

Effect of Early Mobilization Intervention on Controlling Acquired Muscle Weakness among Pediatric Critically Ill Patients

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Abstract

Persistent immobility is linked with short and long-term disabilities in children admitted to critical area. **Aim:** the aim of the study was to assess the effect of early mobilization intervention on controlling acquired muscle weakness among pediatric critically ill patients. Randomized control trial was carried out on 80 pediatric patients divided equally into the study and the control groups in pediatric intensive care unit at Aswan University Hospital. **Tools:** **Three tools were used to collect data:** **Tool I,** included personal data, medical data and assessment scale for monitoring children's muscle strength. **Tool II:** Assessment delirium scale (Richmond Agitation-Sedation Scale). **Tool III:** Assess signs of intolerance. **Results:** after early mobilization intervention, mean of muscle strength in the study group (4.63 ± 0.59) was higher than the control group (3.52 ± 1.89) with highly statistically significant difference ($p < 0.001$). Majority of children in the study group their ambulation distance at ICU discharge were increased. The mean time of moving out of bed was 2.90 ± 1.66 days for children in the study group vs. 3.20 ± 1.42 of them in the control group. Mean length of hospital stay was 4.28 ± 1.59 days for children in the study group vs. 6.38 ± 2.10 day of them in the control group with statistically significant difference between the two groups ($P=0.005$). **Conclusion:** Ambulation distance at ICU discharge was increased among studied group. There was significance difference between the two groups regarding length of hospital stay. Implementation of early mobilization intervention improves the children' muscle strength. **Recommendation:** Early mobilization protocol should be incorporated into daily clinical practice of pediatric intensive care unit.

Keywords: *Acquired Muscle Weakness, Mobilization & Pediatric Critically Ill Patients.*

Introduction

Children with critical illnesses are at risk of developing long-term conditions that may include neuromuscular impairment, cognitive impairment, and mental health disorders. These conditions, known as Post-Intensive Care Syndrome (PICS), may lead to functional deficits, school and social difficulty, and improve quality of life. Interventions aimed at rehabilitation such as early mobilization, reduction of anesthesia, prevention of acquired weakness in the intensive care unit (ICU), delirium, and Post-traumatic stress disorder (PTSD) may improve clinical outcomes and functional recovery in critically ill (Hopkins et al., 2015).

Prolonged bed rest causes severe weakness, inability to provide self-care, and reduce the patient mortality rate for up to five years after discharge from the intensive care unit (Rukstele & Gagnon, 2013). Also, prolonged bed rest in patients often leads to a range of problems such as mobility problems and functional issues, sleep deprivation, delirium, changing feeding conditions, increased hospital length of stay, and an overall burden to the health care system. To address these problems, early exercise and progressive mobility were introduced as an intervention to reduce the duration of both

delirium and ventilator days (Agency for Healthcare Research & Quality, 2017).

The burden is intervene to prevent the rehabilitation of acquired pathological conditions from serious diseases, such as muscle weakness and non-acclimatization, and to improve skin and physical integrity, and neuro cognitive health, thus reducing the duration of advanced life support and length of in the hospital stay (Choong et al., 2018). Prolonged immobility is an important predictor of poor functional outcomes and the development of critical illness-acquired morbidities (Needham et al., 2012). Early movement is defined as exercises that are clinically safe and developmentally appropriate rehabilitation to varying degrees starting during the first 48 to 72 hours of admission to the ICU (Cameron et al., 2015 & Wiczorek et al., 2015). Mobilization is universally defined as "a physical activity performed at an appropriate intensity that produces physiological benefits for the organism", and that acts on circulation, central or peripheral perfusion, ventilation, or consciousness (Castro-Avila et al., 2015). The incidence of generalized muscle weakness is including weakness in the extremities and respiratory muscles, during ICU admission without causes other than acute disease (Hermans, & Van den Berghe, 2015).

Early mobilization treatment and rehabilitation programs in critically ill patients have been associated with decreased intensive care unit (ICU), length of hospital stay, improved muscle strength, and improved self-perception of functional status (Engel et al., 2013).

The primary goal in the management of critically ill patients in intensive care units (ICU) is to maintain maximum stability of hemodynamic circulation and ventilation (Huygh, et al., 2016). In the recent years, mortality rate in pediatric intensive care units has decreased significantly, but the proportion of children who develop some degree of constraint after emptying has increased (Rennick & Childerhose, 2015). Interventions mobilizing early physical therapy include a combination of movement exercises, therapeutic exercises, bed mobility, relocation and gait training as appropriate, in order to reduce the time to bedbound the patient's presence. There has been limited research focusing on the importance of early mobilization in the intensive care unit. In the past, it was thought that long periods of paralysis and prolonged periods of bed rest were to achieve restoration of physiological stability (Adler & Malone, 2012)

Implementing an early mobilization program is possible in most intensive care units, and provides benefits if it does not start at least one or two days after the onset of the Mechanical Ventilation (MV) (Lai et al., 2017). Early mobility reduces raved days, mechanical ventilation days, and the ICU and the hospital stay. Technical results are also improved with early mobility. Early mobility can be performed by any part of a multidisciplinary team including nurses, physical therapists, occupational therapists, or physicians. It consists of activities ranging from passive movement to ambulation (Vanderbilt University Medical Center, 2018). Knowledge of early patient mobilization needs to be taught to physician, nurses and all involving healthcare provider. Nurses play an important role as a patient advocator, collaborator and executives in nursing practice for mechanically ventilated patient over 24 hours a day Chong, (2017).

Significance of the study

Prolonged immobility is associated with significant short and long-term disease states in adults and children with critical illness. The majority of critically ill pediatric patients remain immobilized while they are in the pediatric intensive care unit due to lack of awareness of associated disease conditions, comfort and knowledge about how to mobilize critically ill children, and the lack of guidelines for pediatric practice (Choong et al., 2018). Early mobility can prevent or reduce the risks of acquiring ICU vulnerability, neuropsychiatric disease, and

other complications associated with immobility (Agency for Healthcare Research & Quality, 2017). Children's data on early mobilization interventions is scarce. There is a marked lack of research studying early childhood mobilization, so the aim of this study is to implement an early mobilization intervention in order to control acquired muscle weakness among critically ill pediatric patients.

Aim of the study

The aim of this study was to assess the effect of early mobilization intervention on controlling acquired muscle weakness among pediatric critically ill patients.

Hypotheses

- 1- Acquired muscle weakness will decrease after implementing early mobilization intervention.
- 2- Early mobilization intervention will improve pediatric critically ill patients outcomes.

Subjects & Method

Research design

Randomized control trial was carried out to meet the aim of this study.

Setting

This study was conducted at pediatric intensive care unit in Aswan University Hospital over six months period from the beginning of December 2018 until the end of May 2019.

Sampling

A convenient sample was included 80 children, admitted in the pediatric intensive care unit over six months.

The total sample was randomly divided into two groups (each group contains 40 children) using simple random sample by using a coin (king and writing) for each child entered the intensive care, the study group was the king (selected for implementing early mobilization intervention) and the control group was the writing which exposed only the routine care of the intensive care.

Children with the following contraindication were excluded from the study: Increased intracranial pressure (ICP) greater than or equal to 15, acute or uncontrolled intracranial pressure, positive end-expiratory pressure (PEEP) greater than or equal to 10 on invasive mechanical ventilation, difficult airway, hemodynamic instability, uncontrolled pain, unstable fracture, uncontrolled seizures, hemoglobin less than 8 gm/dL or platelets less than 20 K/micro liter and active bleeding. Pre-existing neuromuscular disease and patients receiving muscle relaxant also excluded from the study.

Tools: Three tools were used to collect data of the present study:

Tool I: Patient's assessment it included two parts

Part 1: personal data as children' age, gender and diagnosis

Part 11: An assessment scale for monitoring children's muscle strength with the Medical Research Council (MRC), which developed by **Hermans et al., (2012)**.

The MRC score of 6 muscles (3 at the upper and 3 at the lower limbs) on both sides, each muscle graded from 0 to 5. The following muscles were examined for its strength: deltoid, biceps, wrist extensor, ileopsoas, quadriceps femoris and tibialis anterior.

Scoring system of Medical Research Council (MRC) scale:

The degree of muscle strength according to MRC grading scale includes: the normal strength (graded 5), ability to resist against moderate pressure throughout range of motion (graded 4), ability to move through a full range of motion against gravity (graded 3), ability to move through a full range of motion with gravity eliminated (graded 2), a flicker of motion is seen or felt in the muscle (graded 1) and no movement (graded 0).

Tool II: Assessment delirium scale (Richmond Agitation-Sedation Scale (RASS): which developed by **Chester et al., (2012)**. This scale is used in the intensive care unit by the researches to detect delirium and measure the alertness or agitation level of the pediatric patient.

Scoring system of RASS

This scale was presented to the patient as follows:

Observe a patient. Patient alert and calm (score 0).

1. If patient has behavior that is consistent with restlessness or agitation (score +1 to +4 using the criteria listed at the Richmond Agitation–Sedation Scale.
2. If a patient is not alert, in a loud speaking voice state the patient's name and direct patient to open eyes and look at speaker. Repeat once if necessary. It can prompt the patient to continue looking at speaker.
 - The patient has eye-opening and eye contact, which is sustained for more than 10 seconds (score -1).
 - The patient has eye-opening and eye contact, but this is not sustained for 10 seconds (score -2).
 - The patient has any movement in response to voice, excluding eye contact (score -3).
3. If a patient does not respond to voice, physically stimulate the patient by shaking shoulder and then rubbing sternum if there is no response to shaking shoulder.
 - The patient has any movement to physical stimulation (score -4).
 - The patient has no response to voice or physical stimulation (score -5).

Tool III: Assessed for signs of intolerance which do not resolve within 10 minutes as: Oxygen saturation less than 88%, increased work of breathing, use of accessory muscles, perioral cyanosis, breathing holding, nasal flaring, subcostal retractions, change in the character of cry, irritability, and abnormal vital signs

Pilot study: A pilot study was done on 10% of the sample size (8 children). No modification was done so children who shared in the pilot were included in the study.

Reliability: The reliability of the Medical Research Council (MRC) manual muscle testing for muscle strength scale was calculated statistically by alpha cronbach test ($r=0.783$). As regards Richmond Agitation-Sedation Scale (RASS), it was ($r=0.0851$).

Method for data collection

Official approval for conducting the study was obtained from the responsible administrative personnel (the directors of Aswan University Hospital and the head of the Pediatric Intensive Care Unit) to carry out the study after explaining the purpose of the study. Explanation of the aim and methodology of the study was done by the researchers. Written informed consent from parents of the studied children was obtained. The researchers assured on research data confidentiality.

Early progressive mobility protocol in pediatric ICU by Clark et al., (2013). This protocol used for the application of early mobilization intervention on children admitted to the PICU.

There are a total of five levels on the protocol, ranging from head of the bed at thirty degrees, turning, and passive range of motion in level one to ambulating in level five. The five progressive levels are implemented by the researchers.

The technique of early mobilization intervention:

Before early mobilization intervention, the researchers assess the stability criteria of each child as:

- Myocardial stability: Heart rate (HR) > 50 and <120, systolic blood pressure (SBP) > 90 and <180- Ischemia- Arrhythmia.
- Oxygenation: Respiratory rate (RR) 10 to 30- Oxygen saturation > 92% - fraction of inspired oxygen (F_{iO_2}) \geq 60%.
- Vasopressors: No new- Increase vasopressor infusion.
- Engage to voice: Open eye to verbal stimulus.
- Neurologic stability: Intracranial pressure (ICP) < 20mmHg According to stability criteria, the researchers select the appropriate level of activity.

Children who do not meet the stability criteria began with the **level one of activity** (passive range of motion) which includes the following activity: Turn every 2hr with an assist, splinting from 5-10 minute,

passive range of motion three time /day 5-10 minute, and head of bed ≥ 30 (5-10 minute).

Children who meet the stability criteria began with level two, three, four, and five of activity which includes the following activity:

Level two of activity (Moderate cooperation): Turn every 2hr with assist, splinting from 5-10 minute, passive range of motion three time /day 5-10 minute, progressive bed setting, (head of bed $45^\circ \times 15$ min) if tolerate then, head of bed 45° , legs lowered position $\times 15$ min if tolerate then, head of bed 65° , legs lowered position $\times 15$ min if tolerate then, chair position within bed (head of bed 90°), legs lowered position $\times 20$ min $\times 3$ /days if tolerate then, full assist in chair.

Level three of activity (Close to full cooperation): Turn every 2hr with assist, splinting from 5-10 minute, passive and active range of motion three time /day 5-10 minute, achieve progressive bed setting 45-60 min three time /day, and setting on edge of the bed with an assist.

Level four of activity: Turn every 2hr with an assist, active, active/assist active range of motion three time /day, full chair position three time /day $\times 60$ min, setting on edge of bed stand at the bedside with nurse assist, active transfer to chair out of bed 30 min three times /day (mealtime).

Level five of activity: Turn every 2hr with assist or self, active range of motion 3 times /day, active transfer to a chair out of bed 30 min three time /day (mealtime), ambulate with an assist, ambulate with assist progressive with distance.

During mobilization intervention, children assessed for signs of intolerance which do not resolve within 10 minutes as:

- Oxygen saturation less than 88%.
- Increased work of breathing.

- Use of accessory muscles.
- Perioral cyanosis.
- Breath holding.
- Nasal flaring.
- Subcostal retractions.
- Change in character of cry.
- Development of any contraindications.
- Irritability.
- Vital signs outside of pediatric normative values.

If the signs of intolerance were present and not resolved within 10 minutes; suspend activity and re-evaluate within 6 hours and if not present, re-assess mobility level every 12 hours and continue with mobilization interventions as indicated by appropriate level.

Continuous monitoring heart rate, blood pressure, or oxygen saturation; to determine that passive motion did not have a negative impact on physiological response and safety.

Early mobilization intervention was implemented no later than 2 or 3 days after children's admission at the PICU and was delivered after cardio-respiratory and neurological stabilization of children.

Statistical analysis

Data entry and data analysis were done using SPSS version 24 (Statistical Package for Social Science). Data were presented as number, percentage, mean, standard deviation. Chi-square and Fisher Exact tests were used to compare between qualitative variables. Independent samples t-test test was used to compare between two quantitative variables. Paired samples t-test was done to compare quantitative data between pre- and post- mobilization intervention. P-value considered statistically significant when $P < 0.05$.

Results

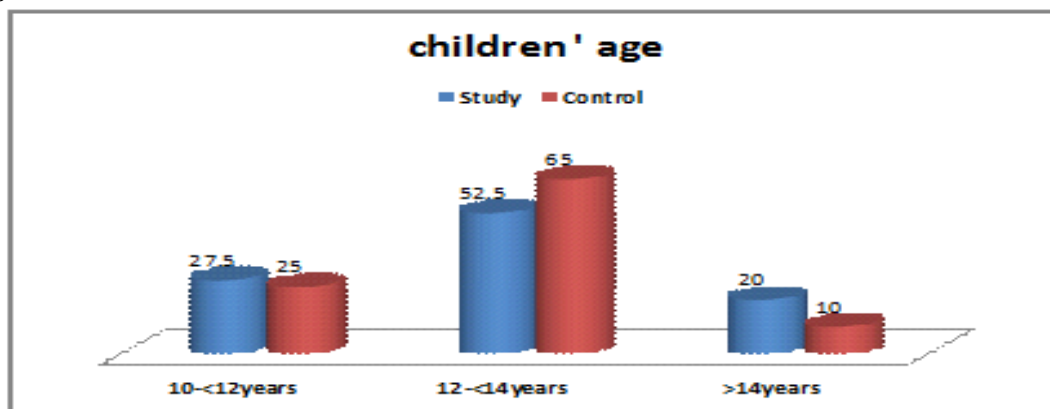


Figure (1): Distribution of children in the study and the control groups according to their age.

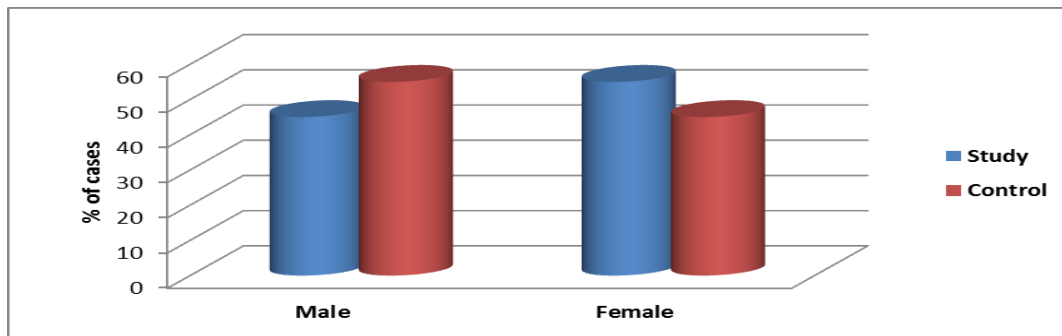


Figure (2): Distribution of children in the study and the control group according to their gender.

Table (1): Muscular strength using MRC-scale among children in the study and the control groups.

	Items	Study (n= 40)		Control (n= 40)		P-value
		n.	%	n.	%	
At admission	No contraction visible or palpable (muscle weakness)	17	42.5	14	35.0	0.448
	Flicker of contraction visible or palpable	2	5.0	2	5.0	
	Movement with gravity eliminated over almost full range of motion	5	12.5	11	27.5	
	A movement against gravity over the almost full range of motion	9	22.5	7	17.5	
	Movement against moderate resistance over full range of motion	2	5.0	4	10.0	
	Normal power (muscle strength)	5	12.5	2	5.0	
After early mobilization intervention (for the study group)	No muscle contraction visible or palpable (muscle weakness)	2	5.0	4	10.0	0.266
	Flicker of contraction visible or palpable	2	5.0	7	17.5	
	Movement with gravity eliminated over almost full range of motion	3	7.5	5	12.5	
	Movement against gravity over almost full range of motion	2	5.0	4	10.0	
	Movement against moderate resistance over full range of motion	4	10.0	7	17.5	
	Normal power (muscle strength)	27	67.5	13	32.5	

Table (2): The mean and stander deviation of children' muscle strength using MRC score (Medical Research Council (MRC) among study and control group.

MRC score	Maximum score	Study (n= 40)	Control (n= 40)	P-value ¹
		Mean \pm SD	Mean \pm SD	
At admission in the PICU**	5	2.75 \pm 0.70	2.52 \pm 0.47	0.852
After implementing early mobilization intervention (study group)	5	4.63 \pm 0.59	3.52 \pm 1.89	0.03*
P-value ²		0.001**	0.02*	

*Statistically significant differences

** PICU: pediatric intensive care unit

Table (3): Alertness or agitation level using RASS score (Richmond Agitation-Sedation Scale) among children in the study and the control groups

	RASS score	Study (n= 40)		Control (n= 40)		P-value
		n.	%	n.	%	
At admission	Light sedation (Briefly (less than 10 seconds) awakens with eye contact to voice)	2	5.0	8	20.0	0.02*
	Drowsy (Not fully alert, but has sustained (more than 10 seconds)	6	15.0	16	40.0	
	Alert and calm (Spontaneously pays attention to the caregiver)	2	5.0	0	0.0	
	Restless (Anxious or apprehensive but movements not aggressive or vigorous)	21	52.5	15	37.5	
	Agitated (Frequent no purposeful movement or patient-ventilator dyssynchrony)	9	22.5	1	2.5	
After early mobilization intervention	Light sedation	0	0.0	4	10.0	0.01*
	Drowsy	0	0.0	5	12.5	
	Alert and calm	40	100.0	31	77.5	
	Restless	0	0.0	0	0.0	
	Agitated	0	0.0	0	0.0	

*Statistically significant differences

Table (4): Percentage distribution of children in the study and the control groups according to the five levels of mobility after early implementing mobilization interventions.

Level of mobility	Study (n= 40)		Control (n= 40)		P-value
	n.	%	n.	%	
Level 1: Passive ROM with clinical stability					--
Yes	40	100.0	40	100.0	
No	0	0.0	0	0.0	
Level 2: Moderate cooperation					0.001*
Yes	28	70.0	15	37.5	
No	12	30.0	25	62.5	
Level 3: Move against gravity					0.001**
Yes	28	70.0	11	27.5	
No	12	30.0	29	72.5	
Level 4: Stand with assistance or march in place					0.01*
Yes	25	62.5	10	25.0	
No	15	37.5	30	75.0	
Level 5: Ambulation distance and perform activity of daily living					0.001*
Yes	23	57.5	9	22.5	
No	17	42.5	31	77.5	

*Statistically significant differences

Table (5): Children' outcomes after early mobilization intervention among study and control group

Children' outcomes	Study (n= 40)		Control (n= 40)		P-value
	n.	%	n.	%	
Ambulation distance at ICU discharge:					0.03*
Increased	38	95.0	30	75.0	
Not increased	2	5.0	10	25.0	
Functional status at hospital discharge:					0.02*
Dependent	5	12.5	14	35.0	
Independent	35	87.5	26	65.0	
Time of moved out of bed: (days)					0.388
Mean \pm SD	2.90 \pm 1.66		3.20 \pm 1.42		
Need for further rehabilitation:					0.01*
Yes	12	30.0	25	62.5	
No	28	70.0	15	37.5	
ICU length of stay: (days)					0.005*
Mean \pm SD	4.28 \pm 1.59		6.38 \pm 2.10		

*Statistically significant differences

Figure (1): Showed the distribution of children in the study and the control groups according to their age. It was found that, more than half (52%) of children in the study group and about two thirds (65%) of them in the control group their age ranging from 12 to 14 years. Only 20% of children in the study group and 10% of them in the control group were their age ranged from 14-16 years.

Figure (2): Presented the distribution of children in the study and the control groups according to their gender. It was found that more than half (55%) of children in both the study and the control groups were female.

Table (1): Revealed the assessment of muscle strength using the MRC scale among children in the study and the control groups. It was found that before early mobilization intervention 42.5% of children in the study group and 32.0% of them in the control group had muscle weakness (no muscle contraction visible or palpable), and only 12.5% of them in the study and 5.0% in the control groups had normal power, while at discharge only 5.0% of children in the study group (after implementing early mobilization intervention) had muscle weakness vs. 10.0% of them in the control group. Also, the results of this study showed improvement in the normal power of children (67.5% in the study group vs. 32.5% in control group no significant difference was observed.

Regarding the mean score \pm SD of muscle strength; **Table (2):** Showed that children' muscle strength according to MRC scale on admission in the PICU was low in the study group as well as the control group with no statistically significant difference ($P=0.852$), while after implementing early mobilization intervention the mean score of muscle strength among children in the study group (4.63 ± 0.59) was higher than those in the control group (3.52 ± 1.89) with statistically significant difference ($p= 0.03$). As well as the table revealed that there were statistically significant differences between mean score of MCR scale among children in both groups (study and control) at admission and after implementing early mobilization intervention $P= 0.001$ and $P=0.02$ respectively

Table (3): Showed an assessment of children' alertness or agitation level using Richmond Agitation-Sedation Scale (RASS score), as presented in this table, only 5.0% of children in the study and zero in control groups were alert and calm at admission while after early mobilization intervention 100.0% vs. 77.5% of children in the study and the control groups respectively were alert and calm. More than half (52.5%) of children in the study group and 37.5% of them in the control group were restless (Anxious or apprehensive but movements not

aggressive or vigorous) at admission, while after early mobilization intervention none of children were anxious and none were agitated in both the study and the control groups.

Table (4): Showed percentage distribution of children in the study and the control groups according to the five-level of mobility, it was found that, children were gradually move from passive range of motion in level one to ambulation distance and perform some activities of daily living (ADLs) in level 5. In level 1 all children (100.0%) in the study group had passive range of motion with clinical stability, gradually more than half (57.5%) of them achieved the highest level of physical activity at Level 5 (ambulation distance and perform some (ADLs) vs. 22.5% in the control group, with highly with significance differences were found between the two groups ($p=0.001$).

Table (5): Represented children' outcomes after early mobilization intervention among the study and the control group, as shown in this table, majority of the children (95.0%) in the study group and three quarters of them in the control group (75.0%) their ambulation distance in the ICU at discharge were increased and there was significant difference between the two groups found ($P=0.03$). As regards the functional status of children at hospital discharge, only 12.5% of children in the study group and more than one-third of them (35.0%) in the control group became dependent and there a statistically significant difference between the two groups was found ($P=0.02$). The mean time of children moved out of bed was 2.90 ± 1.66 days in the study group vs. 3.20 ± 1.42 in the control group. Thirty percent of children in the study group and 62.5% in the control group needed further rehabilitation. The mean of children's length of stay in the ICU was 4.28 ± 1.59 days for the study group vs. 6.38 ± 2.10 days for the control group with a statistically significant difference between the two groups was found ($P=0.005$).

Discussion

The aim of this study was to assess the effect of implementing early mobilization intervention on controlling acquired muscle weakness among pediatric critically ill patients. Nurse-driven early movement scorer to promote a multidisciplinary focus on the early mobility as a part of daily clinical procedures, keep patients in pre- hospital basic mobility and functional levels as much as possible, initiate a mobility protocol when the patient is unstable in his circulatory system (Agency for Healthcare Research & Quality, 2017).

Children's data on early mobilization interventions is scarce. There is a marked lack of research studying early childhood mobilization.

To ensure the optimal timing for initiation of mobilization in this study, researchers initiate the mobilization intervention early on the second or the third day of admission in the ICU. According to **Hodgson et al., (2014)** early mobilization is known to present position occurring within the first 2-5 days of dubbed admission.

In the present study, researchers implemented an early mobilization intervention using activities of tolerance by children such as: passive, active range of movement, turning, gradually sitting on the bed, sitting at the edge of the bed, transferring to a chair and walking according to an early progressive mobility protocol in the care unit. Pediatric concentrated by **Clark et al., (2013)**.

Early intervention had been mobilized within five levels of motor activities that depart from passive ROM with clinical stability at one level for ambulation distance and performance of some activity of daily living at level 5. At level 1 all children in the study and control groups had a passive ROM (run every 2hours with assistance, Splints 5-10 minutes, passive ROM three time / day for 5-10 minutes, and HOB 30 (5-10 minutes)) Gradually more than half of the children in the study group achieved the highest level of physical activity at Level 5 (shifting every 2hrs with help or breath, active ROM three time, active transfer to a chair from bed 30 min three time (eating), ambulate with help). This finding was agreed with the findings of **Havey & Herrmann, (2013)** & **Vollman, (2010)** who reported that carrying out mobility activities every day throughout the hospital stay of patients is called progressive early mobility. Activities begin with turning, passive range of motion (ROM), raising the head of the bed to 30 degrees or more, progressing to active ROM, rising from bed to chair position, hanging down in bed, moving from bed to chair and ending with strolling into the room. The researchers in this study were assessed the children's stability criteria during the early mobilization intervention to ensure children's safety, it was found that, the mean of heart rate, systolic blood pressure, respiratory rate, and Oxygen saturation were within the normal limit. Few children had an arrhythmia, and none of them had ischemia, Also children' PEEP were < 12, Fio2 were $\geq 60\%$, intracranial pressure < 20 mmHg, no new was happened to them, no increase in vasopressor infusion, and open their eye to verbal stimulus. These findings are in agreement with the findings by **Pearmain & Herridge, (2013)** who found that, patients 'safety during task mobilization and patients' responses and adverse events were noted

and documented. The researchers concluded that although adverse events occurred in less than one percent of patients, a crowd of critically ill patients with safe and improved patient outcomes could be ambulated and patients discharged from the intensive care unit. From the researchers' point of view, these results indicate that implementing the progressive early mobility protocol is safe when applied to children who accept the dubbed.

With regard to muscle weakness in children, the current study provided that nearly half of children in the study group, and nearly one-third of them in the control group had muscle weakness at admission, while after implementing the early mobilization intervention the percentage of muscle weakness decreased and strength was improved in more than two-thirds of children and the trelis became normal. These results were in agreement with the results of **Hermans et al., (2015)** study about clinical review: intensive care unit acquired weakness and they reported that cases in the ICU Acquired Weakness in the intervention and control groups were 33.1% and 51.9%, respectively, and early movement significantly reduced the incidence of ICU Acquired Weakness among the study compared to the control group.

In relation to average muscle strength, the present study showed that the mean score of muscle strength among children using the MRC scale in dubbed admission was low in the study group, as well as in the control group with no statistically significant differences were found. Whereas after implementing the intervention of early mobilization, the average score of muscle strength among children in the study group was increased than those in the control group with a highly statistically significant difference. This finding was consistent with other studies conducted by **Asfour, (2016)** who stated that the MRC score for accepting patients after stabilization was lower in patients with the intensive care unit-impaired group ICU Acquired Weakness than in any ICU-group ICU acquired weakness. That was statistically significant. Patients with the acquired weakness group had significantly lower muscle strength than acquired weakness group at ICU discharge.

From the researchers' point of view, these findings may be due to the physiological consequences of bed rest and prolonged immobility leading to a decrease in skeletal muscle utilization, muscle activation becoming less frequent and thus weakening. On the other hand, early progressive mobility protocol that includes activities such as passive or active group of movement or a combination of the two, when applied to children in the so-called improvement of blood circulation, reduce stiffness, and maintain flexibility

in all of these lead to improvement of children's muscles Power.

The present study showed that children in the study group were moved out of bed earlier after the implementation of early mobilization intervention than those in the control group. This result was agreed with the results of **Cameron et al., (2015)** who stated that the patient who received early mobility therapy was moved out of bed sooner than those who did not receive mobility therapy. Shorter bed stays can help reduce ICU and length of hospital stay, thus reducing health care costs. From the researchers' point of view, this result may be related to, when the strength of children's muscle improves; this becomes an incentive for children to get out of bed early.

This study showed a decrease in child length of stay dubbed after implementation of early intervention mobilization in the study group than that in the control group. This finding was agreed with the findings of **Schaller et al., (2016)** who reported that early target-directed mobilization in patients improves mobilization during hospitalization, reduces ICU length of stay, and helps enhance functional mobility after discharge. Also, **Fuest & Schaller, (2018)** in their study established that, early and mobilized based protocol is important for functional recovery and shortening of hospital stay. Also, **Klein et al., (2015)** indicates that negative or active mobilization is associated with reduced ICU and hospital length of stay.

With regard to the walking distance in the conjugation dubbed it, the present study revealed that the majority of children in the study group compared to three quarters of them in the control group and the walking distance increased in the conjugation dubbed. This result was accompanied by **Cameron et al., (2015)** who reported that the benefits of early rehabilitation, either passive or progressive, or both, decreased ICU and hospital stay, increased ambulation distance, and better functional outcomes. Also **Burtin et al., (2009)** stated that all 3 types of rehabilitation (passive and active, or a combination of 2) are associated with greater ambulation distance and better functional status upon discharge from hospital.

It was evident in the current study that the functional status of children was improved in discharge from hospital as most of the children in the study group and about two-thirds of the children in the study group became independent and found a big difference between the two groups. This finding was agreed with another study by **Schweikert et al., (2009)** who found that patients who had early mobilization underwent a significant improvement in functional status at hospital discharge and were associated with

an increased percentage of patients returning to an independent functional state at discharge from hospital (59 versus 35%, $P = 0.02$). Also, another study by **Schaller et al., (2016)** revealed improved function of patients on discharge from hospital after early mobilization.

Conclusion

Based on the results of the present study concluded that: Early mobilization was safe and effective in reducing muscle weakness acquired among the so-called patients. After implementing the early mobilization intervention, the muscle weakness was decreased and improved in more than two-thirds of the children, and the average muscle strength in the study group was increased than the control group with a highly statistically significant difference. About two-thirds of the children became with normal force and their functional condition improved and they traveled upon discharge from the hospital, and the majority of the children in the study group became independent

Regarding the ambulation distance at ICU discharge, the present study revealed that majority of children in the study group vs. three quarters of those in the control group had increased the ambulation distance when discharge from PICU, and children in the study group were moved out of bed earlier than those in the control group.

Recommendations

Based on the results of the current study, it was recommended the following:

- 1- Assessment of muscle weakness should be a part of the daily assessment of pediatric critically ill patients.
- 2- Pediatric intensive care culture should be shifted from keeping patients on restrict bed rest to mobilizing patients as early as possible.
- 3- Early mobilization protocol should be incorporated into daily clinical practice of PICU
- 4- Early mobilization should be considered essential in the overall management of pediatric critically ill patients.
- 5- More research is needed in pediatric intensive care units to identify the most effective methods for early mobilization.

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