P-ISSN: 2617-9806
E-ISSN: 2617-9814

Impact Factor: RJIF 5.2
www.nursingjournal.net

International Journal of Advance Research in Nursing

Volume 8; Issue 1; Jan-Jun 2025; Page No 598-608

Received: 12-04-2025
Accepted: 15-05-2025

Indexed Journal
Peer Reviewed Journal

Effect of cold application and proper subcutaneous injection technique on pain intensity and ecchymosis extent among cardiac patients

[1]Manal Mostafa Fahmy, [2]Inshrah Roshdy Mohammed and [3]Sayed Shehata Mahmoud

[1]Assistant lecture of Medical-Surgical Nursing, Faculty of Nursing, Minia University, Egypt
[2]Professor of Medical Surgical Nursing, Faculty of Nursing, Minia University, Egypt
[3]Assistant Professor of Cardiology, Faculty of Medicine, Minia University, Egypt

Corresponding Author: Manal Mostafa Fahmy

DOI: https://www.doi.org/10.33545/nursing.2025.v8.i1.H.510

Abstract

Background: Pain and ecchymosis at the injection site are among the adverse effects of the subcutaneous anticoagulant enoxaparin. The patient may be unable to continue treatment due to the frequency of side effects. Pain and ecchymosis can be effectively managed with the right subcutaneous injection technique and cold application at the injection site. People can greatly lessen discomfort and potential adverse effects by using cold application and making sure that injection techniques are exact.

Aim of the study: Evaluate the effect of cold application and proper subcutaneous injection technique on pain intensity and ecchymosis extent among cardiac patients.

Design: Quasi-experimental research was utilized.

Subjects: A purposive sample of (120) patients.

Setting: Cardiac department at Minia university cardiothoracic hospital.

Tools: One tool and two scales, the first tool was a structured interview assessment sheet, the second was numerical pain rating scale and the third was Ecchymosis Formation Scale.

Results: mean average age among studied groups was nearly constituting (40.9±8.15years and 41.2±9.15years), respectively, there were a highly statistically significant among both groups regarding pain score and ecchymosis extent.

Conclusion: According to the study, patients who received SC enoxaparin injections using the correct SC injection method and after being chilled for five minutes before to the injection had less ecchymosis and pain than those who received standard nursing care

Recommendation: In cardiac patients, the use of cold application and appropriate SC anticoagulant injection technique reduces the degree of ecchymosis and pain intensity.

Keywords: Cold application, subcutaneous injection, pain, ecchymosis

Introduction

Regardless of current WHO data, Cardiovascular Disease (CVD) continues to be the major cause of death and disability worldwide [1, 2, 3]. It is responsible for 17.9% million deaths worldwide, or 31% of all deaths [4]. Among the multiple CVDs, arterial thromboembolism (ATE) in myocardial infarction and ischemic stroke and venous thromboembolism (VTE), including deep vein thrombosis and pulmonary embolism, account for approximately one in four deaths globally [5, 6]. In addition to having a major negative influence on patients' quality of life, many illnesses also place a heavy financial strain on healthcare and society at large [7, 8].

CVD is affected by a number of risk factors. High blood pressure, high cholesterol, diabetes, smoking, poor diet, lack of physical activity, excessive alcohol use, and air pollution are all modifiable variables. The risk of CVD is also influenced by non-modifiable characteristics like gender, age, and family history. High body mass index, high LDL cholesterol, and high systolic blood pressure are some of the major risk factors for CVD, according to recent studies.-related loss of life and disability-DALYs, or adjusted life years [9]. Ecchymosis and injection site pain are among the adverse effects of the subcutaneous anticoagulant enoxaparin. The patient may be unable to continue treatment due to the frequency of side effects [10]. The subcutaneous injection of enoxaparin is one of the causes of pain for hospitalized patients, which can lead to anxiety, mistrust of medical professionals, and fear of injury [11]. Bruising of the skin may be caused by blood leaking into the subcutaneous tissues due to damage to the underlying blood vessels or the brittleness of vessel walls [12]. The biggest bruises occur 48 hours after the injection and begin to go away 72 hours later [13].

In clinical settings where there is a risk of thromboembolism or when thromboembolitic events have occurred, low molecular weight heparin (LMWH) is commonly utilized as a treatment and especially as a protective measure [14, 15]. The main way that low molecular weight heparin (LMWH), a common anticoagulant, functions is by blocking factor Xa,

an essential enzyme in the coagulation cascade that produces thrombin and causes clots. LMWH has a number of benefits over unfractionated heparin (UFH), including as a more consistent anticoagulant response, a decreased risk of heparin-induced thrombocytopenia (HIT), and easy subcutaneous administration that eliminates the need for routine laboratory testing [16].

The person's health, especially how they administer drugs, may be a risk factor. To guarantee the greatest benefits for the patient, including safety against complications, nurses must be informed about the significance of the medication, its indications, precautions, complications, effective drug administration, and appropriate nursing care [17]. The occurrence of enoxaparin-related local side effects is reduced and maximum effectiveness is guaranteed with proper injection technique [18].

One way to lessen the impact of SC heparin injections is through cold application. Vapor cooling spray, dry ice pack, cold gel pack, or moist cold application can all be used [19, 20]. Using cold reduces swelling and inflammation, reduces pain from swelling, controls bleeding by squeezing the capillary surface, induces local anesthesia by reducing pain perception, and improves coagulation by increasing blood viscosity [20, 21]. Pain and bruise frequency were decreased by applying cold for two or five minutes prior to injection [22]. According to a meta-analysis of eight randomized controlled trials with 694 patients, applying cold compresses reduced the risk of bruises by as much as 40%, especially in the 48 hours after an LMWH injection [19].

Significance of the study

CVD is estimated to have contributed to 438 million disability-adjusted life years lost and 19 million deaths worldwide in 2021, according to the Global Burden of Disease (GBD) study [1&2]. Egypt has one of the highest rates of cardiovascular deaths among the Middle Eastern and North African nations [23]. Poor subcutaneous LMWH delivery might result in side effects such as induration, discomfort at the injection site, ecchymosis, and hemorrhage. **[24&25]**. After receiving SC anticoagulant injections, pain is a frequent side effect. The frequency of this side effect varies depending on the injection technique, site selection, and length. According to studies, between 28.35% and 88.9% of patients experience pain [26]. Between 20.6% and 88.9% of patients experience ecchymosis, or bruising [27]. Patient comfort, treatment compliance, and general well-being can all be greatly impacted by pain and ecchymosis after SC anticoagulant injections. Research suggests that the severity of pain and ecchymosis at the injection site can cause anxiety, decreased adherence, and avoidance behaviors, which can impact the efficacy of anticoagulant treatment [28].

Various non-pharmacological approaches have been investigated to reduce ecchymosis and pain after subcutaneous anticoagulant injections in an effort to increase patient comfort and treatment compliance. An efficient method is cold application, which helps numb the injection site, minimizing bruising and pain perception. With an incidence rate of 24.1%, studies have demonstrated that using a cool-pack technique before to injection dramatically reduces ecchymosis size and pain intensity. Manual pressure application is another extensively researched method. It has been shown to lessen pain and the development of ecchymosis when the injection site is pressed for 10 seconds after the injection. Furthermore, it's been demonstrated that lowering injection speeds (beyond 30 seconds) and holding the needle in place for a few seconds after injection reduce bruising without influencing its occurrence [29]. According to research, standardized subcutaneous injection practices-including injection site, speed, angle, and pressure time-should be taken into account to lower the risk of associated problems [30].

Purpose of the study

Evaluate the effect of cold application and proper subcutaneous injection technique on pain intensity and ecchymosis extent among cardiac patients.

Research question

- **H_1:** Following cold application and appropriate subcutaneous injection technique, there will be notable variations in the degree of pain between the study and control groups.
- **H_2:** Compared to the control group, there will be notable variations in the incidence and severity of ecchymosis in the study group.

Subjects and Methods

- **Research Design:** To achieve this aim, a quasi-experimental research design comprising a study and control group was set up.
- **Setting:** This research was carried out in cardiac department at Minia University cardiothoracic Hospital at Minia Governorate-Egypt.
- **Study Duration:** Data collected from July 2023 to April 2024
- **Subjects:** A purposive sample of both male and female adult patients. In accordance with the sample size formula that follows, which is determined by the (31) formula,

(N=n x 30 / 100) in which:
N=Sample size
N=Total number of 400 adult patients admitted to cardiac department received subcutaneous Enoxaparin sodium 80 mg during the period 2020:2021.
N=400x 30 / 100=120 Patient
So the studied groups were 120 patients that were (60 patient) selected randomly for each group. Group I (the study group). Group II (the control group)

Inclusion Criteria

- Patients in their adult years, aged 18 to 60.
- A recently hospitalized patient to the cardiac unit.
- Individuals who, under a doctor's order, received subcutaneous Enoxaparin sodium 80 mg for three days in a row, separated by twelve hours.
- Patients who were given clopidogrel and aspirin, two antiplatelet medications, together.
- Patients with consciousness.
- The patient has a normal prothrombin time (PT) and international normalized ratio (INR). platelet count and prothrombin concentration (PC)

Exclusion Criteria

- Individuals with cognitive disability or those who are incapable of reporting pain.
- A person who has liver illness.
- A patient who has previously experienced thrombocytopenia brought on by heparin.
- Absence of contraindications (burns or skin lesions) on the abdomen
- A patient who has previously had cold compression allergies.
- Individuals with diabetes who take insulin in the abdomen region
- One of the patients declines to take part in the study.

Tools of Gathering Data

One tool and two scales to collect pertinent data prepared by the researcher after the literature review.

First Tool: Structured interview assessment sheet

It was collected at the first interview and addressed two main parts

- **Part one:** Contains the sociodemographic details of patients, including their age, gender, marital status, place of residence, and level of education.
- **Part two:** Contains the patients' medical data such as patient's past medical history, and body mass index (BMI).

Second Tool: Numerical Pain Rating Scale (NPRS)

The degree of pain perception was measured using this standardized Numerical Pain Rating Scale, which was adopted by (32). The groups under study were given a whole number (ranging from 0 to 10) that most accurately represented how much pain they were experiencing. A line or bar that is horizontal is the standard format.

A higher score denotes more intense pain. The scoring system runs from 0 to 10. In other words, zero indicates no pain, one to three indicates mild pain, four to six indicates moderate pain, seven to eight indicates severe pain, nine to ten indicates intolerable pain. After receiving a SC enoxaparin injection for three days in a row, the degree of pain was measured twice daily.

Third Tool: Ecchymosis Formation Scale: Adopted from [33]. This scale is used to quantify the degree of ecchymosis. With the use of a transparent millimeter ruler, the researcher quantified ecchymosis twice: once at 48 hours and again at 72 hours following injection. From no ecchymosis to noticeable ecchymosis, measurements are made.

Scoring system

Based on surface area, ecchymosis was divided into four groups:

- No: Ecchymosis, which has a diameter of less than 2 cm.
- Ecchymosis is tiny (diameter more than 2 cm).
- Ecchymosis is large (diameter more than 5 cm).
- Marked ecchymosis (diameter more than 10 cm).

Validity and Reliability

The study instruments were subjected to content validity assessment, which involved examining the items to ascertain whether they measured the intended constructs. This testing is conducted by a group made up of five professionals from the medical-surgical nursing academic staff at Minia University's nursing faculty. Each juror stated that the current research instruments were not in need of alteration and were dependable and relevant to the study's goals.

The tools' consistency was verified by reliability testing. Therefore, the degree to which the tool's items measured what they were supposed to measure was determined by measuring internal consistency.In the control group, the Cronbach alpha test results for reliability were (0.955) for the first tool, (0.756) for the pain scale, and (0.773) for the ecchymosis scale; in the study group, the results were (0.786) for the pain scale, and (0790) for the ecchymosis scale.

Pilot study

To assess the viability, objectivity, and application of the data collection method and scales, a pilot research was conducted on 10% (12 patients) of the groups under study. The researcher made no changes to these tools or scales based on the pilot study's findings, and those patients were added to the current study.

Ethical Consideration

The study was authorized by the Minia University faculty dean, the director of the cardiothoracic hospital, the director of the cardiac department, the faculty's ethical committee, and the faculty itself.

The groups who were studied gave their oral consent. Following an explanation of the study's nature, goals, methodology, and advantages, participation in the study was entirely voluntary. The researcher told them that the data they had collected would not be used in any future studies without their agreement.

To ensure anonymity and secrecy, each assessment sheet was coded and did not include the subjects' names. Participants are allowed to leave at any moment and for any reason.

Field work, The current study was carried out in three phases

1. Preparatory Phase

Using books, papers, periodicals, and magazines, a survey of recent, local, and international literature in a variety of areas related to the current topic was conducted. The study's settings were evaluated in relation to the number of patients admitted to Minia University Hospital's cardiac department. after hospital authorities gave its approval to move on with the intended current trial. After the investigated groups satisfied the study's inclusion requirements, the researcher approached them to gather data. After evaluating each scale's validity and reliability, the researcher created a study tool.

2. Implementation phase

Beginning with the control group, which receives standard hospital nursing care, the researcher began this phase over three days a week during the morning and evening shift in the cardiac department. In order to obtain the first tool and

conduct interviews with the patients to complete all of the items in it, the researcher reviewed the patient files on the first day of admission to the cardiac department**.** After conducting the first tool from the control group, the researcher conducted it from the study group using two study strategies that were designed by the researcher based on evidence-based nursing practice [30]. These approaches are as follows:

Technique (1): Cold application at injection site
Included three steps as the following:-

1. The gelatin in the cold pack the researcher used should be frozen for one and a half to three hours in order to obtain the required temperature (15 to 18°C).Throughout the investigation, its temperature was tracked and managed with a common laser thermometer.
2. The researcher covered it with a cotton cloth or towel to act as a barrier between it and the patient's skin, preventing tissue damage and frostbite.
3. Stand on the patient's right side while placing them in a supine position. Before the SC injection of enoxaparin, place a cold pack around the patient's umbilical cord for five minutes, exposing the abdomen while protecting their privacy.

Technique (2): Subcutaneous injection technique.
Three parts of the technique-assessment, preparation, and implementation-were used by the researcher to administer SC injections to the patient's abdomen.

A. Assessment

- Verify the MAR's completeness and accuracy.
- Examine the patient's medical history, prescription history, and allergy history (identifying the type of allergy and typical allergic reaction).
- Check for SC injection contraindications: Determine whether the patient's adipose tissue is adequate or if there is decreased local tissue perfusion.

B. Preparation

- Use two identifiers to correctly identify the patient.
- Explain the process and the rationale behind administering the medication in a composed, assured manner.
- Keep the robe draped over the parts of the body that don't need to be seen and provide seclusion.
- Chooses the right location (the abdomen).There must be sufficient subcutaneous tissue at the location.
- Examine the skin's surface for any signs of edema, inflammation, or bruising. Check for tenderness or masses.
- Place the patient in a supine position for comfort and ease of access.

C. Implementation

- Wear gloves and practice good hand hygiene. Use a single dosage prefilled syringe with a 27 gauge needle.
- -Use a circular motion with an alcohol swab to clean the area at least 5 cm (2 inches) from the umbilicus, then allow it to air dry.
- In the non-dominant hand, place a swab or piece of gauze between the third and fourth fingers.
- Holding the syringe between the thumb and fingers of the dominant hand, hold it as a dart, palm down, insert it at a 90-degree angle, compress the skin at the injection site, and inject an obese patient.
- For 30 seconds, inject the needle in a single, swift, strong motion.
- Put light pressure on the location. Avoid massaging the site. Hold an alcohol swab or gauze to the location for 30 to 60 seconds if heparin is administered.
- Following injection, a circle measuring around 5 cm2 was drawn around the insertion point at the place marked with a water-proof pen.
- Toss an uncapped needle into the container for sharps.
- Move the patient.
- Hand hygiene and gloves should be removed.

3. Evaluation Phase
The studied groups were evaluated as the following
Over the course of three days, the researcher assessed the pain levels of both groups twice a day, once during the morning shift and once during the evening shift, using the NPRS.
It was assessed for the study group following the execution of two study procedures and for the control group following standard hospital nursing care. Additionally, the researcher measured the degree of ecchymosis twice using a transparent millimeter ruler and the second scale (Ecchymosis Formation Scale) for both groups under study. The first time 48 hours and the second time 72 hours following the injection. It was assessed for the control group following standard hospital nursing care and for the study group following the execution of two research procedures.

Statistical design
Statistical analysis of data
Systematic organization, tabulation, categorization, and analysis were performed on the collected data. The statistical program for social science (SPSS) version (22) was used for the data input process since it incorporates the significance test that is featured in statistics textbooks. Measures of mean and standard deviation, among other descriptive statistical techniques. Qualitative data was represented using percentages and frequencies. A probability is used to describe the level of significance (P-value). A p-value of less than 0.05 was considered to be the significance level. The significance of the result increases with a decreased P-value (*). Highly significant (**) was defined as less than 0.001, and Fisher exact, ANOVA and T tests were employed.
To ascertain the kind and strength of a relationship between two numerical variables, the statistical approach of correlation is employed. The value represents the strength of the association, while the co-sign efficient indicates whether the relationship is positive or negative. A correlation is considered poor if the Rho value is less than 0.25, fair if it is between 0.25 and 0.499, moderate if it is between 0.50 and 0.74, and high if it is greater than 0.74.

Limitations of the study

- The hospital pharmacy had a five-month scarcity of Enoxaparin sodium during the current study's execution because of interruptions in its importation at that time.
- Nurses don't know enough about the benefits of cold application at the injection site.
- Nurses frequently administer subcutaneous enoxaparin injections without following the proper and precise method.
- It took a lot of time and work for the researcher to change nursing procedures such that subcutaneous injections were given in the abdomen instead of the arm.

Results: Table 1, shows that the mean average age among studied groups was nearly constituting (40.9±8.15years and 41.2±9.15years), respectively. As regards sex more than half (56.7%, 55.0%) of studied groups were females respectively, and their educational level were constituted (75.0%, 76.6%) of both of studied groups had primary school. According to residence majority (83.4% & 78.3%) of both studied groups lived in rural areas. Finally, the table results found that more than three quarters constituting (86.7%&85.0%) both of studied groups were married respectively, and there are no statistically significant differences in their socio-demographic characteristics were found between both studied groups

Table 1: Distribution of socio-demographic characteristics among both studied groups, (N=120)

Socio-demographic Data	Study group (No=60)		Control group (No=60)		X^2 or Fisher exact	P-Value
	No	%	No	%		
Age / Years						
18->30	3	5.0	1	1.7	1.816	0.637NS
≤30->40	8	13.4	10	16.6		
≤40->50	39	65	42	70		
≤51->64	10	16.6	7	11.7		
Mean ± SD (T-test)	40.9 ± 8.15		41.2±9.15		0.020	0.889NS
Gender						
Female	34	56.7	33	55.0	.034	1.0000NS
Male	26	43.3	27	45.0		
Level of Education						
Illiterate	10	16.6	12	20.0	1.802	0.704NS
primary school	45	75.0	46	76,6		
Secondary school or diploma	4	6.7	2	3.4		
University graduate	1	1.7	0	0		
Master or doctorate	0	0	0	0		
Residence						
Rural	50	83.4	47	78.3	.484[a]	0.643NS
Urban	10	16.6	13	21.7		
Marital Status						
Single	3	5.0	4	6.7	.413	1.0000NS
Married	52	86.7	51	85.0		
Divorced	3	5.0	3	5.0		
Widow	2	3.3	2	3.3		

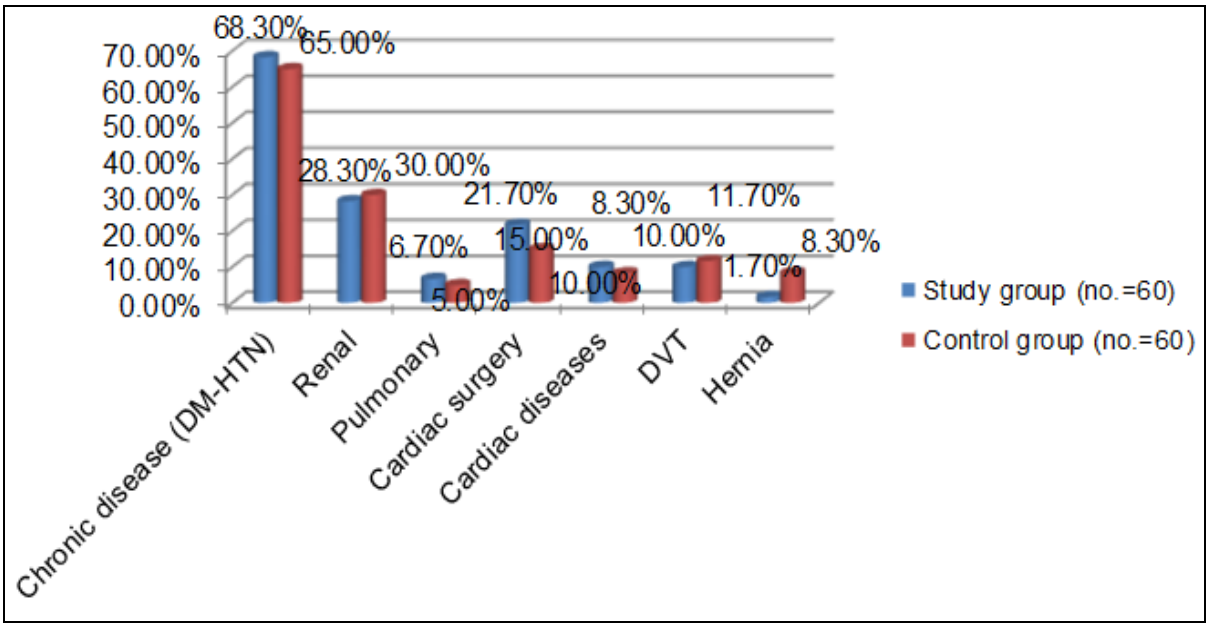

Fig 1: Distribution of past medical history of both studied groups

Figure 1, shows that the highest percentage (68.3%&65.0%) of both studied groups had past history of chronic diseases (DM&HTN) while the lowest percentage (1.7%&8.3&) of them had past history of hernia surgery. Lastly, there was no significant difference between both studied groups regarding past medical data.

Table 2 shows, the mean and SD for the body mass index for the two groups under study were, respectively, 22.1000+.656 and 22.1000+.629). Crucially, the data indicate that there is no statistical significance between the two groups under study, and the majority of both groups (71.6% and 75.0%, respectively) had normal BMIs.

Table 2: Distribution of Body Mass Index (BMI) among studied groups (N=120)

BMI	Study group (No=60)		Control group (No=60)		Fisher exact	P-Value
	No	%	No	%		
Under weight (<18)	7	11.7	6	10.0	0.349	0.968NS
Normal (18,5:24.9)	43	71.6	45	75.0		
Over weight (25:29.9)	7	11.7	6	10.0		
Obese (30:34.9)	3	5.0	3	5.0		
Mean +SD (T-test)	22.1000+.656		22.1000+.629		0.000	1.000NS

Table 3: Distribution of numerical pain level post SC injection through there days among studied groups after implementation of study techniques (N=120)

Numerical Pain Rating Scale	Study group (No=60)		Control group (No=60)		Fisher exact	P-Value	Study group (No=60)		Control group (No=60)		Fisher exact	P-Value
	1st day (1st injection)						1st day (2nd injection)					
	No	%	No	%			No	%	No	%		
▪ (0)=No pain	31	51.7	0	0.0	67.043	0.001**	30	50.0	0	0.0	69.061	0.001**
▪ (1:3)= Mild pain	16	16.6	5	8.4			17	28.4	5	8.4		
▪ (4:6)=Moderate pain	10	16.6	15	25.0			10	16.6	13	21.6		
▪ (7:8)=Severe pain	3	5.0	30	50.0			3	5	30	50.0		
▪ (9:10)=Unbearable pain	0	0.0	10	16.6			0	0.0	12	20.0		
Mean +SD (T-test)	2.2000±0.776		3.7500±0.836		10.520	0.001**	2.2167±0.783		3.8167±0.853		10.699	0.001**
	2nd day (1st injection)						2nd day (2nd injection)					
▪ (0)=No pain	33	55.0	0	0.0	77.615	0.001**	33	55.0	0	0.0	77.506	0.001**
▪ (1:3)= Mild pain	15	25.0	5	8.3			15	25.0	5	8.2		
▪ (4:6)=Moderate pain	10	16.6	14	23.4			10	16.6	14	23.4		
▪ (7:8)=Severe pain	2	3.4	26	43.3			2	3.4	27	45.0		
▪ (9:10)=Unbearable pain	0	0.0	15	25.0			0	0.0	14	23.4		
Mean +SD (T-test)	2.0333±0.7804		3.8500±0.898		11.823	0.001**	2.0333±0.7804		3.8333±0.886		11.808	0.001**
	3rd day (1st injection)						3rd day (2nd injection)					
▪ (0)=No pain	35	58.3	0	0.0	96.597	0.001**	35	58.3	0	0.0	98.183	0.001**
▪ (1:3)= Mild pain	15	25.0	5	8.3			15	25.0	5	8.3		
▪ (4:6)=Moderate pain	8	13.4	11	18.3			8	13.4	11	18.3		
▪ (7:8)=Severe pain	2	3.3	27	45.0			2	3.3	28	46.7		
▪ (9:10)=Unbearable pain	0	0.0	17	28.4			0	0.0	16	26.7		
Mean +SD (T-test)	2.1833±0.7008		3.9333±0.8994		11.888	0.001**	2.1833±0.7008		3.9167±0.8885		11.864	0.001**

* P=≤0.05 (statistical significance), ** P=≤.01 (highly statistical significance).

Table 3, reflects that there were a highly statistically significant among both studied groups regarding their pain score (P=0.001**) in six times through three days after implementation of study techniques

Table 4: Distribution of ecchymosis extent through second and third day among studied groups after implementation of study techniques (N=120)

Ecchymosis Extent	Study group (No=60)		Control group (No=60)		Fisher exact	P-Value
	2nd day after techniques					
	No	%	No	%		
• No: Ecchymosis, which has a diameter of less than 2 cm.	29	48.3	2	3.3	47.458	0.001**
• Ecchymosis is tiny (diameter more than 2 cm).	25	41.7	10	16.6		
• Ecchymosis is large (diameter more than 5 cm)	4	6.7	28	46.7		
• Marked ecchymosis (diameter more than 10 cm).	2	3.3	20	3.4		
Mean +SD (T-test)	1.6500+0.7552		2.8500+0.9356		7.731	0.001**
3rd day after techniques						
• No: Ecchymosis, which has a diameter of less than 2 cm.	43	71.6	10	16.7	63.194	0.001**
• Ecchymosis is tiny (diameter more than 2 cm).	17	28.4	12	20.0		
• Ecchymosis is large (diameter more than 5 cm)	0	0.0	25	41.7		
• Marked ecchymosis (diameter more than 10 cm).	0	0.0	15	21.6		
Mean +SD (T-test)	1.2833±0.4544		2.5333±1.0116		8.698	0.001**

*p=≤.05 (statistical significance), ** p=≤.01 (highly statistical significance)

Table 5: Relation between socio-demographic data and pain level for control group after implementation of study techniques (N=60)

Socio-demographic Data	Pain level, Control group (N=60)					
	1st day		2nd day		3rd day	
	1st time	2nd time	1st time	2nd time	1st time	2nd time
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Age / Years						
18>30	3.00+1.15	3.00+1.15	3.00+1.15	3.00+1.15	3.00+1.15	3.00+1.15
≤30>40	3.82+.79	3.82+.79	3.82+.79	3.82+.79	3.82+.79	3.82+.79
≤40>50	5.00+.00	3.00+.00	5.00+.00	5.00+.00	5.00+.00	5.00+.00
≤51>64	3.50+.70	5.50+.70	3.50+.70	3.50+.70	3.50+.70	3.50+.70
Anova test (p-value)	3.67(.01*)	3.67(.01*)	3.67(.01*)	3.67(.01*)	3.67(.01*)	3.67(.01*)
Sex						
Female	5.00+.79	6.00+.90	5.84+.87	5.90+.84	6.06+.96	6.03+.95
Male	3.66+1.00	3.62+.83	3.62+.79	3.70+.86	3.77+.80	3.77+.80
T test (p-value)	2. 98(.04*)	3.73(.03*)	2.98(.04*)	2.77(.04*)	3.88(.03*)	3.88(.03*)
Level of Education						
Illiterate	3.82+.92	3.89+.90	3.69+.86	3.78+.89	3.91+.83	3.89+.82
Primary school	3.91+.90	3.58+.79	4.08+.51	4.08+.51	4.08+1.16	3.91+1.16
Secondary school or diploma	4.00+.00	4.00+1.41	3.00+1.41	3.00+1.41	3.50+.70	4.00+.70
University graduate	------	------	------	------	------	------
Anova test (p-value)	.075(.92NS)	.603(.55NS)	1.913(.15NS)	1.567(.21NS)	. 402(.67NS)	. 441(.64NS)
Residence						
Rural	3.91+.90	3.85+.88	3.72+.74	3.78+.74	4.06+.76	2.00+.77
Urban	3.61+.86	3.76+.92	3.84+1.14	3.92+1.18	3.46+1.19	2.07+.79
T test (p-value)	1.065(.29NS)	1.29(.77NS)	.465(.64NS)	.505(.61NS)	2.206(.03NS)	.376(.709NS)
Marital Status						
Single	2.75+.500	3.50+1.00	3.00+1.15	4.00+.00	4.00+1.41	4.00+1.41
Married	3.94+.88	3.86+.77	3.76+.78	3.80+1.22	3.94+.88	3.92+.86
Divorced	3.66+.57	4.33+.57	4.66+.57	3.85+.78	4.00+1.00	4.00+1.00
Widow	4.00+1.41	3.00+1.41	3.50+.70	3.71+1.11	3.50+.70	3.50+.70
ANOVA test (p-value)	2.39(.078NS)	. 1.12(.34NS)	2.520(.06NS)	. 065(.97NS)	. 162(.92NS)	.160(.92NS)

*.P is statistical significant at the 0.05 or less **, p is highly statistical significant at the 0.005 level or les

Table 6: Relation between socio-demographic data and ecchymosis extent for both studied groups after implementation of study techniques (N=120)

Socio-demographic Data	Ecchymosis extent study group (No=60)		Ecchymosis extent control group (No=60)	
	2nd day	3rd day	2nd day	3rd day
	Mean +SD	Mean +SD	Mean +SD	Mean +SD
Age / Years				
18>30	1.66+.57	1.00+.00	2.00+.00	2.00+.00
≤30>40	1.87+.83	1.25+.46	2.90+.99	2.00+.81
≤40>50	4.66+.77	3.30+.46	3.64+.87	4.59+1.08
≤51>64	5.40+.69	4.30+.48	4.85+.37	5.00+.57
Anova test (p-value)	4.622(.004**)	.4.432(.005*)S)	4.622(.006*)	4.622(.005*)
Sex				
Female	1.58+.74	1.23+.43	2.90+.94	2.61+.99
Male	1.73+.77	1.34+.48	2.77+.93	2.23+1.08
T test (p-value)	.721(.47NS)	.935(.35NS)	. 538(.59NS)	1.218(.228NS)
Level of Education				
Illiterate	1.62+.83	1.28+.45	2.84+.86	2.54+.95
Primary school	1.70+.48	1.20+.42	2.75+1.21	2.41+1.31
Secondary school or diploma	1.75+.50	1.50+.57	3.50+.70	3.00+.00
University graduate	2.00+.00	1.00+.00	------	------
Anova test (p-value)	.124(.94NS)	.534(.66NS)	. 543(.58NS)	.285(.75NS)
Residence				
Rural	1.64+.77	1.28+.45	2.93+.91	2.61+.99
Urban	1.70+.67	1.30+.48	2.53+.96	2.23+1.08
T test (p-value)	.227(.82NS)	.126(.90NS)	1.366(.17NS)	1.218(.228NS)
Marital Status				
Single	1.33+.57	1.00+.00	2.25+.500	2.50+1.21
Married	1.67+.78	1.30+.46	2.94+/96	2.54+1.00
Divorced	1.33+.57	1.33+.57	2.33+.57	2.66+1.52
Widow	2.00+.00	1.00+.00	2.50+.70	2.00+.00
Anova test (p-value)	.498(.68NS)	. 699(.55NS)	1.114(.35NS)	.198(.89NS)

Table 4, reveals that there were a highly statistically significant among both studied groups regarding their ecchymosis extent (P=0.001**) through second and third day after implementation of study techniques.

Table 5, shows that there is no statistical relation between control group socio-demographic data and pain level through the three days except age and sex (p-value=<.05) after implementation of study techniques.

Table 6, reflects that there is no statistical relation between all socio-demographic data and ecchymosis extent for both studied groups except age (p-value=<.05) through second and third day after implementation of study techniques.

Discussion

Regarding the socio-demographic characteristics of the studied sample. The present study illustrated that the mean average age among studied groups was nearly constituting (40.9±8.15 years and 41.2±9.15 years), respectively. According to the researcher's analysis, this is because in Egyptian populations, the risk of cardiovascular illness rises with the age group under study. The results of the study conducted at the Cardiac Care Unit of Benha University Hospital were consistent with [28], which showed that over half of the sample under study was between the ages of 40 and 50. Moreover [34]. Who stated that the experimental group's quarter was between the ages of 41 and 50, according to the pilot study's findings. In the control group, half of the participants were older than 51 and the other half were between 41 and 50. The findings of [10] contradict this finding, as they showed that the mean scores of the patients' ages in the experimental and control groups were 60.74±5.52 and 60.3±5.59 years, respectively.

Regarding the patient's gender the present study showed more than half of studied groups were females respectively. Based on the researcher's analysis, females have smaller heart sizes and blood vessels, making them more prone to developing plaques. This result were agree with [35]. This result is in line with [11] which showed that, of the sample, two thirds were female. This result was incongruous with [29], who discovered that over 50% of the study sample consisted of men. Likewise, a study conducted by [36], according to which over half of the patients were men.

It is evident from the current study's findings that roughly three quarters of the groups under investigation had only completed primary school. According to the researcher, patients' awareness and understanding of CVD risk factors, subcutaneous injection adverse effects, and how to manage these are impacted by their educational attainment. A comparable finding from [13] showed that three-quarters of the patients had completed primary school [37]. Who also discovered that primary schooling made up the bulk of the sample. The findings of this study did not align with [38] and indicated that a larger proportion of the study group was illiterate and had only a secondary education.

A large majority of patients in both studied groups came from rural settings From the researcher's standpoint, being from rural areas interferes with access to healthcare facilities and leads to a lack of awareness of warning signs and risk factors of CVD. According to the findings [39] which clarified that the bulk of the study participants were from rural areas with low socioeconomic position and low levels of education, this opinion is validated. According to the current study's findings, the majority of the two groups under investigation were married. According to the researcher, the two groups that comprise the majority of the sample are from rural areas that promote early marriage. This result was consistent with [40], which showed that most of the samples were married. Furthermore, all patients in both categories were married, according to [10] as well. More than half of the sample under examination were unmarried, which is in conflict with the current study's findings [41].

Furthermore, this study found that there was no statistically significant differences in socio-demographic characteristics were found between both studied groups. Along the same line, the findings of this study were corroborated by with [40] reported that no statistically significant differences were observed among the groups in sociodemographic and clinical characteristics.

Concerning patients past medical history, the present study findings showed that, highest percentage of both studied groups had past history chronic disease (hypertension and diabetes mellitus). As posited by the researcher, this related to common the metabolic and behavioral risk factors among Egyptian population

This supports the findings of [14] that most of the sample had at least one chronic illness, with diabetes mellitus and hypertension being the most prevalent. Furthermore, as shown in [42] the majority of the patients under study had a history of chronic conditions such as diabetes mellitus, hypertension, and renal illness. The results of the present study are incongruous with the research by [43] which revealed that a third of the sample had a medical history of diabetes mellitus was evident from the current study's results that the majority of the two groups under investigation had normal BMIs; this finding is in line with the finding in [28], which states that two-thirds of the study and control groups had normal BMIs. Furthermore, [10] found that every participant's BMI was normal. Findings from the current study contradicted those of the study by [29] which found that most were overweight or obese.

Regarding the pain level and ecchymosis extent post SC injection after implementation of study techniques, the current study revealed that there were a highly statistically significant among both studied groups regarding their pain score (P=0.001**) and their ecchymosis extent after implementation of study techniques. The occurrence of enoxaparin-related local side effects is reduced and maximum effectiveness is guaranteed with proper injection technique. The researcher chose the abdominal region 5 cm (2 inches) from the umbilicus based on the injection site. According to the study, the abdomen region is the greatest place to provide subcutaneous heparin injections because it absorbs the drug the best. The findings [44] that one in ten injections into the arm caused the needle to reach the muscle instead of the subcutaneous tissue (11.7%) lend weight to this. There were no side effects from abdominal injections. Furthermore, [37] came to the conclusion that stomach pain is typically less intense than arm discomfort.

It was divided between quick and slow injections based on how long the injection lasted. The researcher used a gradual injection strategy for more than 30 seconds in the current investigation. One possible explanation for this could be because gradual injection lowers the pressure at the injection site, which lessens tissue damage and considerably

lessens discomfort and the development of ecchymosis. This supports the results of [10] which showed that enoxaparin injections administered within 30 seconds had much less pain intensity and a significantly lower incidence and size of bruises than injections given within 10 seconds.

Contrary to the results of the current investigation, [45] shown that the size of the bruises caused by injections lasting 10 and 30 seconds did not differ significantly. After the injection, for ten seconds, the researcher applied light pressure to the injection site without rubbing it. The thumb pressure lessens the impact of the drug on the subcutaneous pain receptors.

This result is consistent with the findings of [43] that manual pressure application is a more effective way than conventional application to reduce discomfort and bruising after subcutaneous injection. Furthermore, [46] came to the conclusion that the SC injection delivered by manual pressure had a statistically higher mean comfort score.

In the current study, the study group had lower pain level and ecchymosis extent than control group after using proper injection technique and applying cold application for 5 minute before injection at 48hr. and 72hr. The current study's findings, which are consistent with [40], shown that applying cold compresses for two or five minutes before to SC LMWH injection significantly decreased pain and the frequency of bruises. However, the size of bruises was lessened by two minutes of cold application than by five minutes. Additional data bolsters this conclusion, as [28] found that the study group experienced less pain, bruises, and ecchymosis formation when cold compresses were used for five minutes prior to injection than the control group.

The study by [47] provided similar findings, demonstrating that cold treatment can lessen the extent of bruising 72 hours after injection and the frequency of bruising following subcutaneous injection of low-molecular-weight heparin. Moreover. When comparing the bruising at 48 and 72 hours, the current study's results deviate from those of [42], which found that there was no significant difference between the two times, whether or not the cold application intervention was used.

Regarding, Relation between socio-demographic data and pain level and ecchymosis extent for of both studied groups, the current study showed that there is no statically relation between all patients' socio-demographic data and pain level and ecchymosis extent of both studied groups except age and sex (p-value=<.05). According to the study, elderly people experience more pain than younger people because their muscles, bones, and other tissues are weaker and less resilient. Women's bodies naturally react more strongly to unpleasant stimuli, and their higher nerve density may make them experience pain more acutely than men.

This outcome is in line with [42], which discovered a strong correlation between age and bruises. Moreover, [48] observed no significant association between age and pain severity, but he did determine that there was a significant relationship between age and the degree of bruising, with the extent of bruising increasing with age. The current study supported the findings of [38], concluding that at 12 hours, 24 hours, and 48 hours, a significant association was found in females with the extent of bruising at the injection site at P=0.00*, while in both arms, there was no significant association between site pain intensity and bruising extent and sociodemographic variables and clinical profile (p>0.05).This result contradicted numerous investigations [49, 50], which revealed no discernible relationship between the age of the patients and the size of the bruise.

Recommendations

The researcher proposed the following in light of the current research's findings:

- Offering consistent and ongoing in-service training on the standard SC injection check list based on evidence-based nursing practice.
- In order to assess the efficacy of present procedures and support evidence-based enhancements in patient care, nurses should be encouraged to participate in research projects.
- To guarantee safe and efficient administration, reduce problems, and enhance patient comfort, consistent evidence-based protocols and recommendations for SC injection method should be established.
- Provide frequent training sessions and competency assessments for nursing staff on how to administer SC injections correctly.
- Give nurses the tools and resources they need, including gloves, alcohol swabs, teaching materials, and access to the most recent clinical recommendations.
- A system of rewards and responsibility is used to encourage compliance with the correct SC injection protocol.
- In order to lessen pain and ecchymosis, teach patients and caregivers the correct injection technique, sites, and how to use cold compresses at the injection site at home.
- Urge other researchers to evaluate nurses' attitudes, practices, and knowledge of SC injection technique and cold application at the injection site.
- Urge more researchers to consider alternative approaches for lowering the degree of ecchymosis and pain in individuals receiving SC enoxaparin

Conflict of Interest

Not available

Financial Support

Not available

References

1. Institute for Health Metrics and Evaluation. Global health data Exchange [Internet]. 2024. Available from: https://ghdx.healthdata.org/. Accessed May 31, 2024.
2. Institute for Health Metrics and Evaluation. GBD compare [Internet], 2024. Available from: https://vizhub.healthdata.org/gbd-compare. Accessed May 31, 2024.
3. GBD 2021 Causes of Death Collaborators. Global burden of 288 causes of death and life expectancy decomposition in 204 countries and territories and 811 subnational locations, 1990-2021: A systematic analysis for the Global Burden of Disease Study 2021. Lancet. 2024;403:2100-2132.
4. Vagare RD, Ubale H, Atar AA. Cardiovascular disease-an overview.

5. Ma Z, He W, Zhou Y, Mai L, Xu L, Li C, Li M. Global burden of stroke in adolescents and young adults (aged 15-39 years) from 1990 to 2019: A comprehensive trend analysis based on the global burden of disease study 2019. BMC Public Health. 2024;24(1):2042.
6. Wendelboe A, Weitz JI. Global health burden of venous thromboembolism. Arterioscler Thromb Vasc Biol. 2024;44(5):1007-1011.
7. Lutsey PL, Zakai NA. Epidemiology and prevention of venous thromboembolism. Nat Rev Cardiol. 2023;20(4):248-262.
8. Duffett L, Castellucci LA, Forgie M A. Pulmonary embolism: update on management and controversies. BMJ. 2020;370.
9. Tong Z, Xie Y, Li K, Yuan R, Zhang L. The global burden and risk factors of cardiovascular diseases in adolescent and young adults, 1990-2019. BMC Public Health. 2024;24(1):1017.
10. Aghakhani N, Ghaderi B, Alinezhad V, Baghaei R, Hazrati M. Effect of enoxaparin injection duration on its complications in myocardial infarction patients. Intern Med Today. 2022;29(1):27-33.
11. Taghlili F, Kiapour A, Zavardeh ME. Effect of localized cold compress on pain severity with subcutaneous injection of enoxaparin: A randomized controlled trial. J Kermanshah Univ Med Sci. 2021;25(1).
12. Varghese MJ. A quasi-experimental study to assess the effect of cold application on pain and bruise associated with subcutaneous injection of low molecular weight heparin among ICU patients at selected hospitals, Navi Mumbai. Eur J Mol Clin Med. 2022;9(8):1280-91.
13. Shalmani EF, Pashaki JN, Leili EK, Louyeh AA. The effectiveness of local combined cold-hot application on bruising of enoxaparin sodium. J Pharm Res Int. 2019;26(6):1-8.
14. Işik MT, Öztunç G. Effects of subcutaneous injection after coolant spray on pain, hematoma, and ecchymosis in three different regions. Nursing Forum. 2022;57(3):352-7.
15. Amaniyan S, Ghobadi A, Vaismoradi M. Cold application on bruising at subcutaneous heparin injection site: A systematic review and meta-analysis. SAGE Open Nurs. 2020;6:2377960820901370.
16. Zhang Y, Guo S, Xu J. Multifunctional applications and research advances of low-molecular-weight heparin. Front Pharmacol. 2025;16:1585762.
17. Kullathum Sakkawong, Yuanjai. The role of nurses in caring for patients receiving enoxaparin sodium injections: A systematic review and meta-analysis. [Details incomplete].
18. Mikhael EM, Nassir KF, Alkhaqani AL, Jabbar ZR. Effectiveness of pharmacist-led nurse education on enoxaparin injection technique in Baghdad teaching hospital, Iraq. Al-Rafidain J Med Sci. 2024;6(1):202-7.
19. Mohammady M, Sadeghi N. Effect of cold application on bruising and pain following heparin subcutaneous injection: A systematic review and meta-analysis. J Nurs Scholarsh. 2020;52(6):634-42.
20. Mutlu S, Yılmaz E. The effect of soft tissue injury cold application duration on symptoms, edema, joint mobility, and patient satisfaction: A randomized controlled trial. J Emerg Nurs. 2020;46(4):449-59.
21. Karadağ S, Aydinli A, Yilmaz C, Tutar N. Effect of cold application and compression on pain and bruising in subcutaneous heparin injection. J Vasc Nurs. 2023;41(1):22-26.
22. Buldak Cİ, Çınar Fİ. Effects of cold application before subcutaneous injection of low-molecular-weight heparin on pain, bruising, and hematoma formation: A randomized controlled trial.
23. Reda A, Ashraf M, Bendary A, Elbahry A, Farag E, Bendary M, *et al*. Premature coronary artery disease among Egyptian patients with acute coronary syndrome; data from the cross-sectional cardio-risk project. Eur Heart J. 2019;40(1):440-446.
24. Andras A, Tenna AS, Stewart M. Vitamin K antagonists versus low-molecular-weight heparin for long-term treatment of venous thromboembolism. Cochrane Database Syst Rev. 2017;(7).
25. Li Y, Dong S, Wang P, Sun J, Jiang H, Liu F. Influence of low-molecular-weight heparin injection sites on local bruising and pain: A systematic review and meta-analysis. J Clin Pharm Ther. 2021;46(3):688-697.
26. Mahmoud Mohammad Elrefaey N, Hamed A, Elsayed S. Effectiveness of thumb manual pressure on pain, bruising, and satisfaction associated with anticoagulant subcutaneous injection. Egypt J Health Care. 2023;14(1):1199-1211.
27. Poursafar Z, Jafroudi S, Baghaei M, Kazemnezhad Leyli E, Zarrizei M. Incidence and extent of bruising after subcutaneous injection of enoxaparin sodium in patients hospitalized at coronary care units. J Holist Nurs Midwifery. 2019;29(2):90-6.
28. Omran E, Alan HM. Effect of cold compresses on pain intensity and ecchymosis among patients receiving subcutaneous anticoagulant injection. Mansoura Nurs J. 2022;9(1):261-271.
29. Cevheroğlu S, Büyükyılmaz F. The effect of 3 different local cold applications on pain and ecchymosis in subcutaneous heparin injections. [Details incomplete].
30. Fidan Ö, Şanlıalp Zeyrek A, Arslan S. Subcutaneous injections: A cross-sectional study of knowledge and practice preferences of nurses. Contemp Nurse. 2023;59(3):214-226.
31. Isaac S, Michael WB. Handbook in research and evaluation: collection of principles, methods, and strategies useful in the planning, design, and evaluation of studies in education and the behavioral sciences. Edits Publishers, 1995.
32. McCaffery M, Beebe A. Pain: A clinical manual for nursing practice. Mosby, 1989.
33. Andersen K, Bregendahl M, Kaestel H, Skriver M, Ravkilde J. Hematoma after coronary angiography and percutaneous coronary intervention via the femoral artery: frequency and risk factors. Eur J Cardiovasc Nurs. 2015;4(2):123-127.
34. Merin Neenu, Dinesh A, Sas A. Effect of cold application on pain perception among clients receiving low molecular weight heparin: A pilot study. Int J Nurs Stud Res. 2021;9(9):ISSN: 2320-2882.
35. Betai D, Ahmed AS, Saxena P, Rashid H, Patel H, Shahzadi A, *et al*. Gender disparities in cardiovascular disease and their management: A review. Cureus.

2024;16(5):eXXXX.
36. Düzgün F, Yılmaz D, Durmaz H, Çinar HG, Dikmen Y, Kara H. The effect of duration of pressure on bruising and pain in the subcutaneous heparin injection site. Jpn J Nurs Sci. 2020;17(3):e12325.
37. Sarani H, Navidian A, Mendi AA. Comparing the effect of duration and site of subcutaneous injection of enoxaparin on pain intensity and bruising size in patients admitted to cardiac care units. Int Med Today. 2020;26(4):348-63.
38. Vishakha PS, Kalra S. Effect of slow vs fast subcutaneous low molecular weight heparin (LMWH) on extent of bruising and site pain among patients receiving LMWH admitted in ICUs of a tertiary hospital. Int J Multidiscip Res. 2021;2(9):766-76.
39. Hafez DM, Ali W G. ShotBlocker versus cryotherapy for reducing pain and anxiety associated with subcutaneous injection. Front Nurs. 2023;10(3):363-71.
40. Buldak Cİ, Çınar Fİ. Effects of cold application before subcutaneous injection of low-molecular-weight heparin on pain, bruising, and hematoma formation: A randomized controlled trial. [Details incomplete].
41. Unal N, Tosun B, Aslan O, Tunay S. Effects of vapocoolant spray prior to SC LMWH injection: An experimental study. Clin Nurs Res. 2021;30(2):127-34.
42. Eid W, Hassan M, Mourad A H, Abd Elnaby H. Effect of cold application on local problems among patients receiving subcutaneous enoxaparin. Egypt J Health Care. 2020;11(1):219-233.
43. Elrefaey NM, Hamed A, Elsayed S. Effectiveness of thumb manual pressure on pain, bruising, and satisfaction associated with anticoagulant subcutaneous injection. Egypt J Health Care. 2023;14(1):1199-1211.
44. Bayram SB, Gulnar E, Calıskan N, Kosucu P, Bektas O, Bayram A, *et al*. The effect of two types of subcutaneous heparin injections on pain, ecchymosis, hematoma, and drug absorption: A quasi-experimental study. J Eval Clin Pract. 2025;31(1):e14266.
45. Dehghani K, Najari Z, Dehghani H. Effect of subcutaneous enoxaparin injection duration on bruising size in acute coronary syndrome patients. Iran J Nurs Midwifery Res. 2014;19(6):564-8.
46. Karabey T. The effect of manual pressure after subcutaneous injection on pain and comfort levels. J Vasc Nurs. 2021;39(4):134-9.
47. Wang H, Guan J, Zhang X, Wang X, Ji T, Hou D, *et al*. Effect of cold application on pain and bruising in patients with subcutaneous injection of low-molecular-weight heparin: A meta-analysis. Clin Appl Thromb Hemost. 2020;26:1076029620905349.
48. Dadaeen A, Bahreini M, Bazi P, Ostovar A, Raeisi A, Dobaradaran S. Effect of duration of subcutaneous injection on extent of bruising and pain at injection sites among patients receiving enoxaparin sodium: A randomized self-controlled clinical trial. Int Cardiovasc Res J. 2017;9(2).
49. Amaniyan S, Varaei S, Vaismoradi M, Haghani H, Sieloff C. Effect of local cold and hot pack on bruising of enoxaparin sodium injection site: A randomized controlled trial. Contemp Nurse. 2016;52(1):30-41.
50. Sendir M, Büyükyılmaz F, Çelik Z, Tasköprü I. Comparison of 3 methods to prevent pain and bruising after subcutaneous heparin administration. Clin Nurse Spec. 2015;29(3):174-180.

How to Cite This Article
Fahmy MM, Mohammed IR, Mahmoud SS. Effect of cold application and proper subcutaneous injection technique on pain intensity and ecchymosis extent among cardiac patients. International Journal of Advance Research in Nursing. 2025;8(1):598-608.