Effect of Nursing Rehabilitation Program on knee function and functional status among patients after Anterior Cruciate Ligament (ACL) Reconstruction at El-Manial University Hospital

Hanan Hassan El-Kafafy and Shaimaa M. El-Hadary

Medical- Surgical Nursing Department, Faculty of Nursing, Cairo University, Egypt
Shaimaa66@yahoo.com

Abstract: The anterior cruciate ligament (ACL) is one of the most commonly injured ligaments of the knee. Anterior cruciate ligament (ACL) injury is a serious injury often resulting in hospital admission for surgery. Rehabilitation is a major factor in the success of such surgery. The rehabilitation is very important and has a significant impact on the outcome of the knee and the patient's ability to perform everyday tasks. Rehabilitation nurses are challenged to rehabilitate individuals who have undergone anterior cruciate ligament (ACL) reconstruction to ensure optimal outcomes. Therefore, the aim of the study is to evaluate the effect of nursing rehabilitation program on knee function as indicated by knee function scores, and level of independency in performing activities of daily living as indicated by functional status scores after Anterior Cruciate Ligament (ACL) reconstruction. To fulfill this aim the following research hypotheses were formulated: H1) - Patients undergoing ACL reconstruction that will be exposed to nursing rehabilitation program will have higher knee function scores than patients who will receive the routine nursing care only. H2) -Patients undergoing ACL reconstruction that will be exposed to nursing rehabilitation program will have higher functional status scores than patients who will receive the routine nursing care only. A single-blinded randomized experimental design was used in this study. A convenience sample of 60 adult male and female patients was randomly divided into two equal and matched groups (control & study). Three tools were utilized for data collections; 1) Socio-demographic and biomedical data sheet, 2) Knee function questionnaire 3) Functional status assessment sheet. The study results revealed that knee function and functional status were significantly high among the study group as compared to the control group subjects with the following p values (0.000 & 0.001, respectively). In conclusion nursing rehabilitation program seemed to have a positive impact on ACL reconstruction patients' knee function and functional status. Therefore, replication of this study on a larger probability sample would be of great beneficence to patients and health professionals.
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Key words: Anterior Cruciate Ligament, rehabilitation program, functional status.

1. Introduction

Problems with the musculoskeletal system are generally not life- threatening, but they have a significant effect on the patient's normal activities and productivity. Injury to one part of the musculoskeletal system usually results in injury or dysfunction of adjacent structures and structures enclosed or supported by them. (Smeltzer, et al., 2010).

Renstrom (2008) mentioned that, An ACL injury has serious consequences for the injured individual, in terms of not only treatment costs and time lost from work but also a greatly increased risk of early osteoarthritis. (Myer, 2011) added that Anterior Cruciate Ligament (ACL) tear is a devastating knee injury. Recent studies indicate that an estimated 250,000 ACL injuries occur annually in the United States with approximately 175,000 resulting in reconstructions. The long-term effects of an ACL injury can severely impact the patient's quality of life.

US National Institute of Health (2010) clarified that, An injury to the anterior cruciate ligament can be a debilitating musculoskeletal injury to the knee, The anterior cruciate ligament (ACL) is a cruciate ligament which is one of the four major ligaments of the human knee. The most common method for repairing ACL injuries is arthroscopic surgery.

Pre- and post-operative rehabilitation is a major factor in the success of ACL reconstruction as well as reducing the incidence of complication after surgery focuses on restoring motion and strength, and improving the stability of the joint to prevent future injuries. Rehabilitation is extremely important for the successful outcome of ACL reconstruction. A proper rehabilitation protocol is needed to allow the graft to heal, mature and strengthen while the knee becomes stronger (Chong, 2010).

The goal of postsurgical rehabilitation is to strengthen the knee and restore the range of motion and confidence needed to increase activities to presurgical activity. Following the rehabilitation

program is very important and greatly influences final results (Honkamp, 2010).

The nurse aims to capture the rehabilitation goals and outcomes of clients and helps in setting flexible, realistic, patient-centered, and individually tailored goals that are observable and measurable. Once these goals are set, the patient and nurse review their progress at an agreed time point to see whether the expected outcome has been achieved, or whether the client achieved an outcome that was more or less than expected. (National Association of Orthopedic Nurses, 2011).

2.Subjects and Methods
Aim of the Study
The aim of the study is to evaluate the effect of nursing rehabilitation program on knee function as indicated by knee function scores, and level of independency in performing activities of daily living as indicated by functional status scores after Anterior Cruciate Ligament (ACL) reconstruction.

Hypotheses
To fulfill the aim of this study the following research hypotheses were depicted.

H1- Patients undergoing ACL reconstruction that will be exposed to nursing rehabilitation program will have higher knee function scores than patients who will receive the routine nursing care only.

H2-Patients undergoing ACL reconstruction that will be exposed to nursing rehabilitation program will have higher functional status scores than patients who will receive the routine nursing care only.

Design:
A single-blinded randomized experimental design was used in this study

Setting:
The present study was conducted at Orthopedic Departments, El-Manial University Hospital, affiliated to Cairo University.

Subjects:
A total of 60 adult male & female patients with anterior cruciate ligament injury and prescribed to do an ACL reconstruction will be recruited to fulfill the aim of this study. The sample will be divided to two equal groups, study and control (30 subjects each). Those who are agreeing to join in the study will be included in the study. Matching criteria of both groups will be selected according to age, gender and BMI. To ensure homogeneity of the study sample, the following inclusion criteria were utilized: Adult males and females will be included if they have ACL tear and undergoing a primary ACL arthroscopic reconstruction. Subjects will be excluded if they have: 1) Knee multiple ligamentous injuries. 2) Knee fractures. 3) Taking corticosteroid drugs. 4) Having infectious, neoplastic and/or inflammatory disease

Tools:
Three tools were formulated to collect data pertinent to the study. The study tools were constructed, tested and piloted by the investigator to examine their applicability, clarity, reliability and feasibility for data collection. Then revised by a panel of medical surgical nursing and Orthopedic surgery. Content validity were reviewed and determined by a panel of five expert professors in medical surgical nursing specialty and three from orthopedic surgery specialty. Modifications after testing tools were done to develop final forms. These tools are: Socio-demographic and biomedical data sheet, Knee function questionnaire and Functional status assessment sheet.

1- Socio-demographic and biomedical data sheet:
This tool consists of 10 items covering two main sections: the first one is related to the Biographical and social data such as age, gender, marital status, occupation and educational level. The second section covers biomedical data such as Length of hospital Stay, Affected Knee, Risk factors for ACL tears such as heart disease, pulmonary disease, liver disease and diabetes, Activity level in addition to Body Mass Index.

2- Knee function questionnaire:
This tool was designed to evaluate patient's knee function after ACL reconstruction. There were 6 main items are attributed to determine knee function; the first item was related to knee stability ranging from the score 0, if knee giving way in each step, to 30 which means the knee never giving way, the second one was the use of support which ranging from 0, if weight bearing was impossible, to 10 if the patient Don't use a cane or crutches, the third item concerned the limp and ranging from 0, if the patient has Severe and constant limp when walking, to 10 which indicates no limp when the patient walking, the fourth item was related to Locking or catching sensation in the knee and ranging from 0, which means Knee feels locked at the moment of assessment, to 20 which indicates no locking and no catching sensation, the fifth item was determine the patient ability for climbing stairs and ranging from 0, which mean Climbing stairs impossible, to 15 if there was no problems climbing stairs, the sixth and last items in this tool was related to squatting which ranging from 0, if squatting is impossible because of knee to 15 which indicates no problems in squatting. Total scores for this tool ranging from 0-100; Less than 65 was unsatisfactory knee function, From 65 to 80 considered satisfactory, and greater than 80 to 90 was good, while the score greater than 90 indicates excellent knee function.

3- Functional status assessment sheet:

This assessment sheet was constructed by the researcher for the aim of measuring the level of independence in performing activities of daily living specifically in self-care, transfers and locomotion; this tool has 10 items, for self-care the items were feeding, dressing, toileting and bathing while for transfers the indicated items were transferring and rise from a chair while the walk, ascending stairs, descending stairs and stand were related to the locomotion. Each of the previous items take a score 1 if the patient do it independently with no supervision, direction or personal assistance while a score 0 given if any of the previous activities done with supervision, direction, personal assistance or total care. The scoring system for this tool ranging from 0 to 10. A score of 10 indicates complete independence in all 10 domains measured, and 0 indicates dependence in all 10 domains. To be considered independent, the patient will not require assistance at any time.

Procedure:
1. Official permission was obtained from medical and nursing directors of the areas of the study.
2. A Pilot study was carried out on six patients in order to assess the clarity and the applicability of the tools.
4- Data was collected from sample patients who met the study criteria
5-Patients was randomly allocate into two groups study and control (30 subjects each).
6. The work plan included three main phases; preparatory, implementation and evaluation phases.

1-Preparatory phase:
Written informed consent was obtained from the patients who were willing to participate in the study. Each subject was contacted and informed about the purpose, nature, significance of the study as well as the importance of self-care management. The researcher developed the rehabilitation educational program using an Arabic instructional booklet given to each patient from admission and explained on 4 sessions (30 minutes for each one), on admission, preoperative, postoperative and on discharge.

2-Implementation phase:

A: Socio-demographic tool distribution:
The researcher spent 30 minutes with each patient to collect the baseline data using interview technique. A full history was taken from patients by the researcher, as well, reading the patient's chart was done in order to fill out the first tool.

B: Knee function questionnaire and Functional status assessment sheet distribution:
Knee function questionnaire were performed after one month postoperatively and one time for 2 consequent months (1st, 2nd, and 3rd follow up visits) for all study subjects to evaluate patient's knee function after ACL reconstruction.

Each patient assessed utilizing the Functional status assessment sheet to identify the level of independence in performing activities of daily living related to self-care, transfers and locomotion; it was performed after 3days postoperatively(during hospitalization) and one time for three consequent months later (1st, 2nd, and 3rd follow up visits).

C: Teaching patient:
A rehabilitation program was implemented over 4 sessions, 30 minutes for each one, in order to improve the patient's knee function and functional status.

Objectives of the rehabilitation program
An Arabic booklet was prepared to be distributed over the study subjects to serve as a guide for them each patient owned the instructional booklet to take it at home and during hospitalization. The aim of each session of the program as following:

Session 1 (on admission)
In this section the aim, benefits and the purpose of the study were explained. It was taken 30 minutes, the Arabic booklet was introduced, and introduction to ACL injury, reconstruction, diagnosis and treatment were explained.

Session 2 (preoperative)
This section aimed to prepare patients for surgery and helping them to control pain and swelling as well as developing muscle strength sufficient for normal gait and ADL. It was take 30 minutes, full extension exercise was demonstrated as follow; Passive knee extension using stool or chair, heel prop using a rolled towel, prone hang exercise using the table. Bending (Flexion) is obtained by doing the following exercises; passive knee bend using the table, wall slides using the wall, heel slides by assistance from patient's hands. As well as patients mentally prepared for surgery in this session.

Session 3 (postoperative)
This phase was helping the patient to care for the knee and dressing. It was take 30 minutes, early range of motion exercises, achieve and maintain full passive extension, prevent shutdown of the quadriceps muscles and gait training were achieved in this session as follow; passive extension of the knee by using a rolled towel, active-assisted extension is performed by using the opposite leg, passive flexion by gravity assistance, quadriceps isometric contractions as well as hamstring muscles exercises were done.

Session 4 (on discharge)
This section was help the patient in order to return to optimal activities of daily living /sports, maintain full extension and return to work. It was take 30 minutes, continued strength building through

exercise and light running were encouraged in this session.

3- Follow up and evaluation Phase:

Each patient either in the study or the control group had been met several times; on admission, preoperatively, postoperatively, on discharge and one time for three consequent months later, 1st, 2nd, and 3rd follow up visits. Patients were evaluated using the following tools; knee function questionnaire were performed after one month postoperatively and one time for 2 consequent months(1st, 2nd, and 3rd follow up visits) for all study subjects to evaluate patient's knee function after ACL reconstruction and functional status assessment sheet to evaluate the level of independence in performing activities of daily living was performed after 3days postoperatively(during hospitalization) and one time for three consequent months later (1st, 2nd, and 3rd follow up visits). This to enable the investigator to obtain the needed data that could confirm progress, stabilization or deterioration in the patients' condition. Moreover, the evaluation phase could not be separated from the previously stated phases because the study phases were overlapping, as during the implementation phase immediate evaluation of patient's care which was provided through the rehabilitation program was done after its provision. The functional status were evaluated after 3days postoperatively, and one time for three consequent months later, while the knee function were evaluated after one month postoperatively and one time for 2 consequent months for all study subjects to evaluate patient's knee function after ACL reconstruction.

Statistical Analysis

Data analysis was performed using Statistical Package for the Social Science (SPSS version.16) was used for statistical analysis of the data, as it contains the test of significance given in standard statistical books. Statistical significance was considered at P- value< 0.05

3.Results

Section 1: Socio-demographic & Biomedical Data

Table (1) shows that, the majority (90%) of both study and control groups were males. The highest percentage of them (60%) were in the age group of 19 to 30 years old with a mean of (30.20 $\pm$ 10.67) and (31.26 $\pm$ 10.95 years) respectively, with no significant statistical differences between them (X^2 =0.00 at p = 1.00). The same table denoted that, more than half (66.7% and 60%) of the study and the control group subjects were Read and write, Whereas the lowest percentages of both study and control groups (6.7% and 3.3 %) were having college studies, in addition no one of both study and control groups

(0%) were having Higher Studies, with no significant statistical differences between the study and control group (X^2 =0.92 at p = 0.82).

Figure (A) shows that, more than half (56.7%) of the study and the control group subjects were married, Whereas the lowest percentages of both study and control groups (3.3% and 0 %) were divorced respectively, with no significant statistical differences between the study and control group (X^2 =2.18 at p = 0.70).

Regarding occupation, figure (B) illustrates that (40% and 33.3%) of the study and the control group subjects were Farmer/Manual Work, as compared to (6.7% and 10%) of the both groups were unemployed respectively, with no significant statistical differences between them (X^2 =1.38 at p = 0.92).

Regarding the affected knee, table (2) denoted that, the right knee was most affected in both study and control groups (66.7%, 60% respectively), with no significant statistical differences between them (X^2 =0.28 at p = 0.59). As well 63.3 percent of the study and the control group subjects were having no risk factors for ACL tears/ comorbidities, followed by (13.3%) of both study and control groups were having diabetes, with no significant statistical differences between the study and control group (X^2 =0.00 at p = 1.00).

The same table shows that the highest percentage of both study and control groups (50%, 46.7% respectively) were non sporting, whereas the lowest percentage of both study and control groups (6.7%, 10% respectively) were sporting sometimes with no significant statistical differences between them (X^2 =0.43 at p = 0.93).

Regarding the Body Mass Index the same table denoted that, the highest percentage (33.3%) of both study and control groups were having Healthy weight, while the lowest percentage (6.7%) were having high risk obese of both study and control groups with no significant statistical differences between them (**t** =0.00 at p = 1.00).

Section 2: Hypotheses testing

In relation to hypothesis one, which states that Patients undergoing ACL reconstruction that will be exposed to Rehabilitation program will have higher knee function scores than patients who will receive the routine nursing care only.(Table 3 is related to this hypothesis).

In relation to knee function scores throughout the study periods among the two studied groups, the study group subjects showed a higher means of

scores in relation to knee function sub items; knee stability, use of support, limb, locking or catching sensation in the knee, climbing stairs & squatting and the total knee function scores with a highly significant statistical differences between the two groups (F=17.24 at p = 0.000, F=10.43 at p = 0.002, F=8.16 at p = 0.006, F=11.56 at p = 0.001, F=18.05 at p = 0.000, F=8.08 at p = 0.006 & F=13.95 at p = 0.000 respectively). As illustrated in table (3). So hypothesis one was supported.

In relation to hypothesis two, which states that Patients undergoing ACL reconstruction that will be exposed to a designed rehabilitation program will have higher functional status scores than patients who will receive the routine nursing care only.(Tables 4 is related to this hypothesis).

Table (4) showed that As regards the functional status scores among the two studied groups, the study group subjects showed a higher means of scores in relation to functional status sub categories total scores; self care, transfers, and locomotion and the total functional status scores throughout the study periods with a highly significant statistical differences between the two groups (F=7.52at p =

0.008, F=4.75at p = 0.03, F=17.097at p = 0.000& F=12.89at p = 0.001 respectively). So hypothesis two was supported.

Section 3: Additional findings

It is clear from table(5), that there was a negative correlation between the age, BMI and length of hospital stay in relation to the knee function scores among the study group subjects, with significant statistical differences (r = - 0.823at p = 0.000, r = - 0.778at p = 0.000& r= - 0.817at p = 0.000 respectively).

Table (6), showed that there was a negative correlation between the age, BMI and length of hospital stay in relation to the functional status scores among the study group subjects, with significant statistical differences (r = - 0.770 at p = 0.000, r = - 0.746 at p = 0.000& r= - 0.741 at p = 0.000 respectively).

Table(7) showed that there was a positive correlation between the knee function scores and functional status scores among the study group subjects, with significant statistical differences (r = 0.978 at p = 0.000).

Table 1: Socio-demographic characteristics of both study and Control Group Subjects as regards to Gender,Age & Education (n=60).

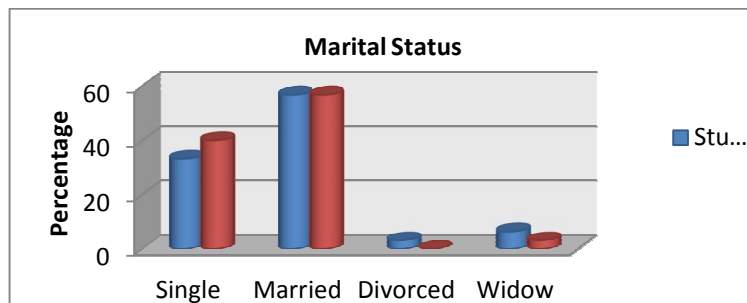| Variables	Study group		Control group		χ^2	P-value
	n	%	n	%		
Gender						
1-Male	27	90	27	90	0.00	1.00
2- Female	3	10	3	10		N.S.
Age/yrs						
• 19 – 30	18	60	18	60		
• 30 < 40	6	20	6	20	0.00	1.00
• 40 < 50	3	10	3	10		N.S.
• 50-60	2	6.7	2	6.7		
• 60-70	1	3.3	1	3.3		
Mean + SD	30.20 + 10.67		31.26 + 10.95			
Education						
1- Illiterate	2	6.7	3	10		
2- Read and write	20	66.7	18	60		
3- Secondary	6	20	8	26.7	0.92	0.82
4- College	2	6.7	1	3.3		N.S.
5- Higher Studies	0	0	0	0		

N.S.= Not Significant

Figure (A):Socio-demographic characteristics of both study and Control Group Subjects as regards to Marital Status (n=60).

Figure (B): Socio-demographic characteristics of both study and Control Group Subjects as regards to Occupation (n=60).

Table 2: Biomedical characteristics as regards to Affected Knee, Risk factors for ACL tears/ comorbidities, Activity level and Body Mass Index of both study and Control Group Subjects (n=60).

Variables	Study group		Control group		χ^2	P-value
	N	%	n	%		
Affected Knee						
1- Right	20	66.7	18	60	0.28	0.59
2- Left	10	33.3	12	40		N.S.
Risk factors for ACL tears/ comorbidities						
1- No	19	63.3	19	63.3		
2- Heart disease	1	3.3	1	3.3		
3- Pulmonary disease	3	10	3	10	0.00	1.00
4- Diabetes	4	13.3	4	13.3		N.S.
5- Kidney disease	2	6.7	2	6.7		
6- Liver disease	1	3.3	1	3.3		
Activity level						
1- A high competitive sports person	10	33.3	9	30		
2- Frequently sporting	3	10	4	13.3	0.43	0.93
3- Sporting sometimes	2	6.7	3	10		N.S.
4- Non-sporting	15	50	14	46.7		
Body Mass Index					t	P-value
1- Under weight < 18.5	6	20	6	20		
2- Healthy weight 18.5-24.9	10	33.3	10	33.3		
3- Overweight 25-29.9	5	16.7	5	16.7	0.00	1.00
4- Obese 30 or more	7	23.3	7	23.3		
5- High risk obese > 35	2	6.7	2	6.7		
Mean + SD	2.63 + 1.24		2.63 + 1.24			

Table (3):Comparison of Knee Function among the Control and Study Groups using One Way Repeated Measures ANOVA all through the Study Periods (n=60).

Variables	1st Follow Up Visit $\overline{X}$ + SD		2nd Follow Up Visit $\overline{X}$ + SD		3rd Follow Up Visit $\overline{X}$ + SD		F ratio	P-value
	Study group	Control group	Study group	Control group	Study group	Control group		
1- Knee stability	29.33+2.85	25.83+7.20	28.66+4.53	18.66+10.49	27.66+6.26	18.50+10.67	17.24	*0.000
2- Use of support	8.33+3.02	6.00+4.02	9.16+2.30	6.50+3.97	9.66+1.26	7.00+3.85	10.43	*0.002
3- Limp	7.83+3.63	5.16+4.25	8.33+3.30	6.00+4.02	9.33+2.17	6.83+3.82	8.16	*0.006
4- Locking or catching sensation in the knee	19.50+2.01	15.16+7.24	19.00+3.32	13.83+7.50	18.50+4.18	13.50+7.08	11.56	*0.001
5- Climbing stairs	8.83+3.13	4.66+3.92	11.50+4.18	5.66+5.20	12.66+3.65	9.50+4.97	18.05	*0.000
6- Squatting	9.66+3.68	8.16+4.25	11.00+3.57	7.16+4.67	12.50+3.65	9.33+4.86	8.08	*0.006
Total knee function scores	83.66+16.34	65.00+28.67	88.16+18.12	58.16+33.43	90.33+19.69	64.66+34.21	13.95	*0.000

* Significant at the $p \leq 0.05$ probability level

Table (4):Comparison of Functional status mean total scores among the Control and Study Groups using One Way Repeated Measures ANOVA all through the Study Periods (n=60).

Variables	During Hospitalization $\overline{X}+SD$		1st Follow Up Visit $\overline{X}+SD$		2nd Follow Up Visit $\overline{X}+SD$		3rd Follow Up Visit $\overline{X}+SD$		F ratio	P-value
	Study Group	Control group	Study group	Control Group	Study group	Control group	Study group	Control group		
Total score for Self-care	3.30+1.26	2.33+1.86	3.46+1.10	2.50+1.85	3.73+0.86	2.66+1.78	3.80+0.76	2.73+1.75	7.52	*0.008
Total score for Transfers	1.46+0.86	1.40+3.99	1.66+0.71	0.86+0.97	1.80+0.55	1.00+0.98	1.86+0.43	1.06+0.98	4.75	*0.03
Total score for locomotion	3.33+1.34	1.90+1.74	3.63+0.96	2.16+1.72	3.70+0.95	2.26+1.74	3.83+0.64	2.36+1.67	17.097	*0.000
Total functional status scores	8.10+3.35	4.90+4.42	8.63+2.94	5.46+4.43	9.23+2.32	5.93+4.32	9.50+1.79	6.20+4.20	12.89	*0.001

* Significant at the $p \leq 0.05$ probability level

Table (5): Correlation Coefficient for age, BMI and length of hospital stay in relation to the knee function scores all through the Study periods among the Study Group subjects (n=60).

Variables	r value	P – value
	Study Groups	
Age & knee function scores	- 0.823	*0.000
BMI & knee function scores	- 0.778	*0.000
length of hospital stay & knee function scores	- 0.817	*0.000

 *Correlation is significant at $p \leq 0.05$ level

Table (6): Correlation Coefficient for age, BMI and length of hospital stay in relation to the functional status scores all through the Study periods among the Study Group subjects (n=60).

Variables	r value	P - value
	Study Groups	
Age & functional status scores	- 0.770	*0.000
BMI & functional status scores	- 0.746	*0.000
length of hospital stay & functional status scores	- 0.741	*0.000

 *Correlation is significant at $p \leq 0.05$ level

Table (7): Correlation Coefficient for knee function scores in relation to functional status scores all through the Study periods among the Study Group subjects (n=60).

Variables	r value	P - value
	Study Groups	
Knee function scores & functional status scores	0.978	*0.000

*Correlation is significant at $p \leq 0.05$ level

4. Discussion

As regards to Socio-demographic and biomedical data the present study delineated a higher representation of male subjects than females in which the majority of both groups are males. This result is in agreement with Wright et al., (2008). in their study which entitled "A Systematic Review of Anterior Cruciate Ligament Reconstruction Rehabilitation". done on 54 appropriate randomized controlled trials of ACL rehabilitation. at Washington University School of Medicine at Barnes-Jewish Hospital, emphasized that men are five times more likely to sustain an anterior cruciate ligament injury than women. A possible explanation that might account for this finding is the fact that ACL injury is thought to be due to their high level of activity than woman.

The current study denoted that the majority of both groups, their ages were ranging from19 to 30 years old. This finding is in agreement with the finding of study by Janssen et al. (2010) in their survey study entitled as "High incidence and costs for anterior cruciate ligament reconstructions performed in Australia" at University of Sydney done on 50 187 patients for ACL reconstruction, reported that The ACL reconstruction incidence rose rapidly through early adulthood and then gradually declined. Males had a higher incidence than females in all age groups.

Regarding the affected knee the study results denoted that, the right knee was most affected in both study and control groups. In this respect, Gillie (2011) who studied "the Incidence and Prevention of Injury of the Anterior Cruciate Ligament in males" done on 300 patients at Liberty University, emphasized that, ACL Injuries were highly frequent in the right knee than the left knee (64% and 36% respectively), and all of the injured were right-hand dominant.

As well 63.3 percent of the study and the control group subjects were having no risk factors for ACL tears/ comorbidities, with no significant statistical differences between the study and control group. In this respect, Calvisi et al., (2008).in their study which entitled" Comorbidity-related quality of life in anterior cruciate ligament insufficiency: a cross-sectional study involving 282 candidates for arthroscopic reconstruction.", done on 282 patients at University of L'Aquila, Italy. emphasized that, Of the 282 patients, 82 had associated comorbidity and 200 did not. And reported that Comorbidity-related HRQoL in candidates for ACL arthroscopic

reconstruction showed no statistically significant differences from the norm.

In relation to the level of activity, the present study showed that the highest percentage of both study and control groups (50%, 46.7% respectively) were non sporting, with no significant statistical differences between them. In this respect, Sonnery-Cottet et al., (2011). in their study which entitled" The influence of the tibial slope and the size of the intercondylar notch on rupture of the anterior cruciate ligament", done on 100 patients at Centre Orthopédique, Santy, France., emphasized that Basically any athletic or non-athletic related activity in which the knee is forced into hyperextension and/or internal rotation may result in an ACL tear. And concluded that Non-sport related injuries and Motor vehicle accidents are the most common cause of ACL tear.

In relation to knee function, the current study reported a higher means of knee function scores among the study group subjects as compared to control group ones with a highly significant statistical differences between the two groups. In this respect, Chmielewski et al. (2011) in their a prospective, longitudinal, observational study which entitled "Longitudinal changes in psychosocial factors and their association with knee pain and function following rehabilitation after anterior cruciate ligament reconstruction." done on 77 patients at Department of Physical Therapy, College of Public Health and Health Professions, University of Florida Health Sciences Center, USA. reported that Interventions that increase self-efficacy for rehabilitation tasks or decrease fear of movement or re-injury have potential to improve short-term outcomes for knee pain and function.

The study results also showed there was a positive correlation between the knee function scores and functional status scores among the study group subjects, with significant statistical differences. This result is in agreement with Wright et al., (2008). in their study which entitled "A Systematic Review of Anterior Cruciate Ligament Reconstruction Rehabilitation". done on 54 appropriate randomized controlled trials of ACL rehabilitation. at Washington University School of Medicine at Barnes-Jewish Hospital, emphasized that the study results indicate that long-term progressive rehabilitation emphasizing increased quadriceps and hamstring strength and knee function to approximate the operated leg which enhance successful return to functional and sports activities after ACL reconstruction.

Speaking in the same stream, Biau et al., (2007). in their meta-analysis From individual randomized studies, which entitled "ACL reconstruction: a meta-analysis of functional scores." done on Fourteen trials

(1263 patients), at Hôpital Cochin, Paris Université 5, France. reported that the study performed a meta-analysis to provide quantitative data to compare patellar with hamstring grafts after ACL reconstruction with regard to knee function and found no difference in final overall International Knee Documentation Committee score or in the number of patients returning to full activity after patellar and hamstring graft reconstruction. And clarified the result that all depends on the rehabilitation process not on the type of graft used.

As regards the functional status scores among the two studied groups, the study group subjects showed a higher means of total functional status scores throughout the study periods with highly significant statistical differences between the two groups. In this respect Narducci et al., (2011). in their systematic review study which entitled "The clinical utility of functional performance tests within one-year post-ACL reconstruction: A systematic review." done on twelve studies at Walsh University Department of Physical Therapy, North Canton, Ohio. For assessment of functional performance as an ACL outcome measure reported that, the rehabilitation has emphasis on progression of activities of daily living, Bathing/Showering, Sleeping, Driving and Weight-bearing.

On the other hand Nyland et al., (2002). in their Quasi-experimental, posttest only study which entitled "Internal health status belief and lower perceived functional deficit are related among anterior cruciate ligament - reconstruction patients." done on 70 consecutive patients with unilateral ACL, at Division of Sports Medicine, Department of orthopedic Surgery, University of Louisville,, Kentucky, USA. Reported that Subjects with lower perceived functional limitations regarded their health status as being controlled more by internal factors. It is not proven whether there is a cause-and-effect relationship or which of these parameters is the antecedent. Related reports suggest that perception of control may positively influence functional outcome and disability levels. Patients who perceive preoperative pain and functional limitation to be excessive may have low tolerance for the stressors associated with surgery and postoperative rehabilitation.

Conclusion

Nursing rehabilitation program tends to be a protocol of choice to maximize the efficiency and quality of nursing care through improving the knee function and overall functional status among ACL reconstructed patients. Moreover, as can be concluded from the present study that the program is properly designed and implemented to be beneficial

in providing care in order to reach the expected outcomes for such patients.

Recommendations

Based on the findings of the present study, the following recommendations are suggested:

1- Establishment of patient-education and rehabilitation unit attached to the orthopedic departments where the patients can find easy simple attractive colored illustrated posters and booklets regarding.ACL rehabilitation and providing a simple equipment for basic exercises.

2- There is a need in a formal educational program or additional degrees like a diploma in rehabilitation nursing in which the nurse can handle the concept of rehabilitation from all scientific aspects, and acquiring the basic rehabilitation skills helping in dealing with patients aiming in reaching the maximum level of performance.

3- Replication of the study on a larger probability sample selected from different geographical areas in Egypt is recommended to obtain data of more generalizability of findings in relation to this problem.

4- Further studies have to be carried out in order to assess the effectiveness of rehabilitation program applications on patient outcomes regarding different orthopedic disorders.

Corresponding authors
Shaimaa M. El-Hadary
Medical- Surgical Nursing Department, Faculty of Nursing, Cairo University, Egypt
Shaimaa66@yahoo.com

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