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Effectiveness of Nurse Led Educational Interventions on Outcomes of Patients with Knee Osteoarthritis Undergoing Genicular Nerves Radio-frequency Ablation

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Abstract:
Background: Knee Osteoarthritis is a prevalent chronic disease that causes pain, functional restrictions, increased healthcare consumption, and significant financial expenses to society. **Aim:** To evaluate the effect of nursing led educational interventions on outcomes of patients with knee osteoarthritis undergoing genicular nerves radio-frequency ablation. **Design:** The study used a quasi-experimental design. **Setting:** Pain Management Unit at Assiut University Hospital. **Subjects:** A purposive sample of 40 adult patients diagnosed with knee osteoarthritis undergoing genicular nerves radio-frequency ablation from both sexes was split equally into two groups (study and control group), each consisting of 20 patients. **Tools: Tool I:** Patient assessment sheet**. Tool II:** Numeric Pain Rating Scale (NPRS). **Tool III:** Knee Injury and Osteoarthritis Outcome Score (KOOS). **Results:** At baseline, both groups reported high pain levels with no significant difference ($p = 0.075$), following intervention both groups experienced a reduction in pain scores over the 3-month period. However, study group exhibited significantly lower pain scores than control group at 1 month (median 5 vs. 6, $p < 0.001$), 2 months (median 2 vs. 5, $p < 0.001$), and 3 months (median 1 vs. 4, $p < 0.001$). Following interventions, the study group demonstrated highly significant improvements across all KOOS domains compared with the control group ($p < 0.001$). **Conclusion:** Nurse-led educational interventions effectively reduced pain and disability in patients with knee osteoarthritis undergoing genicular nerve radiofrequency ablation. **Recommendation:** Nurse-led educational interventions should be incorporated as a standard component of care for patients with knee osteoarthritis undergoing genicular nerve radiofrequency ablation.

Keywords: Knee Osteoarthritis, Nurse Led Educational Interventions, Outcomes & Genicular Nerves Radio-frequency Ablation.

Introduction
The knee joint is one of the body's primary weight-bearing joints. Knee osteoarthritis (KOA) is a common inflammatory disorder affecting the knee joint and is characterized by a series of pathological changes, including cartilage degeneration, joint deformation, destruction, and secondary bone hyperplasia resulting from various contributing factors. These changes are considered hallmark features of degenerative osteoarthropathy **(Wang, 2023)**.

Over 650 million people worldwide suffer from osteoarthritis, with KOA making for almost 80% of cases and disproportionately impacting middle-aged and older persons. It has become a major cause of disability worldwide, resulting in decreased health-related quality of life (HRQoL) and poor performance in activities of daily living (ADLs), thereby imposing substantial burdens on healthcare systems and socioeconomic development. **(Chen et al., 2025).**

Knee osteoarthritis is frequently associated with pain, stiffness, and swelling, which considerably limit patients' ability to perform routine daily activities. As a result, individuals with KOA often experience significant disability **(Zhu et al., 2024)**. Reduced physical activity further leads to deterioration in muscle strength and tone, particularly among older adults. Moreover, persistent pain, social isolation, and reduced work capacity may contribute to emotional distress and psychological imbalance **(Wojcieszek et al., 2022)**.

Osteoarthritis is among the most prevalent musculoskeletal disorders worldwide, affecting millions of individuals. Despite its substantial burden, no disease-modifying treatment is currently available, and management remains primarily focused on symptom control. In most cases, treatment is initiated only after symptoms and structural joint damage has become apparent, reflecting the predominantly reactive nature of current osteoarthritis management approaches **(Dell'Isola et al., 2025)**.

Osteoarthritis in general and KOA in particular, are chronic conditions for which a variety of surgical, pharmacological, and non-pharmacological management strategies are available. Many patients prefer non-surgical approaches because of the pain, risks, and potential complications associated with surgery. Several minimally invasive treatment modalities have been introduced for KOA management, including intra-articular hyaluronic acid (HA) injections, platelet-rich plasma (PRP), and genicular nerve radiofrequency ablation (RFA). These interventions aim to provide sustained symptom relief by directly targeting the underlying joint pathology **(Farì et al., 2024)**.

Radiofrequency ablation involves the application of radio waves to generate a thermal lesion or controlled isotherm. This technique is widely used in the management of chronic pain conditions, including facet joint pain, shoulder pain, knee pain, and trigeminal neuralgia, through the interruption of pain signal transmission by targeted sensory nerves. It may be delivered using continuous, pulsed, or cooled techniques. The procedure is performed under fluoroscopic or ultrasound guidance to ensure accurate localization of the target nerve prior to energy application. As a minimally invasive procedure, RFA is generally well tolerated and, in appropriately selected patients can significantly improve pain, functional status, and quality of life **(Paisley & Devine, 2025)**.

Exercise training is thought to be among the best non-pharmacological treatments for KOA patients, as it may help delay disease progression, alleviate pain, and improve knee function **(Tognolo et al., 2022)**. Strengthening exercises targeting the quadriceps and hamstring muscles have been shown to reduce subjective knee pain, increase range of motion (ROM), and enhance functional performance **(Wei et al., 2024)**.

Furthermore, patient counseling, health education regarding KOA, and functional rehabilitation strategies play a crucial role in promoting self-management skills, adherence to prescribed therapeutic regimens, healthy lifestyle modifications, compliance with exercise programs, and effective symptom management. These interventions may ultimately contribute to improved functional outcomes, reduced disability, and enhanced quality of life among patients with knee osteoarthritis **(Kangeswari & Arulappan, 2022)**.

In addition, nurse-led educational interventions represent an important non-surgical and non-pharmacological approach that can be tailored to patients' individual needs and preferences. Such interventions enhance the quality of care by facilitating the implementation of evidence-based practices while discouraging ineffective or potentially harmful approaches. They also contribute to the standardization of care, patient empowerment, health policy development, performance improvement initiatives, and the promotion of high-value healthcare interventions **(Guerra-Farfan et al., 2023)**.

Significance of the Study:

A recent finding from the Global Burden of Disease Study 2021, which was published in The Lancet Rheumatology, showed that KOA's prevalence was still rising worldwide through 2020 and is projected to rise by 74.9% by 2050 compared with 2020 levels **(Liu et al., 2025)**. According to records from Assiut University Hospital, 45 patients with knee osteoarthritis underwent fluoroscopy-guided radiofrequency ablation in the Pain Management Unit during 2024 **(Assiut University Hospital Records, 2024)**. In Egypt limited evidence is available regarding the effectiveness of nurse-led educational interventions on patients with KOA **(Kangeswari & Arulappan, 2022)**, despite the fact that nurses are essential in educating patients about KOA and providing them with exercises that effectively reduce pain and enhance functional performance. Thus, the current study was carried out to evaluate the effectiveness of nurse-led educational interventions on the outcomes of patients with knee osteoarthritis undergoing genicular nerve radiofrequency ablation.

Operational definitions:

Nurse-led educational interventions: refers to a structured, evidence-based educational program designed and delivered by a qualified registered nurse to enhance participants' knowledge, skills, and self-management abilities regarding a specific health condition. The intervention consists of scheduled educational sessions using teaching methods such as lectures, discussions, demonstrations, counseling, printed materials, and follow-up support.

Patient's outcomes: these are the results which were measured pre and post-intervention; the intensity of pain at rest measured by NPRS and disability assessed by the five different domains (symptoms, pain, ADL, function, and quality of life) of the Knee Injury and Osteoarthritis Outcome Score.

Radiofrequency (RF): is a mini-invasive neuromodulation intervention that is commonly used in chronic pain conditions including general musculoskeletal pain related to several diseases, including knee osteoarthritis (KOA).

Aim of the study

General objective:

To evaluate the effect of nurse led educational interventions on outcomes of patients with knee osteoarthritis undergoing genicular nerves radio-frequency ablation.

Specific objectives:

1- Assess pain intensity and disability for patients with knee osteoarthritis undergoing genicular nerves radio-frequency ablation.
2- Design and implement nurse- led educational interventions.
3- Evaluate the effect of implementing nurse led educational interventions on intensity of pain and disability for patients with knee osteoarthritis undergoing genicular nerves radio-frequency ablation.

Research Hypothesis:

H1: Pain intensity in patients receive nurse led educational interventions in addition to the routine hospital care will be significantly decreased than those patients who will receive routine hospital care only.

H2: Disability in patients receive nurse led educational interventions in addition to the routine hospital care will be significantly decreased than those patients who will receive routine hospital care only.

Subjects and Method:

Research Design:

This study conducted a quasi-experimental (Study/control) research design which is a type of evaluation aims to examines the impact of a policy, event, or intervention without allocating participants or units to conditions at random. Instead, researchers create a reliable comparison and predict what would likely have happened in the absence of the intervention using pre-existing groups, assignment criteria, repeated observations, or naturally occurring changes. **(Miller et al., 2020).**

Setting: The study was conducted at the Pain Management Unit of Assiut University Hospital, Assiut, Egypt. The unit is located on the second floor above the Outpatient Clinics Building and is equipped with two operating/procedure rooms and two recovery rooms. The unit provides various pain management services, including ultrasound-guided and fluoroscopy-guided interventional procedures for pain management conditions.

Sample: Purposive sample of 40 adult patients diagnosed with knee osteoarthritis undergoing fluoroscopy-guided radio-frequency ablation from both sexes and they equally divided into two groups (study & control groups), (20) patients for each one. To avoid contamination bias, participants were assigned according to the time of recruitment. The first 20 eligible patients constituted the control group and received routine care only. The subsequent 20 eligible patients constituted the study group and received nurse-led instructions in addition to routine care

Sample size calculation:

The sample size for the present study was calculated using the finite population correction formula:

$$n = \frac{N}{1 + N\,(e^2)}$$

Where N is the population size, n is the necessary sample size, and e is the error margin. Based on **(Assiut University Hospital Records, 2024)**, the accessible population consisted of 45 eligible patients. Using a margin of error of 5% (e = 0.05), the calculated sample size was approximately 40 patients. Therefore, the final study sample comprised **40 patients**, who were equally allocated into two groups: a **study group (n = 20)** and a **control group (n = 20)**.

Group I (study group): 20 patients received nurse-led educational interventions with hospital care.

Group II (control group): 20 patients received the routine hospital care only.

Inclusion criteria of the patients were adult males and females between the ages of 20 and 65 with osteoarthritis undergoing fluoroscopy-guided genicular nerves radio-frequency ablation, ready to engage in the study with excluding Patients with other inflammatory joint diseases, critically ill patients, patients with a history of knee malalignment, including varus or valgus, patients with psychiatric disorders, patients scheduled for joint replacement surgery, patients receiving steroid injections, and patients receiving physical therapy within the preceding six months were all excluded from the study.

Tools of the study:

Three tools were used to fulfill the aim of the study.

Tool (I): Patient assessment sheet:

It was developed by the researchers based on recent national and international literatures. It was divided into the following two parts:

Part (1): Demographic characteristics: such as age, sex, marital status, educational level, occupation and residence.

Part (2): Clinical data and medical history: included body mass index and presence of comorbidities such as hypertension, diabetes mellitus, pulmonary disease, cardiovascular disease and kidney disease.

Tool (II): Numeric Pain Rating Scale (NPRS): This scale was adopted from **(McCaffery et al, 1989)** who made test instructions as the patient is asked to make three pain ratings, corresponding to current, best and worst pain experienced over the past 24 hours. The average of the 3 ratings was used to represent the patient's level of pain over the previous 24 hours on a scale of 0 (no pain) to 10 (worst pain imaginable).

Tool (III): Knee Injury and Osteoarthritis Outcome Score (KOOS): This scale was developed

by (Roos et al., 1998). It composed of five patient-relevant dimensions and scored separately: Pain (nine items); Symptoms (seven items); ADL Function (17 items); Sport and Recreation Function (five items); Quality of Life (four items). A Likert scale is used and all items have five possible answer options scored from 0 (No problems) to 4 (Extreme problems) and each of the five scores is calculated as the sum of the items included.

Scoring system:

Scores were transformed to a 0-100 scale, with zero representing extreme knee problems and 100 representing no knee problems as common in orthopedic scales and generic measures. Scores between 0 and 100 represent the percentage of total possible score achieved.

Knee Injury and Osteoarthritis Outcome Score (KOOS) Scales scoring and transforming Formulas.

Scale	Raw Score=Sum of Values of the Following Items	Possible Raw Score Range
Pain	P1-P9	36
Symptoms	Sy1-Sy7	28
Activities of daily living	A1-A17	68
Sport/Rec	Sp1-Sp5	20
Knee-related quality of life	Q1-Q4	16

Formula and example for transformation of raw scale scores to a zero-100 scale (0=extreme knee problems, 100=no knee problems)

$$\textbf{Transformed scale} = 100 - \frac{Actual\ raw\ score\ x100}{Possible\ raw\ score\ range}$$

For instance, the following is how a pain raw score of 16 would be transformed:

$$100 - \frac{16x100}{36} = 66$$

Methodology

Administrative approval:

An official permission was obtained from Dean of the faculty of nursing at Assiut University to the hospital director and official approval was obtained from administrative authority of the Pain Management Unit at Assiut university hospital to gather the needed data after study aim explanation.

Tools development:

The study tools and nursing instructions were designed by the researchers after extensive literature review (nursing and medical text book, journals and internet resources).

Content validity and reliability

Five experts (three experts in medical-surgical nursing at the Faculty of Nursing Assiut University and two experts in anesthesia, intensive care, and pain management at the Faculty of Medicine Assiut University) evaluated and approved the study tools to guaranty their content validity, clarity, comprehensiveness, appropriateness, and relevance. After then, the necessary modifications were made. Tool II Numeric Pain Rating Scale (NPRS) reliability was evaluated using Cronbach's alpha. (Kappa statistics = 0.90). Tool III Knee Injury and Osteoarthritis Outcome Score (KOOS) demonstrate strong reliability and validity, confirmed by high internal consistency (Cronbach's alpha around 0.85-0.90) and good test-retest reliability (correlation coefficients 0.78–0.98).

Ethical considerations

This study closely adhered to the ethical norms and guidelines set out by the Faculty of Nursing, Assiut University to safeguard the participants' rights and welfare throughout the research procedure with ethical approval code of (**1120251190)**. After being properly told about the study's objectives, each participant provided their informed consent to participate. It was emphasized that patients might withdraw at any time without it affecting their medical care, and they voluntarily consented to participate. To ensure secrecy and anonymity, all collected data was coded and securely stored, and personal identifiers were eliminated from the datasets. Participants' privacy and dignity were always protected, and any potential risks or discomfort were minimized.

Pilot study:

Before collecting data, a pilot study including four patients (10%) was carried out to evaluate each tool's clarity, objectivity, relevance, practicality, and applicability. This was required for any queries that required data collection and as a result, the necessary modifications were implemented. The patients included in the pilot study were excluded from the final study sample.

Data collection procedure:

This study was conducted through:

Planning Phase:

To evaluate the patient flow and calculate the time needed for data collection, a preliminary exploratory visit was made to the Pain Management Unit. Meetings with the doctors and nursing staff were conducted prior to data collection in order to seek their cooperation and to clarify the goals and methods of the study. After being informed about the study's purpose, patients who met the eligibility requirements were enrolled if they gave their informed consent.

The researchers first develops the educational content after consulting with experts and specialists and reviewing scientific publications, evidence-based websites, scientific databases, and reliable scientific

associations pertaining to knee osteoarthritis and fluoroscopy-guided radiofrequency genicular nerve ablation. It then validated by experts. The content was classified as (information about the disease process, treatment options, information about fluoroscopy-guided genicular nerves radio-frequency ablation, exercise, diet, drugs, life styles follow-ups, and periodic monitoring).

Field work

The data collection was started and continued from September 2025 to April 2026. The data were collected by the researchers 5 days a week from Sunday to Thursday on morning shifts by interviewing patients individually.

Assessment Phase:

The interview started with the researchers introducing themselves and outlining the study's objectives. Oral consent was obtained for participation. During the first visit, the researchers began filling out the patient assessment form to evaluate the patient's clinical and demographic traits, and medical data by using **Tool I**. then assessing patient's level of pain over the previous 24 hours using **Tool II** Numeric Pain Rating Scale (NPRS) **and finally,** disability, assessed by the five different domains (symptoms, pain, ADL, function, and quality of life) of **Tool III**: Knee Injury and Osteoarthritis Outcome Score. **(Pretest)** for both study and control groups.

Implementation phase:

Nurse led educational interventions were explained by the researchers to study group patients before fluoroscopy-guided genicular nerves radiofrequency ablation procedure. The intervention was delivered using an illustrated Arabic educational booklet specifically designed to accommodate patients' educational level and learning needs. The structured nursing-led educational intervention delivered over three sessions, followed by reinforcement during follow-up, the educational sessions were conducted individually in a quiet setting at the Pain Management Unit and utilized explanation, discussion, demonstration, re-demonstration, and feedback techniques. Each session lasted approximately 30-45 minutes.

First session: Understanding Knee Osteoarthritis and Radiofrequency Ablation

The first educational session focused on increasing patients' knowledge regarding knee osteoarthritis and its management. Patients received information about anatomy and function of the knee joint, definition, causes, risk factors, and symptoms of KOA, available treatment modalities including conservative management, intra-articular injections, and radiofrequency ablation, Purpose, benefits, mechanism of action, expected outcomes, safety of fluoroscopy-guided genicular nerve RFA and frequently asked questions and common misconceptions regarding the procedure. Illustrated diagrams and simple explanations were used to facilitate understanding. At the end of the session, patients were encouraged to discuss their concerns and ask questions.

Second session: Post-Procedural Self-Care and Lifestyle Modification

The second session concentrated on post-procedural care and long-term symptom management. Patients were instructed regarding adherence to prescribed medications, importance of regular follow-up visits, weight reduction and maintenance of optimal body weight, healthy dietary practices, including increased consumption of fruits, vegetables, and omega-3-rich foods, adequate fluid intake, and reduction of saturated fats and refined sugars, joint protection strategies and energy conservation techniques, appropriate use of assistive devices such as canes or walking aids when indicated and finally, activities that may increase knee stress and should be avoided, including prolonged standing, repeated stair climbing, prolonged squatting, deep knee bending, floor sitting, and carrying heavy loads. Patient understanding was assessed through discussion and verbal feedback before proceeding to the next session.

Third session: Therapeutic Exercise Training

The third session focused on therapeutic exercises designed to improve knee function, muscle strength, flexibility, and mobility while minimizing stress on the affected joint. The researcher demonstrated each exercise and requested patients to perform return demonstrations to ensure correct technique. The exercise program included gentle range-of-motion exercises, muscle-strengthening exercises, stretching exercises, and functional mobility training tailored to each participant's tolerance and clinical condition. Exercises were performed progressively, with careful monitoring to avoid pain exacerbation and ensure patient safety. The researcher instructed the patients to initiate the exercise program 24 hours following RFA.

The exercise program included:

1. Quadriceps Strengthening Exercise (Straight Leg Extension): The exercise was explained as a method to strengthen the quadriceps muscle and improve knee stability.

2. Towel Press Exercise (Quadriceps Setting Exercise): This exercise aimed to increase quadriceps strength and promote knee joint support.

3. Stretching Exercises: Patients were instructed to perform gentle stretching exercises regularly to maintain knee joint flexibility, reduce stiffness, enhance range of motion and support functional mobility during daily activities.

Additionally, patients were informed about exercises and activities that should be avoided because of

excessive loading on the knee joint, including deep squatting exercises, heavy resistance leg presses, high-resistance stationary cycling, kickboxing activities, running on treadmills, and weightlifting exercises.

Reinforcement and Follow-Up

Following completion of the educational sessions, each participant received a copy of the illustrated booklet for home reference. Reinforcement of educational content was provided during follow-up assessments throughout the three-month study period. The researcher reviewed adherence to recommended exercises and lifestyle modifications, addressed patients' concerns, corrected improper practices when identified, and provided ongoing motivational support to enhance compliance with the prescribed therapeutic regimen. They were also followed up through phone calls.

- Control group: No instructions were provided to patients in this group at the time of intervention by the research team and they only received the routine hospital care provided after fluoroscopy-guided genicular nerves RFA.
- Fluoroscopy guided radiofrequency ablation of genicular nerves, (superomedial, superolateral and inferomedial) was done to all the study participants.

The evaluation phase

The effect of nurse-led educational interventions was evaluated on pain and disability after one month (post), after two months and three months (follow-up) using tool II and III.

Statistical analysis:

Data were analyzed using Statistics Package for Social Sciences (SPSS) version 27 (SPSS Inc., Chicago, IL, USA) Whereas, continuous data were expressed as mean ± standard deviation (SD), minimum and maximum, Differences between the two groups were detected using Independent-Samples T test for continuous data. Nominal data were expressed as percentage. Differences between the two groups were detected using Chi square test. Statistical significance was defined as a P-value of less than 0.05.

Results:

Table (1): Demographic characteristics distribution between the studied groups (n=40)

	Study (n=20)	Control (n=20)	X^2	P-value
Age				
20<30	0(0%)	0(0%)	0.902	0.342
30<40	0(0%)	0(0%)		
40<50	12(60%)	9(45%)		
50-65	8(40%)	11(55%)		
Sex				
Male	8(40%)	7(35%)	0.107	0.744
Female	12(60%)	13(65%)		
Marital status				
Married	20(100%)	19(95%)	1.026	0.311
Widow or widower	0(0%)	1(5%)		
Educational level				
Illiterate	4(20%)	3(15%)	3.329	0.344
Read and write	4(20%)	3(15%)		
Secondary	12(60%)	11(55%)		
University	0(0%)	3(15%)		
Occupation				
Working	8(40%)	4(20%)	1.905	0.168
Not working	12(60%)	16(80%)		
Residence				
Rural	8(40%)	12(60%)	1.600	0.206
Urban	12(60%)	8(40%)		

**Significant level at P value < 0.05,*

***Significant level at P value < 0.01*

Table (2): Clinical data distribution between the studied groups (n=40)

	Study (n=20)	Control (n=20)	t/X^2	P-value
Height (cm)				
Min. - Max.	157 – 165	140 - 170	1.176	0.252
Mean±SD	160±2.83	157±11.05		
Weight (kg)				
Min. - Max.	60 – 90	65 - 100	-0.512	0.612
Mean±SD	81±11.42	83±13.22		
BMI				
Min. - Max.	23.44 - 36.05	27.55 - 39.06	-1.395	0.171
Mean±SD	31.7±4.86	33.64±3.87		
Comorbidities				
Hypertension	16(80%)	10(50%)	2.74	0.097
Diabetes mellitus	8(40%)	2(10%)	3.33	0.067
Kidney disease	4(20%)	4(20%)	0.000	1.000
No	4(20%)	10(50%)	2.74	0.097

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

Table (3): Comparison between the studied groups according to The Numeric Pain scores Pre, post 1, post 2 and post 3 months of nurse- led educational interventions (n=40)

The Numeric Pain Rating Scale scores	Study (n=20)	Control (n=20)	Z	P-Value
Pre nurse-led educational interventions				
Min. - Max.	7 – 9	7 – 10	-1.778	0.075
Median(Q1-Q3)	9(8-9)	10(9-10)		
1 month after nurse-led educational interventions				
Min. - Max.	3 – 6	5 – 8	-3.601	<0.001**
Median(Q1-Q3)	5(4-5)	6(5-7)		
2 months after nurse-led educational interventions				
Min. - Max.	2 – 3	3 – 6	-5.143	<0.001**
Median(Q1-Q3)	2(2-3)	5(4-6)		
3 months after nurse-led educational interventions				
Min. - Max.	1 – 2	3 – 5	-5.555	<0.001**
Median(Q1-Q3)	1(1-2)	4(3-4)		

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

Table (4): Comparison between the studied groups according to Knee Injury and Osteoarthritis Outcome (KOOS) before nurse- led educational interventions (n=40)

Knee Injury and Osteoarthritis Outcome Score (KOOS)	Number of sentence	Study (n=20) Mean±SD	Control (n=20) Mean±SD	T	P-value
Pre nurse- led educational intervention					
Pain score	9	8.06±6.68	5±7.73	1.338	0.189
Symptoms score	7	3.93±6.01	5±10.26	-0.403	0.690
Activities of daily living score	17	0.59±0.88	0.88±1.21	-0.881	0.384
Sport and recreation function score	5	1±2.62	0.5±1.54	0.737	0.466
Knee-related quality of life score	4	27.5±6.54	26.25±2.56	0.796	0.434
Knee Injury and Osteoarthritis Outcome Score (KOOS) total score	**42**	**8.21±2.03**	**7.53±4.38**	**0.638**	**0.529**

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

Table (5): Comparison between the studied groups according to Knee Injury and Osteoarthritis Outcome (KOOS) 1 month after nurse- led educational interventions (n=40)

Knee Injury and Osteoarthritis Outcome Score (KOOS)	Number of sentence	Study (n=20) Mean±SD	Control (n=20) Mean±SD	T	P-value
1 month after nurse-led educational interventions					
Pain score	9	47.22±4.42	30±7.73	8.651	<0.001**
Symptoms score	7	50.71±3.59	30±10.26	8.522	<0.001**
Activities of daily living score	17	49.12±1.81	25.88±1.21	47.753	<0.001**
Sport and recreation function score	5	32±10.05	25.25±1.12	2.985	0.007**
Knee-related quality of life score	4	45±4.8	38.75±2.56	5.137	<0.001**
Knee Injury and Osteoarthritis Outcome Score (KOOS) total score	**42**	**44.81±3**	**29.98±4.29**	**12.684**	**<0.001****

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

Table (6): Comparison between the studied groups according to Knee Injury and Osteoarthritis Outcome (KOOS) 2 month after nurse- led educational interventions (n=40)

Knee Injury and Osteoarthritis Outcome Score (KOOS)	Number of sentence	Study (n=20) Mean±SD	Control (n=20) Mean±SD	T	P-value
2 months after nurse-led educational interventions					
Pain score	9	71.67±5.53	55±7.73	7.843	<0.001**
Symptoms score	7	75.71±3.59	55±10.26	8.522	<0.001**
Activities of daily living score	17	74.12±1.81	50.88±1.21	47.753	<0.001**
Sport and recreation function score	5	57±10.05	50.25±1.12	2.985	0.007**
Knee-related quality of life score	4	60±3.14	51.25±2.56	9.649	<0.001**
Knee Injury and Osteoarthritis Outcome Score (KOOS) total score	**42**	**67.7±2.9**	**52.48±4.27**	**13.182**	**<0.001****

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

Table (7): Comparison between the studied groups according to Knee Injury and Osteoarthritis Outcome (KOOS) 3 month after nurse- led educational interventions (n=40)

Knee Injury and Osteoarthritis Outcome Score (KOOS)	Number of sentence	Study (n=20) Mean±SD	Control (n=20) Mean±SD	T	P-value
3 months after nurse-led educational interventions					
Pain score	9	91.11±6.6	64.44±7.3	12.120	<0.001**
Symptoms score	7	90±7.11	67.14±8.48	9.238	<0.001**
Activities of daily living score	17	88.24±8.48	65.29±7.3	9.166	<0.001**
Sport and recreation function score	5	74.75±1.12	50.25±1.12	69.296	<0.001**
Knee-related quality of life score	4	66.25±6.54	60±8.7	2.569	0.015*
Knee Injury and Osteoarthritis Outcome Score (KOOS) total score	**42**	**82.07±5.34**	**61.43±5.66**	**11.859**	**0.000****

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

Table (1): Shows that the majority of patients in the study and control groups were within the age of 40 to 65 years old, as 60% versus 45% respectively were aged 40 to <50 years while 40% and 55% respectively were aged 50–65 years, about two thirds of participants were female 60% in study versus 65% in control group; nearly all participants were married, 100% of the study group and 95% of the control group. Regarding educational level, secondary education was reported by nearly two thirds of the study group compared to over half of the control group (60% in the study group and 55% in the control group) Furthermore, The majority of participants were not working (60% in the study group and 80% in the control group) and were distributed fairly evenly between rural and urban residences. There were no statistically significant differences between the study and control groups regarding socio-demographic characteristics ($p > 0.05$).

Table (2): Presents that the mean BMIs reflecting obesity across both groups (31.7 ± 4.86 vs. 33.64 ± 3.87, $p = 0.171$) with no statistically significant differences between the study and control groups concerning height, weight, or body mass index (BMI). The majority of the studied sample has hypertension and diabetes. Similarly, the prevalence of common comorbidities such as hypertension in study and control groups (80% vs. 50%) respectively,

diabetes mellitus (40% vs. 10%) respectively, and kidney disease (20% in both) showed no statistically significant differences ($p > 0.05$).

Table (3): Illustrates that pre the intervention, both groups reported high pain levels with no statistically significant difference was observed between the two groups ($p = 0.075$) Following the intervention both groups experienced a reduction in pain scores over the 3-month period. However, the study group exhibited significantly lower pain scores than the control group at 1 month (median = 5 vs. 6, $p < 0.001$), 2 months (median = 2 vs. 5, $p < 0.001$), and 3 months (median = 1 vs. 4, $p < 0.001$).

Table (4): Illustrates that both groups presented with low baseline functional scores as regard the pain score, the study group had a mean score of 8.06 ± 6.68 compared to 5± 7.73 in the control group, for the symptoms score, the study group recorded a mean score of 3.93 ± 6.01, while the control group had a mean score of 5± 10.26, concerning activities of daily living (ADL), the mean score was 0.59 ± 0.88 for the study group and 0.88 ± 1.21 for the control group. Regarding sport and recreation function, the study group achieved a mean score of 1± 2.62 compared to 0.5± 1.54 in the control group. Furthermore knee-related quality of life of the study group had a mean score of 27.50 ± 6.54, compared to 26.25 ± 2.56 of the control group. There were no statistical significant differences between the study and control groups across any of the KOOS subdomains score or in the total score ($p > 0.05$).

Table (5): Demonstrates that one month after the nurse-led educational intervention, both groups experienced an improvement across all KOOS domains However, the study group demonstrated significant improvements compared with the control group. The mean pain score for study group increased significantly to 47.22±4.42, compared with 30±7.73 in the control group ($p<0.001$). Similarly, in symptoms (50.71±3.59 vs. 30±10.26; $p<0.001$), activities of daily living (49.12±1.81 vs. 25.88±1.21; $p<0.001$), sport and recreation function (32±10.05 vs. 25.25±1.12; $p=0.007$), and knee-related quality of life (45±4.80 vs. 38.75±2.56; $p<0.001$). Furthermore, the total KOOS mean score was significantly higher among the study group (44.81±3) than the control group (29.98±4.29), with a highly statistically significant difference ($p<0.001$), reflecting the positive early impact of the nurse-led educational intervention.

Table (6): Shows that two months after the intervention, the study group maintained substantial improvements in all KOOS domains as the mean pain score increased to 71.67±5.53 compared with 55±7.73 in the control group ($p<0.001$). Likewise, mean symptoms scores were (75.71±3.59) than (55±10.26) in the control group ($p<0.001$). Significant improvements were also evident in activities of daily living mean score (74.12±1.81 vs. 50.88±1.21; $p<0.001$), sport and recreation function (57±10.05 vs. 50.25±1.12; $p=0.007$), and knee-related quality of life (60±3.14 vs. 51.25±2.56; $p<0.001$). The total KOOS mean score reached 67.70±2.90 in the study group compared with 52.48±4.27 in the control group, demonstrating a highly statistically significant difference ($p<0.001$). These findings indicate a continued positive effect of the nurse-led educational intervention on knee function, pain, symptom management, activities of daily living and quality of life.

Table (7): Demonstrates that three months after the intervention, the study group achieved highly statistically significant improvements across all KOOS domains compared to the control group ($p < 0.001$) as the mean pain score increased dramatically to 91.11±6.6 compared with 64.44±7.3 in the control group ($p<0.001$) also, symptoms were (90±7.11 vs. 67.14±8.48; $p<0.001$), activities of daily living (88.24±8.48 vs. 65.29±7.3; $p<0.001$), and sport and recreation function (74.75±1.12 vs. 50.25±1.12; $p<0.001$). Moreover, knee-related quality of life (66.25±6.54 vs. 60±8.7; $p=0.015$). The total KOOS mean score reached 82.07±5.34 in the study group, significantly exceeding that of the control group (61.43±5.66) ($p<0.001$). These results suggest that the benefits of the nurse-led educational intervention not only persisted but further increased over time, resulting in substantial improvements in pain, symptoms, functional abilities, activities of daily living, sports and recreational activities, and overall knee-related quality of life after three months.

Discussion:

Knee osteoarthritis is one of the most prevalent causes of physical impairment among adults globally. The global prevalence of KOA exceeds 20% among individuals over the age of 40 years. The disease develops gradually, with pain and functional limitations worsening over time, leading to substantial physical, psychological, emotional, and financial burdens and negatively affecting patients' quality of life. Although osteoarthritis has no definitive cure, available treatment strategies focus on pain relief, disability prevention, functional improvement, and enhancement of quality of life **(Atta et al., 2022; Novin et al., 2024; Oliinyk et al., 2025)**. Thus, the current study was carried out to evaluate the effectiveness of nurse-led educational interventions on the outcomes of patients with KOA undergoing genicular nerve RFA.

Demographic Characteristics:

Regarding age, the present study revealed that most participants in both groups were between forty and sixty five years old. **From the researchers' opinion**, this may be attributed to age-related musculoskeletal changes that increase susceptibility to osteoarthritis. This result is in line with that of **Atta et al. (2022)**, who found that almost, one-third of their participants were between the ages of fifty-one and sixty. Similarly, **Novin et al. (2024)** found that a mean participant age of fifty- five years. **Dell'Isola et al. (2024)** reported a mean age of sixty- six point five years, while **Mohsen et al. (2025)** found that nearly half of their participants were aged between fifty and sixty years.

Concerning sex, the present study revealed that approximately two-thirds of participants in both groups were female. **From the researcher's perspective,** this finding may be related to hormonal changes associated with menopause, particularly the influence of estrogen, which may contribute to the development of osteoarthritis. This result is in line with that of **King et al. (2021)**, who discovered that women made up fifty-nine percent of the study sample. Similarly, **Atta et al. (2022)** found that females with KOA made up less than two-thirds of the groups under study. **Novin et al. (2024)** documented that sixty-seven percent of their participants were women, while **Dell'Isola et al. (2024)** reported that sixty-eight point four percent of participants were female. Likewise, **Mohsen et al. (2025)** found that less than two-thirds of their participants were females.

In terms of marital status, the current study found that almost every participant in both groups was married. These findings are supported by **Mandour et al. (2022)**, who reported that approximately two-thirds of their sample was married. Similarly, **Mohsen et al. (2025)** found that less than three-quarters of the studied patients were married.

With regard to educational level, the current study revealed that nearly two-thirds of the study group reported having completed secondary school, compared to more than half of the control group. These findings are consistent with **Bazied et al. (2022)**, who reported that the majority of their study sample had a high school diploma. Likewise, **Mohsen et al. (2025)** found that less than half of their participants possessed intermediate educational qualifications.

Regarding occupation, the majority of participants in both groups were not working. This finding contradicts the results of **Xing et al. (2020)**, who found that more than half of their participants were engaged in physically demanding occupations. Similarly, **Atta et al. (2022)** reported that more than half of participants across all groups were employed. In contrast, **Mohsen et al. (2025)** found that less than half of their study sample had sedentary occupations.

Concerning residence, nearly equal numbers of participants in the current study were found in rural and urban locations. This result is consistent with the findings of **Mohamed et al. (2020)**, who said that half of the sample under study was rural. Likewise, **Mohsen et al. (2025)** observed that more than half of their participants resided in urban settings.

The findings of the present study demonstrated no statistically significant differences between the study and control groups regarding socio-demographic characteristics. This lack of statistically significant variation confirms the baseline homogeneity of both groups and ensures that demographic factors were unlikely to act as confounding variables when evaluating post-intervention outcomes.

Clinical Characteristics

Regarding clinical characteristics, the present study showed that mean body mass index values reflected obesity in both groups, with no statistically significant differences observed between the study and control groups concerning height, weight, or body mass index. These findings are consistent with **Liu et al. (2022)**, who reported that the prevalence of KOA in the United States has increased alongside population aging and the growing obesity epidemic. Similarly, **Atta et al. (2022)** discovered that over two-thirds of participants in every study group were obese. Furthermore, **Dell'Isola et al. (2024)** reported a mean body mass index of twenty-eight and highlighted that the coexistence of obesity, hypertension, and diabetes was associated with greater baseline pain among patients with knee osteoarthritis.

Regarding comorbidities, the majority of study participants had diabetes mellitus and hypertension. Moreover, the prevalence of common comorbidities, including hypertension, diabetes mellitus, and kidney disease, showed no statistically significant differences between the study and control groups. **From the researcher's perspective,** these findings further support baseline equivalence between groups, indicating that participants had comparable physical status and underlying health conditions before the intervention.

These results are consistent with **Swain et al. (2020)**, who reported that the prevalence of at least one comorbidity among individuals with osteoarthritis was sixty-seven percent. Similarly, **King et al. (2021)** found that eighty-five percent of participants reported at least one comorbidity. More recently, **Moseng et al. (2024)** identified hypertension and diabetes as the most prevalent chronic conditions among patients with osteoarthritis.

Numeric Pain Rating Scale scores:

Regarding pain level, prior to the intervention, both groups reported high pain scores on the Numeric Pain Rating Scale, and there was no statistically significant difference between them. Following the intervention, pain scores decreased progressively in both groups over the three-month follow-up period. However, the study group demonstrated significantly lower pain scores than the control group at one month (median = five versus six), two months (median = two versus five), and three months (median = one versus four). **From the researchers' point of view,** these findings indicate that the nurse-led educational intervention was highly effective in reducing pain levels among study participants throughout the follow-up period.

These findings are consistent with **Tate et al. (2019)**, who reported that at twelve weeks, fifty-nine percent of participants in the radiofrequency ablation group experienced more than fifty percent pain reduction, compared with zero percent in the control group. Similarly, **De Sire et al. (2021)** observed a significant reduction in pain scores, with mean Numeric Pain Rating Scale scores decreasing to nearly half of baseline values within two weeks of treatment.

In addition, **Atta et al. (2022)** found that severe pain was reported before intervention by almost two-thirds or more of the research groups' participants and slightly more than half of the control group, followed by a statistically significant reduction after intervention. In contrast to the results of this study, **Wageck & Nunes (2021)** observed that one week after intervention; about two-thirds of the control group still had knee osteoarthritis pain.

The significant reduction in pain intensity observed among the study group of this study may be attributed not only to the analgesic effect of fluoroscopy-guided genicular nerve RFA but also to the comprehensive nurse-led educational intervention which may have reduced anxiety and enhanced confidence in managing their condition. Furthermore, education regarding post-procedural self-care as medication adherence, weight control, healthy dietary practices, adequate fluid intake, and joint protection strategies likely improved patients' ability to manage symptoms and prevent activities that increase knee stress. The therapeutic exercise training may have contributed to improved muscle support around the knee joint, reduced stiffness, and better physical function, thereby decreasing pain perception. In addition, ongoing reinforcement during follow-up visits and telephone contacts encouraged adherence to recommended exercises and lifestyle modifications, and promoted sustained self-management behaviors. Therefore, the combination of patient education, exercise training, lifestyle modification guidance, and continuous nursing support likely enhanced the overall effectiveness of RFA and contributed to the greater reduction in pain intensity observed among the study group compared with the control group.

Knee Injury and Osteoarthritis Outcome Score (KOOS):

Regarding KOOS, before implementation of the nurse-led educational intervention, both groups demonstrated low baseline functional scores, reflecting substantial pre-existing knee joint impairment. No statistically significant differences were observed between the study and control groups in any KOOS subdomain or in the mean of the total score. **From the researchers' perspective,** these findings establish a valid and unbiased baseline for evaluating the effectiveness of subsequent educational and interventional measures.

This result is supported by **Kangeswari & Arulappan (2022)**, who found that none of the participants in either the study or control groups demonstrated a very high quality of life before intervention. Furthermore, fifty-five percent of participants in the study group and fifty-seven percent in the control group exhibited low quality of life levels during the pretest assessment.

One month after implementation of the nurse-led educational intervention, highly statistically significant improvements were observed across all KOOS domains, including pain, symptoms, activities of daily living, sport and recreation, and quality of life, in favor of the study group compared with the control group. The total KOOS mean score increased markedly to forty-four point eight ± three in the study group compared with twenty-nine point ninety-eight ± four point twenty-nine in the control group. **From the researchers' perspective,** these findings indicate that nurse-led educational interventions can effectively accelerate functional recovery and reduce disability during the early post-procedural period following fluoroscopy-guided genicular nerve radiofrequency ablation.

These results are consistent with those of **Tate et al. (2019)**, who found that radiofrequency ablation was useful in treating refractory knee pain and enhancing functional outcomes in osteoarthritis patients. Similarly**, Gönüllü & Tekin (2020)** demonstrated significant improvements in knee function following intervention, as measured by the Western Ontario and McMaster Universities Osteoarthritis Index and Oxford Knee Score. Furthermore, **Nomikos et al. (2022)** reported increased patient satisfaction and enhanced confidence in self-management following educational interventions.

At two months post-intervention, the study group demonstrated continued and significant improvement across all KOOS domains compared with the control group. The total KOOS mean score increased to

sixty-seven point seven ± two point nine in the study group, compared with fifty-two point forty-eight ± four point twenty-seven in the control group. Indicating a continued positive effect of the nurse-led educational intervention on knee function, pain, symptom management, activities of daily living, sports and recreational activities and quality of life.

The researchers attribute these improvements to the comprehensive nature of the Nurse-led educational intervention, which combined disease-specific education, post-procedural self-care guidance, lifestyle modification, therapeutic exercise training, and continuous follow-up support. The researchers believe that equipping patients with the knowledge and skills necessary to actively participate in their care enhanced adherence to recommended exercises, joint protection strategies, weight-management practices, and other self-management behaviors, thereby contributing to the observed reduction in disability and improvement in functional outcomes.

De Sire et al. (2021), who highlighted the beneficial effects of combined radiofrequency and rehabilitation interventions on pain, function, and quality of life, reported significant improvements in physical function and activities of daily living across all KOOS domains, supporting our findings. Similarly, **Kangeswari and Arulappan (2022)** found that patients with knee osteoarthritis significantly improved in all quality-of-life areas after receiving nurse-led interventions.

Furthermore, sustained and progressive therapeutic improvement was observed at three months post-intervention. The study group achieved highly statistically significant improvements across all KOOS domains compared with the control group, with a total KOOS mean score of eighty-two point seven compared with sixty-one point forty-three in the control group. Suggesting that the benefits of the nurse-led educational intervention not only persisted but further increased over time, resulting in substantial improvements in pain, symptoms, functional abilities, activities of daily living, sports and recreational activities, and overall knee-related quality of life after three months.

These findings are consistent with **Kangeswari & Arulappan (2022)**, who reported significantly greater improvements in quality of life among study participants throughout posttest assessments conducted on days thirty, sixty, and ninety. Similarly, **Dong et al. (2023)** demonstrated that evidence-based nursing interventions reduced negative emotions and improved functional outcomes among patients undergoing hip arthroplasty. More recently, **Mohsen et al. (2025)** reported highly statistically significant improvements in overall quality of life following implementation of nursing guidelines.

From the researchers' perspective, the superior improvement demonstrated by the study group across all KOOS domains may be explained by the multidimensional nature of the nurse-led educational intervention, which targeted not only symptom control but also functional rehabilitation and behavioral modification. Through the illustrated educational booklet and individualized teaching sessions, patients were provided with practical guidance on maintaining joint health, performing daily activities safely, conserving energy, and avoiding movements that place excessive stress on the knee joint.

In addition to the structured exercise training, including quadriceps strengthening, quadriceps setting, and stretching exercises, may have enhanced lower limb strength, joint stability, flexibility, and overall mobility. In addition, education regarding weight management, healthy nutrition, and the appropriate use of assistive devices likely supported patients in reducing mechanical stress on the affected knee, thereby facilitating functional recovery. The regular reinforcement provided during follow-up visits and telephone contacts may have strengthened adherence to the recommended regimen and encouraged the incorporation of self-care practices into daily routines.

Collectively, these factors may have enabled patients to achieve better physical function, perform activities of daily living more effectively, and experience improvements in knee-related quality of life, which were reflected in the progressive enhancement of all KOOS domains throughout the 3 months follow-up period. This finding emphasizes the value of combining procedural interventions with structured nurse-led education to promote sustained functional outcomes in patients with KOA.

Finally, the effectiveness of the nurse-led educational intervention observed in the current study emphasizes the pivotal role of nurses within multidisciplinary osteoarthritis management programs. Nurses are uniquely positioned to provide individualized counseling, reinforce treatment recommendations, identify barriers to adherence, and offer continuous emotional and psychological support. Such interventions may contribute to improved health literacy and empower patients to actively participate in decision-making regarding their treatment, ultimately leading to better clinical outcomes and enhanced quality of life.

Conclusion:

The findings of this study demonstrated that nurse-led educational interventions significantly reduced pain

intensity, decreased disability, and improved functional outcomes among patients with knee osteoarthritis undergoing fluoroscopy-guided genicular nerve radiofrequency ablation (RFA). These findings emphasize the value of nurse-led educational interventions as an effective adjunctive strategy for optimizing patient outcomes, enhancing self-management capabilities, and maximizing the therapeutic benefits of fluoroscopy-guided genicular nerve RFA in this patient population.

Recommendations:

Recommendations for clinical practice:

- Integrate nurse-led educational interventions as a standard element of the care pathway for patients with knee osteoarthritis undergoing fluoroscopy-guided genicular nerves radio-frequency ablation.
- Ensure that patients receive individualized education tailored to their health literacy, learning needs, and functional abilities to enhance adherence to treatment recommendations.
- Strengthen interdisciplinary collaboration among nurses, pain specialists, orthopedic physicians, and physiotherapists to optimize patient care and maximize treatment outcomes.

Recommendations for Nursing Education:

- Enhance nurses' competencies in patient education, pain assessment, self-management support, and communication through continuing education programs and workshops.
- Incorporate training on the use and interpretation of standardized assessment tools, including the NPRS and KOOS, into nursing education and clinical orientation programs.
- Encourage nurses to adopt evidence-based practice by critically appraising and applying current research findings in the management of patients with knee osteoarthritis**.**

Recommendations for Future Research:

- Replicate this study with a large probability sample across multi geographical area and multiple healthcare settings to improve the generalizability of the findings.
- Conduct randomized controlled trials to further evaluate the effectiveness of nurse-led educational interventions compared with routine care.
- Investigate the long-term effects of nurse-led educational interventions beyond three months on pain, functional status, quality of life, and healthcare utilization.
- Compare different methods of delivering nursing education, such as face-to-face instruction, digital platforms, mobile applications, and telehealth, to determine the most effective educational approach.
- Examine the cost-effectiveness of incorporating nurse-led educational interventions into routine care for patients undergoing fluoroscopy-guided genicular nerves radio-frequency ablation.

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