Mansoura Nursing Journal (MNJ) Vol. 10. No. 2 – 2023
Print ISSN: 2735 – 4121 Online ISSN : 2735 – 413X

Original Article

Effect of Changing Angle of Bed on Pain Severity and Vascular Complications among Cardiac Catheterization Patients

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1.ABSTRACT

Background: Cardiac catheterization is a serious medical condition that needs to be managed by qualified health care experts with standardized procedures. Patients following cardiac catheterization are limited in bed to prevent vascular complications. For some patients, complete bed rest for six hours without mobilization can cause back pain. Changing the angle of the bed to several degrees reduces the severity of pain without raising the risk of vascular complications in those patients. Aim: This study aimed to evaluate the effect of changing angle of bed on pain severity and vascular complications among cardiac catheterization patients. **Method**: This study was carried out using a quasi-experimental research design at Mansoura University's Specialized Medical Hospital's Coronary Care Units and post cardiac catheterization unit. A sample of 82patients was randomly assigned to the intervention group (n = 41) and the control group (n = 41).Two tools were used to collect data; pain severity assessment tool and vascular complications monitoring scales tool. **Results**: Highly statistically significant differences were found in the participants' pain scores throughout the 4 th , 5 th , and 6 th hours of sheath removal (p=0.001, 0.000, &0.000 respectively). **Conclusion**: Changing angle of bed to different degrees was related to a reduction of back pain without any increase of vascular complications. **Recommendations:** Involving angle of bed changes in post cardiac catheterization care. Additionally, Future research studies are required to augment the evidence related to post cardiac catheterization care.

Keywords: *Cardiac catheterization patients, changing angle of bed, Pain severity, Vascular* complications

2.Introduction:

With an estimated 17.9 million deaths per year, cardiovascular diseases (CVDs) are the most prevalent cause of death worldwide. With 874,613 deaths attributed to CVD in 2019, it is the most common cause of mortality in the United States. In the US, a myocardial infarction happens about every 40 seconds **(American Heart Association [AHA], 2022)**. Cardiovascular illnesses account for over 46% of all fatalities in Egypt **(WHO, 2018).**

In adults, coronary artery disease (CAD) is the most prevalent form of CVD **(World Health Organization [WHO], 2021)**. Cardiac catheterization is a common procedure and widely used invasive procedure for assessing coronary artery circulations and determining the state of the heart when blood is pumped into the chambers via catheter insertion **(Elnagar et al., 2020)**. Cardiac catheterization is a serious medical condition that needs to be managed by qualified healthcare experts with standardised treatment procedures **(Sania, Nazly, Siddiqui, & Raja, 2022)**. Additionally, it is considered a standardized method for both diagnosing and treating cardiovascular diseases. To achieve a successful management outcome, qualified and skilled health providers are required **(Sameen, 2018)**.

To avoid possible outcomes following cardiac catheterization, it is advised to remain motionless for six hours with complete supine position. Moreover, the affected limb should be kept straight and immobilized (**Suggs, Lewis, Hart, Troutman-Jordan, & Hardin, 2017; Niknam Sarabi, Farsi, Butler, & Pishgooie, 2021)**. Several studies reported that prolonged immobilization causes back muscles weakness. Therefore, the most common complication following transfemoral cardiac catheterization is considered back pain. This leads to lengthy hospital stays and higher treatment costs as well as worse patient outcomes (**Ebeed, Khalil, & Ismaeel, 2017; Neishabouri, Haghighi, Gilvari, &**

Haghighat, 2020; Utami, Fatmasari, Mardiyono, & Shobirun, 2018).

Number of studies has shown that non-pharmacological therapies had the best influence on lowering pain following cardiac catheterization **(Kurt & Kaşıkçı, 2019; Naseri-Salahshour et al., 2017)**. These interventions, which include position changes and bed elevation angles, are easy, inexpensive, non-invasive, and have little side effects **(Cha & Sok, 2016)**. Positioning is critical in the cardiovascular system because it prevents postural hypotension. Furthermore, suddenly changing positions from flat lying to sitting or upright promotes the heart work and prevents thrombus formation (**Utami et al., 2018)**.

Rai, **Dhandapani, Bagga, Gopichandran, and Sharma (2019)** assured the safety of changing patients' position after trans-femoral diagnostic cardiac catheterization. Additionally, they reported that it avoids backaches, minimizes their severity, and therefore improves physical comfort. Similarly, recent studies found that changing position with raising the angle of the bed minimizing back and groin pain without increasing the risk of vascular problems **(Abd El Hafeez, Hafez, & Sanhoury, 2018; Abouelala, Khalil, Bahy, & Habiba, 2022)**.

Similarly, some studies have demonstrated that modifying the patient's posture every hour into supine, semi-fowler's up to 30° or 45° degree, offering intermittent changes to the patient's body reduces back pain and increases comfort without raising any complications **(Rai et al., 2019; Suggs, et al., 2017)**.

Moreover, there is a negative impact of prolonged immobilization on pain severity and patient outcomes. These outcomes are associated with longer hospital stay. Consequently, they reported the importance of changing position post cardiac catheterization **(Abdollahi, Mehranfard, Behnampour, Kordnejad , 2015; Utami et al., 2018)**.

In Egypt, some studies evaluate the effect of positioning after diagnostic cardiac catheterization on bleeding and hematoma only **(Abd El Hafeez et al., 2018; Ebeed et al., 2017)**. So, our investigation was carried out to evaluate the effect of adjusting the bed's angle on pain levels and vascular complications among cardiac catheterization patients.

2.1Research Aim

This study aims to evaluate the effect of changing angle of bed on pain severity and vascular complications among cardiac catheterization patients.

2.2Research Hypotheses

H1: Patients who receive changing angle of bed after cardiac catheterization will have less pain severity than those who will receive hospital routine care.

H2: The vascular complications will be decreased after changing angle of bed among cardiac catheterization patients.

3.Method

3.1Research Design

A quasi-experimental-two groups design was used to conduct the current study. This design examines the impact of one or more independent variables on the dependent variables.

3.2Setting

This study was conducted at the Coronary Care Units (CCUs) and the post cardiac catheterization unit in Specialized Medical Hospital (SMH) at Mansoura University. The coronary care units consist of intensive and intermediate CCU. Each one of them has seven beds. These ICUs are well-equipped with the requisite modern technology for emergency service such as cardiac monitors, mechanical ventilations, defibrillators, oxygen therapy, suctions and crash carts.

3.3Sample

The study involved a convenience sample of 82 patients aged ≥ 18 years of both genders after cardiac catheterization who were admitted to the previously mentioned setting. They were distributed randomly into equal 2 groups:

- **An intervention group**: included 41 patients who were received changing angle of bed to 15°, 30°, and 45° after sheath removal after cardiac catheterization.
- **A control group**: involved 41 patients who were received the routine hospital care after cardiac catheterization with complete supine position for six hours after sheath removal of cardiac catheterization.

3.4Sample size calculation

Using statistics collected from a prior study conducted by **Niknam-Sarabi, et al. (2021)** and considering the level of significance was set at 5%, and Power was set at 80%, with Type of test = two-sided, the sample size was 41 in each group.

3.5Data Collection Tool

Two tools were utilized for gathering information in this investigation. These included:

Tool I: Pain Severity Assessment Tool

This tool involved three parts as follows:

Part I: Patient's Demographic Data

This part was used to address the personal data of the participant as age, gender, occupation and the level of education.

Part II: Health Relevant Data

This section was developed by the researcher after reviewing pertinent literatures **(Kurt & Kaşıkçı, 2019; Rai et al., 2019; Utami et al., 2018)**. It is used to collect data that can affect the participants' pain and vascular complications after cardiac catheterization. It covered patient's health history as medical diagnosis, current smoking, and the type of comorbidities. It also covered participants' cardiac catheterization profile data which included previous history of cardiac catheterization, length of previous diagnostic and therapeutic cardiac catheterization, type of current procedure, femoral sheath size and the patient's clotting factors results.

Part III: Numerical Rating Scale

This scale was adopted from **Freyd (1923)**. It is frequently utilized to evaluate patients' pain levels on a scale of zero to ten, with zero indicating no pain and ten denoting the most intense pain (**Farrar, Troxel, Stott, Duncombe, & Jensen, 2008**). This scale is measured by four-point scales including no pain, mild, moderate, and severe pain. The score was 0, 1-3, 4-6, and 7-10, respectively. This scale is reliable with an interclass correlation coefficient (ICC) of 0.83 (**Farrar et al., 2008**).

Tool II: Vascular Complications Monitoring Scales

This tool was adopted from **Al Sadi, Omeish, and Al-Zaru (2010)**. It was used to measure the incidence of vascular complications in centimeters. These scales were collected 5 periods initiated immediately after sheath removal.

It involves three scales as follows:

1. ***Hematoma Formation Scale:*** This scale was classified according to surface area as: no hematoma (<2cm2 diameter), small hematoma (2≤ 5cm2 diameter), medium hematoma (5≤ 10 cm2 diameter) and large hematoma (≥ 10 cm2 diameter).
2. ***Ecchymosis Formation Scale*:** This scale was categorized in to four categories based on surface area as follows: no ecchymosis (<2cm^2 diameter), small ecchymosis (2≤ 5cm^2 diameter), medium ecchymosis (5≤ 10 cm^2 diameter) and large ecchymosis (≥ 10 cm^2 diameter).
3. ***Oozing Formation Scale*:** This scale was ordered according to the amount of blood on the surface, into four categories: no oozing (dry dressing), mild oozing (< 2cm^2 in diameter dressing soaked with blood), moderate oozing (2≤ 5cm^2 in diameter dressing soaked with blood) and severe oozing (5≤ 10 cm^2 in diameter dressing soaked with blood).

- The content validity for these scales was established by expert opinion and empirical testing. According to **Al Sadi et al. (2010),** they reported that the reliability of hematoma scale was 0.83 and for oozing scale was 0.89.

3.6Validity and Reliability

The content validity of the tools was checked by five experts affiliated with the department of Critical Care and Emergency Nursing, Faculty of Nursing, Mansoura University. The overall consistency of tools was tested by using Cronbach's Alpha test. The reliability of part III of tool I was 0.708, and tool III was 0.825, which denotes high-reliable tools.

3.7Pilot Study

It was conducted on 10% of the entire sample (eight patients) to evaluate the applicability, clarity, and viability of the data collection instruments. These patients were not included in this study.

3.8Ethical Considerations

This study (No. P0.0237) received ethical approval from the Mansoura University Faculty of Nursing Research Ethics Committee. After clarifying the purpose of the study, the hospital director authorized permission. The patient's informed consent was gained once the study's nature, advantages, and perils were explained. The right to agree or reject taking part in this study was explained to the patients, who were advised that participation was voluntary.

3.9Process of Data Collection

The primary investigator gathered data within 3 months from August to October 2022.

1. **Preparation phase**
   - Permission was taken from the administrative authorities of the Specialized Medical Hospital, Mansoura University to conduct this investigation.
   - The PI interviewed patients on the day of their admission and explained to them the nature of the study.
2. **Implementation phase**
   - The PI verified that every patient admitted to the cardiac catheterization and CCUs was spared from the exclusion criteria on the day of admission. The 41 eligible patients were distributed equally between the intervention and control groups.
   - Before the cardiac catheterization procedure: patients' demographic characteristics and

health related data were collected using parts I and II of tool I (**Pain Severity Assessment Tool)**.

- The sheath is promptly removed by the cardiologist and then manual compression was applied for 15-20 minutes at the femoral sheath puncture site**.**
- **The intervention group**: The patient's bed angle was adjusted as follows: The patient was kept in a supine posture for the first three hours following sheath removal, with the affected leg kept straight and immobile. The bed angle then steadily raised over the following three hours, going from 15°, 30°, and 45° at the fourth, fifth, and sixth hours following sheath removal following cardiac catheterization, respectively.
- **The control group**: This group received a routine care after cardiac catheterization.

Evaluation phase

Firstly, the degree of pain was evaluated by using part III of tool I (**Numerical Rating Scale**) for five times starting immediately at sheath removal then at 3rd, 4th, 5th & 6th hours respectively. Secondary, vascular complications monitoring measures were assessed by using tool II. Lastly, the pain severity and vascular complications scores were compared between the employed patients to evaluate the aim of our study.

3.10Data Analysis

The collected data were organized, tabulated and statistically analysed using SPSS software statistical computer package version 26. A significance was adopted at $P<0.05$ for interpretation of results of tests of significance (*). Also, a highly significance was adopted at $P<0.01$ for interpretation of results of tests of significance (**).

4.Results

Table 1 presents the demographic features of the studied sample. It displayed that 75.61% of the intervention group and 65.85% of the control group were from the post-cardiac catheterization unit. Nearly half of both groups (46.34% & 41.46 respectively) were from 60 and minus than 70 years old. Additionally, 73.17% of intervention group and 60.98% of control group were males. Regarding educational level, almost 65.85% of the intervention group and 68.29% of the control group were illiterate. Nearly half of the participants were retired. These data also showed that there were no socio-demographic differences between the two analyzed groups that were statistically significant, demonstrating comparability between both groups.

Table 2 depicts health-relevant data for the studied groups. It showed that ischemic heart disease was detected in 41.46% of the intervention group and 34.15% of the control group. Additionally, 70.73% of the control group and 58.54% of the intervention group were non-smokers. Regarding the co-morbidities, the results showed that hypertension (58.54% & 80.49%, respectively) predominated in the two groups, followed by diabetes mellitus (24.39% & 26.83%, respectively). Thus, it showed that there were no statistically significant differences regarding their health-relevant data, indicating matching between both the study groups.

Table 3 presents the pain levels by NRS after changing angle of bed to 15, 30, and 45 degrees at the fourth, fifth, and sixth hours of sheath removal for intervention group after cardiac catheterization. These findings show a remarkable decrease in the intensity of pain between the three degrees ($p = 0.000$). Slightly 51.22% of intervention group had mild pain at the fourth hour with the angle of the bed at 15 degrees, compared with 63.41% of them having mild pain with angle of bed at 30 °at the 5th hour of sheath removal. Additionally, 97.56% of them had no pain at the 6th hour of sheath removal with bed angle at 45 °.

Table 4 describes pain severity utilizing NRS at the 4th, 5th, and 6th hours of sheath removal for control group without changing angle of bed. These data revealed that significant statistically increasing in pain levels among the 4th, 5th, and 6th hours of sheath removal ($p= 0.000$). Most of the control group (87.80%) had moderate pain at the 4th hour, and more than half (53.66%) of them had moderate pain at the 5th hour of sheath removal. Moreover, more than three-quarters (78.05%) of control group with severe pain at the 6th hour of sheath removal after cardiac catheterization.

Table 5 presents comparison between both studied groups regarding severity of pain utilizing NRS at the 4th, 5th, and 6th hours of sheath removal post cardiac catheterization. This table indicated that there were highly statistically significant changes in NRS scores among both studied groups throughout the 4th, 5th, and 6th hours of sheath removal (p=0.001, 0.000, & 0.000).

Table 6 differentiates between the mean scores of participants' vascular complications scales through the five periods of the study: immediately, after three hours, at the 4th hour, the 5th hour, and the 6th hour of sheath removal. There was no statistical difference between the five periods of the study for the intervention group concerning hematoma, ecchymosis, and oozing scales. Additionally, there were no statistically significant differences between both the studied groups at the 4th hour, the 5th hour, and the 6th hour of sheath removal. Regarding these scales.

5.Discussion

The current study focused on investigating the effect of changing angle of bed on pain severity and vascular complications among cardiac catheterization patients. Eighty-two patients were recruited in this study. While the control group received standard care following a cardiac catheterization, the intervention group received a change in bed angle.

The findings of our study found that approximately half of both studied groups were from 60 and less than 70 years old with a mean of age 58.24±9.460 and 57.10±8.315 years respectively. This may be attributed to that occurrence of CAD increasing with old aging. These results are matched with of a randomized control trial research which investigated the effect of the head of bed elevation on back pain after elective coronary angiography which revealed that the mean age of their participants was 58.1±10.7 (**Türen, Yilmaz, Yesiltepe, & Bektas., 2022**). Additionally, our results are congruent with other similar studies **(Elsaman, 2022; Kardan, Zarei, Taghanaki, Vagharseyyedin, & Azdaki, 2020).**

On the other hand, an investigation was conducted by **Chang et al. (2020)** showed that the average age of their participants was 68.65 ±9.71. This contradiction may be due to differences in the diagnosis of the study sample as their research involved hepatocellular carcinoma. Also, the current research revealed that the male gender was dominant in the studied groups.

This may be associated with the fact that men have a greater chance than women to have cardiovascular diseases (**Ibdah et al., 2020**). This is lined with a study by **kardan et al. (2020)** found that more than half of the studied groups were males. On the contrary, an Egyptian study at Al Orman Assiut University found that most of their study's participants were female. This disagreement was due to the type of study sample because it included patients who were admitted for the first time for PCI **(Mahgoub, Abdelhafez, Adam, & Ahmed, 2022)**.

Regarding the level of education, our study indicated that two -third of both studied groups were illiterate. This is owing to that the majority of our study groups traveled to Mansoura city from adjacent cities. Additionally, **Kardan et al. (2020)** reported that nearly half of the participants were illiterate which supported our findings.

As regard to the occupation, the present findings declared that nearly half of the studied groups had retired. This is expected regarding the age of our study groups (60-<70 years) which retired in accordance with the Egyptian rules and regulations. However, a study conducted by **Hamed and Elsayed (2021)** reported that nearly one third of their intervention group were self-employed while nearly two third of the control group were employed. This discrepancy may be due to most of both their studied groups had higher educational level.

The present research findings revealed that more than half of the intervention group and nearly three-quarters of the control group were non-smokers. Additionally, smoking was assumed to be more common among teenage patients, but in our study, the elderly exceeded the young. This is in consistent with a study conducted by **Abdelateif, S. Ahmed, and G. Ahmed (2019)** showed that around one-quarter of the participants were smokers.

According to the current study, the most commonly encountered comorbidities in both groups were hypertension and diabetes. These results are supported by previous research findings (**Türen et al., 2022**) which found that more than half of the participants had hypertension followed by nearly one third of them with diabetes.

Regarding the severity of pain, our research results revealed that there was statistically significant improvement in the intervention group after changing angle of bed to 15, 30, and 45 degrees at the fourth, fifth, and sixth hours of sheath removal. Moreover, there were highly statistically significant changes between both studied groups throughout the 4th, 5th, and 6th hours of sheath removal. This is may be due to the effect of raising the angle of bed gradually from 15 to 45 degrees which supported by literature review.

Our results are similar to **Rahmani, Naseri, Salaree, & Nehrir (2016**) who found that prolonged bed rest without changing position causes muscle fatigue and weakness due to increasing tissue pressure and reduction of blood supply to muscles and tissues. Additionally, **Türen et al. (2022)** showed that at the third hour, pain levels were considerably higher in the control group (flat position) than in groups B and C (15 and 30 degrees, respectively). Furthermore, group A had significantly higher pain scores than groups

B and C at the sixth hour which suggest our research hypothesis.

Another study conducted by **Busca et al. (2022)** found that in patients undergoing cardiac catheterization, short periods of bed rest were unrelated to complications. Additionally, they reported that the longer the patients were in bed, the more likely they were to suffer from back pain. The findings of our study concluded that changing angle of bed significantly reduced pain severity in the intervention group after changing angle of bed than the control group. Also, our outcomes are agreed with a study demonstrated by **Abd El Hafeez, et al. (2018)** at Alexandria University which reported that control group experienced more back pain compared to modifying changing position group with supportive devices.

The results obtained in the present study are similar to those of several research studies which reported that altering a patient's position following a femoral diagnostic or therapeutic cardiac catheterization contributed to lower level of back pain intensity **(Boğa & Öztekin, 2018; Niknam-Sarabi et al., 2021; Türen, et al., 2022)**. Transfemoral catheterization leads to several complications, especially the access site complications. So, our findings showed that there were no significant differences in the mean scores of vascular complications scales between both studied groups through the five periods of the study regarding hematoma formation, incidence of ecchymosis and presence of ozzing as vascular complications post cardiac catheterization.

These results may be attributed to sufficient manual compression for 20 minutes to the puncture site with a sandbag on the affected limb. Manual compression is still the gold standard for closing the cardiac catheterization site. Moreover, Effective and safe hemostasis techniques are crucial to reduce the patient pain and the burden of complications **(Pang et al., 2022)**.

These findings are in line with an Egyptian study presented by **Abouelala et al., (2022),** which stated that neither group's patients experienced any vascular problems during the course of the investigation. In contrast, **H. Ali and Ali (2019)** found that while there were significant differences between the two groups at 6 and 12 hours after sheath removal, there were no differences in the incidence of oozing, hematoma, or ecchymosis right away.

6.Limitations

This study used a small convenience sample and was only conducted in one university hospital. These considerations hampered the generalizability of the research findings.

7.Conclusion and Recommendations

The results of this study support evidence-based practice concerning to the care of post cardiac catheterization patients. Changing the angle of bed gradually from 15 to 45 degrees at 4th, 5th, and 6th hours after sheath removal had a remarkable reduction in back pain level without aggregating of vascular complications. Future research projects are necessary to add to the body of knowledge around post-cardiac catheterization care.

8.Acknowledgment

The authors would like to express their sincere appreciation to all of the patients and critical care nurses who involved in this study.

9.Declaration of competing interests

There are no potential conflicts of interest.

10.References

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Table 1 *Participants' Socio-demographic Characteristics*

Variables	The studied patients (n=82)				Significance Test	
	Intervention group (n=41)		Control group (n=41)		χ^2	***P* value**
	No	**%**	**No**	**%**		
Clinical settings						
▪ Post-cardiac catheterization Unit	31	75.61	27	65.85		
▪ Intermediate Coronary Care Unit	5	12.20	8	19.51	1.059	0.589
▪ Intensive Coronary Care Unit	5	12.20	6	14.63		
Age categories (in years)						
▪ 30-<40	2	4.88	1	2.44		
▪ 40-<50	7	17.07	8	19.51		
▪ 50-<60	11	26.83	13	31.71	1.486	0.829
▪ 60-<70	19	46.34	17	41.46		
▪ ≥70	2	4.88	2	4.88		
Range	(37-77)		(35-72)		t=0.340	0.562
Mean ± SD	58.24±9.460		57.10±8.315			
Gender						
▪ Male	30	73.17	25	60.98	FET	0.064
▪ Female	11	26.83	16	39.02		
Education level						
▪ Illiterate	27	65.85	28	68.29		
▪ Primary	2	4.88	0	0.00		
▪ Preparatory	0	0.00	3	7.32	7.304	0.121
▪ Secondary	6	14.63	8	19.51		
▪ Bachelor	6	14.63	2	4.88		
Occupation						
▪ Employed	5	12.20	3	7.32		
▪ Un-employed	17	41.46	18	43.90	1.638	0.651
▪ Retired	19	46.34	20	48.78		

Data are expressed as numbers (No), frequency (%), $\chi2$: Pearson Chi-square

Table 2 *Participants' Health Relevant Data*

Variables	The studied patients (n=82)				Significance Test	
	Intervention Group (n=41)		Control Group (n=41)		χ^2	*P* value
	No	%	No	%		
Medical Diagnosis					8.896	0.113
▪ Ischemic heart disease	17	41.46	14	34.15		
▪ Coronary artery disease	4	9.75	9	21.95		
▪ Hypertention	7	17.07	12	29.26		
▪ Acute coronary syndrome	3	7.32	1	2.44		
▪ Myocardial infarction	5	12.20	4	9.76		
▪ Atrial fibrillation	5	12.20	1	2.44		
Current Smoking	17	41.46	12	29.27	FET	0.356
▪ Yes ▪ No	24	58.54	29	70.73		
Type of Co-morbidities	24	58.54	33	80.49	0.268	0.605
▪ Hypertension	10	24.39	11	26.83		
▪ Diabetes mellitus ▪ Coronary heart failure	2	4.88	0	0.00		

Data are expressed as numbers (No), frequency (%), $\chi 2$: Pearson Chi-square,

Table 3 Comparing Pain Severity Using NRS After Changing Angle of Bed to 15 ° , 30° and 45° at the 4th, 5th and 6th Hours of Sheath Removal for Intervention Group Post Cardiac Catheterization

NRS Pain Severity	Intervention Group (n=41)						Significance Test	
	At 4th Hour with AOB at 15°		At 5th Hour with AOB at 30°		At 6th Hour with AOB at 45°		χ^2	*P* value
	No	%	No	%	No	%		
▪ No pain	1	2.44	15	36.59	40	97.56	24.05	**0.000***
▪ Mild pain	19	46.34	26	63.41	1	2.44		
▪ Moderate pain	21	51.22	0	0.00	0	0.00		
▪ Severe pain	0	0.00	0	0.00	0	0.00		

Data are expressed as numbers (No) and frequency (%), $\chi 2$: Pearson Chi-square, *significant at level $P < 0.05$, AOB: Angle of bed

Table 4 Comparing the Pain Severity Using the NRS at the 4th, 5th and 6th Hours of Sheath Removal Without Changing Angle of Bed for the Control Group.

NRS Pain Severity	Control Group (n=41)						Significance Test	
	At 4th Hour with Complete Supine Position		At 5th Hour with Complete Supine Position		At 6th Hour with Complete Supine Position		χ^2	*P* value
	No	%	No	%	No	%		
▪ No pain	0	0.00	0	0.00	0	0.00	**21.03**	**0.000***
▪ Mild pain	5	12.20	1	2.44	0	0.00		
▪ Moderate pain	**36**	**87.80**	**22**	**53.66**	9	21.95		
▪ Severe pain	0	0.00	18	43.90	**32**	**78.05**		

Data are expressed as numbers (No) and frequency (%), $\chi 2$: Pearson Chi-square, **(*)** significant at level $P < 0.05$

Table 5 Comparison Between Both the Studied Groups Regarding Pain Severity Using NRS at 4th, 5th, and 6th Hours of Sheath Removal Post Cardiac Catheterization

Significance Test	Intervention Group Versus Control Group		
	At 4th Hour of Sheath Removal	At 5th Hour of Sheath Removal	At 6th Hour of Sheath Removal
χ^2	**14.571**	**78.148**	**82.001**
***P* value**	**0.001***	**0.000***	**0.000***

Data are expressed as $\chi 2$: Pearson Chi-square, *significant at level $P < 0.05$.

Table 6 Comparison of Mean Scores of Vascular Complications Scales Between Both the Studied Groups Throughout the Five Periods of the Study

Vascular complications Monitoring Scales		The Studied Patients (n=82) Mean ± SD						
		Immediately with Supine Position	After 3 Hours with Supine Position	At 4th Hour with AOB at 15°	At 5th Hour with AOB at 30°	At 6th Hour with AOB at 45°	FET	P-value
A. Hematoma Scale	Intervention Group	0.61±0.771	0.37±0.488	0.15±0.358	0.07±0.264	0.07±0.264	1.078	0.158
	Control Group	0.80±0.782	0.59±0.591	0.49±0.675	0.46±0.636	0.46±0.636	1.945	0.104
t		1.296	3.368	4.184	3.162	3.162		
P-value		0.258	0.070	0.051	0.061	0.061		
B. Ecchymosis Scale	Intervention Group	0.49±0.637	0.37±0.536	0.15±0.358	0.10±0.300	0.10±0.300	3.472	0.069
	Control Group	0.78±0.791	0.54±0.596	0.46±0.636	0.46±0.636	0.46±0.636	1.761	0.138
t		3.404	1.860	3.735	1.084	1.084		
P-value		0.069	0.176	0.077	0.078	0.078		
C. Oozing scale	Intervention Group	1.20±0.511	0.12±0.331	0.00±0.000	0.00±0.000	0.00±0.000	1.546	0.076
	Control Group	1.29±0.602	0.20±0.401	0.00±0.00	0.00±0.00	0.00±0.00	2.056	0.081
t		0.626	0.811	-	-	-	-	-
P-value		0.431	0.371	-	-	-	-	-

Data are expressed as, FET: Fisher's Exact Test, t: Independent-Samples t-test, SD: Standard Deviation, *significant at level $P < 0.05$

AOB: Angle of bed, **N.B**: Control group were in complete supine position for six hours of sheath removal post cardiac catheterization