

▪ **Basic Research**
Clinical Outcomes and Satisfaction Level among Patients Undergoing Diagnostic Cardiac Catheterization

Yasser Mahmoud Ibrahim Shalaby¹, Doaa Abdelnaby Abdelwahab Abdelfatah^{*2}, Ayman Ibrahim Omran³, Azza Ibrahim Abdelkader Habiba⁴

¹ Demonstrator of Medical-Surgical Nursing, Faculty of Nursing, Damanhour University, Egypt. ² Lecturer of Medical-Surgical Nursing, Faculty of Nursing, Damanhour University, Egypt. ³ Lecturer of Cardiology, Damanhour Medical National Institute, Egypt. ⁴ Assistant Professor of Medical-Surgical Nursing, Faculty of Nursing, Damanhour University, Egypt

***Corresponding author: Dr. Doaa Abdelnaby Abdelwahab Abdelfatah**
Lecturer of Medical-Surgical Nursing, Faculty of Nursing, Damanhour University, Egypt
e-mail: doaa.abdelwahab@yahoo.com

Abstract

Background: Diagnostic cardiac catheterization (DCC) is an essential diagnostic procedure for evaluating coronary artery disease and guiding treatment decisions. Although generally safe and well-tolerated, some patients may experience post-procedural complications, pain, and discomfort. Local complications, such as hematoma, infection, and arterial damage, as well as systemic complications like arrhythmia, allergic reactions, and air embolism, can occur and have a negative impact on clinical outcomes and patient satisfaction. **Aim of the Study:** This study aimed to assess the clinical outcomes and satisfaction levels among patients undergoing DCC. **Subjects and methods:** A descriptive cross-sectional research design was employed to collect data in this study. **Setting:** this study was conducted at the cardiac catheterization (CC) unit in the cardiology department of Damanhour Medical National Institute, El-Beheira governorate, Egypt. The study included a convenience sample of 110 adult male and female patients undergoing DCC. **Tools:** Data collection utilized three tools: Tool I: "Patients' vascular access site assessment sheet," Tool II: "Patients' clinical outcomes post-diagnostic cardiac catheterization assessment sheet," and Tool III: "Patients satisfaction structured interview questionnaire." **Results:** The results revealed that 67.3% of the studied patients had normal and acceptable vascular access sites pre-DCC, while 59.1% had impaired and severely impaired vascular access sites post-DCC. Most patients reported experiencing pain at both the back and insertion site. 80% of the patients experienced relatively mild post-DCC complications. Furthermore, 95.5% of patients expressed a satisfactory level of satisfaction with their overall experience in the CC unit. **Conclusion:** While DCC carries a risk of mild negative clinical outcomes, most patients expressed satisfaction with the level of nursing care they received in the CC unit. **Recommendation:** It is recommended to further investigate the effect of implementing a nursing care protocol on patients' clinical outcomes in those undergoing DCC.

Keywords: Clinical Outcomes, Diagnostic Cardiac Catheterization, Satisfaction Level, Patients.

1. Introduction

Cardiac Catheterization (CC) is a minimally invasive procedure that cardiologists use in a wide variety of circumstances to assess heart function, diagnose, and treat cardiovascular conditions (Ali & Ali, 2019). Globally, over 46 million interventional cardiology procedures were performed in 2022, with CC procedures comprising the majority (Bangalore et al., 2022). In Egypt, an estimated 250,000 patients undergo CC procedures each year, with radial vascular access being used in 10% of cases in 2021 (Barbato et al., 2021). The objective of this study is to investigate the clinical outcomes and patient satisfaction among cardiac catheterization patients in Egypt.

Diagnostic cardiac catheterization (DCC) is performed to assess blood flow to the heart, measure blood pressure, check for narrow or blocked blood vessels, and help with the hemodynamic assessment of the heart. It is also used to evaluate and determine the need for further treatment (Amin et al., 2020). On the other hand, therapeutic cardiac catheterization (TCC) can be used to re-open obstructed coronary arteries and restore blood flow without open-heart surgery. It is a type of cardiac revascularization procedure that can be performed through femoral or radial artery access (Niknam et al., 2021).

Historically, femoral artery access was the most commonly used method for CC procedures (Gladden et al., 2022). However, radial artery access has become the predominant route in recent years due to its advantages, such as lower bleeding rates and other vascular access site complications (VASCs). The selection of the artery access route can improve the quality of nursing care and clinical outcomes (Chiarito et al., 2021).

Clinical outcomes refer to measurable or observed results in response to an intervention, recorded at specific times during or after the intervention. They indicate the maintenance or stabilization of health status for patients (Veghel et al., 2020). Successful clinical outcomes for patients undergoing CC include rapid recovery, early ambulation, fewer postoperative sequelae (such as a lower risk of scar formation), and lower hospital costs. These outcomes can improve patient satisfaction, comfort, and quality of life (Yugandhar & Baradhi, 2023).

Following a CC procedure, patients may experience various VASCs, such as hematoma, hemorrhage, aneurysm, arteriovenous fistula, arterial occlusion, neuropathy, and infection (White et al., 2018). These complications, along with systemic complications like arrhythmia, anaphylactic shock, air embolism, and vagal reaction, can impact the patient's clinical outcomes and satisfaction. Many studies have reported that VASCs occur in about 0.1% to 61% of CC procedures, leading to increased morbidity, mortality, length of stay, and cost. Therefore, it is crucial to prevent and treat these complications (Hetrodt et al., 2021).

The efficiency of healthcare delivery is often evaluated through patient satisfaction, which serves as a measure of health system performance and the quality of nursing care. Patient satisfaction refers to the level of consistency between a patient's expectations of ideal nursing care and their understanding of the actual care provided (Hu et al., 2020). Satisfaction with nursing care is an essential component of overall service satisfaction, indicating a nurse's awareness of the patient's needs. Therefore, nurses play a vital role in enhancing patient satisfaction, comfort, and clinical outcomes in CC patients (Lobo et al., 2018).

The investigation of clinical outcomes and patient satisfaction among CC patients in Egypt is crucial to enhancing nursing practice, improving patient outcomes, and reducing death

and morbidity rates. By understanding the factors that contribute to successful outcomes and patient satisfaction, healthcare providers can optimize care delivery and ultimately improve the quality of life for CC patients.

1.1. Significance of the study:

Nurses are crucial in providing comprehensive care to patients undergoing CC procedures. Their role in patient assessment, safety, support, and education contributes to positive clinical outcomes. Adequate preparation of patients, both physically and emotionally, is necessary for optimal care delivery (Abd-Elmaged & Mohammed, 2018). Nurses are also responsible for caring for patients before, during, and after CC, performing various functions such as continuous assessment and monitoring during the procedure. This helps to prevent complications, ensure successful outcomes, and promote patient satisfaction with the care received (Azraai & Ajani, 2019). Therefore, researching the clinical outcomes and patient satisfaction among CC patients is crucial to enhance nursing practice, improve patient outcomes, and reduce death and morbidity rates. This motivated the researcher to investigate this issue.

2. The Aim of the Study:

This study aimed to assess clinical outcomes and satisfaction levels among patients undergoing diagnostic cardiac catheterization.

2.1. **Research questions:** To fulfill the aims of the study, the following research questions were formulated:

1. What are the clinical outcomes among patients undergoing diagnostic cardiac catheterization?
2. What is the satisfaction level among patients undergoing diagnostic cardiac catheterization?

3. Subject and Methods:

3.1. Study Design and Setting:

This study was conducted at the CC unit in the cardiology department of Damanhour Medical National Institute, Egypt. The unit consists of 6 beds in a room with separate partitions for male and female patients, and CC procedures are performed four days a week. The study included adult patients who met the inclusion criteria of being aged 20 to ≤ 60 years old, able to communicate verbally, and willing to participate. Patients with chronic back pain, complications during CC, previous bleeding disorders, and those on mechanical ventilation were excluded. A convenience sample of 110 adult patients undergoing DCC was included, based on the estimated sample size using the Epi info7 program, which determined a minimum sample size of 108 patients.

3.2. Tools of the study:

The researchers developed two tools and adopted one tool for the study based on an analysis of the relevant related literature (Reich et al., 2018, Zaghlol et al., 2018, Maan & Abu Ruz., 2019, Abd El Hafeez et al., 2018, Metwaly et al., 2022 and Ebeed et al., 2017) and translated it into Arabic.

Tool (I): "Patients' vascular access site assessment sheet," consisted of three parts.

Part 1: Patients' personal and clinical profile: it collected personal and clinical data such as age, gender, education level, marital status, and medical history.

Part 2: Vital signs assessment sheet: it assessed vital signs including temperature, heart rate, respiratory rate, and blood pressure.

Part 3: Vascular access site assessment sheet: this part assessed the vascular access site for color changes, temperature, capillary refill, distal pulses, and edema. The score for this part was given based on the presence or absence of these factors, and the total observation scores were converted into mean percent scores to categorize the vascular access site as severely impaired, impaired, acceptable, or normal as follows >75 % severely impaired vascular access site, 25-75% impaired vascular access site, 1-<25 % acceptable vascular access site, and 0 % normal vascular access site.

Tool (II), "Patients' clinical outcomes post diagnostic cardiac catheterization assessment sheet," consisted of two parts.

Part (1): The 0–10 Numeric Rating Scale: adopted from (Boonstra et al., 2016) to assess pain severity at the access site and back, by asking the patient to place a mark on the scale itself or say the number that best matches his pain level. It was categorized from 0 to 10. Zero means that the patient has no pain, while 10 represents the most intense pain.

Part 2: Post-diagnostic cardiac catheterization complications assessment sheet: it assessed post-procedure complications including minor and major local complications (hematoma, bleeding, pseudoaneurysm, arteriovenous fistula, vascular injury) and systemic complications (arrhythmia, anaphylactic reaction, thrombosis or embolism, vagal reaction). Scores were given for the presence or absence of complications, and the total observation scores were converted into mean percent scores to categorize the severity of complications. As follows 0 scores are given for the absent complications, and 1 for present complications. Total observation scores were calculated, then converted into mean percent scores as follows >75 % severe complications, 50 -75 % moderate complications, 1-<50 % mild complications, and 0% on complications. (Metwaly et al., 2022)

Tool (III): "Patient satisfaction structured interview questionnaire," was adopted from (Strickland et al., 2003) and was used to assess patient satisfaction with nursing care. It included items related to communication, medication administration, assistance, and orientation to the hospital environment. Responses were rated on a Likert scale from 0 to 6, indicating the degree to which patient expectations were met. (0- (Expectations not met at all), 1 – (a lot less than expected), 2 – (A little less than expected), 3- (As expected), 4 – (Exceeded expectations a little), 5 – (Exceeded expectations a lot), 6 – (Way beyond expectations). The total scores were calculated with a possible range of 0 to 72, and then it was converted into mean percent scores as follows; <50% mean unsatisfactory level, and \geq 50% mean satisfactory level of satisfaction.

3.3. Ethical consideration

The study obtained written approval from the ethical committee of the Faculty of Nursing at Damanshour University, Egypt, on (16/2/2023), and was assigned the ethical approval code (No.72-e) Official permission was also obtained from the Dean of the Faculty of Nursing, Damanshour University, as well as the administrative authorities of the Damanshour Medical National Institute. Prior to participation, written informed consent was obtained from the patients after a clear explanation of the research objectives. Detailed information regarding the purpose and benefits of the study was provided to the patients, and they had the freedom to participate voluntarily. The study strictly adhered to standard ethical principles, ensuring the maintenance of strict confidentiality and anonymity for all participants during data collection. No risks were posed to the participants.

3.4. Validity and reliability of the tools:

To ensure the validity of the tools five experts in medical-surgical nursing and cardiology were consulted, and their feedback was used to refine the tools. The reliability of the developed tools was assessed using the test-retest method by Cronbach's alpha coefficient. The Cronbach's coefficient alpha for tool II part 2 score was 0.79 which was accepted as reliable which denotes good reliability.

3.5. A pilot study:

A pilot study was conducted on 10% of the patient sample (n=11 patients), who were excluded from the actual study sample from the previously mentioned setting, to ascertain the clarity and applicability of the developed study tools and to identify obstacles that may be faced during data collection. Researchers substituted the excluded sample with another sample that is similar in characteristic to the original sample. The data obtained from the pilot study were analyzed, and the final form of the tools was reconstructed and ready for use.

3.6. Data collection

Data collection started at the beginning of May 2023 and ended in June 2023. Individual interviews were conducted with each patient using the study tools to collect the data needed for the study objective.

3.7. Data collection process:

A structured interview schedule was conducted with each patient twice: once before and once after the CC procedure. The interviews were conducted during the morning and evening shifts on specific days of the week (Sunday, Tuesday, Wednesday, and Thursday).

The first interview: took place in the morning shift before the CC procedure at the CC department to collect data regarding Tool I parts 1,2 and 3.

The second interview: occurred after a specific duration: 6 hours for patients who underwent the procedure via the femoral artery and 3 hours for patients who underwent the procedure via the radial artery just before patient discharge, following the hospital policy to collect data regarding Tool I parts 2 and 3, Tool II parts 1 and 2 and Tool III.

A patient's personal and clinical profile (Tool I part 1) was collected approximately 10-15 minutes before the procedure. Vital signs (Tool I part 2) were assessed before the CC procedure and after a rest period of 6 hours for patients who had the procedure via the femoral artery, or 3 hours for patients who had the procedure via the radial artery, just before patient discharge. The researcher assessed the vascular access site (Tool I part 3) through observation before the procedure and after the specified rest period. The patients' clinical outcomes post diagnostic cardiac catheterization (Tool II part 1 and part 2) were also assessed by the researcher through observation after the specified rest period. Finally, the patient satisfaction structured interview questionnaire (Tool III) was completed by interviewing the patients after the specified rest period.

3.8. Statistical analysis of the data:

The data in this study were analyzed using IBM SPSS software package version 25. Descriptive statistical measures, which included: numbers, percentages, and averages (Minimum, Maximum, Arithmetic mean(X), Standard deviation (SD)). Statistical analysis tests, which included Chi-square, and T-test.

4. Results

The present study findings illustrated the DCC patients' clinical outcomes, which are displayed in Tables 5 and 6, as well as their satisfaction level regarding nursing care received in the CC unit, which is displayed in Table 7.

Table (1) presents the distribution of the studied patients based on their personal characteristics. The findings indicate that approximately two-thirds (63.6%) of the patients belonged to the age group of 50 to 60 years. Regarding gender, the study revealed that more than half (59.1%) of the patients were male. In terms of educational level, it was evident that more than half (50.9%) of the study population couldn't read or write.

Table (2) presents the distribution of the studied patients based on their clinical characteristics, specifically within the context of their current health status. The findings showed that the majority (97.3%) of the studied patients had vascular access through the femoral artery. Additionally, more than two-thirds (69.1%) of the studied patients had a duration of pressure hold to achieve hemostasis ranging from 10 to less than 20 minutes.

Table (3) shows the distribution of studied patients according to their vital signs assessment pre and post-CC procedure. The table indicates that the majority of studied patients had average vital signs pre and post-CC including body temperature (100% pre and the same post-CC), heart rate (93.6% pre and the same post-CC), respiratory rate (97.3% pre and 94.5% post-CC), and blood pressure (85.5% pre and 88.2% post-CC).

Table (4) presents the distribution of the studied patients based on the assessment of their vascular access site. According to the table, more than two-thirds of the studied patients were classified as having a normal (56.4%) or acceptable (10.9%) vascular access site before the CC procedure. Furthermore, more than half of the studied patients were classified as having an impaired (39.1%) or severely impaired (20%) vascular access site after CC.

Table (5) presents the distribution of the studied patients according to the pain experienced following a CC procedure. The table focuses on two types of pain: insertion site pain and back pain. Concerning insertion site pain, (62.7%) of the studied patients reported moderate pain at the insertion site, while 25.5% reported mild pain. Similarly, the table indicates that (61.8%) of the patients experienced moderate back pain, and (27.3%) reported mild pain.

Table (6) shows the distribution of studied patients based on the total complications they experienced following a CC procedure. The table indicates that (61.8%) of the studied patients had mild complications, while 18.2% experienced moderate complications.

Table (7) presents the distribution of the studied patients based on their total overall satisfaction level. According to the table, the majority of patients (95.5%) had a satisfactory level of satisfaction with their overall experience in the CC unit.

Table (8) presents the correlation between total satisfaction, total complication, insertion site pain, back pain, and total vascular access site assessment pre and post-CC. The table indicates the strength and significance of the relationships between these variables. According to the table, there is an intermediate positive significant correlation between total satisfaction and total vascular access site assessment pre-CC ($r= 0.313^{**}$, $p= 0.001$) and post-CC ($r= 0.253^{**}$, $p= 0.008$). Furthermore, the table reveals a weak positive significant correlation

between total complications and insertion site pain ($r= 0.217^*$, $p= 0.023$) and total vascular access site assessment post-CC ($r= 0.211^*$, $p= 0.027$). An intermediate positive significant correlation between insertion site pain and back pain ($r= 0.385^{**}$, $p= 0.000$). Additionally, a weak positive significant correlation between back pain and total vascular access site assessment pre CC ($r= 0.194^*$, $p= 0.041$) and post CC ($r= 0.242^*$, $p= 0.011$).

Table 1: Distribution of the studied patients according to their personal characteristics.

| Demographic Characteristics | Study sample (N=110) | |
|------------------------------------|-------------------------|------|
| | No | % |
| Age | | |
| 20<30 | 1 | 0.9 |
| 30<40 | 13 | 11.9 |
| 40<50 | 26 | 23.6 |
| 50≤60 | 70 | 63.6 |
| Mean ± SD | 50.30 ± 8.36 | |
| Gender | | |
| • Male | 65 | 59.1 |
| • Female | 45 | 40.9 |
| Level of Educational | | |
| • Illiterate (Can't read or write) | 56 | 50.9 |
| • Primary education | 22 | 20.0 |
| • Secondary education | 22 | 20.0 |
| • University | 10 | 9.1 |
| Marital status | | |
| • Single | 1 | 0.9 |
| • Married | 88 | 80.0 |
| • Widow | 1 | 0.9 |
| • Divorced | 20 | 18.2 |
| Place of residence | | |
| • Rural | 26 | 23.6 |
| • Urban | 84 | 76.4 |
| Occupation | | |
| • Office/desk worker | 13 | 11.8 |
| • Manual | 20 | 18.2 |
| • Housewife | 14 | 12.7 |
| • Retired | 6 | 5.5 |
| • Not working | 57 | 51.8 |

Table 2: Distribution of the studied patients according to their clinical characteristics of current health status.

| Patient's clinical characteristics of current health status | Study sample (N=110) | |
|--|-----------------------------------|------|
| | No | % |
| Time of asking for medical help | | |
| <ul style="list-style-type: none"> At the onset of symptoms | 30 | 27.3 |
| <ul style="list-style-type: none"> When the severity of symptoms increased | 42 | 38.2 |
| <ul style="list-style-type: none"> When became unable to tolerate | 16 | 14.5 |
| <ul style="list-style-type: none"> When symptoms affected daily living activities | 22 | 20.0 |
| Weight (Mean \pm SD) | 84.14\pm11.35 | |
| Highest (Mean \pm SD) | 1.69\pm0.086 | |
| Body mass index (BMI) | | |
| <ul style="list-style-type: none"> Underweight (less than 18.5) | 0 | 0.0 |
| <ul style="list-style-type: none"> Normal weight (18.5 to 24.9) | 18 | 16.4 |
| <ul style="list-style-type: none"> Overweight (25to 29.9) | 49 | 44.5 |
| <ul style="list-style-type: none"> Obese (30 and more) | 43 | 39.1 |
| Type of vascular access site | | |
| <ul style="list-style-type: none"> Femoral artery | 107 | 97.3 |
| <ul style="list-style-type: none"> Radial artery | 3 | 2.7 |
| Sheath size | | |
| <ul style="list-style-type: none"> 6 French | 101 | 91.8 |
| <ul style="list-style-type: none"> 7 French | 9 | 8.2 |
| Sheath time | | |
| <ul style="list-style-type: none"> 15- <30 Minutes | 78 | 70.9 |
| <ul style="list-style-type: none"> 30- <45 Minutes | 30 | 27.3 |
| <ul style="list-style-type: none"> 45-60 Minutes | 2 | 1.8 |
| Duration of pressure holds to hemostasis | | |
| <ul style="list-style-type: none"> 10- <20 Minutes | 76 | 69.1 |
| <ul style="list-style-type: none"> 20- <30Minutes | 30 | 27.3 |
| <ul style="list-style-type: none"> 30- <40Minutes | 3 | 2.7 |
| <ul style="list-style-type: none"> \geq40 Minutes | 1 | 0.9 |

Table 3: Distribution of the studied patients according to their vital signs pre and post-CC procedure.

| Variable | Time | Pre-CC procedure N=110 | | Post-CC procedure N=110 | |
|-----------------------------|------|---------------------------|-------|----------------------------|-------|
| | | No | % | No | % |
| 1) Temperature: | | | | | |
| - Average | | 110 | 100.0 | 110 | 100.0 |
| 2) Heart rate: | | | | | |
| - Average | | 103 | 93.6 | 103 | 93.6 |
| - Tachycardia | | 6 | 5.5 | 5 | 4.6 |
| - Bradycardia | | 1 | 0.9 | 2 | 1.8 |
| 3) Respiratory rate: | | | | | |
| - Average | | 107 | 97.3 | 104 | 94.5 |
| - Tachypnea | | 3 | 2.7 | 6 | 5.5 |
| 4) Blood Pressure: | | | | | |
| - Average | | 94 | 85.5 | 97 | 88.2 |
| - Hypertension | | 15 | 13.6 | 10 | 9.1 |
| - Hypotension | | 1 | 0.9 | 3 | 2.7 |

Table 4: Distribution of the studied patients according to total vascular access site assessment.

| Total vascular access site assessment | Pre-CC procedure N=110 | | Post-CC procedure N=110 | |
|--|---------------------------|------|----------------------------|------|
| | No | % | No | % |
| Severely impaired vascular access site | 12 | 10.9 | 22 | 20.0 |
| Impaired vascular access site | 24 | 21.8 | 43 | 39.1 |
| Acceptable vascular access site | 12 | 10.9 | 22 | 20.0 |
| Normal vascular access site | 62 | 56.4 | 23 | 20.9 |

Table 5: Distribution of the studied patients according to pain post-CC procedure.

| Pain site | No pain | | Mild pain | | Moderate pain | | Severe pain | |
|---------------------|---------|-----|-----------|------|---------------|------|-------------|-----|
| | No | % | No | % | No | % | No | % |
| Insertion site pain | 3 | 2.7 | 28 | 25.5 | 69 | 62.7 | 10 | 9.1 |
| Back pain | 8 | 7.2 | 30 | 27.3 | 68 | 61.8 | 4 | 3.6 |

Table 6: Distribution of the studied patients according to total complications.

| Total complications | Post-CC procedure N=110 | |
|--------------------------|----------------------------|------|
| | No | % |
| ▪ Severe complications | 0 | 0.0 |
| ▪ Moderate complications | 20 | 18.2 |
| ▪ Mild complications | 68 | 61.8 |
| ▪ No complications | 22 | 20.0 |

Table 7: Distribution of the studied patients according to total satisfaction level.

| Satisfaction level | No | % |
|------------------------|-----|------|
| ▪ Unsatisfactory level | 5 | 4.5 |
| ▪ Satisfactory level | 105 | 95.5 |

Table 8: The correlation between total satisfaction, total complication, insertion site pain, back pain, and Total vascular access site assessment pre and post-CC (n=110).

| Correlations matrix | | | | | | | |
|---|---------------------|--------------------|---------------------|---------------------|---------------|--|---|
| | | Total satisfaction | Total complications | Insertion site pain | Back pain | Total vascular access site assessment pre-CC | Total vascular access site assessment post-CC |
| Total satisfaction | Pearson Correlation | 1 | .080 | .156 | .070 | .313** | .253** |
| | Sig. (2-tailed) | | .404 | .103 | .470 | .001 | .008 |
| Total Complications | Pearson Correlation | | 1 | .217* | .169 | .136 | .211* |
| | Sig. (2-tailed) | | | .023 | .077 | .158 | .027 |
| Insertion site pain | Pearson Correlation | | | 1 | .385** | .117 | .145 |
| | Sig. (2-tailed) | | | | .000 | .224 | .132 |
| Back pain | Pearson Correlation | | | | 1 | .195* | .242* |
| | Sig. (2-tailed) | | | | | .041 | .011 |
| Total vascular access site assessment pre-CC | Pearson Correlation | | | | | 1 | .054 |
| | Sig. (2-tailed) | | | | | | .574 |
| Total vascular access site assessment post-CC | Pearson Correlation | | | | | | 1 |
| | Sig. (2-tailed) | | | | | | |
| *. Correlation is significant at the 0.05 level (2-tailed). | | | | | | | |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | | | | | |
| Interpretation of r: Weak (0.1-0.24); Intermediate (0.25-0.7); Strong (0.75-0.99) | | | | | | | |

5. Discussion

Diagnostic cardiac catheterization is a crucial diagnostic tool for evaluating coronary artery disease (CAD) and guiding treatment decisions. While the procedure is generally safe and well-tolerated, a certain percentage of patients experience post-procedural complications, pain, and discomfort. (Bordbar et al., 2022) Therefore, the present study aimed to assess vascular access sites and investigate the incidence of post-CC complications, pain levels, and potential associations with patient characteristics, in addition to satisfaction levels among patients undergoing DCC.

In respect of the patients' characteristics under study, according to the results of the current study, the findings of the study indicate that men accounted for more than half of the patients undergoing the CC procedure. This observation can be attributed to several factors associated with gender differences in CAD prevalence. Men are generally more susceptible to CAD compared to women, which could be due to various reasons, including hormonal differences and lifestyle factors such as smoking, stress, and activity level, which can increase the workload on the heart and contribute to the development of CAD and subsequently undergoing CC. These findings are consistent with Ibdah et al. (2020) and Abd El Hafeez et al. (2023), both of which reported that men constituted the majority of patients in their respective studies.

In relation to the type of vascular access site, the current study results showed that the majority of the patients had femoral access. This may be attributed to a shortage of supplies and skills required for the radial approach. This finding is consistent with previous studies by Israeli et al. (2018) and Bangalore et al. (2021) which reported a high prevalence of femoral access among their studied patients.

Concerning the duration of pressure to achieve hemostasis, the present study findings reveal that more than two-thirds of the studied patients had a duration of pressure to achieve hemostasis ranging from 10 to less than 20 minutes. These results may be attributed to the fact that most patients did not receive anticoagulant medications due to undergoing DCC, the use of proper sheath size, and skillful application. These findings are consistent with Metwaly et al. (2022) and Fonseca et al. (2017) similarly reported that the majority of sheaths required less than 20 minutes of pressure to achieve hemostasis.

Regarding vascular access site assessment pre-CC, the present study found that over two-thirds of patients had normal and acceptable vascular access site assessments. This may be connected to the careful assessment, evaluation, and care of patients prior to CC to determine the best vascular site, also the majority of patients had average vital signs. Similar to Metwaly et al. (2022). On the other hand, the post-procedure assessment revealed that more than half of the studied patients had impaired or severely impaired vascular access sites. This observation highlights the potential for procedural complications related to sheath insertion, removal, and manipulation during coronary angiography. The findings of Abd El Hafeez et al. (2018) support this observation, indicating that a high proportion of patients experience abnormal vascular access assessments post-procedure.

Additionally, the study found that most patients experienced mild to moderate back and insertion site pain following DCC. This observation can be attributed to several factors including the insertion and manipulation of the catheter which can cause direct tissue trauma and inflammation, leading to pain at the insertion site. Additionally, post-procedural bed rest

can contribute to back pain due to muscle strain and inactivity post-CC. Furthermore, the anxiety and stress associated with the procedure can exacerbate pain perception. These findings are consistent with the results of Abouelala et al. (2022) reported similar findings, with less than two-thirds of their patients experiencing moderate pain intensity at both the insertion site and back.

In the current study, it was observed that the majority of patients experienced post-CC complications which were mild to moderate complications. This might be related to the age of the studied patients nearly two-thirds of the patients were between the ages of 50 and 60, which made them more at risk for post-CC complications, also the low level of education in the present study showed that more than half of patients can't read or write that contributes to non-compliance with nursing instructions after sheath removal and increases the possibility of complications post-CC.

This finding aligns with the findings of Hetrodt et al. (2021), and Yaqoob et al. (2022) However, it is important to note that the study of Abd El Hafeez et al. (2018) reported no complications in their sample that may be related to nursing care including changing positions with careful assessment.

According to satisfaction level, the present study found that a majority of patients expressed satisfaction with the nursing care they received after the CC procedure. This outcome is the effect of free services, which made the vast majority of patients satisfied and unwilling to complain, also high education level of nurses increases patient satisfaction. The study of Veghel et al. (2020) interacts positively with the present study findings. Also, the study agrees with Feroze et al. (2017) and Folami & Odeyemi. (2019), both reported that the majority of patients showed excellent satisfaction with the quality of care and role delivered by nurses. On the other hand, Thabet et al. (2019) found that most of the studied patients were dissatisfied with the nursing care delivered in the CC unit may be related to the study conducted in a university hospital with overloaded nurses, so no time for communication and explanation for patient make them dissatisfied.

As well as the present study findings demonstrate a significant correlation between satisfaction, and vascular access site assessment pre and post-CC, this finding could be due to those patients having frequent and continuous pre and post-CC nursing care, in addition to skillful nursing staff. Also, the present study findings demonstrate a significant correlation between complications, insertion site pain, and vascular access site assessment post-CC, this is related to the occurrence of the complications associated with impairing the assessment of the vascular access site and needing more pressure in the insertion site which cause insertion site pain.

Furthermore, it was noted that there was a significant correlation between back pain and insertion site pain, it thought to be related to a prolonged laying period with pressure at the insertion site. Also, the current study confirmed a significant correlation between back pain and pre and post-vascular access site assessment, because of the needed prolonged rest period with the impaired vascular access site. which provokes more pain and discomfort. These findings are consistent with the observations of Metwaly et al. (2022) who also reported a connection between CC complications and post-procedural pain.

6. Conclusion and recommendations

6.1. Conclusion

Based on the results of the present study and research questions, the study concluded that more than two-thirds of the studied patients had normal and acceptable vascular access sites pre-CC, while more than half of them had impaired and severely impaired vascular access sites post-CC. Regarding pain post-CC procedure, the majority of the patients in the study reported having pain in both insertion sites and the back that was mild to moderate. Most of the patients also experienced post-CC complications that were relatively mild. However, most of the patients expressed satisfaction with the level of nursing care experienced in the CC unit.

6.2. Recommendations

Based on the findings of this study, the following recommendations are suggested:

6..2.1. Recommendations for patients:

- Health teaching for patients on how to assess and care for access sites before and after DCC.
- Provide a colored illustrated booklet for each patient with DCC and explain the procedure.
- Ensure patients are adequately informed about CC, risk factors, and complications before discharge from the hospital.

6..2.2. Recommendations for nurses:

- Develop instruction media for vascular access site assessment and post-CC assessment as part of routine nursing care for patients undergoing DCC.
- Update nurses' knowledge and practice regarding complications and risk factors for patients undergoing DCC.
- Encourage and support nurses in attending national and international conferences, workshops, and training courses related to nursing care for patients undergoing CC.
- Establish an educational program for nurses in the CC unit to improve their knowledge about patient safety and the prevention of complications after CC.

6..2.3. Recommendations for further research:

- Investigate the effect of implementing a protocol of nursing care on patients' clinical outcomes for those undergoing DCC.

6..2.4. Recommendations for education:

- Include vascular access site assessment and post-CC complications skills in nurses' curricula and training workshops.

6..2.5. Recommendations for organizations:

- Conduct regular staff in-service training to discuss how to assess and prevent vascular access site complications.
- Continuously supervise and evaluate nurses' knowledge and practice to identify their needs and leaks with monitoring.

Abbreviations:

CC: Cardiac Catheterization.

DCC: Diagnostic cardiac catheterization.

TCC: Therapeutic cardiac catheterization.

VASCs: Vascular access site complications.

CAD: Coronary artery disease

Acknowledgments

We would like to express our gratitude to the leadership of Damanhour Medical National Institute and its multidisciplinary staff for their invaluable support in facilitating the implementation of this study. We are also immensely grateful to the patients who participated in this research and generously shared their time and experiences. Their contribution was vital in advancing our understanding of this field.

Funding

This study has not received any external funding.

Conflict of interest

The authors declare that there is no conflict of interest.

Data and materials availability

All data are available upon reasonable request from the corresponding author .

References:

1. Abd El Hafeez, A., Abd, N., Hafeez, A., Hafez, K., & Sanhoury, M. (2018). Effect of changing position on patient outcomes after transfemoral diagnostic cardiac catheterization. *Journal of Nursing and Health Science*, 7(6), 32–42.
2. Abd El Hafeez, D., Mohamed, M., El Shatby, A., & Shaheen, A. (2023). Health related knowledge and behaviors among patients with coronary artery disease. *Alexandria Scientific Nursing Journal*, 25(1), 165–77.
3. Abd-Elmaged, E., & Mohammed, G. (2018). Radial versus femoral access for coronary angiography or intervention and the effect on the nurses, patients and relatives' satisfaction. *Journal of Nursing and Health Science*, 7(1), 17–27.
4. Abouelala, F., Khalil, N., Bahy, A., & Habiba, A. (2022). Effect of gradual sitting position on recovery and satisfaction of patients post trans-femoral cardiac catheterization. *Egyptian Journal of Health Care*, 13(1), 1421–38.
5. Ali, H. A. E., & Ali, M. M. (2019). Effect of designed teaching protocol regarding patients' safety after cardiac catheterization on nurses' performance and patients' incidence of vascular complications. *International Journal of Studies in Nursing*, 4(1), 107-12. <https://doi.org/10.20849/ijsn.v4i1.555>
6. Amin, H., Ahmed, O., Mahedy, N., Ibraheem, M., & Abdellah, A. (2020). Assessment of level of knowledge and practice of patients undergoing cardiac catheterization. *Port Said Scientific Journal of Nursing*, 7(4), 155–83. <https://doi.org/10.21608/pssjn.2020.126805>
7. Azraai, & Ajani E. (2019). Comparison of transradial versus transfemoral approach for coronary angiography and percutaneous coronary intervention. *Journal of Clinical Cardiology and Cardiovascular Therapy*, 1(1), 1-9. <https://doi.org/10.31546/jccvt.1003>
8. Bangalore, S., Barsness, G. W., Dangas, G. D., Kern, M. J., Rao, S. V., Shore-Lesserson, L., & Tamis-Holland, J. E. (2022). Evidence-based practices in the cardiac catheterization laboratory: A scientific statement from the American heart association. *Circulation*, 144(5), 107–19. <https://doi.org/10.1161/CIR.0000000000000996>
9. Barbato, E., Noc, M., Baumbach, A., Dudek, D., Bunc, M., Skolidis, E., Banning, A., Legutko, J., Witt, N., Pan, M., Tilsted, H.-H., Nef, H., Tarantini, G., Kazakiewicz, D., Huculeci, R., Cook, S., Magdy, A., Desmet, W., Cayla, G., ... Haude, M. (2021). Mapping interventional cardiology in Europe: the European Association of Percutaneous Cardiovascular Interventions (EAPCI) Atlas Project. *European Heart Journal*, 41(27), 2579–88. <https://doi.org/10.1093/eurheartj/ehaa475>
10. Boonstra, A. M., Stewart, R. E., Köke, A. J. A., Oosterwijk, R. F. A., Swaan, J. L., Schreurs, K. M. G., & Schiphorst Preuper, H. R. (2016). Cut-Off points for mild, moderate, and severe pain on the Numeric Rating

- Scale for pain in patients with chronic musculoskeletal pain: Variability and influence of sex and catastrophizing. *Frontiers in Psychology*, 7(1), 1466-73. <https://doi.org/10.3389/fpsyg.2016.01466>
11. Bordbar, M., Fereidouni, Z., Morandini, M., & Kalyani, M. (2022). Designing and validation of proposing evidence-based nursing care guidelines in patients undergoing coronary angiography. *Journal of Multidisciplinary Care*, 11(3), 137-42.
 12. Chiarito, M., Cao, D., Nicolas, J., Roumeliotis, A., Power, D., Chandiramani, R., Sartori, S., Camaj, A., Goel, R., Claessen, B. E., Stefanini, G. G., Mehran, R., & Dangas, G. (2021). Radial versus femoral access for coronary interventions: An updated systematic review and meta-analysis of randomized trials. *Catheterization and Cardiovascular Interventions: Official Journal of the Society for Cardiac Angiography & Interventions*, 97(7), 1387-96. <https://doi.org/10.1002/ccd.29486>
 13. Ebeed, M., Khalil, N., & Ismaeel, M. (2017). Vascular complications, and risk factors among patients undergoing cardiac catheterization. *Egyptian Nursing Journal*, 14(3), 259-68.
 14. Feroze, M., Afzal, M., Sarwar, H., Galani, A., & Afshan, S. (2017). Assess knowledge and practice of registered nurses about patient safety after cardiac catheterization in Punjab Institute of Cardiology Hospital, Lahore. *International Journal of Musculoskeletal Pain Prevention*, 2(2), 223-30.
 15. Folami, F. F., Odeyemi, O. (2019). Assessment of patient satisfaction with nursing care in selected wards of the Lagos university teaching hospital (luth). *Biomedical Journal of Scientific & Technical Research*, 17(1), 1-7. <https://doi.org/10.26717/bjstr.2019.17.002941>
 16. Fonseca, P., Almeida, J., Bettencourt, N., Ferreira, N., Carvalho, M., & Ferreira, W. (2017). Incidence and predictors of vascular access site complications following transfemoral transcatheter aortic valve implantation. *Revista Portuguesa de Cardiologia*, 36(10), 747-53.
 17. Gladden, J., Gulati, R., & Sandoval, Y. (2022). Contemporary techniques for femoral and radial arterial access in the cardiac catheterization laboratory. *Rev Cardiovasc Med*, 23(9), 316-25.
 18. Hetrod, J., Engelbertz, C., Gebauer, K., Stella, J., Meyborg, M., Freisinger, E., Reinecke, H., & Malyar, N. (2021). Access site related vascular complications following percutaneous cardiovascular procedures. *Journal of Cardiovascular Development and Disease*, 8(11), 136-43. <https://doi.org/10.3390/jcdd8110136>
 19. Hu, J., Ren, J., Zheng, J., Li, Z., & Xiao, X. (2020). A quasi-experimental study examining QR code-based video education program on anxiety, adherence, and satisfaction in coronary angiography patients. *Contemporary Nurse*, 56(5-6), 428-40. <https://doi.org/10.1080/10376178.2020.1813043>
 20. Ibdah, R. K., Ta'an, W. F., Shatnawi, R. M., Suliman, M. M., Rababah, J. A., & Rawashdeh, S. I. (2020). The effectiveness of early position change postcardiac catheterization on patient's outcomes: A randomized controlled trial. *Nursing Forum*, 55(3), 380-88. <https://doi.org/10.1111/nuf.12438>
 21. Israeli, Z., Lavi, S., Bertand, O. F., Mamas, M. A., & Bagur, R. (2018). Radial versus femoral approach for same-day inter-facility transfer for percutaneous coronary intervention. *Journal of Interventional Cardiology*, 31(2), 230-35. <https://doi.org/10.1111/joic.12486>
 22. Lobo, P., Cleghorn, M., Elnahas, A., Tse, A., Maeda, A., & Queresy, F. (2018). Is quality important to our patients? The relationship between surgical outcomes and patient satisfaction. *Bio Med Journal*, 27(1), 48-52.
 23. Maan, Sh., Abu Ruz, E. (2019). Incidence and predictors of groin complications early after coronary artery intervention a prospective observational study, *Bio Med Central Nursing*, 18(1), 1-10.
 24. Metwaly, A., Abozaid, I., Zaky, M., Youssef, A., Sharaf, M., & Fathy, R. (2022). Risk of complications in patients undergoing diagnostic cardiovascular catheterization at radial versus femoral vascular access sites. *International Journal of Novel Research in Healthcare and Nursing*, 8(1), 830-50.
 25. Niknam, S., Farsi, Z., Butler, S., & Pishgooie, A. (2021). Comparison of the effectiveness of position change for patients with pain and vascular complications after transfemoral coronary angiography: a randomized clinical trial. *Bio Med Central*, 21(1), 114-24.
 26. Reich, R., Rabelo-Silva, E., Santos, S., & Almeida, M. (2018). Vascular access complications in patients undergoing percutaneous procedures in hemodynamics: a scoping review. *Revista Gaucha de Enfermagem*, 38(4), 1-10.
 27. Strickland, O., & Dilorio, C. (2003). *Measurement of Nursing Outcomes*. (Vol. 2), 256-70, Springer publishing company.
 28. Thabet, O., Ghanem, H., & Ahmed, A. (2019). Assessment of nurse's knowledge and practice for patients undergoing cardiac catheterization. *Assiut Scientific Nursing Journal*, 7(17), 95-101.
 29. Veghel, D., Soliman, M., Schulz, D., Cost, B., Simmers, T., & Dekker, L. (2020). Improving clinical outcomes and patient satisfaction among patients with coronary artery disease. *Bio Med Central*, 20(1), 494-512.

30. White, D., Woller, S. C., Stevens, S. M., Collingridge, D. S., Chopra, V., & Fontaine, G. V. (2018). Comparative thrombosis risk of vascular access devices among critically ill medical patients. *Thrombosis Research*, 172(1), 54–60. <https://doi.org/10.1016/j.thromres.2018.10.013>
31. Yaqoob, A., Ali, T., Hasnani, F., & Barolia, R. (2022). Risk factors associated with complications of coronary angiography at a Tertiary Care Hospital in Karachi, Pakistan, *Asian Journal of Allied Health Sciences (AJAHS)*, 7(1), 1–12.
32. Yugandhar, R., & Baradhi, K. M. (2023). Cardiac catheterization risks and complications. *Nursing Journal*, 6(2), 115–67.
33. Zaghlol, H. (2018). Health needs for patients undergoing cardiac catheterization. *Port Said Scientific Journal of Nursing*, 5(1), 213–31. <https://doi.org/10.21608/pssjn.2018.33192>

الملخص العربي

النتائج السريرية ومستوى الرضا بين المرضى الذين يخضعون لقسطرة القلب التشخيصية

مقدمة: تعتبر قسطرة القلب التشخيصية إجراءً ضروريًا لتشخيص واتخاذ قرارات العلاج لمرض الشريان التاجي. على الرغم من أنها آمنة بشكل عام، إلا أنه قد تحدث بعض المضاعفات والألم بعد الإجراء. قد تحدث مضاعفات موضعية مثل التجمع الدموي والعدوى وتلف الشرايين، بالإضافة إلى مضاعفات عامة مثل عدم انتظام ضربات القلب وردود الفعل التحسسية والجلطة الهوائية، مما يؤثر سلبًا على النتائج السريرية ورضا المرضى.

الهدف من الدراسة: هدفت هذه الدراسة الي تقييم النتائج السريرية ومستويات الرضا بين المرضى الذين يخضعون لقسطرة القلب التشخيصية.

عينة وطرق البحث: تم استخدام تصميم بحث مقطعي وصفي لجمع البيانات اللازمة لهذه الدراسة. وأجريت هذه الدراسة في وحدة قسطرة القلب في قسم أمراض القلب بالمعهد الطبي القومي بدمنهور، محافظة البحيرة، مصر. تضمنت الدراسة عينة ملائمة من 110 من المرضى البالغين من الذكور والإناث الذين يخضعون لقسطرة القلب التشخيصية. أدوات الدراسة: تم استخدام ثلاث أدوات لجمع البيانات: الأداة الأولى: " استمارة تقييم مكان الأوعية الدموية المستخدمة للمرضى "، والأداة الثانية: " استمارة تقييم النتائج السريرية للمرضى بعد قسطرة القلب التشخيصية "، والأداة الثالثة: " استبيان رضا المرضى عبر المقابلات المنظمة ".

النتائج: كشفت النتائج أن 67.3% من المرضى الذين شملتهم الدراسة لديهم تقييم لمكان الأوعية الدموية المستخدمة طبيعي ومقبول قبل قسطرة القلب، في حين أن 59.1% لديهم تقييم ضعيف وشديد الضعف بعد قسطرة القلب. أبلغ معظم المرضى عن معاناتهم من ألم في كل من الظهر وموقع الإدخال. عانى 80% من المرضى من مضاعفات خفيفة نسبيًا بعد قسطرة القلب التشخيصية. علاوة على ذلك، أعرب 95.5% من المرضى عن مستوى رضا مرتفع عن تجربتهم الإجمالية في وحدة قسطرة القلب.

الخلاصة: في حين أن قسطرة القلب التشخيصية تنطوي على خطر حدوث نتائج سريرية سلبية خفيفة، فقد أعرب معظم المرضى عن رضاهم عن مستوى الرعاية التمريضية التي تلقوها في وحدة قسطرة القلب.

التوصيات: يوصى بإجراء مزيد من الدراسة عن تأثير تنفيذ بروتوكول الرعاية التمريضية على النتائج السريرية للمرضى الذين يخضعون لقسطرة القلب التشخيصية.