Effect of Gradual Sitting Position on Recovery and Satisfaction of Patients Post Trans-Femoral Cardiac Catheterization

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Abstract

Bed rest is recommended after cardiac catheterization, this frequently results in back pain, urinary retention, and hemodynamic instability. **Aim of the Study:** to evaluate the effect of gradual sitting position on recovery parameters and satisfaction of patients' post trans-femoral catheterization. **Subjects and method:** Quasi experimental pretest-posttest research design. **Setting:** It was conducted at cardiac catheterization department at El-Mahalla Cardiac Center. A purposive sample of 60 patients, divided equally into study group (received gradual change position from flat to sitting) and control group (who received routine hospital care i.e. flat position for 6 hours). **Tool**: "patient's assessment sheet" consisted of 4 parts, "Demographic data"; "Clinical data"; "Patient recovery parameters", and "patient satisfaction scale". **Results:** There was reduction in back pain severity for study group with statistically significant difference p value at ($^{MC}p < 0.001^{*}$) after 4th and 6th hours, absent of vascular complications (hematoma and bleeding) for all patients (100%) in both groups and reduced urinary retention in the study group with highly statistically significant difference p value at ($^{MC}p < 0.001^{*}$). The mean level of satisfaction was highly significant p value at (<0.001*) after four and six hours. **Conclusion**: the gradual change position from flat to sitting position had statistically significant positive effect on recovery parameters including reducing back pain and urinary retention without changes in vital signs, neurovascular status and vascular complications incidence in the study group. **Recommendation**: Enroll changing of patients position in post cardiac catheterization care.

Keywords: Cardiac Catheterization, Gradual Change Position, Patient Satisfaction, Recovery Parameters

Introduction

Cardiovascular diseases (CVD) and vascular disorders account for more than 12% of all diseases worldwide **(Niveditha, & Premavathy, 2019).** Coronary artery disease (CAD) is still the most frequent type of CVD that affecting predominantly persons in their working years. **(Shah, et al 2019).** Mortality and prevalence of CAD differ among countries **(Ralapanawa, & Sivakanesan, 2021).** In developed nations, CAD is responsible for 20% of mortality **(Gowshall & Taylor Robinson, 2018**) and 78% in developing countries **(Niveditha, & Premavathy, 2019; Bakhshi, et al., 2014)**. According to the World Health Organization's data published in 2018, coronary heart disease deaths in Egypt amounted to 163,171, or 29.38% of the total deaths. The age-adjusted mortality rate is 271.69 per 100,000 population, placing Egypt 15th in the world **(World Health Rankings, 2017)**. Early and accurate diagnosis is essential for CAD patients. Cardiac catheterization (CC) is the gold standard for diagnosis of significant coronary heart disease **(Boren, et al., 2015).**

Cardiac catheterization is a vital diagnostic and therapeutic procedure that comprehensively investigates the functioning of the heart and blood vessels. Cardiac catheterization can be accessed through potential arteries including the femoral, brachial, and radial arteries **(Cortese et al., 2015).** It is then directed to the heart using a guide x-ray. This procedure gathers data about the adequate blood supply through the coronary arteries, blood pressure, aspiration of the blood sample, and blood movement in all the chambers of the heart **(Sankar, & Hemalatha, 2007).** Each year it was estimated that around 2.2 million person performs CC intervention all over the world **(Lansky, & Stone 2010).**

Contraindications of CC are bleeding disorder, unstable arrhythmia, renal insufficiency or impaired renal function, which

may deteriorate after angiography, resistant severe high blood pressure, significant peripheral vascular diseases that restricts the artery access, untreated active infection and endocarditis, severe anemia, electrolyte and fluid imbalance, allergy to contrast agent, and encephalopathy **(Tavakol, et al 2012).** Complications from CC are determined by the patient's condition as well as the operator's competence and judgement. Complications connected with trans-femoral CC include the following; arrhythmia, vascular problems (such as bleeding, hematoma, and thrombus formation), myocardial ischemia, coronary artery perforation, cerebrovascular accident including transient ischemic stroke, allergy to contrast agent, and acute renal failure **(Kardan et al., 2020; Christakopoulos et al., 2015).** Some studies reported that CC were associated with complications in around 0.7 to 28% of whole studied subjects **(Manda, & Baradhi , 2018; Tavakol, et al 2012).**

According to **(Fereidouni, et al., 2019; American Heart Association., 2018; Augustin, et al., 2010)** in order to reduce potential vascular complications next trans-femoral CC, the nurse should put direct pressure that may be manually or mechanically over the femoral artery as long as 10-20 minutes until hemostasis is attained. In addition, the clients are instructed to be strictly immobile and to fully rest in bed in a flat position for at least 6 hours immediately posttest, and the head level of the bed should not be more than 30 degree during the bed rest time, as well as the affected limb should remain straight and immobile.

This extended bed rest while minimizing the vascular complications of the CC procedure, frequently results in patient discomfort, urinary retention, dissatisfaction, and an increased risk of back pain. Also expected to increase expenses, health system resources used, length of hospital stay, as well as an increase in the burden of nursing tasks **(Abdollahi et al., 2015; Heravi et al., 2015; Mohammady et al., 2014; Chair et al., 2007).** Back and groin pain, and urinary retention lead to the use of analgesic medications and urinary catheter, each of which have their own set of complications. In order to avoid excessive use of drugs and insertion of urinary catheter, non-pharmacological nursing measures are preferred to enhance patient comfort **(Rigattieri, et al., 2015).** Various nursing strategies such as therapeutic posture of the patient, and elevation the head of bed can reduce back pain, groin pain and urinary retention for patients post CC without increasing vascular complications **(Naseri Salahshour, et al., 2017; Valiee, et al. 2016; Christakopoulos et al., 2015).** These strategies also reduce the workload of health care providers, decrease the length of hospitalization and allow patients to satisfy their basic needs such as eating, drinking, and urination **(Rezaei-Adaryani, et al., 2009).** reduce

Patient satisfaction with health services is regarded as a core requirement for assuring healthcare quality in patient-centered healthcare systems. As a consequence, patient satisfaction level with nursing care has become established as the most important indicator of overall satisfaction with hospital care and an important goal of any healthcare setting **(Goh et al., 2016; Reck, 2013).**

The nurses play a vital and comprehensive role in providing care to patients with heart diseases in addition to patients who undergoing CC procedure. The nurse is also responsible for evaluating the patient for any negative complains in his status, as well as the effect of physiological discomforts such as back pain and urinary retention on the patients' physical and psychological condition which should be taken into attention **(Ibdah, et al., 2020 & Ali et al., 2015).**

Significance of the Study

There is increase in CC procedure performance which rapidly developed and expanded in scope and techniques during the last few decades. **Bangalore, et al., (2021); Ahmed, (2015).** There is a constant need to improve the processes of the health service, in order to make them more efficient and to enhance the nursing intervention performed in the case of hemodynamics, Continuous evaluation of the patient satisfaction develops important issue. Thus, it is possible to identify opportunities for improvement and design expected nursing interventions to enhance the outcomes after the CC procedure (**Capetini, and Camacho, 2020).**

Nevertheless, there is a lack of proper evaluation and management of symptoms that patients face post CC procedure such as back pain, discomfort, urinary and bowel problems, stress

and anxiety. Some methods of managing complications (such as early posture change and early ambulation) have been found in previous studies to have a positive effect in reducing post CC complications **(Fereidouni, et al., 2019).** Evaluation of patients' satisfaction with nursing care may be effective in enhancing nursing service quality by supporting the development of care standards while evaluating both results and patients' level of quality perceptions (**Tang et al., 2013; Senarat, & Gunawardena, 2011).** So, this study was conducted to evaluate the effect of gradual sitting position on recovery parameters (vital signs, neurovascular assessment, back pain, urinary retention, and vascular complications) and satisfaction of patients post trans-femoral cardiac catheterization.

This study aimed to:

Evaluate the effect of gradual sitting position on recovery parameters (vital signs, neurovascular assessment, back pain, urinary retention, and vascular complications) and satisfaction of patients' post trans-femoral cardiac catheterization.

Research hypothesis:

Hypnosis 1: Patients who change position post trans-femoral cardiac catheterization to gradual sitting position will exhibit better recovery parameters rather than who remain in supine position.

Hypnosis 2: Patients who change position post-transfemoral cardiac catheterization will exhibit more satisfaction level than who remain in supine position.

Materials & Method

Materials

Research design:

Quasi experimental (pretest-posttest), research design was used.

Setting

This study was conducted in cardiac catheterization department at El-Mahalla Cardiac Center in El-Gharbia Governorate, one of the specialized medical centers of ministry of health, Egypt.

Subjects:

A purposive sample of 60 adult patients was comprised in the study, divided equally into study and control group. The inclusion criteria encompassed; (1) Adult patients of both sexes who undergoing transfemoral diagnostic CC. (2) Age ranged from 18 to 60 years old. (3) Have desire to participate in the study and cooperative. (4) Prothrombin time and international normalized ratio tests within normal range and free from complications developed during CC. **Exclusion criteria included**; previous history of low back pain, urinary retention, history of bleeding disorder or deep venous thrombosis.

Sample size calculation

The sample size was calculated using Epi info Program version 7, Expected frequency = 50%. Acceptable error = 5%. Confidence interval = 95%. Minimum sample size = 59 (divided randomly into 30 patients in the study group and 30 patients in the control group).

Tools for data collection

One tool "patient's assessment sheet" it was used for data collection; it was developed by the researchers based on comprehensive reviewing the related literature. It was consisted of four parts:

- **Part I;** "Demographic data", This part was used to collect personal data as age, gender, qualification, and occupation.
- **Part II**; "Clinical data", it used to assess condition of patient and clinical history. This part was adapted from **(Valiee, et al 2016; Abdollahi, et al., 2015; Elsaid, et al., 2015).** It was included questions regarding body mass index, initial diagnosis, medical history, smoking habit, bleeding profile, previous experience of femoral CC and its complications.
- **Part three;** "Patient recovery parameters", it used to assess vital signs, neurovascular status, and presence of complications. Neurovascular assessment of the lower limb included (color, leg temperature, capillary refill, presence of distal pulse, presence of leg edema, and movement of the lower limb. Assessment of complications included groin and back pain, vascular complications as (hematoma, and bleeding), and presence of urinary retention. Back pain and groin pain were assessed by using "Numeric Pain Intensity Scale" which categorized as (no pain = 0), (mild pain= 1-3), moderate pain 4-6 and (severe pain 7-10). This part was

adapted from **(Boonstra, et al., 2016**; **Valiee, et al., 2016; Abdollahi, et al., 2015; Farmanbar, et al., 2012; Brodovicz, et al. 2009).**

- **Part four:** "patient satisfaction scale" this part used to assess patient satisfaction about changing the position post CC. It was adapted from **(Voutilainen, et al., 2016).** Its composed of 5 rating scale "1= Very unsatisfied, 2= Unsatisfied, 3= Neutral, 4= satisfied, and 5= very satisfied".

Method

- An official approval to conduct the study was obtained from the authorized personal of El-Mahalla Cardiac Center.
- Tool was designed by the researchers after reviewing of literatures to collect the required data.
- Tool was checked and validated for content and relevance by a jury of five experts in medical surgical nursing, and cardiologist, their opinions and suggestions were taken into consideration.
- Reliability of tool was tested for its internal consistency using Cronbach's Alpha test, the coefficient value was 0.731 for patient satisfaction scale.
- Pilot study was carried out on 10% of the sample to assure the clarity, applicability, and comprehension of the study tool, and to identify obstacles that may be encountered during data collection. Accordingly, the necessary modifications were done. Patients of this pilot study were not included in the study sample.
- According to the previously mentioned study criteria, the patients were randomly assigned into study group (n=30) and control group (n=30).
- Consent was obtained from participate after explanation of the purpose, steps of intervention, risk factors, and benefits.
- Demographic and clinical data were collected from the patients' medical records.
- The control group received routine hospital care, which include immobilization in flat position for 6 hours after performing CC and the affected leg was straight and immobilized. Patients in the study group was instructed to remain in flat position for 2 hours then in semi fowler position with head of the bed elevated by 45°during in the second two hour, followed by sitting position 90 ° for another 2 hours.
- For both study and control groups assessment of vital signs (temperature, pules, respiration, and blood pressure), neurovascular assessment of lower limb, evidence of complications (bleeding, hematoma, urinary retention, groin and back pain) and patient satisfaction were collected by using study tool through 4 phases.
  i. Phase 1, initially after receiving the patients from CC unit.
  ii. Phase 2, after 2 hours.
  iii. Phase 3, after four hours.
  iv. Phase 4, after six hours.
- Two studied groups were checked for vital signs in the same manner as temperature was taken by axillary rout, palpation of the pule through radial pulse, and blood pressure of right arm was measured.
- Neurovascular assessment of the affected limb (right limb) was done.
- Pain intensity of groin and back was assessed by using pain numerical rating scale which ranged from (no pain= 0 to (sever pain =10).
- Data was collected by the researcher, over a period of 3 months from February to May 2021 on Saturday and Monday of each week.

Ethical consideration:

- An Ethical Committee permission was obtained to conduct the study from Faculty of Nursing, Damanhur University, Egypt.
- The aim of the study was communicated to all of the patients who were studied, and they all signed informed consent forms before participating in the study, assuring them of their privacy, freedom, and confidentiality.

- Patients had the right to withdraw from the study at whatever time without any responsibility.

Statistical analysis of the data

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). Qualitative data were described using number and percent. Kolmogorov-Smirnov test was used to verify the normality of distribution. Quantitative data were described using range (minimum and maximum), mean and standard deviation. Significance of the obtained results was judged at the 5% level.

The used tests were

1 - **Chi-square test:** For categorical variables, to compare between different groups
2 - **Fisher's Exact or Monte Carlo correction:** Correction for chi-square when more than 20% of the cells have expected count less than 5
3 - **Student t-test:** For normally distributed quantitative variables, to compare between two studied groups

Results

Table (1): shows comparison between the two studied groups according to demographic data. The mean of age in both study and control groups was 49.63 ± 7.98 and 50.63 ± 7.27 respectively. Regarding gender more than half 56.7% of patients in the study group were females, while 46.7% of them were females in the control group. The majority of patients in both study and control groups were illiterate 40% and 33.3% respectively. No statistically significant differences were detected between the two studied groups regarding to age, gender, qualification and occupation.

Table (2): reveals comparison between the two studied groups according to their clinical data. Regarding body mass index in both study and control groups, nearly half (53.3% and 46.7% respectively) of the studied patients were overweight followed by around third 30% and 33.3% respectively of them had normal weight. Diagnostic CC was the initial diagnosis for all studied groups. Regarding past medical history of associated medical conditions, 46.7% and 36.7% of patients in both groups respectively had ischemic heart disease, 40% from the study group compared to 36.7% of patients in the control group had hypertension, moreover, 36.7% and 20% of them respectively had diabetes mellites. As for smoking, tenth of the study group and 16.7% in the control group were smokers. Regarding INR and prothrombin value, no statistically significant difference was detected between the two groups. Finally, the majority of patients in both study and control groups 83.3% and 93.3% respectively had no history of previous CC.

Table (3) shows comparisons between study and control groups according to patients' vital signs through study phases. this table shows that the great majority of the patients had body temperature, pulse, and respiration within normal range during study phases. As for temperature it was mostly within normal range among both study and control groups along the study phases except for only 3.3% of the study group was hypothermic in first and second measurement while 6.7% of the control group was hypothermic initially.

On the other hand, change in blood pressure was noticed in the minority of patients in both groups, initially hypotension was found in study and control group in 26.7% and 13.3% respectively, this percent decline to reach 3.3% and 6.7% respectively after 6 hours.

Table (4) shows comparison between study and control groups regarding to neurovascular assessment of lower limb through study phases. In relation to the color, it was pink except for 23.3% and 40% were pale in initial stage in both groups respectively, then after 6 hours it was pink for 100% of study group compared to 90% in the control group. Regarding to leg temperature, it was warm in most of the patients in both groups, initially in the study group it was cold for 23.3% compared to 33.5% for the control group, this percentage decreased in both groups until reached 6.7% for both groups after 6 hours. As for capillary refill, only 6.7% of patients in both groups had capillary refill greater than two seconds initially, and the same percentage still presented only in the control group after two hours. concerning palpation of Popliteal pulse, initially it was strong in majority 80% of patient in both groups, while after two hours 93.3% and 90% respectively. in the same line, strong dorsalis pedis pulse was noticed initially in both group in 80% and 86.7% respectively while after two hours 93.3% and 96.7% respectively.

Leg edema was absent all the time among all patients in both groups. In reference to dorsi-flexion movement, initially it was noticed, movement without pain in both groups 70% and 90% respectively then after six hours all the studied groups 100% had no pain. In relation to planter-flexion movement, initially movement without pain was noticed in 80.0% in study group compared to 93.3 % in the control group, while at the end of six hours all patients in the studied groups 100% had no pain with planter flexion movement.

Table (5) illustrates comparison between study and control groups according to presence of complications during study phases. As regards to the severity of groin pain, this table reveals that initially no pain in 73.3% and 70% in study and control groups initially to reach 100% at the end of 6 hours.

Regarding back pain intensity level, initially no pain was reported in study and control groups in 56.7% and 63.3% respectively. After two hours, mild pain was reported in 43.3% and 56.7% respectively. After four hours, no pain was reported among 80% of patients in study group compared with 60% in the control group suffered from mild pain with highly statistically significant difference p value at ($^{MC}p < 0.001^{*}$). After six hours, 86.7% of study group had no pain and 13.3% had mild pain compared to 50% had mild pain, 26.7% moderate, and 16.7% had severe pain in the control group with highly statistically significant difference in both groups ($^{MC}p < 0.001^{*}$).

Regarding vascular complications (hematoma and bleeding), this table shows that all patients in both groups had no vascular complications. However, in relation to urinary retention, it was present in in both groups initially in 30% and 23.3% respectively, after two hours, it was in 56.7% and 63.3% and after four hours it was 13.3% and 43.3% respectively with highly statistically significant difference between both groups p value at ($^{MC}p < 0.001^{*}$).

Table (6): illustrates comparison between the study and control groups according to patients' satisfaction about changing the position during study phases. The patients were highly significantly very satisfied in the study group in setting in 45-degree position by 26.7% and in setting 90-degree position by 33.3%, while no patient in the control group were satisfied in flat position p value at (<0.001*). The mean score of patient satisfaction was highly significant p value at (<0.001*) in semi-sitting and sitting position after four and six hours among the study group (3.90 ± 0.84 and 4.20 ± 0.66) than in control group (1.90 ± 0.71 and 1.93 ± 0.74) respectively.

Table (1): Comparison between the study and the control groups according to demographic data

Demographic data	Study (n = 30)		Control (n = 30)		Test of sig.	p
	No.	%	No.	%		
Age (years)						
18<45	12	40.0	7	23.3		
45 – <55	6	20.0	10	33.3	χ^2= 2.356	0.308
55 – 60	12	40.0	13	43.3		
Min. – Max.	37.0 – 60.0		36.0 – 60.0		t=	0.614
Mean ± SD.	49.63 ± 7.98		50.63 ± 7.27		0.507	
Gender						
Male	13	43.3	16	53.3	χ^2=	0.438
Female	17	56.7	14	46.7	0.601	
Qualification						
Illiterate	12	40.0	10	33.3		
Primary school	4	13.3	7	23.3		
Preparatory school	1	3.3	3	10.0	χ^2=	^{MC}p=
Diplom	3	10.0	6	20.0	5.809	0.321
Technical	2	6.7	0	0.0		
BSC	8	26.7	4	13.3		
Occupation						
Manual	5	16.7	8	26.7		
Professional / clerical	8	26.7	8	26.7	χ^2=	^{MC}p=
Housewife	14	46.7	9	30.0	7.574	0.051
Not working	3	10.0	5	16.7		

SD: **Standard deviation** **t: Student t-test** χ^2: **Chi square test** MC: **Monte Carlo**
p: p value for comparing between the studied groups *: Statistically significant at $p \leq 0.05$

Table (2): Comparison between the study and the control groups according to clinical data

Clinical data	Study (n = 30)		Control (n = 30)		Test of Sig.	P
	No.	%	No.	%		
BMI						
Underweight (>18.5)	1	3.3	2	6.7		
Normal weight (18.5 – 24.9)	9	30.0	10	33.3	χ^2=0.687	^{MC}p= 0.948
Overweight (25 – 29.9)	16	53.3	14	46.7		
Obese (≤ 30)	4	13.3	4	13.3		
Initial diagnosis						
DCC	30	100.0	30	100.0	–	–
Medical history						
Ischemic heart disease	14	46.7	11	36.7	χ^2=0.617	0.432
Hypertension	12	40.0	11	36.7	χ^2=0.071	0.791
DM	11	36.7	6	20.0	χ^2=2.052	0.152
Renal disease	4	13.3	0	.0	χ^2=4.286	^{FE}p=0.112
Liver disease	0	0.0	2	6.7	χ^2=2.069	^{FE}p=0.492
Others (Hyperthyroidism, Peptic ulcer & Asthma**)**	5	16.7	0	0.0	χ^2=5.455	^{FE}p=0.052
Smoking habit						
Smoker	3	10.0	5	16.7		
Ex-smoker	8	26.7	7	23.3	χ^2=0.636	^{MC}p= 0.874
Nonsmoker	19	63.3	18	60.0		
Bleeding profile						
Prothrombin time						
Min. – Max.	12.10 – 17.0		11.90–16.10		t= 1.598	0.115
Mean ± SD.	13.50 ± 1.25		14.05 ± 1.42			
INR						
Min. – Max.	1.0 – 1.29		1.0 – 1.45		t= 1.814	0.075
Mean ± SD.	1.08 ± 0.09		1.13 ± 0.14			
Previous experience of femoral cardiac catheterization						
Yes	5	16.7	2	6.7	χ^2=	^{FE}p=
No	25	83.3	28	93.3	1.456	0.424
Complicated						
Yes	1	3.3	0	0.0	χ^2=	^{FE}p=
No	29	96.7	30	100.0	1.017	1.000

SD: **Standard deviation** **t: Student t-test** MC: **Monte Carlo**

χ^2: **Chi square test** FE**: Fisher Exact**

p: p value for comparing between the studied groups

*: Statistically significant at p ≤ 0.05

#: multiple responses

Table (3): Comparison between the study and the control groups according to patients' vital sings during study phases

Part III: patient recovery parameters	Study (n = 30)								Control (n = 30)								χ^2 (p_1)	χ^2 (p_2)	χ^2 (p_3)	χ^2 (p_4)
	Initial		Flat for 2 hours		45 ° for 2 hours		90 ° for 2 hours		Initial		Flat for 2 hours		Flat for 2 hours		Flat for 2 hours					
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%				
A. Vital signs																				
Temperature																				
Within normal range	29	96.7	29	96.7	30	100.0	30	100.0	28	93.3	30	100.0	30	100.0	30	100.0	χ^2= 0.351 (^{FE}p=1.000)	χ^2= 1.017 (^{FE}p=1.000)	–	–
Hypothermia	1	3.3	1	3.3	0	0.0	0	0.0	2	6.7	0	0.0	0	0.0	0	0.0				
Pulse																				
Within normal range	28	93.3	30	100.0	30	100.0	30	100.0	30	100.0	29	96.7	30	100.0	30	100.0	χ^2= 2.069 (^{FE}p=0.492)	χ^2= 1.017 (^{FE}p=1.000)	–	–
Tachycardia	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	3.3	0	0.0	0	0.0				
Bradycardia	2	6.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0				
Respiration																				
Within normal range	30	100.0	30	100.0	30	100.0	30	100.0	30	100.0	30	100.0	30	100.0	30	100.0	–	–	–	–
Blood pressure																				
Within normal range	20	66.7	26	86.7	29	96.7	29	96.7	26	86.7	23	76.7	25	83.3	28	93.3	χ^2= 3.688 (^{MC}p=0.153)	χ^2= 1.102 (^{MC}p=0.596)	χ^2= 2.855 (^{MC}p=0.234)	χ^2= 0.351 (^{FE}p=1.000)
Hypotension	8	26.7	3	10.0	1	3.3	1	3.3	4	13.3	5	16.7	3	10.0	2	6.7				
Hypertension	2	6.7	1	3.3	0	0.0	0	0.0	0	0.0	2	6.7	2	6.7	0	0.0				

χ^2: **Chi square test** MC: **Monte Carlo** FE**: Fisher Exact** p_1: p value for comparing between the studied groups in **Initial** p_2: p value for comparing between the studied groups in **Flat for 2 hours**

p_3: p value for comparing between the studied groups in **45 ° for 2 hours**

p_4: p value for comparing between the studied groups in **90 ° for 2 hours**

Table (4): Comparison between the study and control groups according to neurovascular assessment during study phases

Part III: patient recovery parameters	Study (n = 30)								Control (n = 30)								χ^2 (p_1)	χ^2 (p_2)	χ^2 (p_3)	χ^2 (p_4)
	Initial		Flat for 2 hours		45 ° for 2 hours		90 ° for 2 hours		Initial		Flat for 2 hours		Flat for 2 hours		Flat for 2 hours					
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%				
B. Neurovascular assessment of affected limb																				
Color																				
Pink /normal	23	76.7	26	86.7	30	100.0	30	100.0	18	60.0	23	76.7	27	90.0	27	90.0	χ^2= 1.926 (0.165)	χ^2= 1.002 (0.317)	χ^2=3.158 (^{FE}p=0.237)	χ^2=3.158 (^{FE}p=0.237)
Pale	7	23.3	4	13.3	0	0.0	0	0.0	12	40.0	7	23.3	3	10.0	3	10.0				
Leg temperature																				
Warm	23	76.7	26	86.7	28	93.3	28	93.3	20	66.7	21	70.0	26	86.7	28	93.3	χ^2= 0.739 (0.390)	χ^2= 2.455 (0.117)	χ^2=0.741 (^{FE}p=0.671)	χ^2=0.0 (^{FE}p=1.000)
Cold	7	23.3	4	13.3	2	6.7	2	6.7	10	33.3	9	30.0	4	13.3	2	6.7				
Capillary refill																				
Less than 2 sec.	28	93.3	28	93.3	30	100.0	30	100.0	28	93.3	30	100.0	30	100.0	30	100.0	χ^2= 0.0 (^{FE}p=1.000)	χ^2= 2.069 (^{FE}p=0.492)	–	–
Greater than 2 sec.	2	6.7	0	0.0	0	0.0	0	0.0	2	6.7	2	6.7	0	0.0	0	0.0				
Popliteal pulse																				
Strong	24	80.0	28	93.3	30	100.0	30	100.0	23	76.7	27	90.0	30	100.0	30	100.0	χ^2= 0.0 (1.000)	χ^2= 0.218 (^{FE}p=1.000)	–	–
Weak	6	20.0	2	6.7	0	0.0	0	0.0	7	23.3	3	10.0	0	0.0	0	0.0				
Dorsalis pedis pulse																				
Strong	24	80.0	28	93.3	30	100.0	30	100.0	23	76.7	27	90.0	30	100.0	30	100.0	χ^2= 0.480 (0.488)	χ^2= 0.351 (^{FE}p=1.000)	–	–
Weak	6	20.0	2	6.7	0	0.0	0	0.0	7	23.3	3	10.0	0	0.0	0	0.0				
Presence of leg edema																				
Absent	30	100	30	100	30	100	30	100	30	100	30	100	30	100	30	100	–	–	–	–
Dorsiflexion																				
Movement without pain	21	70.0	25	83.3	30	100.0	30	100.0	27	90.0	30	100.0	30	100.0	30	100.0	χ^2= 3.750 (0.053)	χ^2= 5.455 (^{FE}p=0.052)	–	–
Movement with pain	9	30.0	5	16.7	0	0.0	0	0.0	3	10.0	0	0.0	0	0.0	0	0.0				
Planter-flexion																				
Movement without pain	24	80.0	25	83.3	30	100.0	30	100.0	28	93.3	30	100.0	30	100.0	30	100.0	χ^2= 2.308 (^{FE}p=0.254)	χ^2= 5.455 (^{FE}p=0.052)	–	–
Movement with pain	6	20.0	5	16.7	0	0.0	0	0.0	2	6.7	0	0.0	0	0.0	0	0.0				

χ^2: **Chi square test** MC: **Monte Carlo** FE**: Fisher Exact**

p_1: p value for comparing between the studied groups in **Initial**

p_2: p value for comparing between the studied groups in **Flat for 2 hours**

p_3: p value for comparing between the studied groups in **45 ° for 2 hours**

p_4: p value for comparing between the studied groups in **90 ° for 2 hours**

Table (5): Comparison between study and control studied groups according to presence of complications during study phases.

Part III: patient recovery parameters	Study (n = 30)								Control (n = 30)								χ^2 (p_1)	χ^2 (p_2)	χ^2 (p_3)	χ^2 (p_4)
	Initial		Flat for 2 hours		45 ° for 2 hours		90 ° for 2 hours		Initial		Flat for 2 hours		Flat for 2 hours		Flat for 2 hours					
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%				
D. Evidence of complications																				
1. groin pain intensity level																	-	-	-	-
Non	22	73.3	20	66.7	28	93.3	30	100	21	70.0	18	60.0	27	90.0	30	100				
Mild	5	16.7	8	26.7	2	6.7	0	0.0	7	23.3	10	33.3	3	10.0	0	0.0				
Moderate	3	10.0	2	6.7	0	0.0	0	0.0	2	6.7	2	6.7	0	0.0	0	0.0				
2. Back pain intensity level																				
Non	17	56.7	8	26.7	24	80.0	26	86.7	19	63.3	11	36.7	4	13.3	2	6.7				
Mild	9	30.0	13	43.3	6	20.0	4	13.3	8	26.7	17	56.7	18	60.0	15	50.0	χ^2=5.612 (^{MC}p= 0.100)	χ^2=5.507 (^{MC}p=0.140)	χ^2=28.671* (^{MC}p <0.001*)	χ^2=43.003* (^{MC}p <0.001*)
Moderate	3	10.0	6	20.0	0	0.0	0	0.0	2	6.7	2	6.7	3	10.0	8	26.7				
Severe	1	3.3	3	10.0	0	0.0	0	0.0	1	3.3	0	0.0	5	16.7	5	16.7				
3. Hematoma																				
Absent	30	100.0	30	100.0	30	100.0	30	100.0	30	100.0	30	100.0	30	100.0	30	100.0	–	–	–	–
4. Bleeding																				
Absent	30	100.0	30	100.0	30	100.0	30	100.0	30	100.0	30	100.0	30	100.0	30	100.0	–	–	–	–
5. Urinary retention																				
Absent	21	70.0	13	43.3	26	86.7	30	100.0	23	76.7	11	36.7	17	56.7	30	100.0	χ^2=0.341 (0.559)	χ^2=0.278 (0.598)	χ^2=6.648* (0.010*)	–
Present	9	30.0	17	56.7	4	13.3	0	0.0	7	23.3	19	63.3	13	43.3	0	0.0				

χ^2: **Chi square test** MC: **Monte Carlo** FE**: Fisher Exact** *: Statistically significant at $p \leq 0.05$

p_1: p value for comparing between the studied groups in **Initial** p_2: p value for comparing between the studied groups in **Flat for 2 hours**

p_3: p value for comparing between the studied groups in **45 ° for 2 hours** p_4: p value for comparing between the studied groups in **90 ° for 2 hours**

Table (6): Comparison between study and control groups according to patient satisfaction about changing the position during study phases.

	Study (n = 30)								Control (n = 30)								Test of sig. (p_1)	Test of sig. (p_2)	Test of sig. (p_3)	Test of sig. (p_4)
	Initial		Flat for 2 hours		45 ° for 2 hours		90 ° for 2 hours		Initial		Flat for 2 hours		Flat for 2 hours		Flat for 2 hours					
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%				
E. Patient satisfaction level about changing the position																				
Very unsatisfied	12	40.0	10	33.3	0	0.0	0	0.0	6	20.0	9	30.0	9	30.0	9	30.0				
Unsatisfied	4	13.3	5	16.7	1	3.3	0	0.0	8	26.7	13	43.3	15	50.0	14	46.7				
Neutral	12	40.0	12	40.0	9	30.0	4	13.3	14	46.7	8	26.7	6	20.0	7	23.3	χ^2=3.526 (^{MC}p=0.317)	χ^2=6.967 (^{MC}p=0.059)	χ^2=46.088* (^{MC}p <0.001*)	χ^2=57.004* (<0.001*)
Satisfied	2	6.7	3	10.0	12	40.0	16	53.3	2	6.7	0	0.0	0	0.0	0	0.0				
Very satisfied	0	0.0	0	0.0	8	26.7	10	33.3	0	0.0	0	0.0	0	0.0	0	0.0				
Mean score (1–5)																				
Min. – Max.	1.0 – 4.0		1.0 – 4.0		2.0 – 5.0		3.0 – 5.0		1.0 – 4.0		1.0 – 3.0		1.0 – 3.0		1.0 – 3.0		t= 1.064	t= 1.266	t= 9.915*	t= 12.487*
Mean ± SD.	2.13 ± 1.04		2.27 ± 1.05		3.90 ± 0.84		4.20 ± 0.66		2.40 ± 0.89		1.97 ± 0.76		1.90 ± 0.71		1.93 ± 0.74		(0.292)	(0.211)	(<0.001*)	(<0.001*)

χ^2: **Chi square test** MC: **Monte Carlo** **t: Student t-test** *: Statistically significant at $p \leq 0.05$

p_1: p value for comparing between the studied groups in **Initial**

p_2: p value for comparing between the studied groups in **Flat for 2 hours**

p_3: p value for comparing between the studied groups in **45 ° for 2 hours**

p_4: p value for comparing between the studied groups in **90 ° for 2 hours**

Discussion

Cardiac catheterization is one of the common diagnostic methods of CAD. Because it is specific invasive procedure it has some post procedure discomforts and possible complications which may affect patients' satisfaction **Abd El Hafeez et al., (2018); Abdollahi et al., (2015)**.Changing position of patients after a femoral CC is a strategy that used to reduce post CC discomfort and should be implemented as a routine practice in CC units worldwide **Fereidouni, et al., (2019)**, therefore, the current study was conducted to evaluate the effect of gradual sitting position on recovery parameters (vital signs, neurovascular assessment, back pain, urinary retention, and vascular complications) and satisfaction of patients' post trans-femoral cardiac catheterization.

Referring to demographic data**,** the results of the present study revealed that mean age of studied groups were 49.63 ± 7.98, 50.63 ± 7.27 in the study and the control groups respectively. This finding was in agreement with **Elsaid et al (2015)** who mentioned that mean age was 50.32 ± 7.71 48.49 ±7.62 in group one and group two respectively. This may be related to age is un-modifiable risk factor for CVD, but this factor is exacerbated by other variables such as sedentary life style, obesity, and diabetes **Rodgers, et al., (2019)**. On the other hand, **Amin, et al., (2020)** documented that mean age of patients in their study was 56.08 ± 9.704.

Concerning gender, the current study showed that (56.7%) and (46.7%) were females in the study and control groups respectively, this result was supported by **Benjamin, et al., (2017); Galiuto & Locorotondo, (2015)** who noticed that, CC procedure due to CVD occurs similarly in men and women especially after menopause. On the other hand, this finding was in contrast with **Elsaid et al., (2015**) who reported that, more than half of their studied patients were males. The findings of this study revealed that no statistically significant differences were detected between the two studied groups regarding demographic and clinical data. This finding was in the same line with **Ibdah, et al., 2020** who reported that no significant differences between participants' demographic and clinical characteristics, which were: gender, chronic disease, allergy, marital status, and educational level.

In relation to smoking, the results of this study showed that about two thirds of all patients in both study and control groups were non-smokers. This may be due to the fact that there are other causes of cardiac diseases the indicate catheterization other than smoking as mentioned by **Hajar, (2017)**, and also due to nearly about half of studied groups were none smoker females. This result diverges from the results of **Abd El Hafeez, et al., (2018)** who found that more than half of patients in the study and the control groups were smokers.

Concerning body mass index these results showed that (53.3%) and (46.7%) for study and control groups were overweight respectively. This finding is in line with **Amin, et al., (2020)** who stated that more than two thirds of the studied patients were obese. Also, this result was harmonious with **Elsaid et al., (2015)** who reported that (68.3%) and (62.2%) were overweight for both studied groups. in the same line this finding agreed with **Scherer, & Hill (2016)** who mentioned that obesity is a major risk factor for CVD, also According to **Jahangir et al., (2014),** who analyzed "The link between obesity and coronary artery disease" and concluded that obesity has severe health consequences, including diabetes mellitus, dyslipidemia, and all independent risk factors for CAD.

Regarding past medical history of associated diseases, the current study revealed that both studied groups had associated diseases namely ischemic heart diseases, hypertension, and diabetes mellites. This finding stands in line with **Ali, & Ali, (2019)** who showed that both studied groups had past history of hypertension and diabetes. This is due to the fact that hypertension and diabetes are regarded as risk factors for all forms of CVD. Similar finding was documented by **Abd El Hafeez et al, (2018)** and **Tewari et al., (2013)** who stated that patients' undergoing transfemoral diagnostic CC had a history of CAD, hypertension and diabetic mellitus.

The results of this study showed that vital signs (temperature, pulse, respiration and blood pressure) were within the normal range along the six hours post the diagnostic CC among almost of the patients. This may be related to that majority of patients in the current study had initially vital

signs within normal range and uncomplicated catheterization procedure which keep vital signs in their normal range, which is in the same line with the results of **Ramadan et al (2019)** in their study about association between time of ambulation and clinical outcome of patients after CC.

On the other hand, a minority of patients in both groups had hypotension this finding may be due to side effect of medications that was giving during CC procedure as analgesic and vasodilators. Moreover, elevated blood pressure also was noticed in small percent of patients in both groups and it was returned to average range in the study group after four hours and remain within normal range along the next six hours of study group but elevated blood pressure starts in the control group after two hours and continued to be elevated after four hours. This difference can be explained simply by the positive effect of gradual changing of position postoperatively that promote circulation which make blood pressure more stable and within normal range other than remaining on flat position for six hours. This effect was mentioned by **Heravi et, (2015)** who found that 45° angle of the bed was the best position in order to reduce the patient's pain after CC based on patient's vital signals.

As regard neurovascular assessment of the affected lower limb, the findings of this study showed that, the majority of studied patients in both groups had normal neurovascular parameters of the affected limb regarding color, temperature, capillary refill, presence of peripheral pulse and leg edema, with no statistically significant difference between two groups. This finding was supported by **Kaushal, (2015)** who reported that, post CC the affected limb must be warm, with normal peripheral pulse and color, as well as without any abnormal sensation such as numbness. This result may ascertain that minor effect of changing position from flat to gradual sitting on neurovascular parameters.

On the contrary, regarding leg color there was less than one quarter (23.3%) and more than one third (40%) of study and control group respectively had pale color of lower limp. Cold temperature of lower limp represented less than one quarter (23.3%) in the study group compared to one third (33.5%) for the control group initially, this percentage decreased in both groups until reached less than one tenth (6.7%) for both groups after 6 hours. These results may be due to the effect of cold weather inside CC unit and the patients were wearing only sterile gown. This results were supported by study finding of **Abd El Hafeez et al, (2018)** who displayed that pale leg was noticed in more than one third of the study group and it decreased gradually to one tenth of patients after complete changing in position while in the control group less than quarter of patients had pale leg only for two hours and returned to pink.

As for presence of popliteal and dorsalis pedis pulse, the present study showed that about one fifth (20%) and (23.3%) of patients in both study and control groups respectively had week popliteal and dorsalis pedis pulse initially and then improved after two hours in both groups. This proved that changing of patients' position did not influence the sensation of popliteal and dorsalis pedis pulse.

In relation to back pain intensity level during study phases the current study showed that initially, no pain was reported in more than half of patients (56.7%) in the study group and less than two thirds (63.3%) of the control group with no statistically significant differences between both groups. After two hours, mild pain was reported in about two fifth (43.3%) in the study group and more than half (56.7%) for control group with no statistically significant differences between both groups. After four hours, no pain was reported among majority (80%) of patients in the study group compared with more than half (60%) in the control group suffered from mild pain with highly statistically significant difference between both groups. After six hours, the majority (86.7%) of the patients in study group had no pain compared to half (50%) had mild pain and over than one quarter (26.7%) had moderate pain, and surprisingly severe pain appeared in more than one tenth (16.7%) of patients in the control group with highly statistically significant difference between both groups.

This may be related to long time on flat position affect muscles of the back while changing position stimulates circulation, improves muscle tone, relives and alternates pressure on back which decrease pain. This was illustrated by **Manueke et al., (2019); Bakhshi, et al., (2014); Mahgoub et al., (2013)** who stated

that patients in the intervention group experienced significantly lower back pain intensity than in the control group after CC. Another study conducted by **Sarabi et al., (2021)** provided evidence that patient in semi-sitting position was safe and helpful in decreasing pain and improving physiological functioning thus relieving tension level, which decreased pain. While long-term bed rest increase tension, causing cellular ischemia, back muscles weakening and fatigue because of the continuous pressure to the same muscles, whereas muscle fatigue causes muscle spasms as mentioned by **Utami et al, (2018).**

Referring to vascular complications (hematoma and bleeding), this study clarified that all patients in both groups had no vascular complications along the study phases. This finding in a line with study that conducted by **Abd El Hafeez et al., (2018)** who observed no vascular complications (100%) of patients in both two groups. This could be explained as the majority of studied patients had hemodynamic stability before performing CC in addition to that, the mean age of studied groups was not advanced. Also this supported by a study conducted by **Al Sadi, et al., (2010)** and **Sabo, et al., (2008**) who concluded that socio-demographic and clinical features have been identified as a risk factors for the development of vascular complications following CC and advanced age was indicated as a factor related to the development of several types of groin problems such as ecchymosis or hematoma. On the other side **Ali & Ali, (2019)** stated in their study that there was no significant difference between the two groups in terms of oozing incidence immediately after sheath removal, however there was a significant difference after 6 hours and 12 hours after sheath removal.

As for urinary retention post CC, the current study noticed that about one third 30% and less than one quarter (23.3%) of both study and control group respectively suffered from urinary retention initially. This percent increased in both groups after two hours from being in flat position to reach more than half (56.7%) and less than two thirds (63.3%) for both study and control groups respectively with no statistically significant difference between both groups.

After four hours it was more than one tenth (13.3%) of the study group and less than half 43.3% of the control group with highly statistically significant difference between both groups. This finding appeared in a study conducted by **Ibdah, et al., (2020); and Fathi et al., (2017)** who reported in their study that the number of patients who suffered from urinary retention was lower in the intervention group in comparison with control group, whereas the two groups had statistically significant differences. It could be explained by the effect of sitting position as it is the natural position for urination which relaxes sphincter of the urinary bladder to open. After six hours there no one of patient in the control group suffered from urinary retention due to overflow of the urinary bladder and moving outside the bed.

In relation to patient's satisfaction about changing position, the patient's satisfaction mean scores were highly statistically significant in favor of the study group in semi-sitting and sitting position after four and six hours after four and six hours and vice versa more than half (46.7%) of the control group unsatisfied from flat position after 6 hours and none of the control group were satisfied. This satisfaction could be explained by the positive effect of gradual changing of patients positions from flat to sitting position in which it promotes circulation, physiological functions and patient's comfort which eventually improves satisfaction which congruent with **Naseri et al, (2017)** in their about the effect of body position and early ambulation on patient's comfort after diagnostic CC. It was also illustrated by **Abd El Hafeez et al, (2018)** who found that patients' satisfaction was lowest in the control group, and higher in the experimental group. Lastly, after analysis of data and discussion, the research hypotheses were proved namely patients who change position post trans-femoral cardiac catheterization to gradual sitting position will exhibit better recovery parameters and more satisfaction level rather than who remain in supine position.

Conclusion:

From the current study it can be concluded that, the gradual change position from flat to sitting position had statistically significant positive effect on recovery parameters including reducing back pain and urinary retention without changes in vital signs or incidence of vascular complications

(hematoma and bleeding) among patients in the study group versus control group.

Recommendations:

- Enroll changing of patients position in post cardiac catheterization care in all related health care settings.
- Replicate the study on larger sample of patients and long period with correlation with age, gender and associated medical conditions.
- Health education program for patients' pre-catheterization about benefits and application of changing position technique to enhance their recovery.

Limitation of the study

Short period of observation of participants which restricted for 6 hours then the patients discharged from the center, Therefore, this short period does not allow for noticing the occurrence of hematoma in the second day post CC

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