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Knowledge of Patient Safety and Post–Cardiac Catheterization Care among Nurses in Jordan: A Cross-Sectional Study

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ABSTRACT:

Background: Cardiovascular disease remains the leading cause of morbidity and mortality worldwide and represents a growing public health concern in Jordan. After the catheterization, the patient is under the nurses' monitoring and it is the nurses who have to take care of the patient in order to protect his safety and to manage his post-procedural care. Unfortunately, there is a lack of evidence regarding the level of knowledge of the Jordanian nurses regarding patients' safety and post-procedural care of their patients who underwent catheterization.

Aim: To assess nurses' knowledge regarding patient safety and post-cardiac catheterization care and identify demographic and professional factors associated with knowledge levels.

Methods: A descriptive cross-sectional study was conducted on a sample of 96 nurses from the critical care and cardiac units of a three hospitals in Amman, Jordan. The data were collected using a structured questionnaire that measured the knowledge across three domains: patient safety principles, post-cardiac catheterization care, and identification and management of complications. The data were analyzed using descriptive statistics and multiple linear regression.

Results: The overall mean knowledge score was 7.60 ± 1.91 out of 10. Good knowledge was demonstrated by 64.6% of participants, while 22.9% and 12.5% demonstrated moderate and poor knowledge, respectively. The highest performance was observed in the post-cardiac catheterization care domain (3.44 ± 0.82), whereas the lowest score was recorded for identification and management of complications (1.45 ± 0.56). Regression analysis indicated that gender ($\beta = 0.09$, $p = .41$), previous training ($\beta = 0.15$, $p = .12$), and educational qualification ($\beta = -0.03$, $p = .77$) were not significant predictors of knowledge. The overall model was not statistically significant, $F(3,92) = 1.25$, $p = .297$, explaining only 4% of the variance in knowledge scores ($R^2 = .04$).

Conclusion: Most nurses demonstrated adequate knowledge regarding patient safety and post-cardiac catheterization care. There are a few areas of recognition and management of complications where there are knowledge/skill deficits. Using a competency based education model, including the use of simulation, and supporting on going professional development will prepare nurses to provide the best care to patients and families in cardiac care settings across Jordan.

INTRODUCTION

Cardiovascular disease (CVD) remains the leading cause of mortality worldwide, accounting for nearly one-third of all deaths (World Health Organization [WHO], 2023). In the Middle East, rapid urbanization, population aging, obesity, smoking, hypertension, and diabetes have contributed to a growing cardiovascular disease burden (Aljefree & Ahmed, 2015). In Jordan, CVD continues to represent a major public health challenge and places considerable pressure on healthcare resources.

Cardiac catheterization is a common, safe procedure used for the diagnosis and treatment of patients with coronary artery disease (AHA, 2023). Although there are risks associated with the procedure, and potential for complications from the use of a catheter in the vasculature, with proper management the complications can be prevented. Complications include bleeding, vascular injury, arrhythmias, infection and contrast-induced nephropathy. These complications can have a very negative impact on the patient's outcome if they are not recognized in a timely manner. Therefore, preventing and promptly managing these complications is essential for ensuring patient safety and improving clinical outcomes.

The main role of the nurse in post cardiac catheterization patient's safety is monitoring of the patient's vital signs, assessment of the vascular access sites, identification of possible complications, administration of the patient's prescribed medications, and patient's education regarding post-procedural care (Hasballah et al., 2019; Mohamed et al., 2022). To perform these roles effectively, the nurse should possess adequate knowledge and clinical competence to look after the patient who has undergone cardiac catheterization (Mitchell, 2008; Sammer et al., 2010).

Previous studies conducted in Saudi Arabia, Egypt, Iraq, Pakistan, Oman, and the United Arab Emirates have generally reported moderate-to-good levels of nurses' knowledge regarding post-cardiac catheterization care (Alshammari et al., 2024; Khalil & Hassan, 2018; Mahmood et al., 2021; Panicker et al., 2022). However, several studies identified important deficiencies in complication recognition and management, particularly regarding bleeding and other post-procedural adverse events (Khalil & Hassan, 2018; Mahmood et al., 2021). Evidence also suggests that continuing education and simulation-based training can improve nurses' competence and patient safety performance (Hamed et al., 2023; Kaddoura et al., 2016).

With the spotlight on patient safety and quality of care in health care in Jordan, there is little research conducted on post-procedural care of patients who have had cardiac catheterization. Specifically, there is little research that evaluates nurses' knowledge in this field and how it compares to that of specialized cardiac nurses. As cardiac services are rapidly increasing, it becomes more necessary to evaluate the level of preparedness that nurses have in order to give the best possible care in a safe and competent manner (Alzoubi et al., 2019).

Therefore, this study aimed to assess nurses' knowledge regarding patient safety and post-cardiac catheterization care in three hospitals in Jordan and to identify demographic and professional factors associated with knowledge levels.

METHODS

Study Design

A descriptive cross-sectional study design was employed to assess nurses' knowledge regarding patient safety and post-cardiac catheterization care and to identify factors associated with knowledge levels. This design was considered appropriate because it enabled the assessment of knowledge at a single point in time and facilitated the examination of relationships between selected demographic and professional variables and nurses' knowledge scores.

Setting

This study was conducted in three hospitals in Amman, Jordan. A total of 96 nurses from the critical care units in the three hospitals where patients post cardiac catheterization procedures were being monitored were studied. These units were the Intensive Care Units (ICUs), the Coronary Care Units (CCUs) and the cardiac catheterization laboratories of the three hospitals.

Healthcare services provided for the heart in Jordan are amongst other health care services provided. Roles and challenges of the nurses in the critical care units after cardiac catheterization procedures include assessing patients for potential complications pre and post procedure, patient education and quality patient care.

Participants and Sampling

The study included a total of 96 registered nurses working in cardiac-related clinical settings. Eligible participants were nurses directly involved in the care of patients undergoing cardiac catheterization and post-procedural monitoring.

Inclusion criteria consisted of:

- Registered nurses working in cardiac care units, intensive care units, coronary care units, or catheterization laboratories.
- Nurses with direct involvement in post-cardiac catheterization patient care.
- Nurses willing to participate voluntarily in the study.

Nurses who were not directly involved in post-procedural cardiac care or who declined participation were excluded.

Instrument

A structured self-administered questionnaire was used to collect data. The two sections of the questionnaire in turn gathered the demographic and professional data of the participants and their knowledge and beliefs regarding the safety of their patients and the post-procedural care of patients who had cardiac catheterization. The questions regarding the knowledge and beliefs of the nurses assessing their patients' safety in relation to post-procedural care in cardiac catheterization consisted of ten multiple choice questions that assessed their knowledge in three different domains.

Section two of the data collection tool addressed the patient's safety and care of post-cardiac catheterization patient. There were 10 questions in total within three knowledge domains. The first domain, 'Patient Safety Principles' contained 4 questions which attempted to assess participants' knowledge and clinical behavior regarding safety of patient care post cardiac catheterization. The second domain, 'Post-Cardiac Catheterization Care' contained 4 questions that attempted to assess knowledge of nursing care of post-cardiac catheterization patient. The third domain, 'Identification and Management of Complications' contained 2 questions which attempted to assess recognition and management of the two most common complications, i.e. bleeding and hemodynamic instability, that may occur following a cardiac catheterization procedure.

Each correct response was awarded one point, whereas incorrect responses received zero points, resulting in a maximum possible score of 10. Knowledge scores were categorized as good (8–10), moderate (6–7), or poor (0–5). Higher scores indicated greater knowledge regarding patient safety and post-cardiac catheterization care.

Data Collection Procedure

The data for this study was collected after the administrative and ethical clearances had been granted. At the clinical times, all the eligible nurses were approached and explained the objective of the study. The participating nurses were informed that their participation in the study was voluntary, and they could withdraw from the study at any time after they had completed the

questionnaire. After they had consented to participate in the study, the questionnaires were completed by the participating nurses in writing. The completed questionnaires were collected by the researcher and checked for any missing data before they were entered.

The questionnaires were distributed to the nurses in paper format. Each nurse completed his/her own questionnaire individually. The completed questionnaires were then collected by the researcher. All the questionnaires were checked for completeness before data entry.

Ethical Considerations

Ethical approval was given by appropriate IRB and hospital administration for this study prior to data collection. Participants were able to withdraw from the study at any time for any reason if they so wished.

All information collected had been treated with confidentiality and anonymity. No personal information had been collected and all data were stored safely and used for the purposes of the research only.

Data Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics were used to summarize participants' demographic and professional characteristics as well as their knowledge scores. Continuous variables were reported as means and standard deviations, while categorical variables were presented as frequencies and percentages. Multiple linear regression analysis was conducted to examine whether selected demographic and professional variables predicted nurses' knowledge scores. The predictor variables included gender, educational qualification, and previous training in cardiac catheterization care. Statistical significance was established at a p-value of $< .05$.

RESULTS

Participant Characteristics

A total of 96 nurses from 3 hospitals were studied. The mean and standard deviation for the age of the participants were 32.17 ± 5.47 years. The mean and standard deviation of years of nursing practice was 9.01 ± 6.29 years, and the mean and standard deviation of years of practice in coronary care units was 5.36 ± 5.65 years.

Of the 96 participants, 60.4% ($n = 58$) were female, and 39.6% ($n = 38$) were male. The largest group of nurses consisted of those holding a Bachelor degree (71.9%, $n = 69$), 16 participants (16.6%, $n = 16$) held a Postgraduate qualification and 11 participants (11.5%, $n = 11$) held a Diploma qualification.

Only 42.7% ($n = 41$) of the participants had formal training for cardiac catheterization care. The majority of the participants, 57.3% ($n = 55$) had no training for these specialized programs.

Table 1. Participant Characteristics (N = 96)

Variable	Category	n (%) / Mean $\pm$ SD
Age (years)	—	32.17 ± 5.47
Gender	Male	38 (39.6)
	Female	58 (60.4)
Educational Qualification	Diploma	11 (11.5)
	Bachelor	69 (71.9)
	Postgraduate	16 (16.6)
Years of Nursing Experience	—	9.01 ± 6.29
Years of CCU Experience	—	5.36 ± 5.65
Previous Training in Cardiac Catheterization Care	Yes	41 (42.7)
	No	55 (57.3)

Overall Knowledge Levels

Nurses' knowledge regarding patient safety and post-cardiac catheterization care was assessed using a ten-item questionnaire. The overall mean knowledge score was 7.60 ± 1.91 , with observed scores ranging from 2 to 10.

Based on predefined classification criteria, 62 participants (64.6%) demonstrated good knowledge, 22 participants (22.9%) demonstrated moderate knowledge, and 12 participants (12.5%) demonstrated poor knowledge.

These findings indicate that although most nurses possessed satisfactory knowledge, a considerable proportion demonstrated knowledge deficits requiring educational attention.

Table 2. Overall Knowledge Levels (N = 96)

Knowledge Level	Score Range	n (%)
Good	8–10	62 (64.6)
Moderate	6–7	22 (22.9)
Poor	0–5	12 (12.5)

Knowledge Scores by Domain

In addition to measuring Knowledge of cardiac catheterization, we also assessed knowledge application for three different knowledge domains: 1) patient safety principles; 2) post-cardiac catheterization patient care; and 3) identification and management of complications.

Knowledge was highest in the area of post-cardiac catheterization care of patients ($M = 3.44 \pm 0.82$ on a scale from 1 to 4). 88.6% of nurses were correct in their assessment regarding the correct position in which a patient with a femoral catheter should rest, and 81.9% were correct in their assessment regarding the encouragement of the intake of fluids as important for the removal of the contrast agent from the body.

The mean score for knowledge of patient safety principles was 2.72 ± 1.00 (out of 4). The greatest number of nurses were able to correctly state that the monitoring of vital signs should be done on a frequent basis during the first post-procedural hours. However, the number of nurses able to identify bleeding, the most common complication after cardiac catheterization, was a fraction of that number.

The lowest score was recorded in the identification and management of complications domain (1.45 ± 0.56 out of two). Although most participants recognized hypotension as a potential indicator of internal bleeding, important gaps remained in nurses' understanding of complication management and patient safety concepts.

Table 3. Knowledge Scores by Domain (N = 96)

Domain	Mean $\pm$ SD	Score Range
Patient Safety Principles	2.72 ± 1.00	0–4
Post-Cardiac Catheterization Care	3.44 ± 0.82	0–4
Identification and Management of Complications	1.45 ± 0.56	0–2
Overall Knowledge	7.60 ± 1.91	2–10

Predictors of Nurses' Knowledge

Multiple linear regression analysis was conducted to determine whether gender, previous training in cardiac catheterization care, and educational qualification predicted nurses' knowledge scores.

The overall regression model was not statistically significant, $F(3,92) = 1.25$, $p = .297$, indicating that the included predictors did not significantly explain variation in knowledge scores. The model explained only 4% of the variance in knowledge levels ($R^2 = .04$).

None of the predictors were found to be statistically significant. The relationship between knowledge and gender (standardized beta coefficient = 0.09, $p = .41$), previous training (beta coefficient = 0.15, $p = .12$), and educational qualification (beta coefficient = -0.03, $p = .77$) all explained very little variance.

The findings revealed that there was little variation of knowledge between different demographics, and between levels of education. Thus, it is the external factors that must be addressed in order to increase the knowledge that the nurses have of patient safety and the post-cardiac catheterization care of the patient.

Table 4. Multiple Linear Regression Predicting Knowledge Scores ($N = 96$)

Predictor	B	SE B	β	t	p
Gender (Male = 1, Female = 0)	0.26	0.31	0.09	0.82	.41
Previous Training (Yes = 1, No = 0)	0.50	0.31	0.15	1.60	.12
Education (Bachelor/Postgraduate = 1, Diploma = 0)	-0.05	0.16	-0.03	-0.29	.77

Model Summary: $F(3,92) = 1.25$, $p = .297$, $R^2 = .04$

The study demonstrated that most nurses possessed good overall knowledge regarding patient safety and post-cardiac catheterization care. Knowledge was strongest in routine post-procedural care activities and weakest in complication recognition and management. Furthermore, demographic and professional variables did not significantly predict knowledge levels, suggesting that educational needs may be shared across nursing groups regardless of gender, educational background, or prior training.

DISCUSSION

This study aimed to assess nurses' knowledge of patient safety and post-cardiac catheterization care in three hospitals in Jordan. Some variables could be related to the degree of knowledge the nurses have. The findings of this study show that the overall knowledge of the participants was very good as 64.6% of them scored very good. However, there are some significant gaps in the identification and management of post-catheterization complications. Gender, the nurses' educational qualification and their previous training did not predict their knowledge.

The finding that most nurses demonstrated good knowledge is consistent with previous studies conducted in Jordan, Saudi Arabia, Egypt, and other regional settings, which reported moderate-to-good knowledge levels among nurses working in cardiac care environments (Alshammari et al., 2024; Alzoubi et al., 2019; Khalil & Hassan, 2018). This may reflect the specialized nature of cardiac units, where nurses are routinely exposed to patients undergoing cardiac catheterization and therefore gain experience through repeated clinical practice.

Even the minimum knowledge deficit may pose a risk to patients and may cause a delay in the identification of any adverse events occurring during and after the procedure. The findings of this study are in line with the findings of previous studies conducted to assess nurses' preparation in managing cardiac cases (Hasballah et al., 2019; Mahmood et al., 2021).

The highest score gained by nurses was in regards to the post- cardiac catheterization care, specifically in regards to patients positioning and the management of fluids by means of proper hydration. The findings of this study are consistent with that of previous studies that have researched the role of the nurse in the cardiac care setting, such as the studies conducted by Bakr et al. (2020) and Korejo et al. (2024). The previous studies found that the nurses are capable of delivering the routine aspects of patient's care as these are carried out on a constant basis in the clinical environment of the patient's care.

In contrast, the lowest scores were observed in the identification and management of complications. Fewer than half of participants correctly identified bleeding as the most common complication following cardiac catheterization. This finding is concerning because bleeding remains one of the most frequent and potentially serious complications associated with invasive

cardiovascular procedures (Teja et al., 2024). Similar knowledge deficits have been reported in Egypt, Iraq, and Pakistan (Khalil & Hassan, 2018; Mahmood et al., 2021; Korejo et al., 2024). One possible explanation is that nurses encounter serious complications less frequently than routine post-procedural care activities, reducing opportunities for experiential learning. In addition, continuing education programs may place greater emphasis on routine care than on emergency management and complication recognition.

There were no significant associations found between participants' gender, highest educational qualification or prior training and their knowledge. Studies have previously reported that nurses with higher in education have knowledge of the issues in the workplace and how to manage them, as well as the knowledge to manage in situations where they are dealing with patients with specialized needs (Ahmed & Ali, 2020; Feng et al., 2018). However, the findings of the current study would suggest that the lack of competence is a universal problem that affects all members of the healthcare workforce (Ahmed & Ali, 2020). The majority of the participants in the current study held similar highest educational qualifications and therefore would be expected to experience similar situations in the healthcare workplace (Ahmed & Ali, 2020). Factors that may have greater influence on clinical competence of nurses are organizational factors, hospital culture, access to and use of educational resources and institutional support (Feng et al., 2018; Alqahtani et al., 2019).

From a Jordanian healthcare perspective, these findings highlight the need to strengthen competency-based education and patient safety initiatives within cardiac care settings. As cardiovascular disease continues to represent a major health burden, nurses must be adequately prepared to recognize complications and respond effectively to emergencies. Regular competency assessments, simulation-based training, and continuing professional development programs may help address the knowledge gaps identified in this study and contribute to improved patient outcomes.

Strengths and Limitations

This study adds to the existing body of knowledge about the knowledge of nurses regarding patient safety and the care of patients after cardiac catheterization in Jordan. The findings of this study could be used by health care organizations to develop educational programs that promote the quality of patient care.

However, the study has several limitations. The cross-sectional design prevents causal inference, and the use of self-administered questionnaires may not fully reflect actual clinical competence. Finally, incomplete data regarding years of experience prevented inclusion of these variables in the regression analysis.

Implications for Nursing Practice

The findings support the implementation of competency-based continuing professional development programs focused on complication recognition and patient safety. Simulation-based education, clinical drills, and regular competency assessments may strengthen nurses' preparedness to manage high-risk cardiac patients. Healthcare organizations should also promote mentorship programs, evidence-based practice, and patient safety culture initiatives to enhance quality of care.

CONCLUSION

Nurses had satisfactory knowledge, skills and attitudes concerning patient safety and post-cardiac catheterization care. However, there were considerable gaps in their ability to recognize and manage complications. Gender, educational qualification and previous training did not predict knowledge of post-cardiac catheterization care. However, organization and systems' factors may influence the competency of the nurses. Enhancing competency-based education, simulation training and continuing professional development programs would improve patient safety and enhance quality of cardiac nursing care in Jordan.

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