

Impact of a Designed Nursing Rehabilitation Program on incidence of complication and length of hospital stay After Anterior Cruciate Ligament (ACL) Reconstruction El-Manial University Hospital

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Abstract: Anterior cruciate ligament (ACL) injury is a serious injury often resulting in hospital admission for ACL reconstruction. Rehabilitation is a major factor in the success of such surgery. Rehabilitation nurses are challenged to rehabilitate individuals who have undergone anterior cruciate ligament (ACL) reconstruction to ensure optimal outcomes. Therefore, the aim of this study is to design nursing rehabilitation program for patients undergoing ACL reconstruction, to implement the designed program, and to evaluate the impact of the program on incidence of complication and length of hospital stay. To fulfill this aim the following research hypotheses were formulated: H1) - Patients undergoing ACL reconstruction who will be exposed to a designed rehabilitation program will have fewer complications than those who will receive routine nursing care only. H2) - Patients undergoing ACL reconstruction who will be exposed to a designed rehabilitation program will have less hospital stay than patients who will receive the routine nursing care only. Quasi-experimental design was utilized in this study. A convenience sample of 60 adult male and female patients was randomly divided into two equal and matched groups (control & study). two tools were utilized for data collections; 1) Socio-demographic and biomedical data sheet, 2) Complications monitoring sheet. The study results revealed significant fewer complication throughout the study periods among the study group as compared with the control group subjects($p= 0.004$) as well shorter length of stay with the following p values(0.01). In conclusion nursing rehabilitation program seemed to have a positive impact on decreasing the number and severity of complication as well as the length of hospital stay for ACL reconstruction patients. Therefore, replication of this study on a larger probability sample would be of great beneficence to patients and health professionals.

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1. Introduction:

Few musculoskeletal conditions have stimulated as much controversy, debate, and research as injury to the anterior cruciate ligament (ACL). Once considered the beginning of the end of normal knee function, the current prognosis of ACL injury, with appropriate treatment, appears to be much better. ACL surgery and rehabilitation have undergone dramatic changes over the past decade, due to extensive clinical experience, improved surgical techniques and better understanding of rehabilitation. (**American association of hip and knee surgeons, 2011**).

American academy of orthopedic surgeon (2011) reported that, The anterior cruciate ligament (ACL) is one of the most commonly injured ligaments of the knee. The incidence of ACL injuries is currently estimated at approximately 200,000 annually, with 100,000 ACL reconstructions performed each year. Anterior cruciate ligament (ACL) injury is a serious injury often resulting in

hospital admission for surgery with the highest incidence seen in young adults (**Flood and Harrison, 2009**).

Renstrom (2008) added 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 complications. 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 (**Beynon and Johnson, 2010**).

Rehabilitation is one of the most important, yet too often neglected, aspect of ACL reconstruction surgery. rehabilitation following ACL 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 rehabilitation is very important and has a significant impact on decreasing the complication. The nurse becomes an important part of the rehabilitation program. Rehabilitation begins immediately after surgery, which involves walking with crutches, contracting the thigh muscles, and attempting to lift the leg independently. (**Rebel, 2008**).

Rehabilitation nurses are frequently called upon to rehabilitate individuals who have undergone anterior cruciate ligament (ACL) reconstruction to ensure optimal outcomes(**Slowik, 2011**). The nurse aims to capture the rehabilitation goals and outcomes of clients and helps in setting flexible, realistic, client-centered, and individually tailored goals that are observable and measurable. Once these goals are set, the client 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**).

thus the aim of this study is the aim of this study is to design nursing rehabilitation program for patients undergoing ACL reconstruction, to implement the designed program, and to evaluate the impact of the program on incidence of complication and length of hospital stay among the study sample at the orthopedic departments of El-Manial University Hospitals, Cairo University.

2. Subjects and Methods

Aim of the Study

The aim of the study is to design nursing rehabilitation program for patients undergoing ACL reconstruction, to implement the designed program, and to evaluate the impact of the program on incidence of complication and length of hospital stay among the study sample at the orthopedic departments of El-Manial University Hospitals, Cairo University.

Design:

To fulfill the aim of this study Quasi-experimental design will be utilized. quasi-experimental studies are conducted to examine the effect of nursing interventions on incidence of complication and length of hospital stay among the study sample. the current study adopts this design because it is difficult to select a random sample representing the current ACL reconstruction population at the orthopedic Settings of the Arab Republic of Egypt. So the research will utilize only two of the three essential elements of a true experimental design, which is the manipulation of the independent variable and control group.

Setting:

The present study was conducted at four orthopedic units, 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:

Two 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. These tools are: Socio-demographic and biomedical data sheet & Complications monitoring sheet.

1- Socio-demographic and biomedical data sheet: (Appendix A)

This tool consists of 14 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 , Cigarettes Smoking, 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- Complications monitoring sheet: (Appendix B)

This sheet was designed to study the expected knee complications after ACL reconstruction. It includes 10 main complications; 1) Knee pain, 2) Knee stiffness, 3) Limited knee range of motion, 4) Knee swelling, 5) knee loosening, 6) Quadriceps muscle weakness, 7) Abnormal gait, 8) Numbness around the incision, 9) Repeated injury to the graft and 10) Deep venous thrombosis (DVT). The scores of this tool ranging from 0 to 10 the greater the score the greater the complications occurred. The score from 0 to 4 indicates mild complications; the score from 5 to 7 means there were moderate complications, while the score from 8 to 10 indicates severe complications.

Pilot Study

A pilot study was carried out for the purpose of testing the tools, to determine clarity, applicability, objectivity and feasibility of conducting the study. To achieve that, the tools were tested over 6 patients. Content validity was reviewed and determined by a panel of four expert professors in Medical Surgical Nursing specialty. Modifications after testing tools were done to develop final forms. Results obtained from the pilot study were not included in the main study. Data were collected for all patients who met the study criteria.

Procedure:

The current study was carried out on three phases; preparatory, implementation and evaluation phases.

1-Preparatory phase: This phase was concerned with assessment of patient's setting and needs will be done first in order to carry out the study in addition to construction and preparation of different data collection tools and designing the ACL reconstruction rehabilitation program formats.

2-Implementation phase: Data of the current study were collected from July 2010 to November 2011, once an official permission was obtained from the director of El-Mania University Hospitals, Cairo University for conduction of the study. A total number of 60 patients who fulfilled the criteria of inclusion were recruited into the present study. For ethical consideration The researcher begin with the control group (30 patients) up to the end of their follow up period then begin with the study group (30 patients) to be in a different time. Patients' written informed consent will be obtained from the patients who will be accepting to participate in the study after clarification of the nature and purpose of the study. Selected patients were met after admission for completion of the socio-demographic and biomedical data sheet to obtain a baseline data about patients. Then the designed rehabilitation program will be provided for the study group which utilized by the investigator who used on daily bases from the time of

admission, preoperatively, postoperatively, and on discharge while the control one will obtain only the routine care then Complications monitoring sheet were completed after 3days postoperatively, and one time for three consequent months later for all study subjects.

3- Evaluation Phase: Each patient either in the study or the control group had been met several times; after admission, postoperatively, and one time for three consequent months later This to enable the investigator to obtain the needed data that could confirm progress, stabilization or deterioration in the patients' condition, Presence of complications as well was evaluated during hospitalization, and during follow up periods

Statistical Analysis

An IBM compatible PC was used to store and analyze the data and to produce graphic presentation of some important results. 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.

Descriptive statistics:

Data were summarized using 1) the arithmetic mean as an average, describing the central tendency of observations for each variable studied; the standard deviation as a measure of dispersion of results around the mean; 2) the frequency and percentage of observation for each variable studied.3) the frequency and percentage of observation for each variable studied.

Inferential statistics:

Parametric inferential statistics were used as follow:

-The student t-test was used for the comparison of means of 2 independent groups.

-Chi- square was used for comparing the frequency and percentages of qualitative variables.

-Repeated Measures ANOVA was used to measure the change over time for the studied variables.

Level of significance:

For all the statistical tests done, the threshold of significance was fixed at the 5% level (P-value). A P-value > 0.05 indicates non significant result and the P-value < 0.05 indicates a significant result and the P-value is the degree of significance. The smaller the P-value obtained, the more significant is the result: the P-value being the probability of error of the conclusion.

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 +

10.67) and (31.26 + 10.95) respectively, with no significant statistical differences between them ($\chi^2 = 0.00$ at $p = 1.00$).

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 ($\chi^2 = 2.18$ 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 ($\chi^2 = 1.38$ at $p = 0.92$).

Table (2) 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 Whereas no one of both study and control groups (0%) were having Higher Studies, with no significant statistical differences between the study and control group ($\chi^2 = 0.92$ at $p = 0.82$).

Regarding the support System, the same table illustrates that more than half (60% and 56.7% respectively) of the study and the control group subjects having the spouse as the support System, with no significant statistical differences between them ($\chi^2 = 0.67$ at $p = 0.95$).

Table (3) shows that the highest percentage of both study and control groups (43.3%, 56.7% respectively) were non smokers with no significant statistical differences between them ($\chi^2 = 1.24$ at $p = 0.74$).

Regarding the affected knee the same table 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 ($\chi^2 = 0.28$ 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 ($\chi^2 = 0.00$ at $p = 1.00$).

Table (4) 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 ($\chi^2 = 0.43$ 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 who will be exposed to a designed rehabilitation program will have fewer complications than those who will receive routine nursing care only. (tables 5 -6 are related to this hypothesis).

In relation to the occurrence of ACL reconstruction complication throughout the study periods among the two studied groups table (5) denotes that the study group subjects showed a lower means of scores in relation to complication than the control one with a significant statistical differences between the two groups ($F = 9.261$ at $p = 0.004$). So hypothesis one was supported.

Regarding the degree of complications table (6) showed that throughout the study periods the high percentage of mild complication was in the study group (56.7%, 70%, 83.3%, 90%) while the high percentage of severe complication (20%, 30%, 30%, 23.3%) was in the control group throughout the study periods.

In relation to hypothesis two, which states that: Patients undergoing ACL reconstruction who will be exposed to a designed rehabilitation program will have less hospital stay than patients who will receive the routine nursing care only (table 7 is related to this hypothesis).

Table (7) showed that (66.7%) of the study group subjects stayed less than 5 days as compared to the control group subjects who they majority (83.3%) stayed from five to seven days, with a statistical significant differences between both groups ($t = 2.58$ at $p = 0.01$). Thus, H_2 was supported.

Section 3 : Additional findings

It is clear from table (8), that there was a positive correlation between the age, BMI and length of hospital stay in relation to the numbers of complications among the study group subjects, with significant statistical differences ($r = 0.868$ at $p =$

0.000, $r = 0.868$ at $p = 0.000$ & $r = 0.848$ at $p = 0.000$ respectively).

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 from 19 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.

The effect of smoking on ACL injury was not explained by the finding of the current study because the majority of both study and control groups subjects were non smokers. In contrast, Sandell (2007), in his study entitled as "cigarette smoking impairs ligament healing, researchers find" reported that Studying people with knee ligament injuries, the team discovered cigarette smoking impairs the recruitment of cells to the injury site and delays healing following ligament-repair surgery. And also added that patient's factors like smoking have been attributed as the few leading causes responsible for unsuccessful ACL reconstruction outcome.

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.

As regards to ACL reconstruction complications & length of hospital stay

Patients after ACL reconstruction are particularly vulnerable to the development of various complications despite the advances in surgery. The finding of the present study revealed that, patients of the routine care group had higher incidence of complications as compared with the rehabilitation program group, in spite of the similarity of base line matching criteria.

Regarding the incidence of ACL complication, the study results showed a significant statistical differences between the study and control groups in developing knee pain, limited knee range of motion, knee swelling, abnormal gait, repeated injury to the graft and deep venous thrombosis throughout the study period. While, regarding the presence of knee stiffness, knee loosening, quadriceps muscle weakness, and numbness around the incision there were a significant statistical differences between the study and control groups in certain period throughout the study and no significant statistical differences between the study and control groups in other period. The current study documented a longer hospital stay period among the control group subjects as compared to the study group ones. This could be attributed to the relative increase in the number and duration of complications.

In this regard, **Dahl et al** (2012). in their study which entitled "Short stay and less pain after ambulatory anterior cruciate ligament (ACL) repair: COX-2 inhibitor versus glucocorticoid versus both combined. ", done on 89 adult patients at Department of Anesthesia and Intensive Care, Baerum Hospital, RUD, Norway. emphasized that Post-operative pain occur after ACL reconstruction surgery. Pain can occur at the incision sites or from the site where the new ACL is taken. Some patients report kneecap pain, especially if part of the extensor mechanism was used for the newly reconstructed ACL. Patients experience Early pain at the surgical scar sites. 42% of patients report some discomfort with kneeling after ACL reconstruction is done with a patella tendon graft. patients complain of late pain behind their kneecap. pain originates from damaged cartilage on the patella surface or abnormal patella tracking. Also reported that bracing and rehabilitation often relieve patella pain.

Regarding knee stiffness, swelling and loosening **Tjounmakaris et al** (2012). in their study which entitled " Complications in brief: anterior cruciate ligament reconstruction. ", done on 200 patients at Jefferson Medical center, Philadelphia, USA. emphasizing the complications that occurred before, during, and after ACL reconstruction surgery. Reported that the major complications that raised include missed concomitant injuries, knee swelling, patellar fracture, knee loosening, knee stiffness, and abnormal gait.

In relation of limited ROM complication, Shelbourne and Patel (1999). in their study which entitled " Treatment of limited motion after anterior cruciate ligament reconstruction.", done on 90 patients at Methodist Sports Medicine Center, Indianapolis, USA. clarified that limited motion or arthrofibrosis after anterior cruciate ligament (ACL) reconstruction is the major complication causes significant pain and functional impairment. And added that Range of motion (ROM) problems after ACL reconstruction have been minimized by improved surgical techniques and implementation of rehabilitation programs.

In regards Quadriceps weakness, **Rittweger et al** (2011). in their study which entitled " Persisting side-to-side differences in muscle strength and tendon stiffness after anterior cruciate ligament reconstruction. ", done on 100 patients at Institute for Biomedical Research into Human Movement and Health, Manchester Metropolitan University, Manchester, UK. emphasized that there were a significant side-to-side differences in quadriceps muscle strength between the study and control group .

Regarding the abnormal gait **Kawahara et al** (2011) .in their study which entitled " Return of normal gait patterns after anterior cruciate ligament reconstruction", done on 36 patients with ACL-deficient knee and 40 healthy controls without pain or restricted range of motion of the lower extremity during gait. at Division of Orthopaedic Surgery, Department of Medicine of Sensory and Motor Organs, Faculty of Medicine, University of Miyazaki, Japan. Emphasized that differences in gait between subjects and controls persisted up to 12 months after surgery. Specifically, subjects with anterior cruciate ligament reconstructions demonstrated significant reductions in midstance knee flexion moments ($P < 0.01$) and tibially directed loading rates ($P < 0.05$) when compared with controls. A possible explanation that might account for this finding is the fact that Individuals with anterior cruciate ligament deficiency typically do not have quadriceps activity during stance. This aberrant pattern has been termed "quadriceps avoidance" gait. However, the subjects had a net external flexion moment throughout most of the stance phase of gait, implying that quadriceps activity was present. After anterior cruciate ligament reconstruction, there is a tendency toward gait normalization, and a quadriceps avoidance mechanism is no longer present.

Regarding presence of numbness after ACL reconstruction, **Kjaergaard and Fauno** (2008). in a study entitled as "Sensibility loss after ACL reconstruction", done on 102 patients at Department of Orthopaedic Surgery, Randers Hospital, Randers, Denmark.. reported that, Injury to the infrapatellar branch of the saphenous nerve (IPBSN), is known to cause regional hypoesthesia of the lower leg after anterior cruciate ligament (ACL) reconstruction. The aim of this study was to describe change, if any, of the hypoesthetic area, during the first postoperative year, twelve days after surgery and at a one year follow-up the patients had their sensibility of the lower leg examined. The findings of this study clarified that hypoesthesia is a common complication (88%) after ACL surgery. Furthermore, the area with sensory loss, felt by the patient shortly after surgery, was shown to decrease significantly by 46.3 percent after one year.

In regarding deep venous thrombosis, **Meighan et al** (2009). in their randomized control trail which entitled "Outcome after reconstruction of the anterior cruciate ligament in athletic patients.", done on 31 patients at Department of Orthopaedic Trauma, Royal Infirmary of Edinburgh, Scotland, UK. This study randomized 31 patients with acute tears of the anterior cruciate ligament (ACL) to receive reconstruction and clarified that in the first

month after surgery, blood clots can develop in the leg. If this occurs, patients will develop painful swelling in their leg. This is more common in patients with a family history of blood clotting disorders. Prompt medical evaluation is necessary since a blood clot that travels to the lungs can be fatal. Blood thinning drugs are used to treat the clotting. And the findings of this study found that two cases of symptomatic deep-venous thrombosis occurred in the both groups.

quality of nursing care through reducing number and severity of complications and length of hospital stay 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. Rehabilitation program is documented to be an effective tool and that facilitate patient acquisition of knowledge related to the injury and specific exercise for each time period.

5. Conclusion

Nursing rehabilitation program tends to be a protocol of choice to maximize the efficiency and

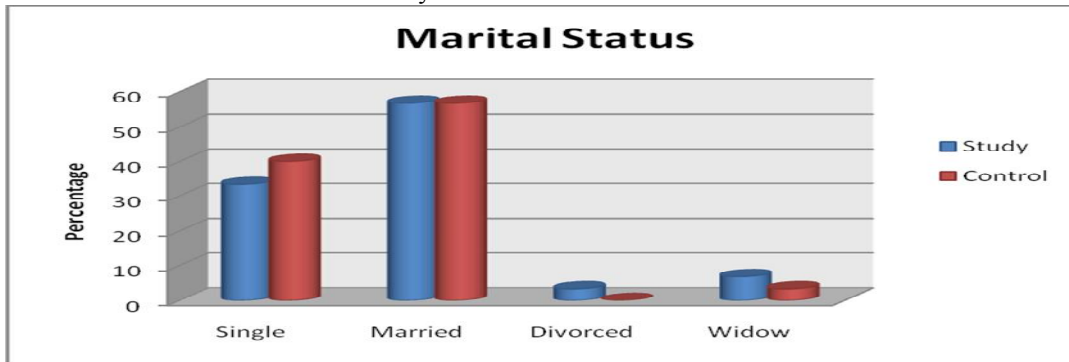


Figure (A) Socio-demographic characteristics of both study and Control Group Subjects as regards to Marital Status (n=60).

(Table 1): Socio-demographic characteristics of both study and Control Group Subjects as regards to Gender & Age (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	0.00	1.00 N.S.
• 30 < 40	6	20	6	20		
• 40 < 50	3	10	3	10		
• 50-60	2	6.7	2	6.7		
• 60-70	1	3.3	1	3.3		
Mean \pm SD	30.20 \pm 10.67		31.26 \pm 10.95			

N.S.= Not Significant

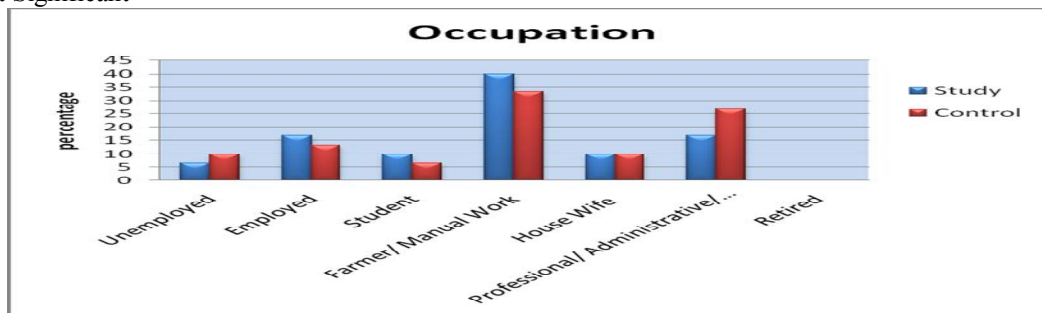


Figure (B) Socio-demographic characteristics of both study and Control Group Subjects as regards to Occupation (n=60).

Table 2):Socio-demographic characteristics as regards to Education and support system of both study and Control Group Subjects (n=60).

Variables	Study group		Control group		χ^2	P-value
	N	%	n	%		
Education						
1- Illiterate	2	6.7	3	10	0.92	0.82 N.S.
2- Read and write	20	66.7	18	60		
3- Secondary	6	20	8	26.7		
4- College	2	6.7	1	3.3		
5- Higher Studies	0	0	0	0		
Support System						
1- No support system	0	0	0	0	0.67	0.95 N.S.
2- Spouse	18	60	17	56.7		
3- Father	5	16.7	4	13.3		
4- Mother	4	13.3	4	13.3		
5- Son	2	6.7	3	10		
6- Daughter	0	0	0	0		
7- Others	1	3	2	6.7		

N.S.= Not Significant

(Table 3): Biomedical characteristics as regards to Cigarettes Smoking Affected Knee, and Risk factors for ACL tears/ comorbidities of both study and Control Group Subjects (n=60).

Variables	Study group		Control group		χ^2	P-value
	N	%	n	%		
Cigarettes Smoking						
1- Yes	12	40	10	33.3	1.24	0.74 N.S.
2- No, Quite in the last six months	2	6.7	1	3.3		
3- No, Quite more than six months ago	3	10	2	6.7		
4- No, never smoked	13	43.3	17	56.7		
Affected Knee						
1- Right	20	66.7	18	60	0.28	0.59 N.S.
2- Left	10	33.3	12	40		
Risk factors for ACL tears/ comorbidities						
1- No	19	63.3	19	63.3	0.00	1.00 N.S.
2- Heart disease	1	3.3	1	3.3		
3- Pulmonary disease	3	10	3	10		
4- Diabetes	4	13.3	4	13.3		
5- Kidney disease	2	6.7	2	6.7		
6- Liver disease	1	3.3	1	3.3		
7- Others	0	0	0	0		

(Table 4): Biomedical characteristics as regards to 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	%		
Activity level						
1- A high competitive sports person	10	33.3	9	30	0.43	0.93 N.S.
2- Frequently sporting	3	10	4	13.3		
3- Sporting sometimes	2	6.7	3	10		
4- Non-sporting	15	50	14	46.7		
Body Mass Index						
1- Under weight < 18.5	6	20	6	20	0.00	1.00
2- Healthy weight 18.5-24.9	10	33.3	10	33.3		
3- Overweight 25-29.9	5	16.7	5	16.7		
4- Obese 30 or more	7	23.3	7	23.3		
5- High risk obese > 35	2	6.7	2	6.7		
Mean \pm SD	2.63 \pm 1.24		2.63 \pm 1.24			

Table (5): Comparison of ACL reconstruction Complication total scores among the Control and Study Groups using One Way Repeated Measures ANOVA all through the Study Periods (n=60).

Variables	During Hospitalization		1 st Follow Up Visit		2 nd Follow Up Visit		3 rd Follow Up Visit		F ratio	P-value
	X ± SD		X ± SD		X ± SD		X ± SD			
	Study group	Control group	Study group	Control group	Study group	Control group	Study group	Control group		
Total Complication scores	3.7±2.92	6.00±1.98	2.66±3.20	5.06±3.12	1.66±3.04	3.80±3.58	1.10±2.48	3.10±3.55	9.261	0.004

* Significant at the ≤ 0.05 probability level

Table (6): Percentage Distribution of ACL Complications Developed among the Two Studied Groups throughout the study periods (n=60).

Variables	Study group		Control Group		χ^2	p-Value
	N	%	N	%		
During hospitalization						
Mild complication	17	56.7	5	16.7	10.33	0.001
Moderate complication	10	33.3	19	63.3	5.40	0.02
Severe complication	3	10	6	20	1.17	0.27
The 1 st follow up						
Mild complication	21	70	11	36.7	6.69	0.01
Moderate complication	5	16.7	10	33.3	2.22	0.13
Severe complication	4	13.3	9	30	2.45	0.11
The 2 nd follow up						
Mild complication	25	83.3	18	60	4.02	0.04
Moderate complication	1	3.3	3	10	1.07	0.30
Severe complication	4	13.3	9	30	2.45	0.11
The 3 rd follow up						
Mild complication	27	90	21	70	3.75	0.05
Moderate complication	1	3.3	2	6.7	0.35	0.55
Severe complication	2	6.7	7	23.3	3.26	0.07

* Significant at the ≤ 0.05 probability level

Table (7): Comparison of the Two Studied Groups as regards Hospital Length of Stay (n=60).

Variables	Study group		Control group		t	P-value
	n	%	n	%		
Length of stay					2.58-	0.01 S*
• < 5 days	20	66.7	1	3.3		
• 5-7 days	5	16.7	25	83.3		
• 8-10 days	2	6.7	0	0		
• 11-13 days	2	6.7	1	3.3		
• 14-<16 days	1	3.3	3	10		
Mean+ SD	1.63+1.09		2.33+0.99			

*Significant at the ≤ 0.05 probability level

Table (8) : Correlation Coefficient for age, BMI and length of hospital stay in relation to the number of Complications all through the Study periods among the Study Group subjects (n=60).

Variables	r value	P - value
	Study Groups	
Age & number of complications	0.868**	0.000
BMI & number of complications	0.868**	0.000
length of hospital stay & number of complications	0.848**	0.000

*Correlation is significant at ≤ 0.05 level

6. Recommendations

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

Recommendations related to patients:

- 1- All ACL reconstruction patients and their family members should receive adequate knowledge and skills regarding the rehabilitation process.

- 2- 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.
- 3- All patients must receive the ACL rehabilitation booklet from admission which must be clarified and explained by the nurse.

Recommendations related to nurses:

- 1- 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.
- 2- Nurses should be encouraged to provide a comprehensive explanation and skills needed for patients regarding all phases of rehabilitation.
- 3- Raise awareness of nurses, head nurses as well the orthopedic team members regarding the importance of the implementation of the rehabilitation program from admission by a specialized nurse.

Further recommended studies:

- 1- 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.
- 2- Further studies have to be carried out in order to assess the effectiveness of rehabilitation program applications on patient outcomes regarding different orthopedic disorders.

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APPENDIX

Appendix A

Socio-demographic and biomedical data sheet

Biographical and social data.

1- Gender	A	B					
A- Male							
B- Female							
2- Age/years	A	B	C	D	E		
A- 19-30 yrs							
B-<30-40 yrs							
C-<40-50 yrs							
D-<50-60 yrs							
E-<60-70 yrs							
3-Marital Status	A	B	C	D			
A- Single							
B- Married							
C- Divorced							
D- Widow							
4-Occupation	A	B	C	D	E	F	G
A- Unemployed							
B- Employed							
C- Student							
D- Farmer/ Manual Work							
E- House Wife							
F-Professional/ Administrative/ Clerical.							
G- Retired							
5-Educational Level	A	B	C	D	E		
A- Illiterate							
B- Read and write							
C- Secondary							

D- College							
E- Higher Studies							
6- Who is your Support System	A	B	C	D	E	F	G
A- No Support System							
B- Spouse							
C- Father							
D- Mother							
E- Son							
F- Daughter							
G- Others							

Biomedical data:

7- Ward/department:	A	B	C	D			
A- Orthopedic (7)							
B- Orthopedic (9)							
C- Orthopedic (18)							
D- Orthopedic (20)							
8- Length of hospital Stay / days	A	B	C	D	E		
A-< 5 days							
B-5- 7 days							
C- 8-10 days							
D- 11-13days							
E-14->16days							
9- Cigarettes Smoking	A	B	C	D			
A- Yes							
B- No, Quite in the last six months							
C- No, Quite more than six months ago							
D- No, never smoked							
10- Alcohol	A	B					
A- No							
B- Yes							
11- Affected Knee	A	B					
A- Right							
B- Left							
12- Risk factors for ACL tears/ comorbidities	Yes (1)	No (0)					
A- No							
B- Heart disease							
C- Pulmonary disease							
D- Diabetes							
E- Kidney disease							
F- Liver disease							
G- Others							
13- Activity level	A	B	C	D			
A- A high competitive sports person							
B- Frequently sporting							
C- Sporting sometimes							
D- Non-sporting							
14-Body Mass Index	A	B	C	D	E		
A- Under weight < 18.5							
B- Healthy weight 18.5-24.9							
C- Over weight 25-29.9							
D- Obese 30 or more							
E- High risk obese > 35							

Appendix B
Complication monitoring sheet

Type of complication	Yes (1 point)	No (0 point)
1- Knee Pain		
2- Knee stiffness		
3- Limited knee range of motion		
4- Knee swelling		
5- knee loosening		
6- Quadriceps muscle weakness		
7- Abnormal gait		
8- Numbness around the incision		
9- Repeated injury to the graft		
10- Deep venous thrombosis (DVT)		

Scoring system

The scores of this tool ranging from 0 to 10 the greater the score the greater complication occurred.

- 0-4= mild complication
- 5-7= moderate complication
- 8-10= severe complication