ICU stay show better functional recovery than those who remain inactive. In addition, **Zhang et al., (2024),** found that the mean sores of ICU mobility scale were higher in the intervention group than control group.

In the same context, the study done by **De Vries et al., (2025),** titled, **"**The feasibility of virtual reality therapy for upper extremity mobilization during and after intensive care unit admission" and showed that active training had a significant impact on mobility scales scores and patients who completed progressively challenging exercise had improve arm function.

The current study findings showed that there was a statistically significant negative correlation between the incidence of muscle weakness of the studied patients and their functional mobility ICU mobility protocol implementation. This correlation is supported by the narrative review done by **Formenti et al., (2025),** and mentioned that ICUAW is sever muscle weakness that complicates the functional recovery of patients. Similarly, the meta-analysis conducted by **Zhou et al., (2025),** stated that ICW cause functional impairment during the intensive care period affecting patients' recovery and quality of life.

Conclusion

Based on the findings of the study, it can be concluded that, nurse –driven early mobility protocol had a significant effect on decreasing the incidence of ICU acquired weakness and improving functional mobility among critically ill patients.

Recommendations

- Assessment of muscle weakness should be a part of the daily assessment of critically ill patients**.**
- Implementation of a nurse-driven early mobility protocol as standardized protocol in critical care units.
- Early mobilization protocol should be incorporated into daily clinical practice of ICU.
- Continuous training related to early mobilization should be promoted in all ICU settings.

References

Atkins-Whyte, C., (2025). Implementation of Johns Hopkins Highest Level of Mobility Scale to Reduce Length of Stay. A Direct Practice Improvement Project. Doctoral thesis of Nursing

Practice. Grand Canyon University. Arizona

Chen, J., & Huang, M., (2024). Intensive care unit-acquired weakness: Recent insights, Journal of Intensive Medicine, 4 (1), PP 73-80.

De Vries, M., Beumeler, L.F.E., van der Meulen, J., Bethlehem, C., den Otter, R., Boerma, E.C. (2025). The Feasibility of Virtual Reality Therapy for Upper Extremity Mobilization during and after Intensive Care Unit Admission. *PeerJ*, *13*, e18461.

El saman, S., Mohamed, A., Baraka, A., (2022). Correlation between Intensive Care Unit Acquired Weakness and Hyperglycemia in Critically Ill Geriatric Patients, Egyptian Journal of Health Care, EJHC Vol. 13(3), PP 1169-1177.

Formenti, P., Menozzi, A., Sabbatini, G., Gotti, M., Galimberti, A., Bruno, G., Pezzi, A., & Umbrello, M. (2025). Combined Effects of Early Mobilization and Nutrition on ICU-Acquired Weakness. *Nutrients*, *17*,1073.

Gama Lordello, G.G., Gonçalves Gama, G.G., Lago Rosier, G., De Carvalho Viana, P.A.D., Correia, L.C., Fonteles Ritt, L.E. (2020). Effects of cycle ergometer use in early mobilization following cardiac surgery: A randomized controlled trial. *Clinical Rehabilitation 34* (4). 450-459.

Handley, M. A., Lyles, C. R., McCulloch, C., & Cattamanchi, A., 2018: Selecting and Improving Quasi-Experimental Designs in Effectiveness and Implementation Research. *Annual review of public health*, *39*, PP: 5–25. Available from: https://doi.org/10.1146/annurev-publhealth-040617-014128.

Higuchi, T., Ide, T., Fujino, T., Tohyama, T., Nagatomi, Y., Nezu, T., Ikeda, M., Hashimoto, T., Matsushima, S., Shinohara, K., Nishihara, M., Iyonaga, T., Akahoshi, T., Ushijima, T., Shiose, A., Kinugawa, S., Tsutsui, H., & Abe, K. (2025). Clinical characteristics and predictive biomarkers of intensive care unit-acquired weakness in patients with cardiogenic shock requiring mechanical circulatory support. *Scientific reports, 15, 3535.*

Hodgson, C., Bailey, M., Bellomo, M., Brickell, K., Broadley, T., Buhr, H., Gabbe, B., Gould, D., Harrold, M., Higgins, A., Hurford, S., Iwashyna, T., Neto, A., Nichol, A., Presneill, J., Schaller, S., Sivasuthan, J., Tipping, C., Webb, S., & Young, P. (2022). Early active mobilization during mechanical ventilation in the ICU. *The New England of Medicine, 387, 19.*

Key, W., (2023). Implementation of a Nurse-Driven Early Mobility Protocol in Critical Care to Reduce Intensive Care Unit Acquired Weakness (ICUAW). Doctor of Nursing Practice Projects. 96.

Latronico, N. & Gosselink, R. (2015). A guided approach to diagnose sever muscle weakness in the intensive care unit. Rev bras ter intensive, volume (27), issue (3), pp (1171).

Lee, J., Kim, Y., & Lee, H. (2025). Nurse-involved early mobilization in intensive care unit: A systematic review and meta-analysis. Nursing in Critical Care, 30,e13278.

Lopes, A., Coltro, P., Lopes, V., Fiori, S., Knaopik, J., & Boumer, T. (2020). Muscle weakness assessment in older intensive care unit patients. Geriatr Gerontol Aging, 14(3): 166 – 72.

Mahran, G., Mahgoub, A., Ibrahim, B., Tolba, A., (2023). Effect of Physiotherapy with A Digital Electronic Acupunctoscope on Preventing The Intensive Care Unit-Acquired Muscle Weakness, Egyptian Journal of Health Care, 14(1).

El-Raghi Mostafa, A. (2023). Risk Factors for Acquired Muscle Weakness Among Critically all Patients. *Menoufia Nursing Journal*, *8*(1), 31-43. doi: 10.21608/menj.2023.288651

Paton M, Chan S, Tipping CJ. (2023). The effect of mobilization at 6 months after critical illness - meta-analysis. NEJM Evid, 2: EVIDoa 2200234. 10.1056/ EVIDoa2200234.

Petrucci, M., Gemma, S., Carbone, L., Piccioni, A., Della Polla, D.A., Simeoni, B., Franceschi, F., Covino, M. (2025). ICU-Acquired Weakness: From Pathophysiology to Management in Critical Care. Emerg. Care Med., 2, 4.

Rawal, H., & Bakhru, R., (2023). Early Mobilization in the ICU, *CHEST Critical Care,,* Open Access Published DOI: https://doi.org/ 10.1016/j.chstcc.2023.100038.

Schallom, M., Tymkew, H., Vyers, K., Prentice, D., Sona, C., Norris, T., Arroyo, C., (2020). Implementation of an Interdisciplinary AACN Early Mobility Protocol, *Critical Care Nurse*; 40[4]:e7-e17)

Sepúlveda, P., Gallardo, A., Arriagada, R., González, E., Rocco, P., Battaglini, D., (2025). Protocolized strategies to encourage early mobilization of critical care patients: challenges and success. Critical Care Science, 37:e20250128

Singam A. (2024). Mobilizing Progress: A Comprehensive Review of the Efficacy of Early Mobilization Therapy in the Intensive Care Unit. *Cureus*, *16*(4), e57595.

Söderberg, A, Thelandersson, A, Fagevik-Olsén, M, Karlsson, V. (2025). "I will get out of this" -The patients' experience of early mobilisation in intensive care. A hermeneutic study. Intensive and Critical care Nursing, 86, 103884, Article 103884.

Tipping, C.J., Bailey, M.J., Bellomo, R., Berney, S., Buhr, H., Denehy, L., Harrold, M., Holland, A., Higgins, A.M., Iwashyna, T.J., Needham, D. (2016). The ICU mobility scale has construct and predictive validity and is responsive. A multicenter observational study. Annals of the American Thoracic Society.13(6):887-93.

Vanhorebeek, I., Latronico, N., & Van den Berghel, G. (2020). ICU- acquired weakness. *Intensive Care Medicine, 46,* 637–653.

Zhang, C., Wang, X., Mi, J., Zhang, Z., Luo, X., Gan, R., and Mu, S., (2024). Effects of the High-Intensity Early Mobilization on Long-Term Functional Status of Patients with Mechanical Ventilation in the Intensive Care Unit Critical Care Research and Practice, Article ID 4118896.

Zhou, J., Zhang, C., Zhou, J. D., & Zhang, C. K. (2022). Effect of early progressive mobilization on intensive care unit-acquired weakness in mechanically ventilated patients: An observational study. *Medicine*, *101*(44), e31528..available at : https://doi.org/10.1097/MD.0000000000031528

***Z*hou, Y., Liu, Y., Han, Y., & Yan, H. (2025).** Meta-analysis of the effects of bundle interventions on ICU-acquired weakness intervention. *Technology and Health Care,* 33, 671–683.