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An assessment of cardiac nurses' knowledge and practices regarding patient safety after cardiac catheterization

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ABSTRACT

Cardiac catheterization is a medical procedure that helps doctors examine the heart and its blood vessels in detail. It involves inserting catheters (thin tubes) into a blood vessel in the arm or leg and guiding them to the heart with the help of X-ray images. This process allows for the collection of data on blood flow, pressure, and oxygen levels in the heart, as well as taking samples and imaging the heart's arteries and chambers. Ensuring patient safety, which means preventing harm during healthcare, is crucial, especially after this procedure. The team performing cardiac catheterization must prioritize safety and quality care to avoid complications. This study, the first of its kind in the Northern Region of Saudi Arabia, aims to evaluate the knowledge and practices of cardiac nurses regarding patient safety after cardiac catheterization. It employs a descriptive, correlational, cross-sectional design and analyzes data using frequency and percentages. Conducted from July to September 2023 at a Cardiac Center in Hail, Saudi Arabia, it involves nurses with varying levels of education and experience in cardiac care. The research tools include a questionnaire on potential complications post-catheterization and an observation tool for nursing care. The findings indicate that experience affects knowledge levels, with nurses having over five years of experience showing higher knowledge. The study also finds that most nurses have moderate to adequate knowledge about patient safety post-catheterization, but there's room for improvement. Compared to similar studies, this research underscores the importance of experienced nursing care in preventing complications. It suggests the need for enhanced training and education focusing on care after cardiac catheterization to improve patient outcomes.

1. Introduction

Cardiac catheterization is a helpful diagnostic procedure that examines the heart and its blood arteries in extensive detail (Rahman et al., 2020). With X-ray guidance, one or more catheters are introduced through a peripheral blood vessel in the antecubital artery or vein or femoral artery or vein (Sarma and Jentzer, 2023). This technique collects information such as blood supply adequacy through the coronary arteries, blood pressure, blood flow across the chambers of the heart, blood sample collection, and x-rays of the heart's ventricles or arteries. Cardiac catheterization is a test that can be done on either side of the heart and looks for various functions on the left and right sides. The right atrium, ventricle, and pulmonary artery pressures are measured, blood samples are taken, and the tricuspid and pulmonary valve functions are assessed while examining the right side of the heart (Manzi et al., 2024; Callan and Clark, 2016). A catheter inserted through an artery is used to examine the left ventricle, mitral and aortic valve function, and coronary artery blood flow during a left-sided cardiac catheterization. A number of issues might arise from delayed or insufficient care or from patient transfers following cardiac catheterization. Patient safety is defined as the absence of

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unintentional injury as a result of a healthcare encounter. It is the cardiac catheterization team's job to make that commitment to each patient and to one another. A well-functioning unit with a safety culture, proven clinical quality outcomes and high internal/external customer satisfaction scores can avoid the hazards associated with a less reliable unit (Cahill et al., 2015).

Patient safety in reducing complications is widely acknowledged as critical in coronary care unit (CCU) practice. Individuals have the right to safe and effective health care. A CCU is a nursing specialty that works with patients who have various cardiac diseases such as acute coronary syndrome, myocardial infarction, rheumatic heart disease, various arrhythmias, and patients who have had various cardiac interventional procedures such as coronary angiogram, percutaneous transluminal coronary angioplasty, permanent pacemaker implantation, balloon valvotomy, and so on. A cardiac nurse's duties include evaluating and tending to patients with heart issues and those who have had cardiac catheterizations; monitoring patients for any unfavorable indicators of a change in health; ensuring safe transportation; giving medication; assisting with basic personal hygiene requirements; controlling bleeding; and maintaining hemostasis. This will lessen the patient's risk of developing vascular problems. Increased risk for vascular complications was found in patients who were older than 70 years, were female, had renal failure, and underwent percutaneous intervention (Dumont et al., 2006). The data collected from the Cardiac Center at Hail reveals that 1044 cardiac catheterization procedures were done from January to September 2023. Out of this, only 22.983% are done as emergency procedures, while others are done electively. The various interventional procedures done are coronary angiography, percutaneous coronary intervention (PCI), primary percutaneous coronary intervention (PPCI), Temporary pacemaker, Permanent pacemaker insertion, implantable cardioverter-defibrillator (ICD), cardiac resynchronization therapy with defibrillator (CRTD), leadless pacemaker (micra), thrombosuction, electrophysiological study (EPS), and transcatheter aortic valve implantation (TAVI).

Minor infections, bleeding, irregular heartbeats, and reactions to drugs or dye are common complications. There is also a chance that more significant but uncommon issues will arise during the surgery. Heart or lung difficulties, stroke, heart attack, or renal failure are examples of significant cardiac catheterization consequences. In order to reduce the formation of hematomas, the factors that have been discovered to enhance the risk of haematoma development might serve as backdrop for modifications in procedure and raise the emphasis on patients at elevated risk (Andersen et al., 2005). Cardiac nurses are in charge of ensuring patient safety and reducing vascular problems throughout cardiac catheterization procedures. They must be aware of the requirements for patient safety. Each nurse should be knowledgeable about high-risk patients and safe techniques for managing and maintaining homeostasis.

Based on the investigator's experience in the cardiac ward and CCU at the Cardiac Center in Hail, Saudi Arabia, some recently hired staff members in both departments are not as knowledgeable about safe procedures. Therefore, the researcher intended to carry out a study to evaluate cardiac nurses' understanding of safety protocols following cardiac catheterization procedures.

2. Literature survey

The relevant literature review for the study is covered in the following sections: Study on the nursing practices and care given to patients who have had cardiac catheterization, Evaluation of cardiac nurses' performance, and Studies on the detection and management of complications throughout cardiac catheterization.

2.1. Nursing practices and care given to patients with cardiac catheterization

Juran et al. (1999) conducted a study on the nursing interventions to decrease bleeding at the femoral access site after PCI. The goal of the research is to establish a baseline of care to reduce bleeding complications and assess the association between nursing interventions and complications at the arterial access site in PCI patients. A descriptive, correlational study involving 4010 patients examined the nursing care interventions given following cardiac procedures.

Nursing interventions and their influence on bleeding at the access site after percutaneous coronary procedures were evaluated using regression approaches based on observed standards of care. Several significant connections were discovered between nurse interventions and moderate to severe bleeding at the access site. Early removal of the arterial sheath, the type of pressure mechanism utilized to establish arterial hemostasis, personnel allocation, and the person and method used to remove the sheath were the most important factors in reducing problems at the access site.

The majority of nursing interventions designed to reduce bleeding at the vascular access site result in an increase in nursing workload; nevertheless, they do not have a meaningful impact on groin hemorrhage. The significance of ongoing clinical research investigations in validating nursing practice based on patient outcomes is highlighted by these results.

Rolley et al. (2010) developed a study on nursing care practices following a PCI. The authors provide an overview of the priorities and practice requirements for cardiovascular nurses in Australia and New Zealand. A comprehensive assessment of the literature and current clinical guidelines served as a basis for developing the survey's items. Using a secure online data collecting technique, a 116-item

web-based survey was distributed to cardiovascular nurses via email lists of professional cardiovascular nursing organizations. Information was gathered between March 2008 and March 2009. A total of 148 people took the survey, with 110 (74.3%) completing all of the questions. All responders were registered nurses with an average of 12.3 years of clinical experience in the cardiovascular context (SD 7.61). A variety of practice patterns were seen in terms of ambulation time after PCI, sheath removal procedures, pain management, and patient positioning. Respondents consistently evaluated psychological care as a higher power priority than other activities, and they also highlighted a knowledge gap in this area. The survey revealed a wide range of practice habits and educational needs.

Nasser et al. (1995) studied peripheral vascular problems after interventional procedures. According to the researchers, the most common peripheral vascular problems are hematomas, pseudoaneurysms, arteriovenous fistulae, acute arterial occlusions, cholesterol emboli, and infections, which occur at a rate of 1.5-9%. Advanced age, repeat percutaneous transluminal coronary angioplasty, female gender, and peripheral vascular disease are major predictors of such problems following coronary interventional treatments. Minor factors include anticoagulation level, use of thrombolytic medicines, raised creatinine levels, poor platelet counts, longer anticoagulation periods, and use of larger sheath size. Treatment options for arteriovenous fistulae and pseudoaneurysms that involve ultrasound guidance for compression repair are also covered, along with more recent techniques such as hemostatic puncture closure devices. According to the study's findings, anticipating and identifying potential peripheral vascular complications early on and paying close attention to the ideal activated clotting time for sheath removal after coronary interventional procedures may result in fewer vascular complications and shorter, less expensive hospital stays.

Best et al. (2010) conducted a prospective study of early ambulation 90 minutes post-left heart catheterization using a retrospective comparison group. The investigators studied a prospective non-concurrent design with a retrospective control. Using a retrospective control, the researchers used a prospective non-concurrent design for their research. For a duration of six months, the control group (n=402) following the conventional three- to four-hour ambulation regimen had retrospective data from the APPROACH database and chart reviews examined. For a period of six months, the experimental group (n=193) underwent prospective data collection. The findings indicated that early ambulation at 90 minutes for specific patients is safe and may improve patient comfort and care quality.

2.2. Cardiac nurses' performance

Yan et al. (2011) conducted a study on continuous quality improvement of nursing care. The authors looked into the effects of management involvement in the process of updating the operating procedures for the cardiac catheterization clinical pathway. The cardiac catheterization clinical pathway was revised by recruiting study participants who were BNHI-qualified cases for Tw-DRGs 125 payment principles. In terms of mean medical care costs, patient volumes, healthcare quality, length of hospital stay, and financial risk, researchers compared pre- and postrevision numbers. Precardiac catheterization nursing care completion rates, mean durations of stay, number of diagnoses, number of surgical treatments, and number of complications or co-morbidities all showed significant variations. Following the adoption of the change, medical utilization was likewise significantly reduced ($p<.05$).

Schiks et al. (2007) studied the performance evaluation of arterial femoral sheath removal by registered nurses after PCI. The authors set out to determine if the performance of nurses in 1999 and 2005 adhered to the arterial sheath removal technique. They also compared the two measurements to look for variations in performance over time. During the removal of sheaths from elective, simple PCI patients, they observed and educated registered nurses in the process. They created and utilized a list consisting of 65 items and ten elements. The findings demonstrated that the norm of more than 90% for the total score was not met in 1999 (n=43 observations with 13 nurses) or in 2005 (n=42 observations with 16 nurses): they discovered 82% and 80%, respectively.

Sangkachand et al. (2011) conducted research on the attitudes, practices, and quality of patient care of nurses in relation to continuous ST segment monitoring. In a cardiac intensive care unit, the researchers studied 202 patients suffering from acute coronary syndrome and 61 nurses. We collected baseline data regarding the usage of ischemia monitoring by nurses, as well as their attitudes toward its quality. After that, instruction was given, and all monitors had the ST-Map program installed. Four months later, follow-up data were collected. Before ST Map, 13% of nurses had ever used ischemia monitoring; subsequently, 90% had ($P<.001$). Inadequate knowledge was the most common reason for not employing ischemia monitoring before the ST Map (62%). Knowing when a patient has ischemia was the most prevalent reason for liking ischemia monitoring following ST Map (80%). The time it took to obtain a 12-lead electrocardiogram in response to symptoms or ST-segment changes was 5 to 15 minutes before the ST Map and always less than 5 minutes subsequently (P.001). The time it took to return to the catheterization laboratory before and after the ST Map was the same. The study concluded that ST Map was related to increased utilization of ischemia monitoring, improved nurse attitudes toward ischemia monitoring, and a quicker time to get 12-lead electrocardiograms.

2.3. Detection and management of complications throughout cardiac catheterization

Dumont et al. (2006) conducted a study on predictors of vascular complications post-diagnostic cardiac catheterization and PCIs. The researchers provide the results of a retrospective, descriptive, and correlational analysis involving 11,119 patients who received femoral artery access cardiac catheterization and/or percutaneous intervention between 2001 and 2003. The study indicated that patients with renal failure, venous sheaths, age more than 70, female gender, and percutaneous intervention had a higher risk of vascular problems.

Using a retrospective comparison group, Best et al. (2010) carried out a prospective study on early ambulation 90 minutes after left cardiac catheterization. In contrast to the present practice of ambulating patients three to four hours after LHC sheath removal, the investigators hope to ascertain the safety of ambulating patients ninety minutes after sheath removal. With a retrospective control, the study used a prospective non-concurrent design. Six months of retrospective data from the APPROACH database and chart reviews were examined for the control group (n=402) following the conventional three-to-four-hour ambulation regimen. For a period of six months, the experimental group (n=193) underwent prospective data collection. According to the study's findings, it is safe for some patients to begin walking around 90 minutes early.

Duffin et al. (2001) conducted a study on femoral arterial puncture management after percutaneous coronary procedures: a comparison of clinical outcomes and patient satisfaction between manual compression and two different vascular closure devices. The researchers evaluated the safety, efficacy, and patient preferences of Perclose and Angio-Seal, two devices, in comparison to traditional MC, for 1,500 patients undergoing percutaneous coronary procedures, prospective demographic, peri-procedural, and late follow-up data were gathered from patients undergoing femoral artery closure by MC (n=469), Perclose (n=492), or Angio-Seal (n=539). The following were the peri-procedural, post-procedural, and post-hospitalization endpoints: 1) patient satisfaction, 2) closure method efficacy, and 3) safety of closure method. Individuals receiving Angio-Seal treatment saw faster times to hemostasis ($p<0.0001$, interventional and diagnostic) and ambulation (diagnostic, $p=0.05$; interventional, $p<0.0001$) than those treated with Perclose. Access site problems were higher in those treated with Perclose (Perclose vs. Angio-Seal, $p=0.008$; Perclose vs. MC, $p=0.06$). Greater overall satisfaction, improved wound healing, and less discomfort were reported by Angio-Seal patients (each vs. Perclose or vs. MC, all $p<or=0.0001$). Angio-Seal was found to lower the median post-procedural duration of stay for diagnostic catheter only ($p<0.0001$ for Angio-Seal vs. MC; $p=0.009$ for Angio-Seal vs. Perclose). The investigation found that there was no variation in the duration of stay for interventional cases.

Filis et al. (2007) conducted a study on the management of early and late detected vascular complications following femoral arterial puncture for cardiac catheterization. The researchers assessed when and if conservative, urgent, or elective surgical treatment was suitable. Among 10,450 cardiac diagnostic or therapeutic catheterizations, 45 consecutive iatrogenic vascular trauma patients were studied retrospectively. Patients' demographics, catheterization type, time from catheterization to initial diagnosis, complication type (thrombosis, infection, bleeding, pseudoaneurysm, etc.), time from complication presentation to definite treatment, diagnostic imaging and decision making, surgical or conservative management, length of stay, and clinical outcome were determined and analyzed. The researchers found and treated 18 pseudoaneurysms, six bleedings, nine hematomas, five deep vein thromboses, three arteriovenous fistulas, two arterial embolisms, and two arterial thromboses as well as 30 early and 15 late (after the patient's discharge) arterial problems. Thirty-one patients were treated conservatively, eight had emergency surgical repair, and three had elective surgical repair. The study revealed that bleeding and acute limb ischemia were the most common reasons for emergency surgical therapy, while the majority of pseudoaneurysms, fistulas, and vein thrombosis were effectively managed conservatively.

3. Methods

This study used a descriptive, correlational, cross-sectional design and employed a convenience sampling method. It aimed to evaluate the knowledge of nurses regarding patient safety following cardiac catheterization in specific settings. Data collection involved a standardized tool divided into two parts: the first part gathered demographic and work-related information, along with questions related to complications after cardiac catheterization; the second part examined the practices of nurses in the CCU and Cardiac Ward post-cardiac catheterization. The research was conducted at the Cardiac Center in Hail, Saudi Arabia.

Participants included all nurses from the CCU and cardiac ward at the Cardiac Center in Hail who directly cared for patients after cardiac catheterization and were willing to participate. Nurses who did not work in these specific areas or handle post-catheterization patients and those whom the research team believed could affect the study's outcomes were excluded from the study.

3.1. Study instruments

A standardized, self-prepared questionnaire and observation instrument were created to evaluate the skills and knowledge of cardiac nurses employed in the CCU and cardiac ward. Ten pre-prepared

questions cover a variety of topics, including blood tests, physical activity, post-catheterization care, and preventing problems following cardiac catheterization. An observational tool was created to evaluate the practice. The questionnaire used in this investigation was subjected to content validation.

3.2. Data collection procedure

The study was conducted in the cardiac center's CCU and cardiac ward in Hail, Saudi Arabia, and involved 30 cardiac nurses and 30 patients. The research methodology included a survey using a questionnaire to assess the cardiac nurses' knowledge regarding issues that may arise during cardiac catheterization. This questionnaire consisted of ten questions and was complemented by 30 observational studies of selected samples.

Official approval for data collection was obtained from the Nursing Director of the Cardiac Center in Hail, Saudi Arabia. A preliminary meeting with the nursing administrative staff was held to discuss the study's objectives and ensure alignment and support.

The research instruments were validated and tested for reliability before being reproduced and distributed to the participants. Convenience sampling was used to select participants, and the researchers provided clarifications on any unclear questionnaire items. Questionnaires were collected immediately after completion by the emergency department nurses.

Upon collection, all questionnaires were edited and coded. Subsequently, the collected data were analyzed using suitable statistical methods to draw conclusions from the study.

3.3. Data analysis

To analyze the demographic characteristics of emergency department nurses at the Cardiac Center in Hail, Saudi Arabia, including age, educational background, and years of experience, the study employed methods such as Frequency Count and Percentage Distribution. Additionally, descriptive statistics were utilized to assess the nurses' knowledge and practices concerning patient safety following cardiac catheterization.

4. Results

Analysis involves organizing, categorizing, modifying, and summarizing data to address research questions and examine relationships between variables. Interpretation then follows, which is the process of understanding the data and contextualizing the results within a broader framework.

According to the analysis presented in Tables 1 and 2, the average age of female respondents is 23, with a standard deviation of 1.47, while the average age for male respondents is 22, with a standard deviation of 1.2. When assessing the knowledge levels of these groups, the results yielded a non-significant p-value of 0.11. This indicates that there is a weak relationship between gender and the level of knowledge.

4.1. Sample distribution based on demographic data

The demographic data collected included age, gender, years of experience, area of practice, and highest level of educational attainment. The study involved a sample of 30 healthcare knowledge workers who participated in the survey. Descriptive statistical results are displayed in Table 2, illustrating the distribution of the sample across the demographic variables. Notably, the proportion of male participants was lower compared to that of female participants.

4.2. Sample description according to observation tool

An observational tool was utilized to evaluate the quality of care, including demographic data of the sample and nursing care following cardiac catheterization. To ascertain the demographic characteristics of emergency department nurses at the Cardiac Center in Hail, Saudi Province, Saudi Arabia—specifically their age, educational qualifications, and years of experience—methods such as Frequency Count and Percentage Distribution were used. The observational study included 30 observations and involved 14 staff nurses and 30 patients.

4.3. Sample distribution based on age

In this context, it is clearly seen that the sample distribution represents the population. The classification of the sample by age is given in Table 1. Age was categorized into four groups: 20-29 (N=16), 30-39 (N=6), 40-49 (N=4), and 49-59 (N=4). It is seen that the majority of the respondents are between 20-29 years old.

Table 1: Depicts the age distribution of samples

Age	Frequency	Percentage
20-29	16	53.5
30-39	6	20
40-49	4	13.3
50-59	4	13.3
Total	30	100

Table 2: Distribution of samples according to sex

Sex	Frequency	Percentage
Male	4	13.3
Female	26	86.6
Total	30	100

Table 3 presents data obtained from a sample of 12 staff nurses with 1 to 5 years of experience, 16 with 5 to 10 years of experience, and 2 with over 10 years of experience. The analysis shows that nurses

with fewer than 5 years of experience had a mean knowledge score of 6.8 with a standard deviation of 1.22. Those with more than 5 years of experience had a mean score of 8.8 with a standard deviation of 1.32. A p-value of 0.015, which is statistically significant, suggests that nurses with over five years of experience tend to have higher knowledge levels.

Further, nurses with over 5 years of experience showed knowledge scores ranging from 5 to 10, with a median of 8 and a mode of 9. Those with under 5 years of experience had scores ranging from 4 to 9, with both the median and mode being 7. This indicates a notable difference in knowledge levels based on experience.

Table 3: Distribution of sample according to experience

Years of experience	Frequency	Percentage
1-5	12	40
5-10	16	53.3
>10	2	6.7
Total	30	100

4.4. Description of samples according to observation tool

The Observation study was done on 14 staff nurses and 30 patients.

Table 4 shows the data collected from the samples, including 14 patients who had CAG, 12 patients who had PCI, two of whom had EPS, one TAVI, and one CRTD. Thus, 30 individuals had various cardiac catheterization techniques. The data shows that the majority of patients (46.67%) had coronary angiography. All patients were carried by bed to the ward or CCU. Only twenty (20) of the thirty (30) patients had a radial puncture for cardiac catheterization, with the remainder having a femoral site.

Table 4: Distribution of samples according to the procedure

Name of the procedure	Frequency	Percentage
Coronary angiography	14	46.67
PCI	12	40
EPS	2	6.67
TAVI	1	3.33
CRTD	1	3.33
Total	30	100

Table 5 presents data collected from 12 patients in the CCU and 18 patients in the Cardiac Ward. The majority of patients, approximately 60%, were transferred to the Cardiac Ward following their procedure.

Table 5: Distribution of samples according to area

Area	Frequency	Percentage
Cardiac ward	18	60
CCU	12	40
Total	30	100

Table 6 shows the description of the association between levels of knowledge regarding patient safety after cardiac catheterization among cardiac nurses in the Cardiac Center at Hail, Saudi Arabia.

Table 6: Frequency and percentage distribution of the level of knowledge (N=30)

Level of knowledge	Frequency (n)	Percentage (%)	Mean	SD
Adequate≥80%	10	33.33	1.4	
50%<Moderate≤80%	15	50	6.84	2.6
Poor≤50%	5	16.67	9.14	

The study's analysis showed that among 30 cardiac nurses, 50% exhibited moderate knowledge, 33.33% demonstrated adequate knowledge, and 16.67% had poor knowledge regarding patient safety following cardiac catheterization.

Post-procedure, all patients in both the ward and the CCU had their distal pulses checked and puncture sites assessed, although the frequency varied. This variation was due to (1) low-risk patients being moved to the ward where, due to higher staff-to-patient ratios, frequent assessments were challenging, and (2) continuous monitoring for cardiac events was conducted in the CCU while in the ward, only vital signs were regularly checked and recorded. Despite the less frequent assessments in the ward, no patients experienced difficulties.

Effective communication was maintained with patients in both the CCU and the ward. Intravenous (IV) fluids were administered to post-operative patients until the sheath removal was completed; for other patients, fluids were discontinued once oral intake was deemed satisfactory. No vasovagal attacks or adverse symptoms were reported.

Urinary assessments and interventions were necessary for two patients who had not urinated for eight hours; following nursing interventions, their urine output returned to normal. All patients who had eaten showed no adverse symptoms, and their intake/output was meticulously recorded. Family visits were facilitated, and documentation was thoroughly completed. For patients who underwent PCI, sheath removal was conducted smoothly, and adequate compression was applied to ensure bleeding cessation.

The observational data confirmed that neither the ward nor the CCU experienced any issues attributable to inadequate nursing care.

5. Discussion

Cardiac catheterization is a crucial standardized method for diagnosing, evaluating, and treating various cardiovascular diseases, yet it can lead to mild to severe complications, potentially increasing morbidity and mortality. Nurses play a vital role in patient care post-cardiac catheterization, necessitating an expansion of their knowledge and the application of evidence-based practices to enhance patient safety and outcomes (Ahmed, 2015).

Effective nursing care is imperative not only to extend patient life but also to mitigate complications associated with cardiac catheterization.

Consequently, it is essential for nurses to be well-informed and skilled in the post-procedure care of these patients. The objective of this study was to assess nurses' knowledge and understanding of patient safety following cardiac catheterization.

The study's findings indicated that out of 30 cardiac nurses, 50% displayed moderate knowledge, 33.33% showed adequate knowledge, and 16.67% had poor knowledge regarding patient safety after the procedure. These results are consistent with a similar study conducted in selected hospitals in Guwahati, Assam, India, which found that the majority of staff nurses had an average knowledge level (52%), 44% had good knowledge, and 4% scored poorly.

Additionally, among the subjects, staff nurses with more than five years of experience demonstrated higher knowledge levels compared to those with less than five years. However, in terms of patient care, there were no significant differences in practice levels. This study underscores that the quality of nursing care provided after cardiac catheterization is crucial in preventing the development of complications.

5.1. Major findings of the study

Data analysis shows that participants with less than five years of experience had an average knowledge score of 6.8 and a standard deviation of 1.22. Those with more than five years of experience had an average score of 8.8 and a standard deviation of 1.32. A significant p-value of 0.015 was obtained from comparing these groups, indicating that individuals with more than five years of experience have a higher level of knowledge. Additionally, the observational tool used in the study confirmed that no complications arose due to inadequate nursing care in either the ward or the CCU.

6. Conclusion

The findings of this study suggest that the occurrence of complications in patients following cardiac catheterization is minimal among cardiac nurses at CCH, which can be attributed to the staff nurses' sufficient understanding and diligent nursing care. Additionally, the study concludes that cardiac nurses demonstrated a moderate level of knowledge concerning patient safety post-cardiac catheterization. Statistical analysis confirmed a significant association between nurses' knowledge of patient safety after cardiac catheterization and variables such as age, job experience, and years of experience in the cardiac unit. There is a recognized need for innovative training approaches and the inclusion of post-cardiac catheterization care in educational sessions to enhance nursing proficiency in this area.

The research was conducted only at the Cardiac Center in Hail, Saudi Arabia. Cardiac nurses who decline to take part in this research are excluded. The study only included cardiac nurses working in the cardiac ward and the CCU, and for each group, the sample size was limited to thirty.

The present study suggests that to ensure high-quality nursing care, administrative and nursing leaders ought to facilitate relevant educational workshops, establish standardized patient care protocols in simulation labs, and assess the competencies of newly hired staff nurses who care for patients after cardiac catheterization. Additionally, to enhance the generalizability of the findings, it is recommended that the study be replicated using a larger probability sample. A longitudinal study design is also advised to monitor changes in knowledge and practices over time, providing insights into the effectiveness of training and interventions.

Compliance with ethical standards

Ethical consideration

This study's ethical research considerations included the following: Approval of the IRB-affiliated ethics committee. The researcher explained the study's purpose and objectives to the sample of nurses who would participate in the study. Nurses were informed that they had the option to accept or decline participation and that they may withdraw at any moment. Confidentiality and anonymity were guaranteed. Prior to research participation, each nurse was required to provide written consent following a brief explanation of the study's goal and expected outcomes. The nurses who agree to participate in the study will be asked to complete an informed consent form. Furthermore, each nurse was aware of the significance of his or her collaboration.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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