Effect of Rehabilitation Exercise Program on Outcomes of Patients Undergoing Patellar Fracture Surgery

Neama Mamdouh Mostafa[1], Eman Mohamed Hashem[2], Mohamed Alaa Eldin Abdel Aziz[3], Mervat Abd EL-Fatah Ismael[4]

[1]Assistant Professor of Medical- Surgical Nursing, Faculty of Nursing, Assiut University, Egypt.

[2,4]Lecturer of Medical- Surgical Nursing, Faculty of Nursing, Assiut University, Egypt.

[3]Lecturer of Orthopedic Surgery and traumatology, Faculty of Medicine, Assiut University, Egypt.

ABSTRACT

Background: Following patellar fracture surgery (internal fixation), a rehabilitation exercise program is essential to returning to daily activities. **Aim:** To evaluate the effect of rehabilitation exercise program on outcomes of patients with patellar fractures surgery. **Research design:** A quasi experimental research design was utilized. **Sample:** A convenient sample of 50 male and female adult patients underwent Patellar fracture fixation (tension band wiring) with an age ranged from 20 to 60 years old. Patients divided on random basis equally into study and control groups (25 patients for each). **Setting:** The study was carried out in truma center at Assiut University Hospital. **Tools: Tool (I)** Patient's health needs assessment record. **Tool (II)** Lysholm Rating Scale. **Tool (III)** Patient satisfaction with nursing care quality questionnaire. **Results:** nearly half patients (48%) of study group had fair level of Lysholm knee score after 1.5 month while one fifth (20%) in control group. after two weeks, the great majority of the study group (96%) was satisfied with the quality of the nursing care, compared to more than half (56%) in the control group.. **Conclusion:** Rehabilitation exercise program was effective in improving function of patients' knee post patellar fracture and satisfaction with nursing care quality. **Recommendation:** Rehabilitation exercise program are recommended to be an integral part of the preoperative nursing teaching for patients underwent Patellar fracture surgery.

Introduction

The patella is the tiny bone that sits in front of the knee joint, where the tibia and femur connect. It connects the tibia to the muscles in front of the thigh and protects the knee. A smooth substance known as articular cartilage covers the undersides of the patella and the ends of the femur. The bones may move more smoothly together thanks to this cartilage. (*Sayum* **et al., 2021**).

When the patella, the tiny bone at the front of the knee, breaks, it is called a patellar fracture. Numerous mechanisms exist for the patella to fracture. If a bone has a fracture, it could shatter into multiple pieces or it could be a straightforward, clean break in two. The top, middle, or bottom of the bone may break. The kneecap can occasionally sustain fractures in multiple places. **(Cedars, 2018).**

The most common way that patellar fractures happen is when someone falls on their knee or is struck sharply, perhaps in a head-on accident. Indirect fractures of the patella are also possible. For instance, pulling apart the patella might occur from an abrupt contraction of the quadriceps muscle in the knee. **(Luo et al., 2020).**

Pain and swelling in the front of the knee are the most typical signs of a patellar fracture. Additional signs and symptoms could be bruises, weakness in the knee or problems maintaining an extended leg raise, and difficulty walking. The doctor will check the knee after going over the patient's medical history and symptoms. In many cases, especially when the fracture is displaced, the fracture's edges can be felt through the skin. To assist in diagnosing the fracture, the physician will also request x-rays. **(Kruse et al., 2022).**

A cast or splint can be used to treat certain mild patellar fractures until the bone heals. Knee flexion can be gradually increased as recovery occurs. Brace for range of motion must be worn until clinical evidence of healing (not sore on touch) and union (on X-rays) are observed. But in the majority of patellar fractures, the damage causes the bone fragments to shift. Surgery is required to replace the kneecap in these more complex fractures. **(Steinmetz et al., 2019**).

Rehabilitation is defined as "A set of interventions designed to optimize functioning and reduce disability in individuals with health conditions in their environment" (**Mark et al., 2022).**

Exercise programming is the process of creating a customized fitness plan for a person based on their needs, medical history, and present functional level. The plan is intended to assist the person reach their goals in a safe and efficient manner.(**Kruse et al., 2022).**

Returning to regular activities requires rehabilitation, which is essential. Nurses should give patients targeted exercises during their rehabilitation to assist strengthen ther leg muscles, increase knee range of motion, and reduce stiffness. Exercises for passive range of motion (ROM) can start 48 hours after surgery if the fixation is stable. Following that, patients can proceed to isometric exercises and active range of motion.. The length of recovery from a patellar fracture will depend on several factors, such as the extent of damage and the amount of time required for therapy. Most patients can resume their regular activities in three to six months. Patients who suffer from serious fractures can return to activity may take longer. (**Kruse et al., 2022**).

Through teaching and providing instructions to patients on how to execute range of motion exercises, weight bearing limit, ambulation with the use of crutches, and exercise limits, nurses are regarded as a

164

cornerstone in the rehabilitation process of helping patients recover and improve with their conditions..(**Mahmoud et al., 2022**)

Significance of the study

Patellar fractures are severe injuries that can occur in many different ways. These injuries make up around 1% of all bone injuries, and they are most common in people between the ages of 20 and 50. Because the patellar bone plays such an important role in the knee's extensor mechanism, fractures involving it can cause severe disability. In order to recover range of motion, strength, and movement control following a patellar fracture surgery and enable a return to the highest level of activity and function, an efficient and successful rehabilitation program is crucial. (**Mark et al., 2022**). According to the statistical report of Assiut University Hospital, the total number of patients admitted with patellar fracture were 150 cases (**Assiut University Hospital Record, 2023**), Therefore, the purpose of this study was to assess how rehabilitation exercise programs affected the outcomes of patients who underwent surgery for patellar fractures.

Operational definitions

- Patients' outcomes: measurements are based on comparisons of knee function, and patient satisfaction with the quality of care received between the two groups (study & control).

Aims of the study:

General aim:

The study aimed to evaluate the effect of rehabilitation exercise program on outcomes of patients undergoing Patellar fracture surgery.

Objectives:

1. Assess knee function and patient satisfaction with the quality of care provided

2. Evaluate the effect of rehabilitation exercise program on outcomes (symptoms, knee function and patient satisfaction with the quality of care provided) of patients with patellar fractures surgery.

Research hypotheses

To fulfill the aim of the study the following research hypotheses were formulated:

H₁: The study group's overall mean knee function scores would be higher than the control group's.

H₂: The total mean scores of patient's satisfaction with nursing care quality would

be higher in the study group than those in the control group.

Methods

Research design:

This study used a quasi-experimental research design.

Quasi-experimental research design aims to establish a cause-and-effect relationship between an independent and dependent variable. A quasi-experiment does not rely on random assignment. Instead, subjects are assigned to groups based on non-random criteria. **(Pasternak & mllier.,2020)**

Setting:

This study was conducted in truma center at Assiut University Hospital. The trauma center consists of one floor, it consists of ten rooms each room has eight beds and there was a nursing room in this floor. Then follow up was conducted in the orthopedic outpatient Clinics. Owing to the large number of patients attending this department, which were specialized on the admission of those patients, the study settings were chosen.

Sample:

A convenient of 50 adult patients with aged ranged between (20-60) years old and from both gender with patellar fracture was included in the study. Patients were

randomly divided into two groups by flipping a coin [tails = control group (25 patients), heads= study group (25 patients). The control group received the usual hospital routine care only, while the study group received the usual hospital routine care and rehabilitation exercises program.

Inclusion criteria: of the participants were adult males and females aged 20 to 60 years old with recent Patellar fracture surgery and ready to engage in the study.

Exclusion criteria: Patients who were suffering from mental health problems and patients who were uncooperative or refused to participate in the study were excluded

The sample size:

Power analysis was used to statistically calculate the sample size with confidence **level 0.95** and p value **< 0.05**. The following factors were taken into account when calculating: With a significant level (α) of 0.5 for Type I error and a power test (1-B) of 80% for Type II error, it was determined that a minimum sample size of 25 patients was needed for each group.

Tools

Three instruments were employed to gather data**:**
Tool I: Patient's health needs assessment sheet:

It was developed by the researcher without modification after reviewing relevant and recent related literature and research studies **Luo et al., (2020) & Regasa et al., (2023)** to collect demographic & medical data, it consisted of two parts.

Part (1): Patient demographic information: Age, gender, place of residence, degree of education, kind of work, and duration of hospital stay were all included.

Part (2): Medical information on patients: It contained history of knee osteoarthritis, previous knee injuries, and surgical history of knee and mechanism of injury.

Tool II: Lysholm Rating Scale:

It was developed by (**Tegner and Lysholm, 1985).** It is a patient-administered instrument to measure function in patients with a variety of knee injuries. It measures activities of daily living (ADLs). The factors of limp, support, and locking are worth a potential of 23 points; pain and instability, 25 points each; swelling and stair climbing, 10 points each; and squatting, 5 points. It was used three times; one time before applying rehabilitation exercise program and 1.5 month and 3 months post operatively.

Scoring system:

On a point system ranging from 0 to 100, eight elements are scored to generate an

overall score. Subsequently, an assignment receives a score of 95–100 for "excellent," 84–94 for "good," 65–83 for "fair," or fewer than 65 for "poor."

Tool III: Patient satisfaction with nursing care quality questionnaire(PSNCQQ):

It was developed by **(Laschinger et al., 2005)**. Its purpose is to measure patient satisfaction with both the overall standard of nursing care and the level of care received during the hospital stay. The total scale of the PSNCQQ had 22 questions. The PSNCQQ includes three more items in addition to the standard 19 items. These are intended to evaluate the validity of the questionnaire and facilitate the assessment of patient satisfaction with overall nursing care quality, patient treatment during hospital stays, and patient intentions to refer friends and family to the hospital. The validity of PSNCQQ: Patient satisfaction with the quality of nursing care in an Arabic setting was measured using an item-level content validity score that varied from.83 to 1, and a scale-level content validity index of.94. **(Alaa et al., 2019)**.

Scoring system: A five-point Likert scale was utilized to assess the quality of nursing care. The descriptive intensity for each item was ranked from 1 = poor, 2 = acceptable, 3

= good, 4 = very good, and 5 = excellent, with a total possible score ranging from 19 to 95.

Method:
The study was conducted through the following:
Content validity and reliability:

Five experts (two professors in orthopaedic surgery and three professors in medical-surgical nursing) evaluated the research instruments' content validity. They looked for things like ease of administration, comprehensiveness, clarity, and understanding.

Reliability: Cornbach's alpha is the most widely used method for evaluating internal consistency of the research tools. It can be interpreted like other reliability coefficients. The normal range of value is between 0.00 and 1.00, and higher values reflect a higher internal consistency. The reliability of the study tools: Lysholm Rating Scale was 0.9 and (Patient satisfaction with nursing care quality questionnaire was 0.97.

A pilot study:

To assess the viability, comprehensibility, and practicability of the study instruments on 10% of the sample (5 cases), a pilot study was conducted. An estimation of the time required to complete the tools was also

given. A small adjustment was made in accordance with the findings of the pilot study analysis. These patients were removed from the research and substituted with another.

Ethical consideration:

Assiut university ethical committee was obtained with IRB no: 1120240564 at March, 8, 2023 before starting the study. There was no risk to study participants during the research's implementation. The study adhered to common ethical guidelines for clinical research. Oral agreement was obtained from study participants who were either guides or patients after a discussion of the investigation's purpose and nature. You might be assured of anonymity and confidentiality. Every research participant was free to withdraw from the study at any time without providing a reason or to decline participation altogether. Study subjects' privacy was considered during data collection.

Technique for data collection:

– After securing the administrative approval, data collection was started and continued over 10 months from the beginning of January 2023 up to the end of October 2023. Patients were divided randomly into two groups: the study

group (25 patients) and the control group (25 patients).

-The data were collected by the researchers three times /week (both morning and afternoon shifts) by interviewing patients individually and applied three times two weeks, 1.5 month and 3 months post operatively.

Filed work (procedure):

Administrative approval:

An official permission to carry out the study was obtained from the responsible hospital authorities of the trauma unit and outpatient clinics at Assiut University Hospital, after explaining the purpose of the study.

The study was carried out on four phases:

I. Planning phase:

This phase is concerned with construction and preparation of the different data collection tools and designing rehabilitation exercise program after reviewing the related literature, journals, and text books **Ismael et al., (2019) & Tanvi et al., (2023).** The researchers translated the rehabilitation exercise program into Arabic language, which were delivered to the entire study group.

II. Assessment phase:

The researchers engaged in patient interviews, wherein they elucidated the

study's objectives and requested their participation. Subsequently, Using Tool I (parts 1 and 2), each patient was questioned separately to obtain personal information, medical history, and current medical records. Additionally, assessments were conducted to evaluate patients' knee function by using tool II and patients' satisfaction by using tool III. These interviews lasted approximately 45 minutes.

III. Implementation phase:
Control group:

The patients received the routine hospital care according to the hospital policy during data collection process without implementing the rehabilitation exercise program.

Study group:

The researcher started to apply rehabilitation exercise program for the study through three sessions (one theoretical and two practical). Each session ranged between (30- 45) minutes. Each patient in the study group obtained a copy of the teaching booklet of rehabilitation exercise.

The first session: Was started during first 24 hours post admission preoperatively. It contained teaching patients about simple anatomical patellar overview, patellar fracture management; definition, incidence,

mechanism of injury, classification, signs and symptoms, diagnosis, complications of fracture, treatment, complication after surgery. Finally, this session ended by postoperative and follow up visits instructions.

The second session: Was started after 24 hours post admission preoperatively, it included training on the basic rehabilitation exercises which is designed to guide patient through the next 6 weeks with some simple exercises to gradually increase the movement, decrease the pain and steadily improve the patellar and knee function. Rehabilitation exercise program contained of 5 phases from first day post operatively until 3 months post operatively and described as the following. **Phase I (0-2 weeks): It included exercises as:** Isometric quadriceps, hamstring, adductor/abductor strengthening and Ankle Theraband exercises. **Phase II (2-6 weeks): It includes exercises as**: Isometric quadriceps, hamstring, adductor/abductor strengthening, ankle theraband exercises and initiate straight leg raises.

The third session: Was done postoperatively before patients discharged from the hospital and contained training on exercises that would be performed from the 6 weeks postoperatively until patients return

to full activities as the following: **Phase III (6-10 weeks): It included exercises as:** Isometric quadriceps, hamstring, adductor/abductor strengthening, ankle theraband exercises and straight leg raises. **Phase IV (10-12 weeks): It included exercises as:** Isometric quadriceps, hamstring, adductor/abductor strengthening, ankle theraband exercises, straight leg raises and start stationary bicycle. **Phase V (3 months): It included exercises as:** Return to full activities as tolerated.

- Monthly follow-up phone calls were carried out to provide feedback and suggestions according to patients' feedback and emphasize the compliance with exercises that should be followed by participants to maintain the achieved results. Conclude what is discussed and encourage patients to contact healthcare providers when they have health problems.

- Each session started by a summary about what had been given through the previous session, it was accompanied by feedbacks. Discussion, motivation and reinforcement during sessions to enhance learning. **By the end;** a summary was made and time allowed for questions and answers& plan for next session was made.

170

- **Teaching methods/media were used**: Lecture, demonstration and re-demonstration, illustrated pictures, recorded videos on mobile screen questions and answers, power point presentations, brain storming, and printed hand out.

IV: Evaluation phase:

The study tools (II, III) were used to assess the study and control groups. There were three times this evaluation was conducted (two weeks, 1.5 and 3 months postoperative). After making follow-up appointment arrangements over the phone with the patients, the researchers visited the outpatient clinics.

Statistical analysis:

Before undergoing additional statistical analysis, the data were checked for homogeneity variances and normalcy using the Anderson-Darling test. Whereas continuous variables were characterized by mean and standard deviation (Mean, SD), categorical variables were described by number and percent (N, %). When comparing two categorical variables, the chi-square test or Fisher's exact test were utilized appropriately; when comparing two continuous variables, the "independent-samples t-test" and the ANNOVA test were used. A statistically significant result was

defined as a two-tailed "p < 0.05". The relationship between the variables was displayed using Pearson correlation. IBM SPSS 23 was used to conduct all of the analyses.

Results

Table (1): Frequency distribution of demographic data for the studied patients (n=50)

Sociodemographic data	Study (n=25)		Control (n=25)		X2	P. value
	No	%	No	%		
Age group						
<40 years	11	44.0	12	48.0	0.12	0.942
40 -50 years	7	28.0	6	24.0		
>50 year	7	28.0	7	28.0		
Mean±SD(range)	48.84±9.05(28-58)		42.60±10.35(22-60)		0.45	0.654
Sex						
Male	18	72.0	18	72.0	0.00	1.000
Female	7	28.0	7	28.0		
Residence						
Urban	13	52.0	18	72.0	2.12	0.145
Rural	12	48.0	7	28.0		
Education Level						
High education	9	36.0	12	48.0	2.41	0.492
Secondary education	8	32.0	7	28.0		
Read and write	4	16.0	1	4.0		
Illiterate	4	16.0	5	20.0		
Occupation						
Working	12	48.0	16	64.0	1.30	0.254
Not Working	13	52.0	9	36.0		
Length of Stay						
Less than 10 days	25	100.0	16	64.0	10.98	0.001**
More than 10 days	0	0.0	9	36.0		
Mean±SD(range)	7.88±0.92(6-10)		9.88±1.56(8-13)		5.50	<0.001**

-Chi square test   - Independent T-test
*Significant level at P value < 0.05, **Significant level at P value < 0.01
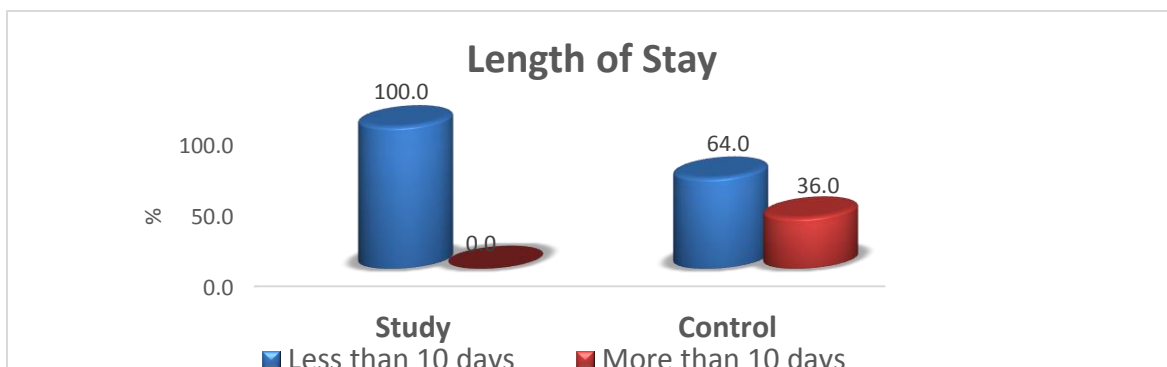

Figure (1): Distribution of studied patients according to length of hospital stay.

Table (2): Frequency distribution of medical data for the studied patients (n=50)

Medical data	Study (n=25)		Control (n=25)		X2	P. value
	No	%	No	%		
Previous history of knee osteoarthritis						
Yes	5	20.0	5	20.0	0.00	1.000
No	20	80.0	20	80.0		
Previous knee injuries						
Yes	4	16.0	6	24.0	0.50	0.480
No	21	84.0	19	76.0		
If yes please specify type of injury						
Tendon Injury	1	25.0	0	0.0		
Tendon tear	0	0.0	1	16.7		
Simple fracture	1	25.0	0	0.0	4.58	0.333
Meniscus Tear	1	25.0	1	16.7		
Anterior Cruciate ligament Injury	1	25.0	4	66.7		
Have you ever undergone any surgical procedure of knee						
Yes	6	24.0	8	32.0	0.40	0.529
No	19	76.0	17	68.0		
Surgery type						
Anterior cruciate ligament reconstruction	1	16.7	4	50.0		
anterior cruciate repair	1	16.7	1	12.5		
Injection on the knee	1	16.7	0	0.0	4.16	0.655
Internal Fixation	0	0.0	1	12.5		
Meniscus repair	1	16.7	1	12.5		
Tendon repair	2	33.3	1	12.5		
Mechanism of injury						
Motor Car accident	13	52.0	13	52.0		
Gunshot	1	4.0	1	4.0		
Fall on the Floor	3	12.0	3	12.0	0.53	0.991
Fall from high	1	4.0	2	8.0		
Fall down	4	16.0	4	16.0		
Assault	3	12.0	2	8.0		

-Chi square test

*Significant level at P value < 0.05, **Significant level at P value < 0.01
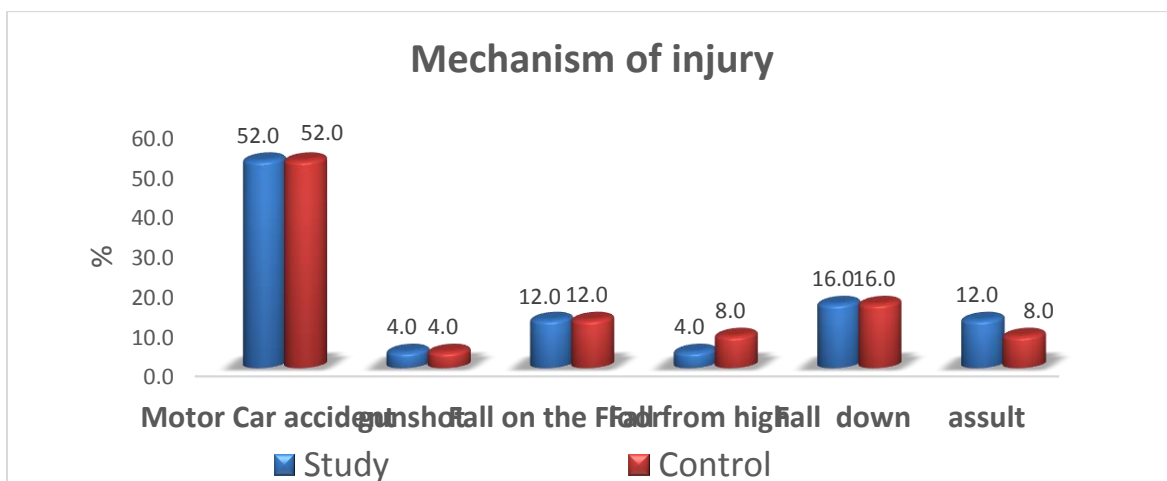

Figure (2): Distribution of studied patients according to mechanism of injury

Table (3): Total and subtotal score of Lysholm Knee Score (two weeks, 1.5 month and 3 months) for the study and control groups post rehabilitation program (n=50).

Lysholm Knee Score	After 2 week			After 1.5 month			After 3 month		
	Study	Control	P.value	Study	Control	P.value	Study	Control	P.value
	Mean±SD	Mean±SD		Mean±SD	Mean±SD		Mean±SD	Mean±SD	
-Limp	3.64±1.47	3.36±1.11	0.451	4.52±0.87	3.6±1.66	0.018*	4.76±0.66	4.2±1	0.024*
-Using cane or crutches	2.08±1.53	2.4±1.66	0.481	4.64±0.99	3.16±1.75	0.001**	4.88±0.6	3.32±1.52	0.000**
-Locking sensation in the knee	3.96±5	2.72±4.19	0.346	11.76±4.26	7.68±5.79	0.007**	14.8±1	12.88±3.57	0.013*
-Giving way sensation from the knee	7.8±3.84	6±4.56	0.138	18±5.59	12.2±7.78	0.004**	21.6±4.73	18.4±4.26	0.015*
-Pain	6.8±4.3	6.08±3.98	0.542	16.4±4.9	11.4±7.57	0.008**	21.4±4.68	18.6±4.45	0.035*
-Swelling	2.24±2.11	2.32±2.93	0.912	7.28±3.36	4.88±3.52	0.017*	9.68±1.11	7.68±2.56	0.001**
-Climbing	3.68±2.63	3.2±2	0.471	7.44±2.55	5.28±2.64	0.005**	8.72±2.23	6.8±2.58	0.007**
-Squatting	3.32±1.41	3±1.44	0.431	4.28±0.84	3.52±1.36	0.021*	4.88±0.33	4.2±1.12	0.005**
Lysholm Knee total Score	33.52±17.21	29.08±12.27	0.299	74.32±16.81	51.72±26.32	0.001**	90.72±7.63	76.08±10.83	0.000**

-Independent T-test

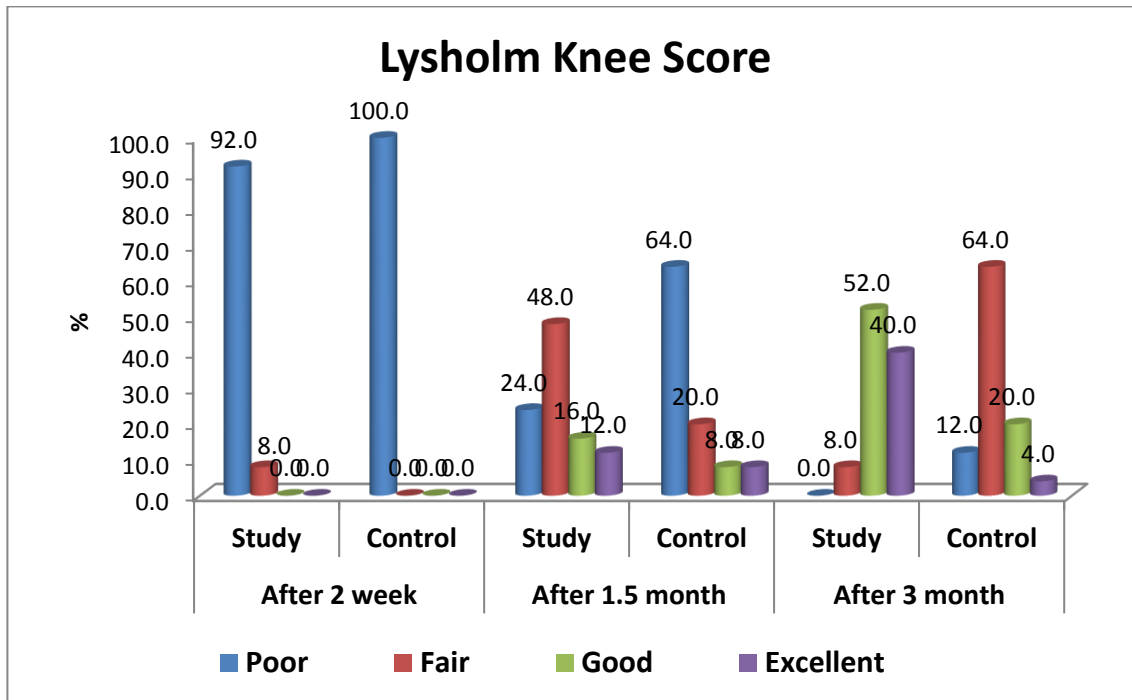*Significant level at P value < 0.05, **Significant level at P value < 0.01

Figure (3): Lysholm Knee Score levels for both the study and control groups, two weeks, 1.5 month and 3 months post rehabilitation program (n=50).
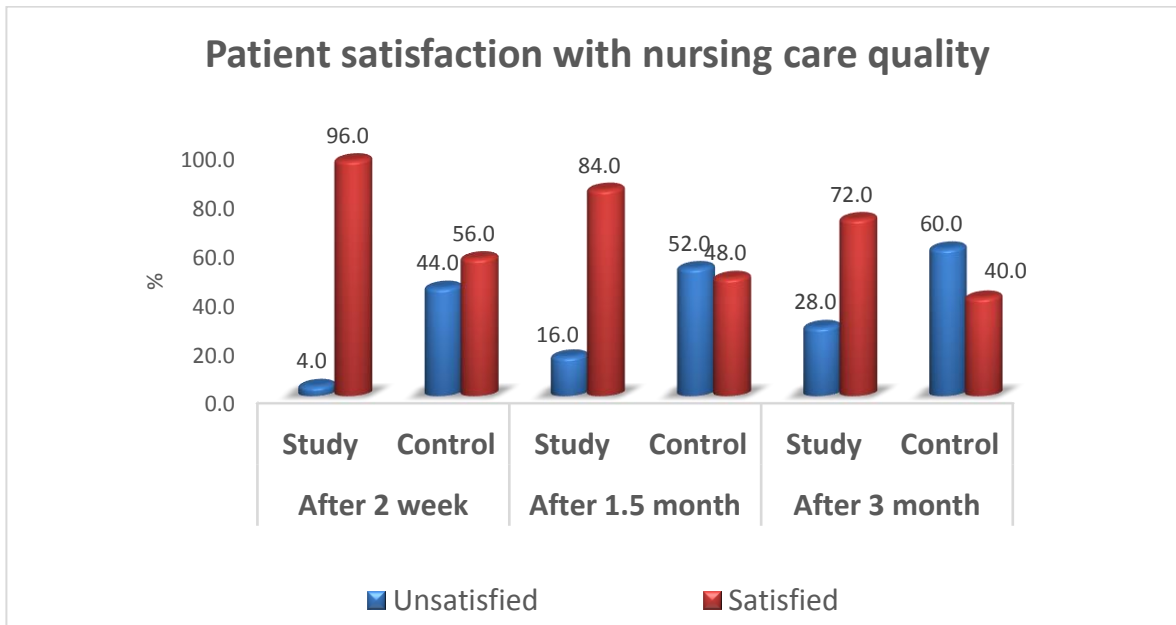

Figure (4): patients' satisfaction with nursing care quality score levels for the study and control groups, two weeks, 1.5 month and 3 months post rehabilitation program (n=50)

Table (4): The total mean score of patient's satisfaction with nursing care quality scale for the study and control groups, two weeks, 1.5 month and 3 months post rehabilitation program (n=50)

patient's satisfaction with nursing care quality scale	Study group (n=25)	Control group (n=25)	P. value
	Mean±SD	Mean±SD	
2 weeks post rehabilitation program	77.2±7.62	67.64±7.37	0.0001**
1.5 month post rehabilitation program	80±11.92	66.56±14.78	0.001**
3 months post rehabilitation program	79.6±21.48	60.72±21.01	0.003**

***Significant level at P value < 0.01*

Table (5):- Correlation Co- efficient between patient satisfaction with nursing care quality and Knee function for the study and control groups (After 2 weeks, 1.5 months and 3 months)

Correlations	Patient satisfaction with nursing care quality					
	Study			Control		
	After 2 week	1.5 month	3 month	After 2 week	1.5 month	3 month
Limp	-.045	.192	.040	0.301	0.355	0.096
Using cane or crutches	-.156	-.084	-.149	0.193	0.311	.403*
Locking sensation in the knee	.010	.352	-.111	0.188	0.235	0.327
Giving way sensation from the knee	-.027	.203	.181	0.011	0.288	.437*
Pain	-.113	.335	.085	0.136	.466*	0.229
Swelling	-.143	.293	-.132	0.191	.489*	0.214
Climbing	-.001	.416*	.487*	-0.122	0.353	-0.005
Squatting	.037	.485*	-.007	0.117	0.238	0.034
Lysholm Knee Score	-.064	.406*	.465*	0.205	.427*	.492*

Statistically Significant Correlation at P. value <0.05
Statistically Significant Correlation at P. value <0.01

Table (6): Correlation Co- efficient between knee function with patients' demographic and medical data for the study and control groups (After 2 weeks, 1,5 month and 3 months)

Demographic & medical data		Lysholm Knee Score					
		Study			Control		
		After 2 week	1.5 month	3 month	After 2 week	1.5 month	3 month
-Age	R	-0.008	-0.225	-0.119	0.147	0.220	0.107
	P	0.971	0.280	0.570	0.485	0.291	0.610
-Sex	R	0.081	-0.126	0.000	0.025	0.031	-0.011
	P	0.700	0.549	0.998	0.904	0.883	0.960
-Residence	R	-0.286	-0.281	-0.285	-0.167	-0.117	0.014
	P	0.166	0.173	0.167	0.424	0.578	0.948
-Education Level	R	-0.039	-0.009	0.124	-0.124	0.047	-0.292
	P	0.853	0.966	0.554	0.554	0.825	0.156
-Occupation	R	-0.080	-0.098	-0.057	-0.151	0.187	-0.105
	P	0.705	0.641	0.785	0.473	0.370	0.618
-Length of Stay	R	0.080	-0.342	-0.258	0.203	0.202	0.012
	P	0.705	0.094	0.213	0.332	0.332	0.953
-Previous history of osteoarthritis	R	-0.115	0.253	0.182	-0.196	-0.260	-0.083
	P	0.584	0.223	0.384	0.347	0.209	0.693
-Previous knee injuries	R	0.104	0.081	-0.308	0.012	-0.365	0.197
	P	0.621	0.699	0.134	0.956	0.073	0.344
-Surgical procedure of knee	R	0.123	-0.063	-.435-*	0.069	-0.153	0.175
	P	0.558	0.765	0.030	0.744	0.465	0.402
-Mechanism of injury	R	.438*	0.179	-.001-	0.064	0.053	-.012-
	P	0.028	0.391	0.995	0.762	0.603	0.954

Statistically Significant Correlation at P. value <0.05
Statistically Significant Correlation at P. value <0.01

Table (7): Correlation Co- efficient between patient satisfaction with nursing care quality with Patients' demographic and medical data for the study and control groups (After 2 weeks, 1.5 months and 3 months)

Demographic & medical data		Patient satisfaction with nursing care quality					
		Study			Control		
		After 2 week	1.5 month	3 month	After 2 week	1.5 month	3 month
-Age	r	0.208	-0.057	-0.150	0.180	-0.044	0.187
	P	0.318	0.785	0.474	0.388	0.833	0.370
-Sex	r	0.294	-0.084	-0.174	-0.123	0.029	-0.121
	P	0.154	0.690	0.404	0.559	0.891	0.563
-Residence	r	0.285	0.254	0.132	-0.196	-0.080	-0.251
	P	0.167	0.221	0.528	0.347	0.703	0.226
-Education Level	r	0.142	0.211	-0.016	-0.126	-0.371	-0.176
	P	0.498	0.311	0.941	0.548	0.068	0.399
-Occupation	r	0.262	-0.226	-0.193	0.069	-0.265	0.043
	P	0.206	0.277	0.355	0.744	0.201	0.840
-Length of Stay	r	0.157	-0.113	-0.212	0.183	.436*	0.095
	P	0.454	0.591	0.310	0.380	0.029	0.650
-Previous history of osteoarthritis	r	-.442-*	0.223	0.328	0.019	-0.213	-0.041
	P	0.027	0.285	0.110	0.927	0.307	0.846
-Previous knee injuries	r	.480*	-0.019	-0.138	0.041	-0.049	0.188
	P	0.015	0.929	0.511	0.845	0.817	0.368
-Surgical procedure of knee	r	0.228	0.008	-0.144	0.252	-0.003	0.324
	P	0.272	0.970	0.492	0.225	0.989	0.114
-Mechanism of injury	r	-0.195-	0.046	-0.018-	0.430*	0.133	0.082
	P	0.351	0.826	0.932	0.046	0.527	0.596

Statistically Significant Correlation at P. value <0.05
**Statistically Significant Correlation at P. value <0.01*

Table (1) Shows that mean age of the study group was 48.84±9.05 (28-58) while in control group was 42.60±10.35 (22-60) and more than two fifth of both groups were less than forty years. As regard gender, more than two thirds (72%) of both groups were male. It was found that more than half (52%) of study group lived in urban area while more than two thirds (72%) in control group. As regard educational level, more than one third (36%) of study group was having high education while more than two fifths (48%) in control group. As regard occupation, more than two fifths (48%) of study group working while more than half (64%) of control group. Length of stay was less than 10 days for study group while more than half (64%) of control group. There was no statistical significance difference between the two groups regarding demographic data.

Figure (1): Shows that length of stay was less than 10 days for study group while more than half (64%) of control group.

177

Table (2) Shows that one fifth (20%) of patients in both groups had prior history of knee injury or osteoarthritis. Anterior cruciate ligament reconstructions were performed on 50% of the control group compared to (16.6%) in the study group and tendon repair was performed to (33.3%) of the study group compared to (12.5) of the control group. In terms of the mechanism of injury, a motor car accident occurred in over half (52%) of both groups.

Figure (2): Clarifies that as regard to the mechanism of injury, a motor car accident occurred in over half (52%) of both groups.

Table (3): Explains that, there was no statistically significant difference between the study and control groups regarding knee function and symptoms, 2 weeks after application rehabilitation exercise program while, there was a highly statistically significant difference between the study and control group after 1.5 months and 3 months, with p values of (0.001**,0.000**), respectively.

Figure (3): Shows that, after 1.5 months of rehabilitation exercise program , one fifth (20%) of the control group had a fair level of Lysholm knee score, compared to nearly half (48%) of the study group. After three months, more than half (64%) of the control

group had a fair Lysholm knee score, compared to more than half (8%) of the study group.

Figure (4): Explains that, after two weeks of rehabilitation exercise program, the great majority of the study group (96%) was satisfied with the quality of the nursing care, compared to more than half (56%) in the control group. Over half (52%) of the control group was not satisfied after 1.5 months, compared to 84% of the study group. After three months, 72% of research participants were satisfied with their nursing care, compared to 40% of the control group.

Table (4): Shows that there were highly statistically significant difference between study and control group after 2weeks, 1.5 month and 3 month with p value (0.0001**,0.001**,0.003**) respectively according to patient's satisfaction with nursing care quality scale

Table (5): Demonstrate that there was a positive correlation between the Lysholm Knee Score and patient satisfaction with the quality of nursing care 1.5 months and 3 months after rehabilitation exercise program for the Study and Control groups (.406*, .427*), (r=.465*, .492*) respectively.

Table (6): Explains that the relationship between the Lysholm knee score and the

medical and sociodemographic variables was not statistically significant. After two weeks, there was a statistical significant correlation for the study group's Lysholm knee score and the mechanism of injury.

Table (7): Demonstrates that there was no statistically significant relation between patient satisfaction with the quality of nursing care, demographic and medical variables. After two weeks, there was a statistical significant relation between the mechanism of injury for the control group and patient satisfaction with the quality of nursing care.

Discussion

The patella protects the anterior aspect of the knee joint, serves as the insertion for the quadriceps tendon, and functions as a fulcrum to maximize the efficiency of the extensor mechanism. Patella Fractures are traumatic knee injuries caused by direct trauma or rapid contracture of the quadriceps with a flexed knee that can lead to loss of the extensor mechanism. **(Luo et al.,2023)**

The purpose of the current study was to evaluate effect of rehabilitation exercise program on outcomes of patients undergoing patellar fracture surgery.

The distribution of patients according to their demographic variables showed that mean age of the study group was 48.84±9.05 while in control group was 42.60±10.35 and more than two fifth of both groups were less than forty years and more than two thirds of both groups were male. The present study was supported by **(Abouelwafa et al., 2022)** who stated that more than one-fifth of patients were female and more than two thirds of patients were male. The age range was 19 to 55 years old, with a mean of 32.83. This study finding also was in line with **(Elshenawie & Ahmed, 2018)** who observed that more than half of patients were in the age (40 – <50 years).

This finding also supported by (Shawky et al., 2023) entitled: Treatment of comminuted patellar fractures using modified cerclage wiring, AlAzhar international medical journal and demonstrated that there were three female patients and twelve male patients. Ages ranged from 18 to 64 (average age 38.87±14.80 years). According to the researcher, patellar fractures are more common in men and those under forty years old as a result of motor car accidents. Patella fractures usually occur in younger people as a result of high energy trauma or eccentric

muscular contraction. Additionally, this investigation supported. **(Regasa et al., 2023)** who stated that 60% of studied participants were male.

Concerning their educational level, the current study results revealed that more than one third of study group was having high education while more than two fifths in control group. As regard occupation, more than two fifths of study group working while more than half of control group. From the researcher's opinion, patellar fracture increase in working groups due to indirect trauma such as powerful quadriceps contraction onto a fixed knee and risk for accidents .This result disagrees with **(Elshenawie & Ahmed, 2018)** who clarifies that half of the patients can read and write. In relation to Occupation, it was seen that more than half of the patients were house wife. However, less than one fifth were professional.

As regard history of previous osteoarthritis, one fifth of patients had history of previous osteoarthritis for both groups From point of view, symptomatic knee and hip osteoarthritis were both associated with an increased risk of recurrent falls and this increase incidence of patellar fracture .This result agreed with

(Muthuri et al., 2020) They reported that the correlation between a history of knee injuries and the development of knee osteoarthritis differed markedly depending on the kind of injury, including ligament or tendon damage, meniscus damage or meniscectomy, and fractures of the femur, knee, or lower leg. (OR = 5.95, 95% 4.57-7.75), compared to unspecified injuries (OR = 3.12, 95% 2.17-4.50).

As regard history of previous surgery, one fifth and nearly one third of patients had history of previous surgery. This result agreed with **(Guan et al., 2020)** They reported that there were 22 indirect fractures and 9 direct fractures out of a total of 31 patella fractures after ACL reconstruction. After ACL reconstruction, the average interval between the occurrence of an indirect patella fracture and its incidence rate was 11 weeks, or 0.55%.

As regard mechanism of injury, more than half of both groups had motor car accident. This result was supported by **(Esmailiejah et al ., 2016)** who stated that fractures of the patella may result from either direct or indirect mechanisms. A direct blow mostly results in commination, articular damage and anterior soft tissue injury. In case of indirect injury, when the force of the fall

overwhelms the resistance to knee flexion, the extensor mechanism fails and results in either tendons rupture or bone break. Later type of force usually results in transverse fracture.

Also (**Joao et al., 2015**) who said that the majority of open patella fractures, as opposed to closed fractures of the same joint, are caused by high-energy trauma, such as those sustained in auto accidents, with direct trauma serving as the primary mechanism. The type of trauma that resulted in the patella fracture can also lead to comminuted patella fracture and related fractures of the other joints.

The finding of this results disagreed with (**Adjal & Ban., 2022**) who revealed that all six patients had fractured their patella following a simple fall during normal daily activities. Also this study disagreed with (**Regasa et al., 2023**) who stated that fall dawn injury (42.75%) was the main mechanism of injury in study participants .

Regarding comparison between study and control group related to (Lysholm Knee Score): The study's findings demonstrated a statistically significant difference between the study and control groups in terms of the knee function of the

patients following a patellar fracture at 1.5 and 3 months.

This results agreed with (**Alok & Bindusar,2023**) who clarified that the study group demonstrated substantial postoperative improvement in patients underwent ACL reconstruction, as evidenced by positive outcomes on clinical assessments and the Lysholm knee scoring scale. The researcher believes that improvement of function in study group due to the effect of the postoperative rehabilitation program for 3 months postoperatively

Also (**Tanvi et al., 2023**) mentioned that the evolution of patellar fracture fixation continues to maximize options to balance rigid fixation with low-profile fixation constructs. Improving functional outcomes, minimizing soft-tissue irritation, and limiting postoperative complications are possible by using the therapeutic principles of rigid anatomical fixation and meticulous soft-tissue handling.. The current study assumed 3 sessions of face-to-face instructions, phone follow-up, and illustrated booklet to instruct and follow training, also due to the continuous follow up of the study group by the researchers to insure their adherence to perform exercises at regular

time according to the recommendations in the handout given to them

In the current study; it was founded that more than two fifths of study group had fair level of Lysholm knee score after 1.5 month while one fifth in control group. After 3 months, more than half of study group had good level of Lysholm knee score while more than half of control group had fair level of Lysholm knee score. This study finding was supported by (**Jiao & Yanan, 2022**) who illustrated that the knee joint Lysholm score of the study group was higher compared to the control group at 2 weeks, 4 weeks, 8 weeks, and 12 weeks after operation.

Also (**Damayea et al., 2021**) demonstrated the patient's extensive rehabilitation, which included proprioception, gait, balance, and cryotherapy in addition to strengthening and range-of-motion activities. A visual analogue scale, goniometry, manual muscle testing, Berg balancing scale, and lower extremity functional scale were used to evaluate the functional outcomes. The patient responded positively to the therapeutic methods and outcome evaluations, showing notable improvement.

This underscores the necessity for a well-rounded treatment approach to manage patellar fractures and optimize patient outcomes effectively. According to the researcher's opinion, study group had good level of function after 3 months than 1.5 month because improving function need more time adherence for exercise program.

Regarding comparison between study and control group related to patient satisfaction with nursing care quality shows that there was highly statically difference between study and control group regarding satisfaction with nursing care quality after 2 weeks, 1.5 months and 3 months. According to the researchers' view, satisfaction with nursing care increase in study group due to understanding exercises after discharge and improving function. This finding was comparable to one found in a research by (**Ismael et al., 2019**) who stated that there was a statistically significant difference between the study and control group regarding patient`s satisfaction (about 80% of the study group was satisfied with nursing care quality, 3.3% of the control group was satisfied with nursing care quality).

This result was also in agreement with the finding of (**Yuliu & Qiuyan , 2023**) who reported that the intervention group's Newcastle satisfaction with nursing scales

score was (80.902 ± 7.016) points, whereas the control group's score was (78.131 ± 8.213) points. The variations between these groups were statistically significant. Patients' comprehension of perioperative health and their level of satisfaction with nursing care may both be enhanced by the use of a brief educational video in the perioperative care of patients with lower limb fractures.

This finding is also confirmed in the study by **(Jiao , Yanan ، 2022)** who found that the study group was very satisfied in 78 cases, satisfactory in 20 cases, and general in 2 cases, and the satisfaction rate was 100.00%, while in the control group, 445 cases were very satisfied, 20 cases were satisfied, 15 cases were general, and 8 cases were dissatisfied. The satisfaction rate was 82.00%. The nursing satisfaction of the study group was higher compared to the control group.

Regarding correlation Co- efficient between patient satisfaction with nursing care quality and Lysholm Knee Score (Tegner and Lysholm) for study and control group (After 2 weeks, 1.5 months and 3 months), this result revealed that there was a positive correlation between patient satisfaction with nursing care quality

and Lysholm Knee Score for the study and control groups after 1.5 and 3 months. This finding was in agreement with **(Luís et al., 2022)** who found that a consistently high and durable patient satisfaction rate after osteochondral Allograft transplantation was found. Satisfied patients reported lower pain and higher function, activity levels, and quality of life as **compared with patients** who were not satisfied. Likewise, (**Jonathan & Peter , 2023),** explained the excellent patient satisfaction rate that resulted from a revision complete knee arthroplasty using straightforward and trustworthy outcome measurement techniques. We discovered a somewhat positive association between satisfaction and functional outcomes as well as a strong positive correlation between assessment methodologies. According to the researcher, the study group's satisfaction with nursing care increased as their function improved after participating in a rehabilitation exercise program, compared to the control group.

Regarding correlation Co- efficient between Lysholm Knee Score with patient demographic data for study and control group (After 2 weeks, 1,5 month and 3 months). The present study showed that there was no statistically significant difference between sociodemographic data

& medical data and Lysholm knee score. There was a positive correlation between Lysholm knee score and mechanism of injury for study group after 2 weeks. From the researcher's point of view, positive correlation between Lysholm knee score and mechanism of injury for study group due to enhancing motor functioning as a result of understanding rehabilitation exercise program.

This finding congruent with a study by **(Briggs et al., 2024)** who mentioned that The Lysholm score and age demonstrated no correlation; there was no significant difference in the Lysholm score between men and women.

This finding comes into disagreement with **(Reiche et al., 2024)** who showed that incorporation of motor learning interventions to enhance perceptual-motor functioning may be beneficial for all individuals after Anterior Cruciate Ligament reconstructions, regardless of the injury mechanism.

Regarding correlation Co- efficient between patient satisfactions with nursing care quality with Patient demographic data for study and control group (After 2 weeks, 1.5 months and 3 months). The current study revealed that there was no statistically significant difference between

sociodemographic data & medical data and patient satisfaction with nursing care quality. This finding disagreed with **(Mukesh et al., 2021)** who claimed that age, gender, and ethnicity were sociodemographic characteristics linked to overall patient satisfaction. Most of the patient satisfaction categories were correlated with other sociodemographic factors like occupation, education, and religion. In five of the seven dimensions, age was found to be the most reliable predictor of patient satisfaction. According to the researcher, comprehension of the rehabilitation exercise program improves study group satisfaction with nursing care quality independent of age, sex, occupation, or marital status.

Conclusion

-There were highly statistically significant difference between study and control group after 1.5 month and 3 months with p value (0.001**,0.000**) respectively according to function of patients' knee post patellar fracture

-Rehabilitation exercise program was effective in improving symptoms, function of patients' knee post patellar fracture and satisfaction with nursing care quality

Recommendations

-Rehabilitation exercise program are recommended to be an integral part of the preoperative nursing teaching for patients undergoing patellar fracture surgery and a booklet should be available at trauma center and orthopedic outpatient clinic as a reference.

-A specialized rehabilitation nurse should be in the outpatient orthopedic clinic to teach the patient rehabilitation instructions needed

Data availability

All the data generated or analysed during this study are included in this article.

Conflict of interest

The authors declare that they have no conflicts of interest.

References

Abouelwafa ,A., Waleed ,S., Ayman, A., (2022): Evaluation of Internal Fixation of Patellar Fractures Using Cannulated Screws with Tension Band versus Modified Tension Band Wiring , Egyptian Journal of Medical Research (EJMR), Vol. (3), No.(4), P.p (132).

Adjal,J., & Ban,I., (2022): Patella fractures treated with suture tension band fixation. Journal of Orthopaedic Surgery and Research. Vol.(16), No.(179),P.p(1198).

Alaa, A,, Omar, M., , Huda, A., & Suja, K., (2019): Psychometric Properties of an Arabic Version of the Patient Satisfaction With Nursing Care Quality Questionnaire. The journal of nursing research: Vol.(27) No.(1), P.p (587).

Alok, C.,& Bindusar,T., (2023): COMPREHENSIVE CLINICAL EVALUATION OF ANTERIOR CRUCIATE LIGAMENT INJURY: PREOPERATIVE ASSESSMENT TO POSTOPERATIVE OUTCOMES Journal of Population Therapeutics & Clinical Pharmacology .Vol.(30), No.(19), P.p (548-553).

Briggs,K., Richard, S., & Hines,S.,(2024): Lysholm Score and Tegner Activity Level in Individuals with Normal Knees, The American journal of sport medicine, American Orthopaedic Society for Sports Medicine. Vol.(37), No.(5), P.p(78).

Cedars,S., (2018): Fractured Kneecap. Cedars Sinai organisation. https://www.cedars-sinai.org/health-library/diseases-and-conditions/f/fractured-kneecap.html.accessed at 10 p.m at 16/1/2024.

Damayea. H., Brent R. S., Milton, T.,Little, D., (2021): Patella Fractures: Approach to Treatment. American Academy of Orthopaedic Surgeons.Vol. (29), No.(6), P.p(119).

Elshenawie, H., & Ahmed,H.,(2017): Effect of Rehabilitation Exercises Program on Functional Outcomes among Patients with Knee Fracture, IOSR Journal of Nursing and Health Science (IOSR-JNHS) e-ISSN: 2320–1959.p- Vol. (6), No.(4), P.p (66-84).

Esmailiejah,A., Keipourfard ,A ., &Hashemi,Y., (2016): Isolated Bilateral Traumatic Patellar Fracture: A Case Report, American Journal of Medical Case Reports, Vol.(4), No.(6), P.p (186-189).

Guan H Tay,, Satish K Warrier, Guy Marquis, (2020):indirect patella fracture following ACL reconstruction , review pages 494-500, https://doi.org/10.1080/17453670610 046451

Ismael., Muhammad,Z. , El-Kady,H., & Ghanem,H.,(2019): Impact of Nursing Rehabilitation Protocol on Patient`s Satisfaction for Tibial Plateau Fracture Surgery, Assiut Scientific Nursing Journal http://asnj.journals.ekb.eg http://www.arabimpactfactor.com. Vol. (7), No (19), P.p (100 - 107).

Jiao, D., &Yanan, L.,(2022): Effect of Nursing in Operating Room Combined with Intraoperative Heat Preservation Intervention on Prevention of Incision Infection and Improvement of Hemodynamics in Patients with Anterior Cruciate Ligament Injury and Reconstruction under Knee Arthroscopy, Randomized Controlled Trial, Computational and Mathematical Methods in Medicine. Vol.(15),No.(3),P.p(124).

Joao, A., Liliane, B., Vanessa, Silva., Elias ,J., Netoa , F., Machry K., &Tiango, A., (2015): Vertical Open Patella Fracture, Treatment, Rehabilitation and the Moment to Fixation , www.jocmr.org ,This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited, J Clinical Medical Research.Vol.(7),No.(2), P.p (129-133).

Jonathan, Q., Peter, D., &Jones, R., (2023): Assessment of patient satisfaction following revision total knee arthroplasty, ANZ Journal of Surgery.Vol.(93),No.(4),P.p(111).

Kruse, M., Wolf, O., Mukka, S., &Bruggemann, A., (2022): Epidemiology, classification and treatment of patella fractures: an observational study of fractures from the Swedish Fracture Register. European Journal of Trauma and Emergency Surgery. Vol.(48), No.(6), P.p(4727–4734).

Kruse, M., Wolf, O., Mukka, S., &Brüggemann, A.,(2022):. Epidemiology, classification and treatment of patella fractures: an observational study of 3194 fractures from the Swedish Fracture Register. European Journal of Trauma and Emergency Surgery. Vol.(12), No.(30), P.p (1-8).

Laschinger, H., Linda, M., Cheryl, P., & Joan, A. (2005): A psychometric analysis of the patient satisfaction with nursing care quality questionnaire: an actionable approach to measuring patient satisfaction. Journal of Nursing Care Quality. Vol.(20), No. (3), P.p(220-230).

Luís, E., Tírico, M., Julie, C., McCauley, M., William, D., &Bugbee, M., (2022): Is Patient Satisfaction Associated With Clinical Outcomes After Osteochondral Allograft Transplantation in the Knee? The American Journal of Sports Medicine**.** Vol.(47), No.(1), P.p(198).

Luo, T., Marino, D., &Pilson, H., (2020). "Patella Fractures". *StatPearls. Treasure Island (FL):* Cureus. Vol.(28),No.(15), P.p (12).

Luo,T.,Dominic, V., &Marino, H., (2023): Patella Fractures,National library of medicine. Treasure Island (FL). https://pubmed.ncbi.nlm.nih.gov/30020702/.Accessed at 8 p.m at 20/1/2024.

Mahmoud Mahmoud, H., Fathy Ahmed Dawood, R., & Ahmed Mohamed Eldesoky, H. (2022). Effect of Nursing Rehabilitation Program on Knee Functional Outcomes for Patients underwent Arthroscopic Meniscus Surgery. *Egyptian Journal of Health Care*, *13*(2), 1-26.

Mark, K., Olof, W., Sebastian, M., & Anders, B., (2022): Epidemiology, classification and treatment of patella fractures: an observational study of fractures from the Swedish Fracture Register. European Journal of Trauma and Emergency Surgery. Vol.(48), No.(6), P.p(4727–4734).

Mukesh, Adhikari.,Narendra, R .,Shiva, R.,Archana, Shrestha., & Dipak, P., (2021): Patient satisfaction and its socio-demographic correlates in a tertiary public hospital in Nepal: a cross-sectional study,BMC Health Services Research. Vol.(21), No.(135),P.p(985).

Muthuri S.G, McWilliams .D.F, Doherty,M Zhang,W, (2020): History of knee injuries and knee osteoarthritis: a meta-analysis of observational studies

Posternak, M. A., & Miller, I. (2020). Untreated short-term course of major depression: A meta-analysis of studies using outcomes from studies using wait-list control groups. *Journal of Affective Disorders, 66*, 139–146

Regasa G, Kebede S, Desta T and Demie TG. (2023): Functional Outcomes of patellar fractures After Operative Treatment and Its Associated Factors at Addis Ababa Burn, Emergency and Trauma Hospital, Ethiopia. MJH, Volume 2 (1):

Reiche,E ., Collins,K ., Genoese,F ., Walaszek,M ., Triplett,A., Christopher ,C., Matthew, H., & Shelby, B., (2024): Lower Extremity Reaction Time in Individuals With Contact Versus Noncontact Anterior Cruciate Ligament Injuries After Reconstruction ,Journal of Athletic Training. .*Vol.(* 59),No. (1),P.p (66–72).

Sayum, F., Lenza ,M., Tamaoki, M., Matsunaga, F., &Belloti,J., (2021).

"Interventions for treating fractures of the patella in adults". *The Cochrane Database of Systematic Reviews. Vol.(2),No.(1), P.p(651). CD009651. doi:10.1002/14651858.cd009651.pub 3. PMC 8095054. PMID 33625743.*

Schuett, D., Hake, M., Mauffrey, C., Hammerberg, E., Stahel, P., & Hak ,D., (2015): Current treatment strategies for patella fractures. Orthopedics. Vol.(38), No. (6), P.p(377-384).

Shawky, M. , Abd Allah,U., &Bissar ,M., (2023): Treatment of comminuted patellar fractures using modified cerclage wiring,AlAzhar international medical journal. Al-Azhar International Medical Journal.Vol.(2),No.(1),P.p(51-56).

Steinmetz, S., Wernly, D., Moerenhout, K., Trampuz, A., & Borens,O., (2019): Infection after fracture fixation. EFORT Open Rev. Vol.(4), No.(7),P.p(468–475).

Tanvi, S., Mirapurkar,A., Manali, A., Shruti, S., & Pratik, P., (2023): A Comprehensive Physiotherapeutic Rehabilitation Protocol for Malunited Post-operative Patellar Fractures: A Case Report, https://www.cureus.com/channels/dmmc. Cureus.Vol.(16), No. (2), P.p (765).

Tegner, Y., & Lysholm,J., (1985): Rating systems in the evaluation of knee ligament injuries.Clinicl orthopedic and related research. Vol. (198), No.(27), P.p (43-49).

Yuliu, Z.,& Qiuyan, Y., (2023): Effect of application of short-form video health education on the health knowledge and satisfaction with nursing care of patients with lower extremity fractures, BMC Nursing.Vol.(22), No.(1),P.p(654).