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Shaimaa Sayed Mohamed,
Assistant Lecturer, Medical-Surgical Nursing, Faculty of Nursing, Minia University, Minia, Egypt

Jehan Sayed Ali
Professor of adult nursing, Faculty of Nursing, Minia University, Minia, Egypt

Ahmed Osman
Professor, Orthopedic Surgery, Faculty of Medicine, Minia University, Minia, Egypt

Hend Elham Mohamed
Assistant Professor, Medical-Surgical Nursing, Adult Nursing Specialty, Faculty of Nursing, Minia University, Minia, Egypt

Saher Hamza Taha
Medical-Surgical Nursing, Adult Nursing Specialty, Faculty of Nursing, Minia University, Minia, Egypt

Corresponding Author:
Shaimaa Sayed Mohamed,
Assistant Lecturer, Medical-Surgical Nursing, Faculty of Nursing, Minia University, Minia, Egypt

Effect of postoperative hip joint exercises therapy on physical mobility status among patients with hip fracture surgery

Shaimaa Sayed Mohamed, Jehan Sayed Ali, Ahmed Osman, Hend Elham Mohamed and Saher Hamza Taha

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Abstract
Background: Hip fractures (HF) range from benign to potentially fatal, based on the mechanism of injuries and connected vascular injury. The term hip fracture or head of femur fracture describes a break or fracture close to the upper 3rd of the femur, expanding to five cm under the smaller trochanter.
Objective: Evaluate the effect of post-operative exercises on physical mobility status among patients with hip fracture surgery (HF).
Sample: A purposive composed of sixty patients post hip fracture operation.
Tools: Three tools in this research. The first tool was a structured questionnaire for patient interviews. First Part: Demographic Data (DD) and Medical Data (MD). 2nd tool: Cumulated ambulation scale (CAS). 3rd tool: Oxford muscle strength scale.
Results: there is a statistically significant difference ($P \leq 0.01$) between the pre- as well as post-test of the study groups regarding all items of the implemented exercises program; the intervention group (IG) or post-test group improves ambulation score due to strengthening the muscles through exercises compared to the pre-test.
Conclusion: Early Nursing intervention and exercise therapy performance improve the physical mobility of hip fractured patients in the post-test group after surgery post six months.
Recommendation: Designing standardized structured nursing protocol regarding hip fracture in the post-operative to upgrade nurses' knowledge and practice, and further research studies are needed on larger study samples.

Keywords: Hip fracture surgery, postoperative exercises, physical mobility hip fracture, cumulated ambulatory scale

Introduction
An HF affects the top third of the femur, which is located 2.5 inches (5 cm) below the lesser trochanter. Intracapsular fractures are breaks in the capsule around the hip joint. The three sites of intracapsular fractures (fractures of the femur neck) are capital (fracture of the femur head), sub-capital (fracture directly below the head of the femur), and transcervical (fracture of the femur neck) [1].
High-energy events like falling from a ladder or vehicle accident typically cause fractures that occur in young patients. Because HF can be quite painful, it is advised to have surgical treatment as soon as possible. Prolonged bed rest makes the exercise treatment and rehabilitation more challenging [2].
Exercise is important for improving physical mobility and function after hip fracture HF specifically, exercise therapy is a critical intervention that is needed to establish best practices and result in the largest improvement in physical function, pulse resistance, and balance exercises, which is the most impact intervention for increasing mobility, must be monitored by a trainer or physiotherapist [2]. After HF, the orthopedic surgeon and physical therapist may recommend exercises for 20-30 minutes or 2-3 times/daily during early recovery in the first five weeks [3].
Following hospital release, physical therapy and mobility treatments for HF improve mobility, accelerate walking, somewhat enhance functionality, and lower the risk of falls. Following surgery, appropriate rehabilitation and exercise have been demonstrated to

decrease hospital stays, enhance physical function, and support patients in maintaining an independent daily life, all of which lower medical and caregiver expenses [4].

Significance of the Study

Globally, HF is expected to increase by 4.5 million annually by 2050, with high mortality rates, disability, and dependence. This health issue, primarily caused by falls, is economically burdensome to the healthcare system; the age-standardized incidence rate has slightly raised in men [5].

Postoperative hip joint rehabilitation is crucial for enhancing mobility and restoring basic status. Despite successful surgery, hip fractures cause high death, disability, and dependence, increasing medical costs and mortality rates worldwide [6, 7].

Subject and Method

Aim of the research

The present study aimed to evaluate the effect of post-operative hip joint exercises on mobility status among patients with hip fractures.

Research Hypothesis

The patients who received the nursing intervention and exercises will have improved mobility level at the post-test compared with the pre-test in the same study group.

Research Design

A quasi-experimental (QE) design was used to fulfill the purpose of this research.

Setting

The current research was carried out at the orthopedic surgery department, which belongs to the Minia University Hospital (MUH) in Minia City (MC), Egypt

- **Subjects**

  Sample Size

  A purposive sample of 30 adult patients who have hip fractured surgery was recruited in the research (pre as well as post-test) group.

  The sample size was estimated by using the Mohapatra & Chamola [8] formula that is calculated as ($n = z^2 \times p (1- p) / d^2$). Where n is the mean sample size, Z is the mean confidence degree, and P is the mean prevalence expected or proportion (proportionately speaking; if 20%, P= 0.02 as well as d mean precision (proportionately; if 5%, d= 0.05).

  $N= (1.96)^2 \times 0.04 (1-0.04) / (0.05)^2 = 60$ patients.

- **Inclusion Criteria**

  All hip fracture patients aged 18 to 60 years with hip fracture surgery in the post-operative period, Both sexes. Conscious patients with normal cognitive function, Patients who intent to share in the research. In addition to traumatic patients

- **Exclusion Criteria**

  The participants that had one or more of the following criteria were excluded (Muscle atrophy, Lower extremities deformities, Peripheral vascular disorders, Paralysis or Parathesis, Rheumatoid arthritis, and osteoarthritis.

- **Study Duration:** Data collection started from July 2021 to March 2023

- **Tools for gathering Data:** This was designed by the researchers after a review of extensive literature.

1st tool: Socio-demographic (DD) as well as Clinical Data (CD) Structured Schedule Interview

It was collected at the 1st interview, as well as it addresses two main parts:

- **1st part:** Patients' socio-demographics, such as patients' (age, gender, education, residence, occupation, etc.)
- **2nd part:** Patients' health profile or medical data such as (pre-fracture comorbidities, anthropometrics for nutritional assessment as measuring body mass index
- **2nd tool: The Cumulated Ambulation Scale (CAS)** This scale was adopted from Hansen *et al.* [9] to evaluate and measure the patients' independency in three activities. The scale is composed of (1) getting into as well as out of bed, (2) both seated and standing in a chair and (3) the ability to walk while using the proper walking assistance.

The CAS scoring system: every function was assessed on a three-point ordinal scale: two mean independent assistance of human, while one mean requiring assistance of human to make function, and also zero mean unable to make function despite assistance of human). A daily score between 0 and 6 (one-day CAS) is obtained by adding the scores for each function. A score of 6 indicates independent ambulation on that specific day; a number ranging from 0 to 18 (referred to as the three-day CAS) can be obtained by adding the total scores obtained during the first three days following surgery.

3rd tool: Oxford Muscle Strength Scale: This scale was adopted from Stangl-Correa *et al.* [10]. The Oxford Scale is used to quantify the power or strength produced by the contraction of muscle; it scored on a 0 to 5 rating scale, with five present maximal strength, so detailed awareness of muscle anatomy is needed to carry out this appropriate assessment as (size, contour, tone, and muscle strength). The Oxford Scale assesses specific six muscle groups and the hip muscle involved.

Tools Validity

To assess the research tools' content validity and item clarity, a panel of five experts in Adult Care Nursing Specialty and Medical Surgical Nursing (MSN) reviewed the instruments that had been produced. The present study instruments were deemed legitimate and pertinent to the study goal by all jury members.

Tools Reliability

The Alpha-Cronbach test was used statistically to determine the reliability of the study instruments. The PHA and UTIAC had reliability scores of 0.77 and 0.89, respectively. The first internal consistency tool's reliability was assessed using Cronbach's alpha test, which identified strong and exactly dependable instruments.

Pilot Study

A pilot of the research was applied on 10% (n = 6) of the total patients admitted to the last mentioned orthopedic surgical department, meeting inclusion standards to test the applicability, clarity, and objectivity of the research tools and determine the time required for fulfilling it.

- **Ethical Considerations**
  The research received official permission from the ethical committee of research at Minia University, Faculty of Nursing, and from the director of the Orthopedic Surgery Department. Patients provided written consent after being fully informed about the research purpose and procedures, with the right to refuse participation or withdraw at any time. The data collected was used solely for research purposes.

Study Procedure

- **Preparatory Phase**
  The patient met inclusion criteria was informed about the research's purpose and nature, and a pilot study was conducted, with written consent obtained and the investigator granted permission.
- **Implementation Phase**
  Once permission was gained to conduct the research. The researcher starts data collection as soon as patients are admitted to the orthopedic department. Firstly, the researchers filled out the first tool (parts 1 and 2); this tool was filled within 10-15 m per patient every day, and information was gathered using the first instrument for the pre-test group.
  The researcher first collected data from the pre-test group, which received routine nursing intervention. After gathering data, the pre-test group was given an educational rehabilitation booklet. Following this, the researchers collected data from the post-test group in the same manner
- **1st session** was done on the 1st day through the first contact and meeting with the patient in the preoperative periods to take the socio-demographic and clinical data using tool one**.** The patient was assessed by using tool two (the CAS). Researchers demonstrated the patient's skills through role-playing and demonstration of the exercises on the patient, including all rehabilitation exercises and the performance. Patient muscle strength was assessed using tool three by the Oxford muscle strength scale, and patients may be weighed throughout the study to find out the body mass index BMI, in order to improve the physical functioning of the patient, every patient was given the opportunity to ask any question to clear up any misunderstandings. This session takes from 15 to 45 minutes immediately following surgery, depending on the patient's tolerance. On average, there were around 1:2 patients every day.
- The post-test group received an educational rehabilitation booklet designed in the Arabic language with pictures to remind them to ensure their understanding and competency for demonstration of the procedure at home once daily for ten weeks after discharge. After a thorough examination of relevant literature, the researchers designed it [11]. It consisted of some educational procedure illustrations such as (ROM exercises, isometric exercises, breathing and coughing exercises, positioning, assessment of neurovascular condition.
- Each patient takes 15 – 45 minutes from the second day postoperatively until the patient is discharged and follow-up by a caregiver via telephone interview.

Evaluation Phase

- The evaluation phase started from the first day postoperative, after the implementation of the exercises program, immediately post, after five weeks, and after about ten weeks from discharge, so the patient was evaluated three times. Evaluation was done to the study groups in the same manner.
- **Limitations of the Study**
  Limited national studies have investigated the correlation between nursing intervention, exercise performance, and improved mobility of patients post-hip fracture surgery in Egypt.

Statistical Analysis of Data: Data was coded and transferred into a specially designed format, then fed to the computer and analyzed. The statistical analysis of the data was conducted using version 22 of the Statistical Program for Social Science (SPSS).

Results

Table 1: Distribution of Two Pre-test and Post-test Groups Related to Their Demographic Characteristics (no.=60)

Demographic Characteristics	Pretest (n =30)		Post test (n =30)		Sig. test	P-value
	No.	%	No.	%		
Age						
18 - 39 years	10	33.3	11	36.7	X^2 = 1.32	0.517
40 - 59 years	8	26.7	11	36.7		
60- 65 years	12	40	8	26.6		
Mean± SD	43.2±18.5		49.1±13.6		t=1.39	0.168
Gender						
Male	22	73.3	21	70	X^2 = 0.082	0.774
Female	8	26.7	9	30		
Education						
Illiterate	5	16.7	4	13.3	X^2 = 7.39	0.117
Read and write	11	36.7	5	16.7		
Secondary	6	20	10	33.3		
University	8	26.6	11	36.7		
Residence						
Urban	13	43.3	12	40	X^2 = 0.069	0.793
Rural	17	56.7	18	60		
Occupation						
Housewife	6	20	6	20	X^2 = 3.88	0.422
Employee	6	20	9	30		
Farmer	3	10	5	16.7		

Un employed	15	50	10	33.3		
Marital Status						
Single	10	33.3	3	10	$X^2 = 4.90$	0.086
Married	18	60	25	83.3		
Widow	2	6.7	2	6.7		
Living Condition						
Living with family	30	100	30	100	…..	……

* Statistical significant differences ($P \leq 0.05$)

Table (1) explains the studied sample socio-demographic characteristics; regarding age, the mean age of the study and pre-test group was 43.2±18.5 & 49.1±13.6, respectively, in relation to gender, 73.3% & 70% of the studied sample was males, for education, 36.7% of the post-test group were read and write compared to 36.7% of the pre-test group were graduated from university and 56.7% & 60% of them were lived in rural areas. Regarding occupation, 50% & 33.3% of post-test and pre-test, respectively, were unemployed. Also, 60% & 83.3% of them were married. Also, 100% of the post-test and pre-test group lived with their families.

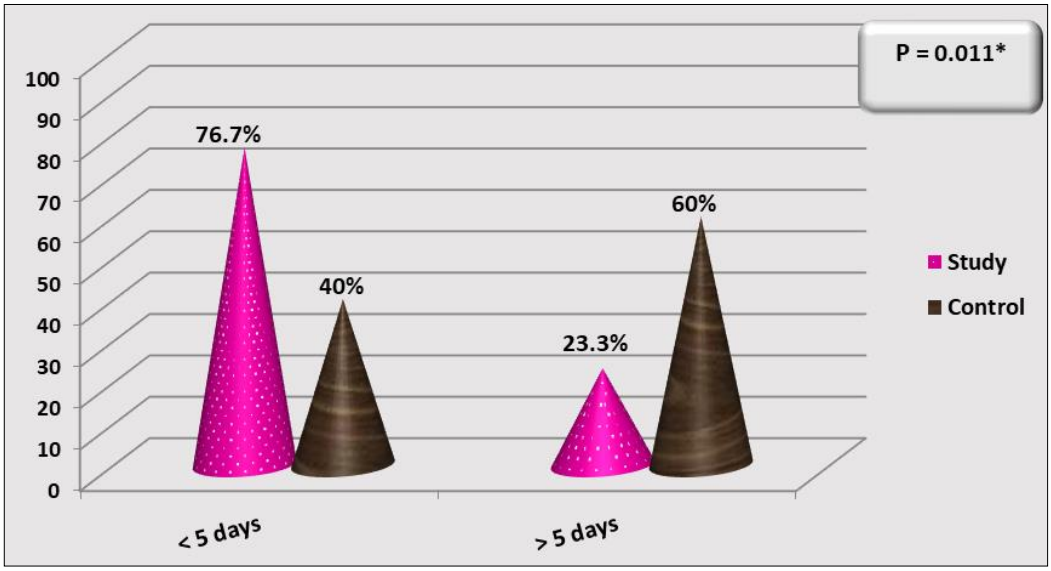

Fig 1: Distribution of Pre-test and Post-test Groups Related to Length of Hospital Stay (no=60)

Figure (1): Reveals that 76.7% of the post-test group and 40% of the Pre-test group had less than five days length of hospital stay

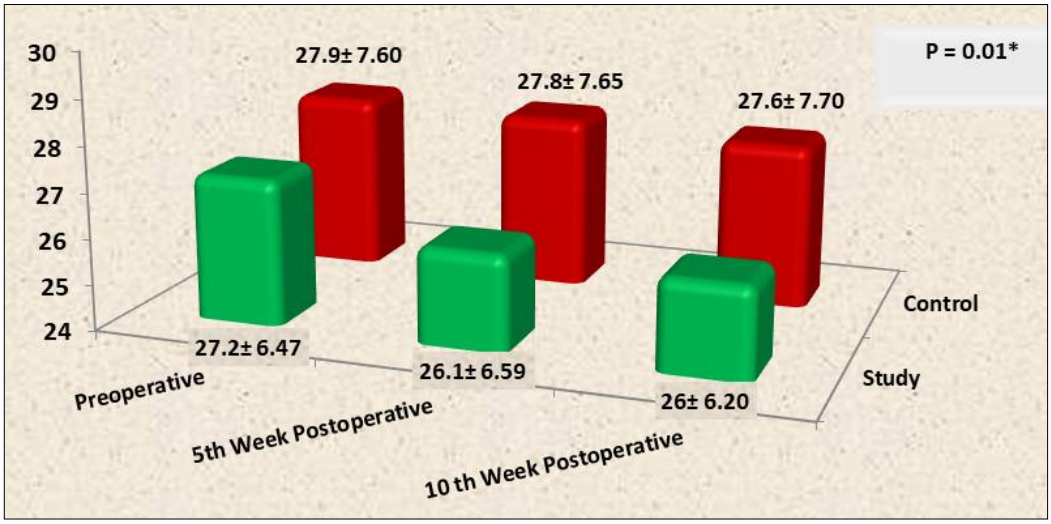

Fig 2: Distribution of Pre-test and Post-test Groups Related to their Body Mass Index (no.=60)

Figure (2): Cleared that the BMI mean decreased in the research group from preoperative to the 10th week postoperatively with a statistically significant difference between both groups.

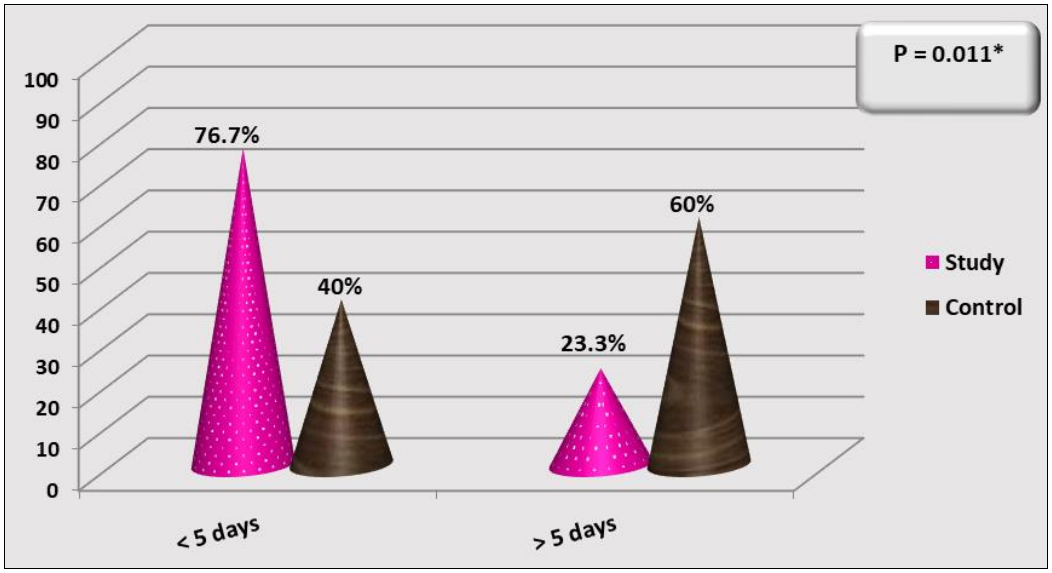

Fig 3: Mean Score of Two Study and Control Groups Related to their Thigh Circumference (no.=60)

Table 2: Distribution of Two Pre-test and Post-test Groups Related to Their Previous Health History (no.=60)

Health Profile	Pre-test (n=30)		Post-test (n=30)		X^2	P-value
	No.	%	No.	%		
Previous Hospitalization for Orthopedic Reason:						
▪ Yes	1	3.3	0	0	1.01	0.313
▪ No	29	96.7	30	100		
Presence and Type of Chronic Illness						
▪ No	25	83.3	25	83.3	4.21	0.519
▪ Diabetes	2	6.7	1	3.3		
▪ Hypertension	1	3.3	1	3.3		
▪ Diabetes & Hypertension	2	6.7	2	6.7		
▪ Hepatic disease	0	0	1	3.3		
Number of Comorbidities						
▪ No comorbidities	25	83.3	25	83.3	0.400	0.819
▪ One disease	2	6.7	3	10		
▪ Two diseases	3	10	2	6.7		
Previous Education Related to Rehabilitation after Hip Fracture Surgery						
▪ No	30	100	29	96.7	1.01	0.313
▪ Yes, from family/friends	0	0	1	3.3		

* Statistical significant differences ($P \leq 0.05$)
** Highly Statistical significant differences ($P \leq 0.01$)

Table (3): Distribution of Both post-test and pre-test Groups Regarding Their Cumulated Ambulation Scale (CAS) (no.=60)

Cumulated Ambulation Scale	Pretest (n = 30)			Post test (n = 30)			X^2 (P-value)
	Getting in and out of bed	Sit–to–stand to sit in an armchair	Waking with or without walking an aid	Getting in and out of bed	Sit–to–stand to sit in an armchair	Waking with or without walking an aid	
	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)	
Preoperative							
▪ Independent	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2.06 (0.150)
▪ Able with assistance	0 (0)	0 (0)	0 (0)	2 (6.7)	0 (0)	0 (0)	
▪ Not able	30 (100)	30 (100)	30 (100)	28 (93.3)	30 (100)	30 (100)	
5th Week Postoperative							
▪ Independent	2 (6.7)	0 (0)	0 (0)	26 (86.7)	3 (10)	0 (0)	39.2 (0.001**)
▪ Able with assistance	26 (86.7)	28 (93.3)	29 (96.7)	3 (10)	26 (86.7)	28 (93.3)	
▪ Not able	2 (6.7)	2 (6.7)	1 (3.3)	1 (3.3)	1 (3.3)	2 (6.7)	
10th Week Postoperative							
▪ Independent	7 (23.3)	2 (6.7)	1 (3.3)	30 (100)	25 (83.3)	16 (53.5)	42.6 (0.001**)
▪ Able with assistance	23 (76.7)	28 (93.3)	29 (96.7)	0 (0)	5 (16.7)	14 (46.7)	
▪ Not able	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
Friedman test	**109.4 (0.001**)**						
Mean Total Score	6.20±1.21			9.30±1.44			t = 9.05 (0.001**)

* Statistical significant differences ($P \leq 0.05$)
** Highly Statistical significant differences ($P \leq 0.01$)

Figure (3): Cleared that the mean score of thigh circumference decreased in the study group from preoperative to the 10th week postoperatively with a statistically significant difference between both groups (0.01*)

Table (2) mentions the previous health history of the study and control groups; the result presented that 96.7% & 100% of the study as well as control groups, respectively, weren't hospitalized for orthopedic reasons before the study. Regarding chronic illness, 83.3% of the two groups didn't have any chronic diseases, and 83.3% of them hadn't any comorbidity and 100% & 96.7% of the study and control groups hadn't any previous education related to rehabilitation after hip fracture surgery.

Table (2) Revealed that 93.3% & 100.0% of the post-test and pre-test groups were not able to get in and out of bed, and 100% of them were not able to sit to stand to sit in an armchair; also, 100% of them were not able to walk with or without walking aid at the preoperative evaluation, while, 100% & 23.3% of post-test and pre-test group were independent when getting in and out of bed, and 83.3% & 6.7% of them were independent to sit to stand to sit in an armchair. Also, 53.5% & 3.3% of them were independent to walk with or without a walking aid at the 10th week from implementing the rehabilitation protocol, with a highly statistically significant difference between the two groups.

Table 3: Distribution of Two pre-test and post-test Groups Related to Their Total Score of Cumulated Ambulation Scale (CAS) (no.=60)

	Preoperative		5th Week Postoperative		10th Week Postoperative		Friedman test
	Pretest (n = 30)	Post test (n = 30)	Pretest (n = 30)	Post test (n = 30)	Pretest (n = 30)	Post test (n = 30)	
	No (%)	No (%)	No (%)	No (%)	No (%)	No (%)	
▪ Independent	0 (0)	0 (0)	2 (6.7)	3 (10)	2 (6.7)	25 (83.3)	109.4 (0.001**)
▪ Able with assistance	0 (0)	2 (6.7)	26 (86.7)	26 (86.7)	28 (93.3)	5 (16.7)	
▪ Not able	30 (100)	28 (93.3)	2 (6.7)	1 (3.3)	0 (0)	0 (0)	
X^2 (P-value)	2.06 (0.150)		0.533 (0.766)		35.6 (0.001**)		

* Statistical significant differences ($P \leq 0.05$)
** Highly Statistical significant differences ($P \leq 0.01$)

Table (3): cleared the mobility status related to the CAS scale are 93.3% & 100% of the post-test as well as pre-test groups, respectively, were not able at the preoperative evaluation, while 83.3% and 6.7% of post-test as well as pre-test group respectively were independent at the 10th week postoperatively after implementing the physical therapy protocol with highly statistically significant difference between both groups.

Table 4: Correlation between Muscle Strength and Cumulated Ambulation Score among Pre-test and Post-test Groups at the End of the Program (n=60)

	Muscle Strength			
	Pretest (n = 30)		Post test (n = 30)	
	r	*p*	*r*	*p*
Cumulated Ambulation Score	0.165	0.384	0.322	0.043*

* Statistical significant differences ($P \leq 0.05$)
** Highly Statistical significant differences ($P \leq 0.01$)

Table (4) showed a statistically significant positive correlation between muscle strength and cumulated ambulation score among the post-test group after implementing the rehabilitation group.

Discussion

One of the most frequent and serious types of injuries that people can sustain is HF, which can result in death, institutional care, disability, and poor quality of life. Even though surgery is advised as the initial c course of therapy, only one in three persons regains their prior degree of independence, half become immobile, and 25% need round-the-clock care in a nursing home [12].

Regarding socio-demographics, the current study revealed that the mean age among post-test as well as pre-test groups were (43.2±18.5 & 49.1±13.6) respectively, which could be explained in light of the increased incidence of motor car accidents that affect the young age. The majority of both groups (73.3% & 70%) lived in rural places, also almost of both groups were married respectively. These come in accordance with Ahmed *et al*. [13], whose post-test illustrated that the mean age among the post-test and pre-test groups was 56.93±10.97 years old, and most of the studied participants were married, and the highest of them were living in a rural place.

Concerning gender, the current study showed that the highest percentage among post-test and pre-test groups were males, which agreed with Dong *et al*. [3] study in which more than half of post-test and pre-test groups were males, this agreed with Dong *et al*. [3] who stated that hip fractures are common and economically burdensome to health care system globally with fall being the leading cause, the age-standardized incidence rate has slightly increased in men.

Related to the educational level, actual research clarified that nearly a quarter of the post-test as well as pre-test groups had a university education, and all of the post-test as well as pre-test groups lived with their families; from the perspective of the researchers, the increased percentage of university education could be regarded to the increased interest of education in the last years, this finding comes in the same point with AdelEbada El Sayed *et al*. [14] whose research documented that (23.1% & 28.5%) of post and pre-test groups had a bachelor degree of education and the majority of them lived with their families.

This research results showed there are no statistically significant variations in any of the personal characteristic traits between the study as well as control groups; the researcher explained this result as indicating that both post and pre-test groups were compatible, and any difference found between the two groups is a result of the applied educational physical therapy protocol. This finding is consistent with Liu *et al*. [15], who reported that there was no statistically significant difference between the two groups' demographic features in all aspects.

Furthermore, Mostafa Mahrous & Faheem Gendy [16] found that the hip fracture patients' discharge instructions had a noteworthy and beneficial impact on their recovery to their

pre-fracture level in the majority of daily living activities and the DING *et al*. [17] results showed that it further helps patients improve their overall prognosis compared to routine nursing.

The actual research clarified that there were no significant differences between patient demographics and the cumulated ambulation scale; this could be due to the homogeneity of the two groups, so the demographic characteristic didn't affect the result of the study, and any effect found was regarded to the applied educational physical therapy protocol, that was equivalent with Ahmed *et al*. [13] they mentioned there was no significant difference between socio-demographic data and ambulation scores in both groups.

Concerning muscle strength, there is a significant improvement in muscle strength between the post and pre-test group post implementing the educational physical therapy protocol, which supports the positive impact of the implemented rehabilitation protocol on increasing muscle strength.

This is agreed by Segev-Jacubovski [18] noted that the ongoing rehabilitation programs implemented either early or late following total hip replacement surgery can result in a notable increase in muscle strength and function.

As regards improving muscle strength in relation to ROM exercises, this is agreed by Berg *et al*. [19] stated that implementing muscle strength training (MST) and ROM exercises in the early postoperative period raises lower extremities and maximum muscular strength and improves postural stability in addition to traditional treatments. Moreover, Abd El-Naby *et al*. [6] showed that there was a statistically significant difference between the post-test group and pre-test groups regarding their functional status after implementing nursing instructions postoperatively.

Conclusion

The actual research illustrated that there is an improvement in physical mobility among the post-test group who received NI compared with the pre-test group.

Recommendations

- Periodic training and educational programs about exercise therapy for the prevention of mobility restrictions must be developed for the health staff, especially the nursing members.
- Provide the hospitals or orthopedic departments' libraries with adequate advanced teaching aids regarding orthopedic nursing care in the form of textbooks or online websites.
- Preoperative teaching and training programs for patients about measures that can reduce postoperative hip fracture complications and care that can be done
- Replicated the actual research in a bigger sample size to get results that may be applied broadly.

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