

Impact of Instructional Guidelines on Patients' Knowledge and Anxiety Regarding Cardiac Catheterization' Complications

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Abstract

Background: Cardiac catheterization is a medical procedure that helps doctors examine the heart and its blood vessels in detail. Cardiac catheterization has several complications that embrace the following: infection, injury, and pain at the Intra Venous site (IV) or sheath insertion site, blood clots, and harming urinary organs may occur because of the distinction dye common in kidney disease and patients with Diabetes Mellitus (DM). Ensuring patient safety, and preventing harm during healthcare, is crucial, especially after this procedure. Hence, **the study aimed to** evaluate the impact of instructional guidelines on patients' knowledge and anxiety regarding cardiac catheterization' complications. **Subjects and method: Design:** A quasi-experimental research design was used with a pre-and post-test. **Setting:** the research was conducted in the Cardiac Catheterization Unit. **Subjects:** A purposive sample of all 100 patients in two groups with 50 patients who were willing to participate in the study, and patients who were admitted were included and divided into two equal groups, the experimental group who received instructional guidelines and the control group received routine care instructions. **Two tools were used:** Tool (I) An interviewing questionnaire, which included two parts: (a) Personal data; (b) knowledge assessment data, and Tool (II) Spielberger's State-Trait Anxiety Inventory. **Results:** The results of this study revealed that there were significant differences in anxiety and knowledge level among patients undergoing cardiac catheterization in the control group compared with the experimental group after the instructional guidelines implementation at ($P < .001$), besides a lower incidence of complications among patients in the experimental group than in control group. **Conclusion:** The current study concluded that instructional guidelines implementation had a significant positive effect on improving knowledge and reducing anxiety levels and complications among the studied patients undergoing cardiac catheterization in the experimental group than control group and lower incidence of vascular complications among patients in the experimental group. **Recommendations:** Patients should be provided with sufficient information about cardiac catheterization, risk factors, and complications before discharge from the hospital, Training program about complications for patients undergoing cardiac catheterization. The study should replicated on a large sample to generalize the results with replication of the current study with a larger sample.

Keywords: Anxiety, Cardiac Catheterization Complications, Instructional Guidelines, Knowledge

Introduction:

Cardiac catheterization is a useful diagnostic technique that thoroughly inspects the heart and its blood vessels (Rahman et al., 2020). A peripheral blood vessel in the femoral artery or vein or the antecubital artery or vein is used to introduce one or more catheters under X-ray guidance (Sarma and Jentzer, 2023). This method gathers data such as blood pressure, blood flow across the heart's

chambers, x-rays of the heart's ventricles or arteries, blood supply adequacy through the coronary arteries, and blood sample collection. One test that can be performed on either side of the heart is cardiac catheterization, which examines the left and right sides of the heart for different functions. Blood samples are obtained, the tricuspid and pulmonary valve functions are evaluated, and the right atrium, ventricle, and pulmonary artery pressures are

monitored while the right side of the heart is examined (**Manzi et al., 2024**).

Invasive cardiac catheterization is recommended in many different situations. It is employed in the treatment of individuals with heart conditions for both therapeutic intervention and diagnostic assessment. The following are some of the complications associated with cardiac catheterization: blood clots, infection, pain, and injury at the Intra Venous site (IV) or sheath insertion site, and damage to the urinary organs due to the dye that is common in kidney disease and patients with Diabetes Mellitus (DM) (**Ahmed, 2020**). Hemostasis, retroperitoneal hemorrhage, bleeding at the access site, pseudoaneurysms, and the development of arteriovenous fistulas are examples of vascular problems (**Graziano Eda & Bianchi, 2024**).

In patients undergoing cardiac catheterization, higher anxiety levels have been associated with worse outcomes. According to **Spielberger (2019)**, "Anxiety is a state in which a person feels apprehensive and their autonomous nervous system is activated in response to a vague and unclear threat." Excessive anxiety has been associated with negative clinical outcomes by lowering immune response and altering cardiovascular function, including vascular inflammation, endothelial dysfunction, and heart rate variability (**Renna et al., 2020**).

Anxiety can be greatly increased while waiting for the surgery. The invasive nature of the procedure and the uncertainty surrounding the diagnosis and local vascular complications, including thrombosis and embolism, hematoma/retroperitoneal bleeding, pseudoaneurysm, dissection of arteriovenous fistulas, vascular complications following transradial access, and other major complications, including death, myocardial infarction, stroke, dissection and perforation of the great vessels, atheroembolism, allergic reactions, acute renal failure, infection, radiation injury, and arrhythmias (**Balon et al., 2018**).

In addition, patients' dread of hospitalization is influenced by a variety of factors, including communication with nurses,

the nature of the illness and its risks, leaving home and family, and the hospital environment. Anxiety in patients undergoing cardiac catheterization is less focused than depression. New evidence, however, indicates that anxiety is associated with a higher risk of death and complications, independent of the severity of the illness, depression, or health practices (**Iozzia et al., 2018**).

Patient anxiety is decreased and recovery is improved by effective nurse education. 26% of cardiac patients experience weariness, and 42% experience anxiety, according to **Malek et al. (2018)**. In the meantime, **Ahmad and Ayasrah (2020)** found that 20% of patients were terrified about heart surgery. Anxiety is impacted by a fear of making surgical errors, the repercussions, and losing control of the procedure (**Ali et al., 2020**).

A skilled nurse who is aware of the problems that can arise and has the ability to identify them is needed to provide nursing care for patients having cardiac catheterization. A safe and accurate technique as well as an improvement in physical and mental health is the goal of the combination of nursing knowledge and skills used both before and after cardiac catheterization. Patients must be educated before having a cardiac catheterization; the nurse should describe the process to them (**Merrill-Washington, 2020**).

To achieve satisfactory treatment goals, nurses can employ a range of non-pharmacological techniques to reduce the anxiety of patients undergoing cardiac catheterization. Benson's relaxation techniques include the following steps: sit quietly in a comfortable position, close your eyes, deeply relax all of your muscles, starting with your feet and working your way up to your face, and breathe through your nose (**Abu Maloh, et al., 2021**). The terms diaphragmatic breathing, abdominal breathing, belly breathing, and timed respiration are other synonyms for deep breathing. The lower abdomen rises when the lungs fill with air from the nose (**Merrill-Washington, 2020**).

Using guided imagery is an effective psychological technique that improves coping mechanisms. In addition to one's entire body and emotions, imagery incorporates all of the senses. It is an attitude toward concepts, emotions, experiences, and interpretations. Heart rate, blood pressure, and breathing patterns are just a few of the physiological changes that imagery can induce. Finding hope, courage, and other inner attributes that can assist deal with a range of situations might be beneficial. This technique can be used by almost anyone. A trained professional leads patients through a guided imagery session. You can utilize relaxing music that includes or excludes natural sounds. Additionally, patients are taught to make their images and/or utilize cassettes that have already been made (De Paolis et al., 2019).

The responsibilities of a cardiac nurse include assessing and caring for patients with heart problems and those who have had cardiac catheterizations; keeping an eye out for any negative signs of a change in health; making sure that patients are transported safely; administering medication; helping with basic personal hygiene needs; controlling bleeding; and maintaining hemostasis. The patient's risk of vascular issues will be reduced as a result. Patients who had renal failure, were female, older than 70 years, and had undergone percutaneous intervention had an increased risk of vascular problems (Dumont et al., 2020).

Significance of the study:

Globally, 50% of cardiovascular deathbeds are caused by heart disorders. All causes of death: 12.8%; in Egypt, 29.4%. In 17% of emergency rooms, patients complain of chest pain. Eight to ten percent require catheterization. There is now a greater requirement for cardiac catheterization. It is a very profitable, less invasive, and safe practice. It is cutting down on hospital stays, wait times, and treatment and diagnosis lists (Mohamed et al., 2021).

Complications from cardiac catheterization operations lower patient outcomes and raise the morbidity rate. To avoid, identify, and treat these issues early on, nurses are essential. For patients undergoing

cardiac catheterization operations, vascular access difficulties may result in discomfort, an extended hospital stay, and worse outcomes. Nurses are primarily responsible for the removal of femoral sheaths and the management of associated problems following cardiac catheterization operations in various acute and critical care settings. According to Ebeed et al. (2019), nurses must thus be aware of the causes of vascular problems as well as the risk factors that predispose them.

Anxiety lowers quality of life by directly affecting the immune system and the healing process following surgery. Researchers have been interested in measuring the impact of educational interventions on patients' anxiety levels, but they have paid less attention to nurses' supportive care, effective communication, and use of anxiety and fatigue-reduction techniques in addition to education (Hernández-Avalos, et al., 2021).

Aim of the study

To evaluate the impact of instructional guidelines on patients' knowledge and anxiety regarding cardiac catheterization' complications

Research hypotheses:

H1: Patients undergoing cardiac catheterization who received instructional guidelines are expected to have an improved mean score of knowledge among the experimental group compared to the control group.

H2: Patients undergoing cardiac catheterization who received instructional guidelines are expected to have a lower mean score of anxiety among the experimental group compared to the control group.

H3: Patients undergoing cardiac catheterization who received instructional guidelines are expected to have fewer complications among the experimental group compared to the control group.

Subjects and Method:

Research design:

A quasi-experimental research design was used

in the current study, which compared the actual effectiveness of the chosen patients by randomly assigning them to one of two groups (Maciejewski, 2020).

Setting:

This study was applied in the cardiac catheterization unit at Sohag University Hospital, Egypt.

Subjects:

A purposive sample of 100 patients undergoing cardiac catheterization who were willing to participate in the study that randomly Within six months, they were split into two equal groups. Two equal groups were formed by random assignment; fifty patients received routine care and instructional guidelines in the experimental group, whereas fifty patients received routine care alone in the control group.

Data collection tools:

Two tools were developed to collect the current data; as follows:

Tool (I): An Interviewing questionnaire; It was created by researchers using information from the pertinent literature review and was separated into two sections:

Part one: It included demographic data such as age; gender, patient's education, and residence.

Part two: It included patient's knowledge about cardiac catheterization as it included questions developed by the researchers to assess patients' knowledge regarding vascular complications for patients undergoing cardiac catheterization. It consisted of 17 multiple choice questions about the definition of cardiac catheterization, types, indications, contraindications, risk of catheterization, factors to prevent complications, local complications, signs and symptoms of aneurysm, creatinine test, complications of delayed dressing removal, renal failure and dye used, vulnerable groups signs and symptoms of hematoma, patient's immobilizations after catheterizations, patients at risk for pulmonary edema, and nursing action regarding hematoma formation.

Scoring system:

For both known and unknown answers, the overall patient knowledge percentages were computed. Each full, accurate response received two marks; incomplete responses received one mark; and incorrect or unknown responses received zero marks. The forty-mark total, which represented 100%, was then divided into two categories: satisfactory and unsatisfactory. A score between 50% and 100% indicated the satisfactory level, while a score below 50% indicated the unsatisfactory level.

Tool (II) Spielberger's State Anxiety Inventory (SSAI): The Spielbergers (1983) Situational anxiety was assessed on the day of admission and the evening before surgery in both the study and control groups using Spielberger's State Anxiety Inventory. The Spielberger's State Anxiety Inventory has 20 items and a score between 20 and 80. Anxiety was considered severe if the score was between 20 and 31, mild to moderate if it was between 32 and 42, moderate to high if it was between 43 and 53, nearly severe if it was between 54 and 64, severe if it was between 65 and 75, and extremely severe if it was between 75.

Validity of the tools:

To ensure sentence clarity and content appropriateness, five expert professors—two in medical-surgical nursing, one in psychiatry, and two in the field of cardiac surgery—reviewed the instructional guideline and its tools' content validity, clarity, comprehensiveness, appropriateness, and relevance. According to the panel's ruling, no changes were made.

Reliability of the tools:

The reliability of the SSAI tool was 0.93 using Cronbach's α , whereas the reliability of the knowledge-related questions was 0.87 using Cronbach's α test.

Pilot study:

Before beginning the actual data collection, 10% of the study subjects (10 patients) completed a pilot study to assess the study tools' efficacy, clarity, and techniques as well

as the study sample's availability. Students who took part in the pilot study were added to the study sample.

Ethical considerations:

The Faculty of Nursing's research ethics committee provided written first permission. Following a thorough explanation of the study's objectives and data collection methodology, the Faculty of Nursing granted official authorization to conduct the study. The head nurse of the cardiac catheterization unit, the hospital manager, and the executive of Sohag University Hospital all formally gave their consent to the researchers. Patients gave their oral agreement to participate in the trial, and participants were made aware that their involvement was completely optional and that they might leave at any moment without providing a reason. They were informed of the study's goal and given the assurance that any information they provided would be kept private and utilized exclusively for that reason.

Fieldwork:

Data collection began in early September 2023 and ended at the end of February 2024, a period of six months. 50 patients in the experimental group received routine care and instructional guidelines, whereas 50 patients in the control group received simply routine care. They were randomly assigned into two equal groups and split into two experimental and control groups. For data collection, researchers visited the aforementioned location two days a week, from 9 a.m. to 12 p.m. Before the intervention, Spielberger's State Anxiety Inventory and the interview questionnaire were completed.

Group discussions, models, and illustrations were among the teaching strategies used. Depending on the patient's comfort level and comprehension level, the researchers spent approximately an hour interviewing each patient in the experimental group. They introduced themselves, explained the purpose of the study, and got their oral consent before gathering information from the patients on their demographics, knowledge, and Spielberger's State Anxiety Inventory.

The researcher administered the intervention to the intervention group for at least one day

because the patients were admitted to the hospital one day before the procedure. Instructional recommendations for the first day comprised (1) establishing communication between the patients and the researcher nurse; and (2) providing an overview of the process, including information on vascular problems for patients undergoing cardiac catheterization. The 17 multiple-choice questions covered the following topics: what cardiac catheterization is; what kinds of catheterizations are available; indications and contraindications; risk of catheterization; factors to prevent complications; local complications; aneurysm signs and symptoms; creatinine test; complications of delayed dressing removal; renal failure and dye used; signs and symptoms of hematomas in vulnerable groups; and patient immobilizations following catheterizations.

(3) encouraging the patient to talk about anxiety and its causes, and clearing up patients' misconceptions; (4) introducing Benson's relaxation, deep breathing, guided imagery, prayer repetition, and practicing preferred anxiety management techniques (to ensure the patient appropriately learned them); and (5) nursing action regarding hematoma formation and patients at risk for pulmonary edema.

The researchers, who were sufficiently knowledgeable about anxiety management, instructed the experimental group to perform the relaxation technique twice a day for ten minutes each time. During the first session, when the subjects were being reviewed, the patients were encouraged to share any problems that were bothering them, and the researcher responded to their inquiries. The patients then exercised the chosen anxiety control technique.

Each intervention session lasted roughly 45 to 60 minutes, with the length of time being modified according to the patient's needs. Both the experimental and control groups received standard medical treatment, which included medication and patient hemodynamic status monitoring. Patients in both groups experienced anxiety on the day of surgery and filled out SSAI the night before.

- Each of the four sessions—two for the theoretical portion and two for the practical portion—separated the subjects into six groups, with ten patients in each group. Each session

lasted roughly twenty to thirty minutes. Each one took a total of two hours.

Each patient in the control group was interviewed by the researchers one-on-one for approximately half an hour. They introduced themselves, explained the purpose of the study, and got their oral consent before gathering information from the patients about their demographics, Spielberger's State Anxiety Inventory, and knowledge without any kind of training.

Statistical analysis:

The data was coded and converted into a format specifically made for computer feeding. Every entered piece of data was checked for mistakes. Version 20 of the statistical package for social sciences (SPSS) was used to evaluate the data, which were then displayed in tables and graphs. ANOVA with repeated measurements, chi-square analysis, independent sample t-test, and mean and standard deviation calculations were all carried out. Significance was assessed using the P-value at 0.05, with a P-value > 0.05 being considered statistically insignificant. P-values < 0.05 are considered statistically significant, whereas those ≤ 0.001 are considered extremely significant.

Results:

According to **Table 1**, seventy percent of the patients in the experimental group and seventy-four percent of the patients in the control group were between the ages of forty and sixty. 54% of the experimental group was made up of men, compared to 52% in the control group. Regarding education, 74% of patients in the experimental group lived in an urban area, compared to 72% in the control group, and 54% of patients in the experimental group had completed secondary school, compared to 60% in the control group.

Figure 1: Shows that most patients (80%) in the study said that doctors were the primary source of their information on cardiac catheterization.

Table (2) shows that, in comparison to the control group, the experimental group's patients had a higher percentage of satisfactory knowledge about cardiac catheterization across all post-instructional guidelines, and that the difference between the two groups' patient knowledge was highly statistically significant ($P=0.001$).

Table 3: Before the instructional guidelines, the experimental and control groups' total knowledge level scores differed statistically significantly ($P > 0.05$).

Table (4) demonstrates that the mean anxiety score following the instructional guidelines differed significantly between the experimental and control groups. This difference showed that following the implementation of the instructional guidelines, the experimental group experienced less anxiety.

Figure (2): After following the instructional directions, the experimental and control groups' overall anxiety levels significantly improved. This difference showed that the experimental group's anxiety level had decreased after the implementation of the instructional guidelines. 60 percent of the patients in the study had extremely high anxiety levels before the implementation of the guidelines, but this level dropped to zero after the guidelines.

Table 5 shows that the incidence of hematoma, ecchymosis, and oozing was significantly different in the two groups after the instructional guidelines ($p= < 0.001^{**}$).

Table (1): Distribution of studied patients in both groups regarding their personal data (n=100)

Item	Experimental group (50)		Control group (50)		X ² (P)
	No.	%	No	%	
Age in years					
21 ≤ 40 years	15	30	13	26	0.514 (0.642)
40 ≤ 60 years	35	70	37	74	
Gender					
Male	27	54	28	52	0.613 (0.745)
Female	23	46	22	48	
Educational level					
Read and write	8	16.0	2	8	0.743 (0.843)
Secondary	27	54.0	30	60	
Higher	15	30.0	16	32	
Residence					
- Rural	13	26	14	28	0.713 (0.933)
- Urban	37	74	36	72	

P>0.05, no statistically significant difference

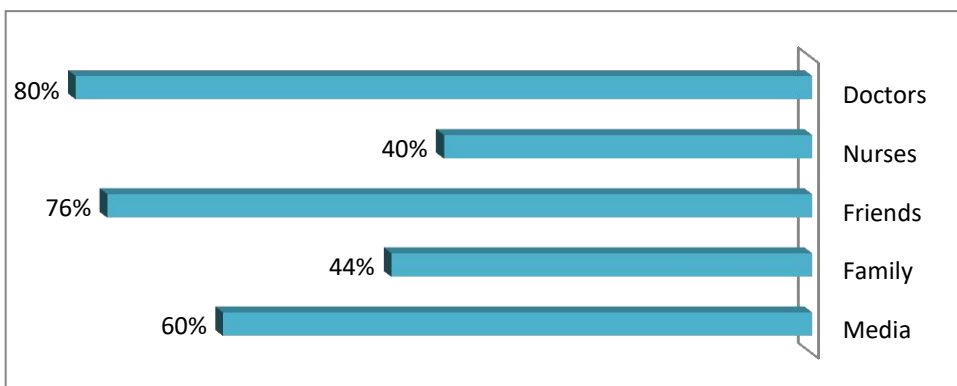


Figure (1): Source of knowledge regarding cardiac catheterization among the studied patients.

Table (2): Comparison of pre-and post-instructional guidelines median knowledge in the experimental group and control group among studied patients undergoing cardiac catheterization

Items of knowledge	No = (100)		Z	P-value
	Experimental group (50) (N/%)	Control group (50) (N/%)		
Meaning of cardiac catheterization	42 (84)	12 (24)	94.22	<0.001*
Types	43 (86)	15 (30)	88.13	<0.001*
Indications for cardiac catheterization	45 (90)	17 (34)	98.33	<0.001*
Contraindications	38 (76)	12 (24)	78.23	<0.001*
Factors to prevent complications	44(88)	17 (34)	68.33	<0.001*
Complications of cardiac catheterization	48 (96)	18 (36)	76.44	<0.001*
Risk of catheterization	43(86)	16 (32)	58.44	<0.001*
Post-care of catheterization	48 (96)	15 (30)	56.34	<0.001*
Questions related to cardiac catheterization	47 (94)	19 (38)	66.52	<0.001*
Follow-up and home care	44(88)	18 (36)	73.47	<0.001*

*Highly significance at 0.001 levels

Table (3): Total knowledge level of the studied patients undergoing cardiac catheterization in experimental and control groups pre and post-instructional guidelines

Total knowledge	Experimental group (50)		Control group (50)		T	P-value
	No	%	No	%		
Satisfactory	47	94	12	24	5.043	<0.001*
Unsatisfactory	3	6	38	76		

P<0.001, a very highly statistically significant difference

Table (4): Differences in Mean Anxiety Score in the Experimental and Control Groups

Total knowledge	Experimental group (50)	Control group (50)	T-test	P-value
Pre- instructional guidelines	67.64± 2.44	66.78± 4.42	0.69	0.789 NS
Post- instructional guidelines	36.42± 3.07	69.22± 3.45	15.78	<0.001*

P>0.05, no statistically significant difference

P<0.001, a very highly statistically significant difference

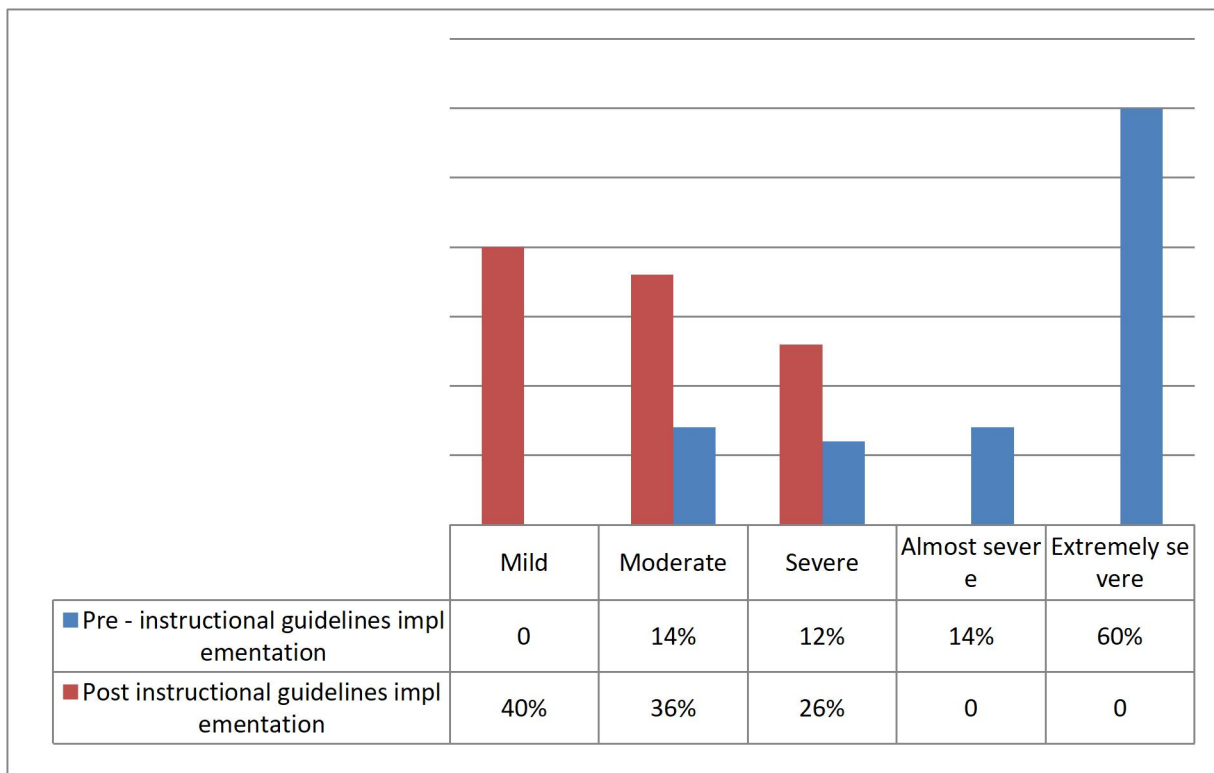


Figure (2): Total Anxiety level of the studied patients undergoing cardiac catheterization in experimental and control groups pre and post-instructional guidelines

Table (5): Difference between both (control & experimental) groups according to incidence of vascular complications (hematoma) post instructional guidelines

Clinical data	Control group (n=50)		Experimental group (n=50)		chi-square p-value
	(No.)	%	(No.)	%	
Hematoma					
No hematoma	8	16	20	40	16.43 < 0.001**
Small hematoma	15	30	14	28	
Medium hematoma	18	36	12	24	
Large hematoma	9	18	4	8	
Ecchymosis					
No Ecchymosis	14	28	25	50	20.55 < 0.001**
Small Ecchymosis	13	26	12	28	
Medium Ecchymosis	11	22	9	18	
Large Ecchymosis	12	24	2	4	
Oozing					
No Oozing	15	30	28	56	10.66 0.005*
Small Oozing	23	46	13	26	
Medium Oozing	12	24	7	14	
Large Oozing	0	0.0	0	0.0	

(n.s) Not Significant ** = highly statistically significant at ≤ 0.01

Discussion:

Following cardiac catheterization operations, one of the most frequent issues observed is local difficulties at the sheath introduction site. Bleeding is brought on by a transverse vein or artery perforation that delays hospitalization and necessitates a transfusion. An accumulation of blood in the soft tissue of the lower abdomen or upper thigh is called a hematoma (Chanudet et al., 2019).

According to the study's findings, fewer than three-quarters of the patients in the experimental and control groups, respectively, were between the ages of 40 and 60. According to Ahmed (2019), almost two-thirds of the patients in the study were male, and the bulk of them were between the ages of 40 and 50. In line with Ebeed et al. (2019), who at the National Institute of Heart in Embaba, Cairo, reported in their thesis titled "Vascular complications and risk factors undergoing cardiac catheterization" that the majority of the patients in the study were between the ages of 50 and 59, with a mean age of 53.22 ± 8.9 years, and that over half of them were men and less than half of them were illiterate.

According to the current study, there were no statistically significant variations in the characteristics of the intervention and control groups, indicating that the characteristics of the study participants were homogeneous. Similar findings were made by Hassan et al. (2019), who used a locally designed Assiut Femoral Compression Device (AFCD2) to compare the safety and feasibility of early sheath removal following percutaneous coronary intervention (PCI) with manual compression (MC). The study sample was composed of 37% males and 38% females, with a mean age of 57 ± 9 and 56 ± 10 years, respectively. Age-related changes in the heart and blood arteries, such as a reduction in elasticity and the capacity to react to variations in compliance, may be connected to this of the arterial system that increases the work needed to drive the blood to various organs of the body due to resultant increase in the resistance to the pumping action of the heart.

Moreover, the majority of patients were men. The increased exposure to stress in life and smoking are the causes of this. Additionally, Elsaid et al. (2019), who examined the effects of early ambulation three versus five hours after a transfemoral diagnostic cardiac catheterization, found that more than half of their patients were male. This suggests that

female hormones protect women against coronary artery disease (CAD). It was in contrast to **Galiuto (2019)**, who found that cardiac catheterization for coronary vascular disease (CVD) happens similarly in men and women, particularly after menopause, because estrogen deficiency causes several structural and functional changes in the cardiovascular system that raise the risk of cardiovascular disease.

The current study's findings showed that most of the patients investigated said that doctors were the primary source of their information about cardiac catheterization. From the perspective of the researchers, it verified that the patients under study obtained information from the appropriate source.

According to the study's findings, there was a highly statistically significant difference between the experimental and control groups' patient knowledge of cardiac catheterization, with the experimental group having the highest percentage of patients who understood all post-instructional guidelines. This is a reflection of the impact of educational guidelines on patients' knowledge, according to the researchers. This validates the patients' demand for instructional guidelines that improve their knowledge about cardiac catheterization.

According to the current study's findings, the experimental and control groups' overall knowledge level scores before and after the instructional guidelines differed statistically significantly. The present study's findings demonstrated that the experimental group's knowledge of the patients under investigation was significantly different from that of the control group and that this difference was positive. According to the researchers, this outcome shows the benefits of instructional guidelines that satisfy patients' demands and give them enough information to lessen their fear. This improvement focuses on the fact that the majority of patients are very interested in learning more about their ailments.

The results of the study found that there was a highly significant difference between the two groups after the intervention, which supported hypothesis one. This finding reflected the researcher's role as a nursing educator, which

acts as a continuous reference, and the possibility that practice changes as a result of the intervention. **Shaban et al.'s (2019)** study they found that all participants' knowledge scores improved after the educational program was put into place.

The current study's findings demonstrated that, regarding the mean anxiety score following the instructional guidelines, there was a highly statistically significant difference between the experimental and control groups. This difference showed that the experimental group experienced less anxiety following the application of the instructional principles. These findings were corroborated by the current study's objectives and hypotheses. The success of the execution of the instructional principles, which reduced anxiety, was mirrored in the researchers' point of view. It is in line with a semi-experimental one-group study that **Rincy et al. (2019)** carried out to determine the impact of instruction on patients' anxiety and knowledge levels before cardiac catheterization. Results indicated that there was a strong correlation between the sample group's anxiety and knowledge level before and knowledge level of the sample group before and after teaching ($P < 0.001$) and also found that reduction of anxiety is related to patients' high knowledge level.

According to **Ferreira et al. (2020)**, education has been shown to decrease psychological issues like anxiety, and patients who got the required training before cardiac catheterization exhibited noticeably fewer psychological issues (**Molazem et al., 2022**). According to a study by Jamshidi et al. (2019), the main outcome of the adoption of educational programs was a decrease in psychological issues including anxiety. Additionally, the findings of this study align with the findings of **Buzatto & Zanei's (2020)** research, which demonstrated the significant impact of training programs in lowering anxiety in patients having invasive cardiac catheterization. The study found that patients in the intervention group experienced much less anxiety than those in the control group experience. The finding is in agreement with the results presented by **Dogan et al., (2022)** which indicated that the use of patient-centered

educational interventions can reduce their anxiety.

The findings of this study are consistent with research by **Aboalzim (2019)** on the amount of information given to patients undergoing such evasive screening procedures, which revealed that patients' anxiety levels are raised by a lack of education and information regarding cardiac catheterization. In conclusion, another study by **Garvin et al. (2023)** used two patient groups: an intervention group and a control group. During the coronary angiography, the informed group, the intervention group, recorded lower anxiety rates than the control group.

According to the current study's findings, the experimental and control groups' overall anxiety levels significantly improved after following the instructional guidelines. This difference showed that the experimental group had a lower level of anxiety after the implementation of the instructional guidelines. Before the implementation of the guidelines, three-fifths of the patients under study had extremely high levels of anxiety, but after the interventions, their levels dropped to zero.

According to the researchers, it demonstrated how well the post-instructional instructions were implemented in lowering anxiety. These attest to the notable changes in patients' anxiety levels that mirrored the primary objectives of the application of the instructional instructions. Similar findings were obtained by **Zakerimoghadam et al. (2018)**, the results showed that the experimental and control groups differed statistically significantly ($P < .001$).

According to **Navvabi et al. (2019)**, who looked at how education affected the anxiety levels of patients who had coronary artery bypass grafts in Shiraz, the experimental group's anxiety levels decreased following the intervention, which supports these findings. Additionally, **Guo et al. (2018)** investigated how a preoperative educational intervention increased recovery and decreased anxiety in heart patients. They found a substantial difference between the experimental and control groups, which is in line with the results of the current study.

Preoperative training can help patients feel less worried when combined with other preoperative treatments, according to this study by **Varaei et al. (2019)** explored the impact of an orientation tour combined with an angiography procedure on the anxiety and satisfaction of individuals undergoing coronary angiography.

This result was therefore consistent with this investigation. In contrast, **Asilioglu and Celik (2019)** found conflicting results in their study which revealed that following training, the experimental group's anxiety level did not differ significantly from the control group's.

The results of this investigation showed that, after receiving instructional guidelines, the incidence of hematoma, ecchymosis, and oozing varied significantly between the two groups. This can be explained by the fact that nurses' satisfactory practice and thorough understanding of post-cardiac difficulties contribute to the low incidence of complications in cardiac patients following cardiac catheterization. According to **Rezaei-Adaryani et al., (2019)** and **Balon et al. (2019)**, which found that patients who had sheath removal using a compressor or bandage pressure had a lower level of hematoma at the end of the assessment period. The experimental group produced no significant increase in the amount of bleeding and hematoma when compared with the control group ($P > 0.05$).

Similar to this, **Hamel (2022)** found that the study group's hematoma grew right after the sheath was removed and reduced 12 hours after the evaluation time. The incidence of hematoma was lower in patients assigned to the intervention group than in those in the control group, according to **Schupke et al. (2024)** and **Larson et al. (2024)**, who also added in their study about immediate mobilization after coronary angiography or percutaneous coronary intervention following hemostasis with angiose vascular closure device that no significant bleeding complications were seen between the groups with baseline characteristics not differing between the groups.

Additionally, Vati et al. (2019) noted in their study on the Effect of Low Fowler's Position on Back Pain and Vascular Complications after Trans-Femoral Cardiac Catheterization that patients in the control group (supine position) experienced a significant increase in ecchymosis when the dressing was removed from the puncture site 12 hours after catheterization, compared to patients in the experimental group (low fowler position) ($p < 0.02$).

These results are consistent with those of Mohammady et al. (2024), who found that their intervention increased comfort and satisfaction levels throughout the intervention group without increasing the quantity of bleeding or seeping following sheath removal. These current study results, however, conflict with those of Jones (2022), who found no scientific difference in bleeding from the femoral puncture site following femoral sheath removal between the study and control groups.

Conclusion:

Based on the results and hypotheses of the present study, the study findings concluded that the results support the research hypothesis in that instructional guidelines implementation had a significant positive effect on improving knowledge and reducing anxiety levels and complications among the studied patients undergoing cardiac catheterization in the experimental group than the control group and lower incidence of vascular complications among patients in the experimental group.

Recommendations:

Based on the current study results, the following recommendations are proposed:

- Sufficient information about cardiac catheterization and complications should be provided to patients before discharge from the hospital.
- Training program about complications for patients undergoing cardiac catheterization.
- The study should replicate on a large sample to generalize the results with

replication of the current study with a larger sample.

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