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Effect of early ambulation on reducing hematoma, bleeding, and pain in patients after diagnostic cardiac catheterization

[1]Marwa Mohammed Haggag, [2]Jehan Sayyed Ali, [3]Lobna Mohammed Gamal, [4] Eman Fadl Abd Elkhalik and [5]Ashraf Rady Mohamed

[1]Assistant Lecturer of Critical Care Nursing, Faculty of Nursing, Minia University, Egypt
[2]Professor of Medical Surgical Nursing, Faculty of Nursing, Minia University, Egypt
[3]Professor of Critical Care Nursing, Faculty of Nursing, Minia University, Egypt
[4]Assistant Professor of Medical-Surgical Nursing, Faculty of Nursing, Minia University, Egypt
[5]Lecturer of Cardiology and Vascular Medicine Faculty of Medicine, Minia University, Egypt

Corresponding Author: Marwa Mohammed Haggag

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Abstract

Background: Cardiac catheterization is one of the major diagnostic procedures in CADs involving examination of the right or left part of the heart and the coronary arteries. Cardiac catheterization procedures may lead to local vascular complications after the removal of the femoral arterial sheath.

Aim: evaluate the effect of early ambulation on reducing hematoma, bleeding, and pain in patients after diagnostic cardiac catheterization (DCC).

Research Design: A quasi-experimental research design (study and control groups) was utilized to fulfill the aim of this study.

Setting: This study was carried out at the Cardiac Catheterization Unit, Minia Cadiothorathic University Hospital, Minia City, Egypt.

Sample: A purposive sample of 80 patients 40 for each group (male and female) post DCC.

Tools: The current study included three tools designed and used for collecting data.

First Tool: Patient Assessment, which includes two parts. First Part: Personal Data and Second Part: Medical Data.

Second Tool: Femoral Vascular Complication Assessment and

Third Tool: Numerical Pain Intensity Scale.

Results: Revealed that more than half of the studied groups 72.5% were in the age group from 50 to 65 years. Furthermore, the table revealed that 62.5% of the SG & 77.5% of the CG were male. The study findings revealed that there was a statistically significant positive correlation between early ambulation and the total systolic and diastolic blood pressure among study group.

Conclusion: Early ambulation post DCC is safe and has a positive effect on reducing complications among study group.

Recommendation: Replication of the study on a larger probability sample from other geographical locations in Egypt to guarantee the generalizability of the study.

Keywords: Reducing hematoma, bleeding, and pain, early ambulation, & post diagnostic cardiac catheterization

Introduction

Cardiac catheterization procedures are used for diagnosing and treating patients with confirmed coronary artery disease. Right heart catheterizations allow for direct measurement of right-sided cardiac and pulmonary hemodynamics. Left heart catheterizations provide a diagnostic and therapeutic role in those with coronary artery disease. (Senger *et al*. 2024) [22]. Diagnostic Cardiac Catheterization (DCC) used to assess blood flow to the heart, measure blood pressure, examine for narrow or blocked blood vessels, and assess the hemodynamics of the heart. Also used to evaluate and determine the need for further treatment (Amin *et al*., 2020) [2]. DCC is extremely helpful in the evaluation of patients with suspected or known heart disease. For example, to determine if blockages in the arteries that supply the heart muscle (coronary artery disease) The patieSnt is positioned under an x-ray machine and contrast dye is injected through a catheter, the tip of which is positioned in the coronary artery of interest. The resulting images are recorded on photographic film or a digital medium, such as a computer or compact disk, for subsequent analysis and storage (Coomes *et al*. 2020).

Early ambulation is a nursing intervention that encourages physical exercise, enhances independence after surgery, and mitigates the effects of inactivity. Early ambulation following CC has recently been an intriguing and challenging topic for nurses. This nursing practice is usually used in intensive care units. As a result, primary care nurses must provide early intervention for pediatric cardiac care (Elsayed Elaraby *et al*. 2025). Early ambulation should be encountered as a main post-catheterization strategy, as it shows a significant impact on pain occurrence, intensity,

presence of postural hypotension, and urinary retention (MA Alaa Eldin, *et al*. 2021) [12].

Nurses play an important role in providing patients with high-quality care during the cardiac catheterization (CC). Nurses who have received specialized cardiac training must assess and monitor patients carefully. Cardiac catheterization staff and nurses who care for post-cardiac catheterization procedure patients should collaborate to reduce complications and treat them when they occur when possible (Abdeltawab *et al*., 2024)

The nurse plays a crucial role in preparing the patient before cardiac catheterization (CC). Firstly, fast for 8 to 12 hours before the CC procedure; explain that deep breathing exercises and holding the breath help for better visualization of the heart and also the duration of the procedure, and medication is given before CC as mild sedatives and antihistamines (Mahgoub, A., *et al*. 2013) [14].

World Health Organization (WHO) reported that cardiac disorders still responsible for 30.8% of mortalities, and one person has died from myocardial injury MI each 43 seconds (Brunner LS. *Et al*. 2018) [4] and (Mozaffarian D *et al*. 2016) [17]. According to a study conducted in Iran, cardiovascular diseases accounted for 50% of all deaths every year 79% of deaths connected to chronic diseases (Sadeghi M *et al*. 2017) [21]. Cardiac catheterization being the most radical technique for cardiac disease detection (Mozaffarian D, *et al*. 2016) [17].

Significance of the Study

Cardiac catheterization is the frequently used approach that may lead to vascular complications that occur in 0.43-5.8% of patients; include bleeding, hematoma, and thrombus formation (MA Alaa Eldin, AR Khamis, & Mohamed Abdelhamed, 2021) [12]. Cardiac catheterization (CC) nursing care standards are a crucial concern for all healthcare teams in terms of providing high-quality care to patients and reducing post CC complications. Few studies on nursing care, particularly early ambulation after DCC in Egypt. Therefore, this study conducted to evaluate effect of early ambulation to minimized femoral complications among patients after DCC.

Patient and Methods

Aim of the Study

The present study aimed to evaluate the effect of applying early ambulation on reducing hematoma, bleeding, and pain in patients after DCC.

Research Hypothesis

To fulfill the aim of this study, the following research hypothesis.

1. Early ambulation two hours after diagnostic cardiac catheterization will have reduced the rate of vascular complications (hematoma and bleeding) among the study group compared to the control group.
2. **Research Design**
   A quasi-experimental research design was utilized in the current study (study and control).

Sample

A purposive sample of 80 post diagnostic cardiac catheterization patients, divided equally into study group (SG) and control group(CG) 40 for each group according to the inclusion criteria was collected over 12 months from April 2022 to the end of April 2023. The sample size was estimated by using the (Naing, Winn, & Rusli, 2006) formula, which is computed as ($n = t^2 \times p\ (1- p) / m^2$). Beginning with control group according to the determination of the sample size calculated by the following formula):

$$n = \frac{t^2 \text{ x } p\ (1\text{-}p)}{m^2}$$

$$N\ \frac{(1.96)^2 \text{ x } 0.055\ (1\text{- } 0.055)}{0.05^2}$$

N = 80 patients (40 patients in the study group and 40 patients in the control group**).**

n = required sample size

t = Confidence level at 95% (standard value of 1.960).

p = Prevalence of cardiac catheterization in Cardiothoracic Minia University Hospital 2020.

m = Margin of error at 5% (standard value of 0.050)

$N= (1.96)^2 \times 0.062\ (1\text{-}0.062) / (0.05)^2 = 80$ patients.

The estimated required sample size was 80 patients who were selected according to the following inclusion and exclusion criteria:

Inclusion Criteria

1. Age (18 to 65 years)
2. Diagnostic Cardiac Catheterizations (DCC)

Exclusion Criteria

1. Patient who have femoral artery, complications developed during cardiac catheterization.
2. Patient who have bleeding immediately after diagnostic cardiac catheterization.
3. Previous diagnostic cardiac catheterization
4. Patient who is exposed to cardiopulmonary resuscitation during diagnostic cardiac catheterization

Setting

This study was carried out at the Cardiac Catheterization Unit, Minia Cadiothorathic University Hospital, Minia City, Egypt.

Tools of Data Collection

The current study tools were designed and used for collecting data, these tools were developed by the researcher, the content of these tools were established after extensive literature review.

First Tool: Patient Assessment after Femoral Sheath Removal Post DCC: It includes two parts: this tool developed by the researcher and covered two parts

- **First Part: Patients' Personal Data** such as patients' code, age, gender, weight, height, level of education, residence, marital status**,** and occupation.
- **Second Part: Patients' Medical Data that included 3 parts:**

- **1st Part: Past Medical History:** hypertension, diabetes mellitus, previous myocardial infarction, previous angina, renal disease, previous hospitalization, bleeding disorders.)
- **2nd Part: Current Medical History:** date of admission, femoral sheath size, time of sheath indwelling and length of hospital stay
- **3rd Part: Vital Signs:** monitoring Body Temperature (BT), Heart Rate (HR), Respiratory Rate (RR), Blood Pressure (BP), Selected site Peripheral Pulse. Immediately after arrival at post cardiac catheterization unit, then every 15 minutes in the first hour, then hourly until the first 6 hour then every two hours till discharge

Second Tool: Vascular Complication Assessment after Femoral DCC:
The researcher based on a literature review developed this tool. It comprised of three parts:

First Part: Hematoma Formation Monitoring
It was adopted from Al Sadi, Omeish & Al-Zaru *et al*. (2010) to measure hematoma size. It classified hematoma into four categories according to the surface area: No hematoma (<2cm2 in diameter), Small hematoma (2≤ 5cm2 in diameter), Medium hematoma (5≤ 10 cm2 in diameter), and large hematoma (≥ 10 cm2 in diameter). The borders of hematoma were measured by using two-dimensional rulers. The researcher measured the hematoma size immediately post DCC, and at discharge after early ambulation schedule

Second Part: Femoral Vascular Bleeding Assessment
- **Visual Guide Bleeding Monitoring**
  It was used to determine the absorptive capacity of dressing wetted with blood and supersaturated as compared to dry one. Three different sizes of commonly used surgical gauze (10 × 10 cm, 30 × 30 cm, and 45 × 45 cm) were tested for their absorptive capacity and used to reconstruct the analogue. The increment in blood spill was 3 ml in the 10×10 gauze, 10 mL in the 30 × 30 gauze, and 40 mL in the 45 ×45 gauze. The stains that resulted from this spill were photographed for the visual guide. After the gauze testing was complete, four patterns were selected for each surgical gauze to construct the visual guide. Each pattern represented 25%, 50%, 75%, and 100% saturation. The researcher measured the dressing size immediately post DCC, and at discharge after early ambulation schedule

Third Tool: Numerical Pain Intensity Scale: It was adopted from (McCaffery, 1994) and (Eriksson K, *et al*., 2014).
- It was used to assess the level of pain intensity at affected site. Pain intensity ranging from no pain (scored = 0) to worst (scored = 10).
- Pain level was assessed immediately post diagnostic cardiac catheterization, before and after mobilization.
- Scoring system: (0: no pain, 1-3: mild pain, 4 - 6: moderate pain, 7- 9: severe pain and the worst pain 10).

Tools Validity
- Content and contrast of the study tools were tested by a panel of five expert's opinions in the field of Critical Care Nursing and Medical Surgical Nursing in Nursing Faculty at Minia University and according to their opinion some modifications were applied. The instrument was examined for content coverage, clarity, relevance, applicability, wording, length, format, and overall appearance.

Tools Reliability
Reliability for the study tools was estimated using the Cronbach's Alpha test to measure their internal consistency to evaluate how well the tools consistently measure, what they were designed to measure. Reliability of patient assessment after femoral sheath removal after DCC, vascular complication assessment after femoral DCC, early ambulation schedule and numerical pain intensity scale were (0.96, 0.71, and 0.86) respectively.

Pilot Study
A pilot study was carried out on 10% (n = 8) of the total sample of patients admitted to the DCC unit, meeting inclusion criteria to ascertain the clarity, feasibility, and applicability of the study tools and estimate the time required for fulfilling it. In light of the pilot study, there were no modifications done to data collection tools, so the patients who were included in the pilot study were also included in the actual study sample.

Ethical Considerations
Official permission to conduct the study was obtained from the Research Ethical Committee in the Faculty of Nursing, the Dean of the Nursing Faculty, the Manager of Cardiothoracic Minia University Hospital, the Manager of the Cardiac Catheterization Unit (CCU), and an agreement from Egypt Academic for Research Center and Technology to carry out this study. Patients in this study were entire voluntary, each patient informed about the purpose, procedure, benefits, nature of the study and that he/she had the right to withdraw from the study at any time without any rationale, and then written consents were gained. Confidentiality and anonymity of each patient were ensured through coding of all data and protecting the obtained data.

Study Procedure
Preparatory Phase
It included reviewing of the current and relevant related literature and theoretical knowledge of the various related aspects using textbooks, articles, and periodical magazines in order to develop the data collection tools.

Implementation Phase
This phase includes the early ambulation immediately after cardiac catheterization procedure. Selected patients according to inclusion and exclusion criteria were admitted to cardiac catheterization unit, were scheduled for early ambulation was informed by the investigator individually about purpose and nature of the study
Post the procedure; the researcher used three fingertips to apply direct pressure at the groin puncture site. The time of compression averaged 20 - 30 minutes.While applying pressure, the femoral sheath was withdrawn. Dressing was applied over the site of puncture through apply 4 folded sterile 4×4 gauze sponges and apply optimal pressure when

securing tape without hip abduction. Groin site was inspected for assessment of vascular complications (hematoma, bleeding) at the catheter puncture site which was done immediately, before each time of ambulation as scheduled by using first part of the second tool: hematoma formation monitoring sheet.

The researcher used the second and third part of the second tool to assesses bleeding after the procedure (Visual Guide Bleeding Monitoring) to create a realistic amount of absorbed blood in the dressing. Then Patients started to mobilize after 2 hours from the cardiac catheterization procedure. During immobilization period, the patient was allowed to raise the head of the bed gradually to 15°, then 30° to 45°, and then to 90° set on the bed for 10 minutes at least, allowed the patient to stand when her/his condition was stable, the patient set on a chair for 10 minutes, and then the patient walked on the ward with an assistant.

During position changes, supportive devices as small pillow were used to support body parts (head, neck, shoulder, lumber curvature and between knee), and the affected leg was maintained straight. Patients were instructed to support the puncture site while move. When there was no discomfort and no sign of bleeding or hematoma, the patient was allowed to walk on the ward on his own for a small distance of a few meters. If the patient had any discomfort, they immediately rested in bed.

Patients were instructed to recognize puncture site complications. Also they were instructed about what they are not allowed to do during mobilization, e.g., lifting heavy things and biking. The researcher performed several inguinal inspections. These inspections consisted of examinations of the puncture site, and the patients were asked about pain to assess pain level by using Numerical Pain Intensity Scale. In the early stages of ambulation, inspections was performed before ambulation and after each stage of ambulation.

Evaluation Phase

- The base line evaluation was done by first tool: Patient assessment after femoral sheath removal after DCC (first and second part), these data was collected by the researcher before performing the intervention.
- The hemodynamics was measured immediately after arrival at post DCC unit, then every 15 minutes in 1st hour and then hourly for 6th hour and finally before discharge.
- Evaluation of hematoma formation was done by using the first part of the second tool: (hematoma formation monitoring) immediately, at 6 hours, and then before discharge.
- Evaluation of femoral vascular bleeding was done by using the second and third part of the second tool: (visual guide bleeding monitoring and digital sensitive scale) immediately, at 6 hour, and then before discharge.
- Evaluation of pain level was done by using the fourth tool: pain intensity numeric scale as follow:

Pain level was assessed before mobilization and then after each position change till discharge

Statistical Analysis of Data:

The collected data was tabulated, computerized, analyzed and summarized by using descriptive statistical tests to test research hypothesis by using SPSS version (IBM 22) and excel for figures. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations for quantitative variables. Chi square test was used to detect the relation between two categorical variables. Correlation coefficient was done by using Pearson correlation test. The sign of the coefficient indicates the nature of relation (positive/negative) while the value indicates the strength of relation as follows: Weak correlation less than 0.25, a fair correlation value between 0.25-0.499, a moderate correlation value between 0.5-0.739, and strong correlation for values between 0.740-0.99. The level of significance was be accepted at $P< 0.05$ and was be considered highly significant when P-value less than or equal 0.01.

Results

Table 1: Frequency Distribution of Studied Groups Regarding their Personal Data (n=80)

Personal Data	Study Group (n=40)		Control Group (n=40)		F / X^2 (p value)
	N	%	N	%	
Age					
30- 40 years	4	10	2	5	0.927 (0.0700)
40- 50 years	7	17.5	9	22.5	
50 - 65 years	29	72.5	29	72.5	
Mean ± SD	54.7 ± 7.20		53.7 ± 8.58		
Gender					
Male	25	62.5	31	77.5	2.14 (0.222)
Female	15	37.5	9	22.5	
Marital Status					
Married	30	75	34	85	1.25 (0.264)
Widowed	10	25	6	15	
Residence					
Urban	8	20	12	30	1.06 (0.302)
Rural	32	80	28	70	
Education					
Illiterate	10	25	6	15	1.50 (0.682)
Read and Write	10	25	10	25	

Secondary	14	35	18	45	
University	6	15	6	15	
Occupation					
House Wife	10	25	4	10	4.01 (0.260)
Worker	18	45	20	50	
Farmer	4	10	8	20	
Pension	8	20	8	20	
Body Mass Index (BMI)					
Healthy Body Weight: (18.5 - 24.9 kg/m2)	24	60	28	70	
Overweight / pre-obese: (25 - 29.9 kg/m2)	12	30	12	30	
Obese (≥ 30)	4	10	0	0	
Mean ± SD	24.6 ± 3.10		23.3 ± 2.05		

Table (1) Revealed that more than half of the studied groups 72.5% were in the age group from 50 to 65 years. Furthermore, the table revealed that 62.5% of the SG & 77.5% of the CG were male. Concerning marital status, 75% of the SG & 85% of the CG were married. Regarding residence, 80% of the SG and 70% of the CG came from rural areas. Concerning the level of education, 35% of SG and 45% of the CG had secondary education. In relation to occupation, it showed that 45% of the SG and 50% of the CG were workers. According to body mass index, 60% of the SG and 70% of the CG had a healthy body weight.

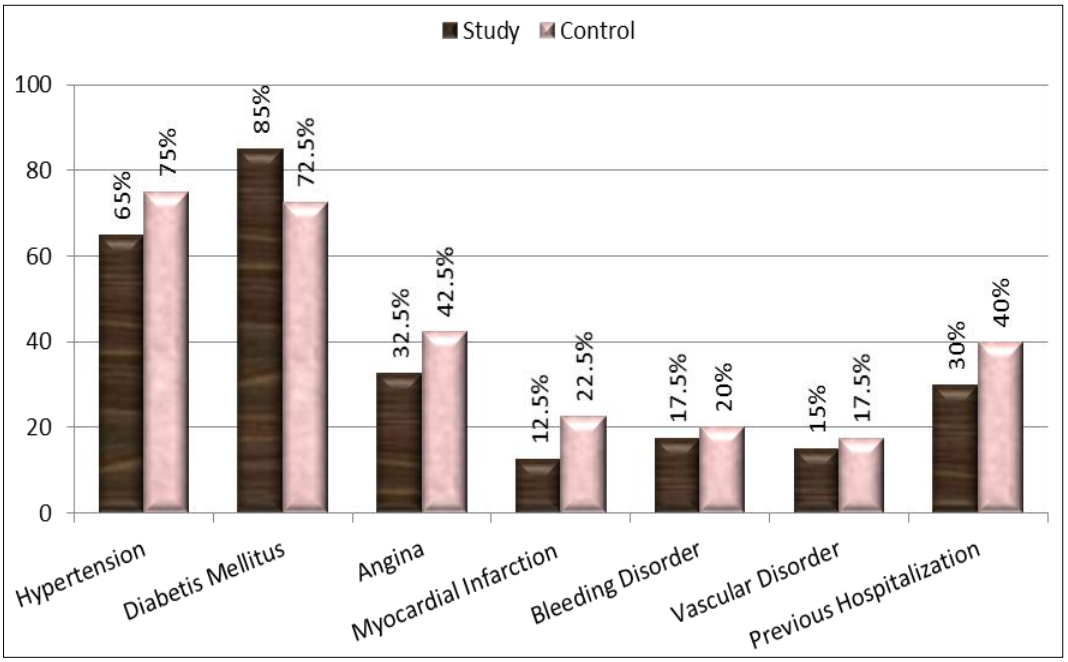

Fig 1: Frequency Distribution of Studied Groups Regarding Their Medical Data (n=80)

Figure (1) Illustrates that 85% of the SG and 72.5% of the CG, respectively, had diabetes mellitus. While 65% of the SG and 75% of the CG, had hypertension. Additionally, 30% of the SG and 40% of the CG had previous hospitalizations. Furthermore.

Table 2: Frequency Distribution of Studied Groups Regarding Their Current Diagnostic Cardiac Catheter Data (n=80)

Current Diagnostic Cardiac Catheter Data	Study Group (n=40)		Control Group (n=40)		F / X^2 (p value)
	N	%	N	%	
Size of Sheath					
• 6 French	34	85	38	95	2.22 (0.136)
• 7 French	6	***15***	***2***	***5***	
Time of Sheath Indwelling /(Minute)					
• 5 - < 15 minute	30	75	25	62.5	1.45 (0.228)
• 15 - < 30 minute	10	25	15	37.5	
Length of Stay Post Diagnostic Cardiac Catheter					
• 6 - < 8 hour	32	80	23	57.5	4.71 (0.030*)
• 8 - 10 hour	8	20	17	42.5	

* Statistical Significant Difference ($P \leq 0.05$)

Table (2) Indicates that 85% and 95% of the study and control groups, respectively, had utilized a sheath size of 6 French. In addition, it was noticed that 75% and 62.5% of the study and control groups, respectively, had the indwelling sheath within a timeframe of 5 to less than 15 minutes. Furthermore, 80% and 57.5% of the study and control groups, respectively, had a length of stay at the hospital post-DCC lasting between 6 and 8 hours, with a statistically significant difference presented by (0.030).

Table 3A: Mean and Standard Deviation of Vital Signs among Studied Groups Regarding Time Post Diagnostic Cardiac Catheterization (n=80)

Vital Signs Measuring Time Post Diagnostic Cardiac Catheterization	Mean Standard Deviation of Vital Signs among Studied Groups							
	Temperature		Respiration		Peripheral Pulse		Apical Pulse	
	Study Group (n=40)	CG. Receive Routine Hospital Care (n=40)	Study Group (n=40)	CG. Receive Routine Hospital Care (n=40)	Study Group (n=40)	CG. Receive Routine Hospital Care (n=40)	Study Group (n=40)	CG. Receive Routine Hospital Care (n=40)
• Immediately	37.3 ± 0.147	37.2 ± 0.133	18.4 ± 2.27	19.1 ± 3,37	96.2 ± 2.71	97.9 ± 4.83	98.3 ± 7.81	97.3 ± 9.26
t (p value)	1.05 (0.786)		1.06 (0.218)		1.94 (0.056)		1.35 (0.612)	
• After 1 Hour	37.1 ± 0.966	37.0 ± 0.661	16.6 ± 0.806	17.1 ± 1.07	92.8 ± 4.32	95.0 ± 3.28	96.9 ± 6.27	97.9 ± 4.98
t (p value)	0.891 (0.991)		1.58 (0.116)		2.56 (0.012*)		2.72 (0.399)	
• After 2 Hours	37.1 ± 0.124	37.2 ± 0.142	16.8 ± 1.53	18.2 ± 2.82	94.4 ± 3.77	96.4 ± 1.98	96.3 ± 6.72	97.4 ± 6.04
t (p value)	3.75 (0.001**)		2.60 (0.011*)		2.92 (0.004**)		0.770 (0.414)	
• After 4 Hours	37.08 ± 0.129	37.2 ± 0.230	16.5 ± 1.67	17.6 ± 2.44	92.2 ± 6.49	96.7 ± 4.86	93.8 ± 5.84	95.6 ± 5.58
t (p value)	10.5 (0.007**)		2.29 (.0.025*)		3.44 (0.001**)		1.26 (0.210)	
• After 6 Hours	37.05 ± 0.265	37.2 ± 0.341	16.3 ± 1.21	16.8 ± 1.18	90.0 ± 5.01	93.4 ± 2.27	91.5 ± 5.13	93.01 ± 5.47
t (p value)	4.74 (0.006**)		2.47 (0.016*)		3.84 (0.001**)		1.40 (0.165)	
• After 8 Hours	37.1 ± 0.131	37.2 ± 0.142	16.8 ± 0.712	18.05 ± 1.25	90.2 ± 2.60	94.4 ± 2.60	90.9 ± 4.98	92.4 ± 4.74
t (p value)	3.49 (0.001**)		5.35 (0.001**)		2.92 (0.005**)		1.87 (0.46*)	
• After 6 Hours	37.0 ± 0.074	37.1 ± 0.151	16.3 ± 1.26	17.9 ± 1.59	92.4 ± 6.12	97.2 ± 2.26	89.2 ± 5.33	91.3 ± 4.68
t (p value)	12.7 (0.001**)		2.70 (0.023*)		4.62 (0.001**)		2.07 (0.006**)	
• At Discharge	37.05 ± 0.675	37.1 ± 0.213	16.7 ± 1.31	18.7 ± 1.41	92.0 ± 4.00	96.6 ± 4.00	88.6 ± 5.93	92.0 ± 4.94
t (p value)	9.12 (0.016*)		3.86 (0.006**)		6.90 (0.001**)		2.74 (0.008**)	

* Statistical Significant Difference ($P \leq 0.05$)
** Highly Statistical Significant Difference ($P \leq 0.01$)·

Table (3A): Demonstrates that the mean & standard deviation of temperature, respiration and pulse had improved among the SG starting from 2 hours until discharge post-diagnostic cardiac catheterization with a statistically significant difference.

Table 3B: Mean & Standard Deviation of Blood Pressure Regarding Measuring Time among Studied Groups Regarding Time Post Diagnostic Cardiac Catheterization (n=80)

Blood Pressure Measuring Time Post Diagnostic Cardiac Catheterization	Mean & Standard Deviation of Blood Pressure among Studied Groups			
	Systolic Blood Pressure		Diastolic Blood Pressure	
	Study Group (n=40)	CG. Receive Routine Hospital Care (n=40)	Study Group (n=40)	CG. Receive Routine Hospital Care (n=40)
• Immediately	106.9 ± 3.32	107.5 ± 3.36	71.0 ± 2.02	71.6 ± 2.30
t (p value)	0.869 (0.388)		1.28 (0.202)	
• After 1 Hour	107.5 ± 4.08	108.8 ± 3.18	73.1 ± 3.99	73.0 ± 4.05
t (p value)	1.02 (0.657)		1.01 (0.975)	
• After 2 Hours	111.0 ± 4.11	114.8 ± 6.93	73.0 ± 2.48	71.6 ± 2.84
t (p value)	3.50 (0.001**)		2.38 90.019*)	
• After 3 Hours	108.6 ± 5.71	112.0 ± 5.83	73.2 ± 4.31	71.0 ± 4.96
t (p value)	3.04 (0.003**)		2.16 (0.034*)	
• After 4 Hours	106.7 ± 5.37	113.5 ± 7.94	71.7 ± 3.62	70.0 ± 3.20
t (p value)	3.67 (0.009**)		2.25 (0.027*)	
• After 5 Hours	109.0- ± 3.78	117.7 ± 9.86	73.4 ± 4.16	71.1 ± 2.33
t (p value)	2.67 (0.009**)		3.11 (0.003**)	
• After 6 Hours	108.0 ± 2.48	113.6 ± 7.38	71.5 ± 3.57	69.1 ± 2.02
t (p value)	4.45 (0.001**)		3.88 (0.001**)	
• At Discharge	105.0 ± 4.46	108.0 ± 6.40	75.0 ± 3.20	71.9 ± 2.99
t (p value)	4.68 (0.001**)		4.43 (0.001**)	

T Independent Sample T Test
* Statistical Significant Difference ($P \leq 0.05$)
** Highly Statistical Significant Difference ($P \leq 0.01$)

Table (3B) Demonstrates that the mean & standard deviation of systolic and diastolic blood pressure had

improved among the SG starting from two hours until discharge post-diagnostic cardiac catheterization with a statistically significant difference.

Table 4: Frequency Distribution of Studied Groups Regarding Incidence Time of Hematoma Post-Diagnostic Cardiac Catheterization (n=80)

Hematoma Formation Monitoring	Hematoma Incidence Time among Studied Groups Post-Diagnostic Cardiac Catheterization.			
	Immediately		At Discharge	
	Study Group (n=40)	CG. Receive Routine Hospital Care (n=40)	Study Group (n=40)	CG. Receive Routine Hospital Care (n=40)
• No hematoma (< 2cm^2 in diameter)	33 (82.5%)	34 (85%)	38 (95%)	29 (72.5%)
• Small hematoma (2 ≤ 5cm^2 in diameter)	4 (10%)	4 (10%)	2 (5%)	7 (17.5%)
• Medium hematoma (5 ≤ 10 cm^2 in diameter)	3 (7.5%)	2 (5%)	0 (0%)	4 (10%)
F (p value)	0.949 (0.330)		7.44 (0.013*)	

F: Fisher Exact
* Statistical Significant Difference ($P \leq 0.05$)

Table (4) Documented that 82.5% of the SG & 85% of the CG exhibited no hematoma immediately post-diagnostic cardiac catheterization, while 95% of the SG and 72.5% of the CG had no hematoma at discharge, post DCC with a p-value of 0.013.

Table 5: Frequency Distribution of Studied Groups Regarding Incidence of Femoral Bleeding Post-Diagnostic Cardiac Catheterization (PDCC) (n=80)

Bleeding Monitoring (Blood Wetted Dressing Size)	Femoral Bleeding Incidence Time			
	Immediately		At Discharge	
	Study Group (n=40)	CG. Receive Routine Hospital Care (n=40)	Study Group (n=40)	CG. Receive Routine Hospital Care(n=40)
Bloody Dressing Size				
• 10 X 10 cm (Dressing weight < 3 mg.)	37 (92.5%)	38 (95%)	37 (92.5%)	30 (75%)
• 30 X 30 cm (Dressing weight > 3 mg.)	3 (7.5%)	2 (5%)	3 (7.5%)	10 (25%)
F (p value)	0.213 (0.644)		4.50 (0.034*)	

F: fisher exact
* Statistical Significant Difference ($P \leq 0.05$)

Table (5) Illustrates that 92.5% of the SG and 95% of the CG had blood-wetted dressing weight less than 3 mg immediately post DCC compared to 92.5% and 75% of the study & control groups, respectively, at discharge post DCC, with a statistically significant difference represented by a P value (0.034).

Table 6: Relation between Pain Intensity Level and Changing Head of the Bed Position among Studied Groups Post-Diagnostic Cardiac Catheterization (n=80)

Pain Intensity Level	Changing Head of the Bed Position HOB							
	First Two Hours Low Fowler (HOB 15 Degree)		Post Four Hours Semi-Fowler (HOB 30 Degree)		Post Six Hours Semi-Fowler (HOB 45 Degree)		Before Discharge High Fowler (HOB 90 Degree)	
	Study Group (n=40)	CG. Receive Routine Hospital Care(n=40)	Study Group (n=40)	CG. Receive Routine Hospital Care(n=40)	Study Group (n=40)	CG. Receive Routine Hospital Care(n=40)	Study Group (n=40)	CG. Receive Routine Hospital Care(n=40)
• None (0)	8 (20%)	8 (20%)	8 (20%)	6 (15%)	36 (90%)	27 (67.5%)	38 (95%)	31 (77.5%)
• Mild (1 - 3)	13 (32.5%)	14 (35%)	26 (65%)	18 (45%)	4 (10%)	10 (25%)	2 (5%)	6 (15%)
• Moderate (4 - 6)	16 (40%)	17 (42.5)	6 (15%)	16(40%)	0 (0%)	3 (7.5%)	0 (0%)	3 (7.5%)
• Severe (7-10)	3 (7.5%)	1 (2.5)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
F/X^2 (P value)	1.06 (0.785)		6.28 (0.043*)		6.85 (0.032*)		5.71 (0.039*)	

F: fisher exact
X^2: chi square
**Statistical Significant Difference ($P \leq 0.05$)

Table (6) Shows that 20% of the SG, when the HOB was at 15 degrees, and 20% of the CG who RRHC, had no pain in the first two hours. In addition, it was noticed that 20% of the SG when the HOB was at 30 degrees and 15% of the CG who receive routine hospital care (RRHC) had no pain post four hours. Furthermore, 90% of the SG when the HOB was at 45 degrees and 67.5% of the CG who RRHC had no pain post six hours. Finally, 95% of the SG when the HOB was at 90 degrees and 77.5% of the CG who RRHC had no pain at discharge time. There was a statistically significant relationship between the pain intensity level and HOB position at post four, six, and discharge times. Represented by p-values of 0.043, 0.032*, and 0.039, respectively.

Table 7: Relation between Pain Intensity Level and Early Ambulation (Walking) among Studied Groups Post-Diagnostic Cardiac Catheterization (n=80)

Pain Intensity Level	Early Ambulation (Walking)							
	Walk Around the Bed With Assistance Post Two Hours		Walk Around the Bed Without Assistance Post Four Hours		Allowed to Walk in the Room With Assistance Post Six Hours		Allowed to Walk in the Room Without Assistance Before Discharge	
	Study Group (n=40)	CG. Receive Routine Hospital Care (n=40)	Study Group (n=40)	CG. Receive Routine Hospital Care (n=40)	Study Group (n=40)	CG. Receive Routine Hospital Care (n=40)	Study Group (n=40)	CG. Receive Routine Hospital Care (n=40)
None (0)	32 (80%)	28 (70%)	32 (80%)	28 (70%)	40 (100%)	28 (70%)	40 (100%)	31 (77.5%)
Mild (1 - 3)	6 (15%)	8 (20%)	6 (15%)	8 (20%)	0 (0%)	10 (25%)	0 (0%)	9 (22.5%)
Moderate (4 - 6)	2 (5%)	4 (10%)	2 (5%)	4 (10%)	0 (0%)	2 (%)	0 (0%)	0 (0%)
F/X^2 (P value)	1.21 (0.544)		1.21 (0.544)		14.1 (0.001**)		10.1 (0.001**)	

F: fisher exact
X^2: chi square
**Statistical Significant Difference ($P \leq 0.05$)

Table (7) Shows that 80% of the SG had no pain when allowed to walk around the bed with or without assistance post two & four hours. In addition, it was observed that 100% of the SG reported no pain when allowed to walk in the room with or without assistance at six hours and before discharge time. While 70% of the CG who underwent RRHC reported no pain at two, four, and six hours, an additional 77.5% of them experienced no pain before discharge. There was a statistically significant relationship between the pain intensity level and early ambulation among study group noted post six hours and prior to discharge, indicated by a p-value of 0.001.

Table 8: Correlation between Total Pain Intensity Level and Early Ambulation among Study Group after Diagnostic Cardiac Catheterization (n=40)

Total Pain Intensity Level	Early Ambulation of Study Group after Diagnostic Cardiac Catheterization (n=40)
	r (p)
Pain	- 0.347 (0.002**)

** Highly Statistical Significant Difference ($P \leq 0.01$)·

Table (8) Revealed that there was a statistically significant negative correlation between total pain intensity level and both of early ambulation after diagnostic cardiac catheterization among SG, documented by 0.002.

Table 9: Correlation between Early Ambulation, and Total Vital Signs among Study Group after Diagnostic Cardiac Catheterization (n = 40)

Total Vital Signs	Early Ambulation of Study Group after Diagnostic Cardiac Catheterization (n=40)
	r (p)
Temperature	- 0.266 (0.017*)
Apical Pulse	- 0.238 (0.033*)
Respiratory Rate	- 0.342 (0.002**)
Systolic	0.464 (0.001**)
Diastolic	0.401 (0.001**)

* Statistical Significant Difference ($P \leq 0.05$)
** Highly Statistical Significant Difference ($P \leq 0.01$)·

Table (9) Shows a statistically significant negative correlation between early ambulation and total temperature, apical pulse, and respiratory rate after diagnostic cardiac catheterization among SG. In addition, the findings revealed that there was a statistically significant positive correlation between early ambulation and the total systolic and diastolic blood pressure among SG.

Table 10: Correlation between the Total of Hematoma and Bleeding Incidence and Total Early Ambulation among the Study Group after Diagnostic Cardiac Catheterization (n=40)

Total Femoral Complication Incidence	Total Early Ambulation (n=40)
	r (p)
Total Hematoma	- 0.474 (0.002**)
Total Bleeding	- 0.351 (0.001**)

** Highly Statistical Significant Difference ($P \leq 0.01$)

Table (10) shows a statistically significant negative correlation between incidence of hematoma and early ambulation among SG after diagnostic cardiac catheterization. The table revealed that there were negative correlations between the incidence of bleeding and early ambulation & application of among SG after diagnostic

cardiac catheterization.

Discussion

Diagnostic cardiac catheterization is a widely used procedure for evaluating cardiovascular diseases, including coronary artery disease, valvular disorders, and structural abnormalities. Despite its diagnostic benefits, the procedure carries risks of complications, particularly at the femoral access site, such as hematoma, bleeding, and pseudoaneurysm formation. Proper post-procedural care is crucial in minimizing these complications and promoting patient recovery (Wang *et al.*, 2024) [24].

Early ambulation can enhance circulation and prevent complications like deep vein thrombosis (Morika *et al.*, 2021) [16]. So that, the present study aimed to evaluate the effect of early ambulation on reducing femoral complications and pain among patients after diagnostic cardiac catheterization.

As regard to demographic characteristics among the studied sample, the current study showed that most of the patients in the study and control patients were between the ages of fifty and sixty-five years. This may be rendered to patients in this age group has a higher prevalence of coronary artery disease (CAD), hypertension, and diabetes mellitus, making them more likely to undergo diagnostic cardiac catheterization.

This finding is consistent with (Hamdi *et al.*, 2023) [7] who reported that the highest percentage of study and control patients' age was more than fifty years. In addition, the current study finding was similar to the study conducted by (Mahmood, 2023) [13] who reported that approximately half of the patients participating in the diagnostic and therapeutic groups were within the age groups of (50 - 59) years old.

Regarding to Gender, the current study findings displayed that more than half of the study and control group were males. This may be attributed to lifestyle factors, as men tend to develop coronary artery disease (CAD) at an earlier age due to higher exposure to risk factors such as smoking, hypertension, and dyslipidemia.

The current study finding was compatible with the study conducted by (Mahmood, 2023) [13] who concluded that more than two thirds of study and control participants were male. This is in the same line with the finding of a study done by (Baljepally *et al.*, 2021) [3] who had shown that men are more likely than women to undergo cardiac catheterization procedures.

According to Marital Status, it was noticed that almost four fifth of the study participants were married. The current study finding was compatible with the study conducted by (Kurt *et al.*, 2019) who reported that more than two thirds of study sample were married. The result of the present study is supported by (Amin *et al.*, 2020) [2] whose study findings clarified that about two thirds of the study and control group were married.

Concerning Residence, the current study findings showed that about three quarters of study participants were from rural areas. From the researcher point of view this may be due to most of the governorate in Upper Egypt is villages with a low degree of health care services and restricted access to medical care. This result is contrast with (Ibrahem Shalaby *et al.*, 2024) [9] whose study findings illustrated that more than two thirds of study and control sample were from urban areas. Furthermore, the current study findings were opposite to the study conducted by (Amin *et al.*, 2020) [2] who reported that more than two thirds of studied patients were from urban areas.

Regarding to education, the current study results showed that two fifth of study participants had secondary education degree. The current study finding was compatible with the study conducted by (Amin *et al.*, 2020) [2] who reported that more than one third of study participants had secondary school degree. In opposite, (Pamuk *et al.*, 2024) reported that more than half of study sample had elementary educational level.

Concerning to Occupation, it was observed that more than two fifth of study and control participants were workers. This may be rendered to most of study participants were male. This finding is consistent with (Yujeong, 2022) [25] who undergoing cardiac catheterization procedures and found that the majority of patients undergoing cardiac catheterization procedures were employed, with a significant percentage working in manual labor jobs. This finding is contradicted with (Hamdi *et al.*, 2023) [7] who reported that more than half of study sample were housewives. At the same line, (Ibrahem Shalaby *et al.*, 2024) [9] reported that more than half of study participants were not working.

As regards Body Mass Index, the current study findings showed that more than half of study and control participants had healthy body weight. The current study findings were in contrary with the study done by (Baljepally *et al.*, 2021) [3] whose study results showed that more than half of studied sample had overweight in regarding to body mass index.

Concerning frequency distribution of studied patients regarding their medical data, the present study results showed that more than four quarter of study and control participants were hypertensive and near to two thirds had diabetes mellitus. From the researcher point of view, this may be attributed to there is a strong association between these conditions and cardiovascular disease (CVD). Hypertension and diabetes are well-established risk factors for coronary artery disease (CAD), often-necessitating diagnostic cardiac catheterization for assessment and management. Furthermore, Hypertension contributes to arterial stiffness, endothelial dysfunction, and increased vascular resistance, which elevate the risk of ischemic heart disease and procedural complications. Similarly, diabetes mellitus accelerates atherosclerosis and impairs endothelial function, increasing the likelihood of multivessel disease and delayed vascular healing post-catheterization.

This finding is consistent with (Hamdi *et al.*, 2023) [7] who found that more than half of the study and control patients undergoing cardiac catheterization had hypertension, while less than half of them were having diabetes mellitus. Also, the finding of a study done by (Hamdi *et al.*, 2023) [7] who found that hypertension, or high blood pressure, is a major risk factor for cardiovascular diseases and is a common comorbidity in patients undergoing cardiac catheterization.

Regarding to frequency distribution of studied patients regarding their current medical data, the current study findings displayed that the vast majority of study and control patients had been examined utilized a sheath size of 6 French. While, about four quarter of them experienced a hospital stay lasting between 6 to 8 hours. This finding was compatible with (Ibrahem Shalaby *et al.*, 2024) [4] who

concluded that the vast majority of studied participants used a sheath size of 6 French with Sheath time (15- <30 Minutes).

Regarding to mean scores of vital signs among studied patients post diagnostic cardiac catheterization, the current study findings showed a notable reduction in studied patients' vital signs from initial evaluation to discharge (post-intervention) compared to the control group with statistically significant differences between the two groups. From the researcher point of view these results indicate the positive impact of post-cardiac catheterization care. This decline in heart rate, blood pressure, and respiratory rate can be attributed to hemodynamic stabilization following the procedure, as well as the effectiveness of early ambulation in reducing vascular stress, pain, and procedural anxiety.

This finding is consistent with (Mustafa & HASSAN, 2020) indicated that vital signs in experimental group return to normal levels after the procedure until discharge. The results of this study indicated a significant difference between periods of measurements of the patients' vital signs. At the same line, (Ibrahem Shalaby *et al.*, 2024) [9] reported the same findings related to participants vital signs assessment pre and post-CC procedure.

Related to relation between pain intensity level and early ambulation (changing head of the bed position) among studied patients post-diagnostic cardiac catheterization, the present study finding showed that all study group had no pain at discharge when the stud group were in high fowler position (HOB 90 degree) with a highly statistical significant difference between observations as p value was (0.001). The current study findings similar to the study conducted by (Wang *et al.*, 2024) [24] who found that early mobilization significantly decreased back pain in patients after trans-femoral cardiac catheterization. Thus, early ambulation appears to be beneficial in reducing pain intensity levels post-procedure, supporting its implementation in enhanced recovery protocols.

The same as reported by (Morika *et al.*, 2021**)** [16] who found a significant relationship between early ambulation and pain intensity levels in patients post-diagnostic cardiac catheterization. The intervention group experienced a reduction in average pain scale from 3.63 to 0.38 after early ambulation, while the control group showed minimal change from 3.38 to 3.75, with a statistically significant effect, suggesting that early ambulation effectively lowers pain intensity in these patients, supporting its use as a beneficial nursing intervention.

The current study findings similar to the study conducted by (Ibdah *et al.*, 2020) [8] whose study found that early position change 1 hour after sheath removal post cardiac catheterization significantly reduced back pain intensity compared to the control group. This intervention improved patients' comfort levels and alleviated urination problems without increasing the risk of vascular complications such as bleeding and hematoma. Thus, early ambulation, through changing the head of the bed position, is effective in managing pain intensity among patients post-diagnostic cardiac catheterization.

Regarding to relation between pain intensity level and early ambulation (walking) among studied patients post-diagnostic cardiac catheterization, it was noticed that almost four quarter of the studied patients had no pain while walking around the bed with assistance or without assistance, while one hundred of them had no pain when allowed to walk in the room with or without assistance with a highly statistical significant difference between observations.

These findings aligns with the study conducted by (Wang *et al.*, 2024) [24] who found that early mobilization significantly decreased back pain intensity in patients post-trans-femoral cardiac catheterization, particularly when mobilization occurred within 3-4 hours compared to 5-6 hours, and also showed reduced pain at 12 hours versus 24 hours after the procedure. Also, (Morika *et al.*, 2021) [16] reported that a significant reduction in pain intensity levels among patients post-cardiac catheterization who engaged in early ambulation, with the intervention group's average pain scale decreasing from 3.63 to 0.38, compared to the control group's minimal change.

As regards correlation between total pain intensity level and early ambulation among studied patients after diagnostic cardiac catheterization, it was observed that there was a highly statistical significant negative correlation between early ambulation of studied patients and the total pain intensity level after diagnostic cardiac catheterization. This finding is consistent with (Hamad *et al.*, 2023) [6] who reported that early mobilization significantly reduced back pain among patients after diagnostic coronary angiography, indicating a negative correlation between early ambulation and total pain intensity levels, with statistical significance.

Concerning correlation between total vital signs, early ambulation among studied patients after diagnostic cardiac catheterization, it was revealed that there was a statistical significant negative correlation between early ambulation, of study group and their body temperature, apical pulse and respiratory rate after diagnostic cardiac catheterization. The observed negative correlation indicates that as early ambulation duration increased, body temperature, apical pulse, and respiratory rate significantly decreased, suggesting improved cardiovascular efficiency, better thermoregulation, and reduced metabolic stress

This result suggesting that early mobilization contributes to hemodynamic stability and overall physiological recovery following invasive cardiac procedures. Early ambulation enhances venous return, prevents circulatory stasis, and reduces the risk of complications (Wang *et al.*, 2024) [24].

Regarding to correlation between total femoral vascular complication incidence and total early ambulation among study group after diagnostic cardiac catheterization, the current study findings showed that a statistical significant negative correlation between early ambulation of study group and incidence of hematoma and bleeding after diagnostic cardiac catheterization.

The current study finding was contradicted with the study conducted by (Tuozzo *et al.*, 2023) [23] whose study reported no significant difference in the incidence of hematomas between the standard bed rest group and the early ambulation group, indicating no correlation between total femoral vascular complication incidence and early ambulation among studied patients. Disagree with (Puliyakkuth *et al.*, 2024) [19] who reported that there was no significant correlation between total femoral vascular complication incidence and early ambulation. Both groups experienced minimal complications, with only two bleeding

cases in the intervention group and one in the control group, indicating safety in early ambulation.

Regarding to Correlation between Occurrence of Femoral Vascular Complication and Past Medical Data among Studied Patients after Diagnostic Cardiac Catheterization, the present study findings showed that the only influencing factor was hypertension as it showed a statistically significant positive correlation with the incidence of bleeding and hematoma after diagnostic cardiac catheterization.

The current study finding was compatible with the study conducted by (Majeed *et al.*, 2016) [15] who reported that multiple factors associated with increased frequency of vascular complications, including past medical history. However, specific correlations between hypertension and diabetes mellitus with femoral vascular complications were not detailed in the provided information.

The current study finding was opposite to the study conducted by (Al-Makhamreh *et al.*, 2014) [1] who found no correlation between femoral vascular complications and past medical history factors such as hypertension and diabetes mellitus among patients after percutaneous coronary interventions, indicating these conditions do not increase the risk of such complications.

Regarding to Correlation between Occurrence of Hematoma and Total Pain Intensity Level among Studied Patients after Diagnostic Cardiac Catheterization, the current study showed that there was a statistically significant positive correlation between the incidences of hematoma intensity and pain level among studied patients after diagnostic cardiac catheterization. The current study finding was compatible with the study conducted by (Hamdi *et al.*, 2023) [7] who reported that Hematoma formation is a common complication post-cardiac catheterization, and its presence is associated with increased pain levels, which can affect patient recovery and satisfaction. The same as reported by (Sugiharto *et al.*, 2025) who concluded that the presence of hematoma is linked to increased pain levels, as the physical manifestation of hematoma can exacerbate discomfort and prolong recovery time.

Conclusion

Early ambulation post DCC is safe and has a positive effect on reducing complications among study group.

Recommendation:

Replication of the study on a larger probability sample from other geographical locations in Egypt to guarantee the generalizability of the study.

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