

Original Research Article

Effectiveness of a novel subcutaneous enoxaparin injection technique in reducing injection-related pain and ecchymosis: a quasi-experimental study

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ABSTRACT

Background: Subcutaneous injections frequently cause local complications like pain and ecchymosis. Pre-injection ice application is a simple, non-pharmacological nursing intervention that may reduce these complications. To evaluate the effectiveness and clinical applicability of pre-injection ice application.

Methods: A quantitative, true experimental post-test-only control group design was used. Through purposive sampling, 100 patients aged 20–50 years were randomly assigned to an experimental group (n=50, receiving pre-injection ice application) or a control group (n=50, receiving standard protocol). Post-test pain was assessed via the numeric pain rating scale (0–10), and ecchymosis was evaluated using a graded observational scale.

Results: In the experimental group, 40% reported no pain, 24% mild, and 36% moderate pain; none experienced severe pain. In the control group, 86% reported severe pain and 14% moderate pain. The mean pain score was significantly lower in the experimental group (2.38 ± 2.24) than the control group (8.32 ± 1.50), with a mean difference of 5.94 ($t=15.57$, $p<0.001$). For ecchymosis, 60% of the experimental group had no bruising (0% Grade III), whereas only 4% of the control group was bruise-free (52% Grade III). The mean ecchymosis score was significantly reduced in the experimental group (1.76 ± 0.96) versus the control group (3.18 ± 0.96 ; $t=7.39$, $p<0.001$). Sociodemographic variables showed no significant associations with outcomes.

Conclusion: Pre-injection ice application effectively minimizes pain and ecchymosis, offering a practical, resource-efficient technique to enhance clinical nursing care quality.

Keywords: Ice application, Pain, Ecchymosis, Subcutaneous injection

INTRODUCTION

Injection administration is one of the most frequently performed invasive nursing procedures. Although injections are routinely used for diagnosis, treatment and prevention, they may cause pain, anxiety, tissue trauma and local complications. Patient comfort during routine nursing procedures is an important component of quality and patient-centred care.¹⁻³ Subcutaneous injections are commonly used for medications that require slow and

steady absorption, including low-molecular-weight heparins. Enoxaparin sodium is a low-molecular-weight heparin anticoagulant widely used for the prevention and treatment of thromboembolic disorders. It is administered subcutaneously and may be required repeatedly, particularly among patients with cardiovascular conditions, immobility and postoperative needs.^{4,6} Pain and ecchymosis are frequently reported local complications following enoxaparin administration. Pain may be influenced by needle insertion, tissue distension,

injection technique and individual pain perception, while ecchymosis may occur because anticoagulation increases susceptibility to bleeding into subcutaneous tissues. These complications may cause discomfort, anxiety, dissatisfaction and reluctance toward repeated injections.^{5,6} Evidence indicates that injection-related complications may be influenced by the duration and technique of injection, injection site, skin-fold handling, aspiration and post-injection massage. Cold application has also been investigated as a non-pharmacological intervention. Studies and systematic reviews reported beneficial effects of cold application in reducing pain, bruising and hematoma following subcutaneous low-molecular-weight heparin injections.^{7-9,11,18-20}

The review of literature in the present study identified evidence from both international and Indian studies supporting cold application and improved injection techniques. However, the availability of local experimental nursing evidence remains limited. Therefore, the present study was undertaken to evaluate a simple ice-application technique for reducing pain and ecchymosis among patients receiving enoxaparin injection at GIMS Teaching Hospital, Gadag.^{10,12-17}

Objectives

To evaluate the novel injection technique in reducing pain intensity. To evaluate the novel injection technique in minimizing ecchymosis at the injection site. To find out the association between pain score and ecchymosis score with selected sociodemographic variables among patients in the experimental group.

METHODS

Research approach and design

A quantitative research approach with a post-test-only control group design was adopted. The experimental group received the novel injection technique, while the control group received the routine method of enoxaparin administration. Post-test assessment of pain and ecchymosis was performed in both groups.

Setting and participants

The study was conducted for the period of one year that is 01 May 2025 to 30 May 2026 at GIMS Teaching Hospital, the study population comprised patients attending the hospital for medical care. A total of 100 patients aged 20–50 years who were receiving enoxaparin injection were selected by purposive sampling, with 50 participants in each group.

Inclusion criteria

Patients aged 20–50 years of either gender, patients receiving enoxaparin injection and patients willing to provide informed consent.

Exclusion criterion

Antenatal women were excluded.

Intervention

The finalized intervention consisted of application of ice at the enoxaparin injection site before administration of the subcutaneous injection. The intervention protocol was developed from the objectives, literature, evidence-based guidance and expert suggestions, and was reviewed by experts in medical-surgical nursing.

Tools

Section A consisted of selected sociodemographic and clinical variables including age, gender, educational status, occupation, site of injection, body build and previous experience of pain or ecchymosis. Section B used the numeric pain rating scale, ranging from 0 to 10, categorized as no pain (0), mild pain (1–3), moderate pain (4–6) and severe pain (7–10). Section C used an observational scale for ecchymosis measurement. Ecchymosis was graded from 0 to 3 according to the size and appearance of discoloration: Grade 0, no ecchymosis; Grade I, <2 cm, Grade II, 2–5 cm and Grade III, >5 cm.

Validity and reliability

Content validity of the sociodemographic and ecchymosis assessment tools was established through opinions and suggestions from experts in Medical-Surgical Nursing and related specialties. The Numeric Pain Rating Scale is a standardized instrument with established reliability and validity; the observational ecchymosis scale was considered suitable for assessing the extent of ecchymosis.

The purpose of the study was explained to participants, informed written consent was obtained, and confidentiality was maintained. The collected data were organized, tabulated and analyzed according to the objectives of the study.

Statistical analysis

Descriptive statistics included frequency, percentage, mean and standard deviation. Inferential statistics included the independent t-test for comparison of mean pain and ecchymosis scores between groups and the chi-square test for association between outcome scores and selected sociodemographic variables.

RESULTS

A total of 100 participants were included, comprising 50 in the experimental group and 50 in the control group. The major demographic and clinical characteristics are summarized in Table 1.

Table 1: Selected demographic and clinical characteristics of participants.

Characteristics (in years)	Experimental group (n=50)	Control group (n=50)
20–30	3 (6%)	1 (2%)
31–40	13 (26%)	17 (34%)
41–50	34 (68%)	32 (64%)
Male	26 (52%)	30 (60%)
Female	24 (48%)	20 (40%)
Farming occupation	15 (30%)	13 (26%)
No previous pain/ecchymosis experience	30 (60%)	30 (60%)
Most frequent injection site	Left abdomen: 21 (42%)	Right abdomen: 18 (36%)

Table 2: Distribution of participants according to post-test pain category (n=100).

Pain category	Experimental group	Control group
No pain	20 (40%)	0 (0%)
Mild pain	12 (24%)	0 (0%)
Moderate pain	18 (36%)	7 (14%)
Severe pain	0 (0%)	43 (86%)

Table 3: Comparison of mean post-test pain scores between groups.

Group	N	Mean	SD	Mean difference	t	P value
Experimental group	50	2.38	2.24	5.94	15.57	<0.001
Control group	50	8.32	1.50			

Table 4: Distribution of participants according to post-test ecchymosis grade (n=100).

Ecchymosis grade	Experimental group	Control group
No ecchymosis	30 (60%)	2 (4%)
Grade I	2 (4%)	7 (14%)
Grade II	18 (36%)	15 (30%)
Grade III	0 (0%)	26 (52%)

Table 5: Comparison of mean post-test ecchymosis scores between groups.

Group	N	Mean	SD	Mean difference	t	P value
Experimental group	50	1.76	0.96	1.42	7.39	<0.001
Control group	50	3.18	0.96			

Table 6: Association between pain score and selected sociodemographic variables in the experimental group (n=50).

Variables	χ^2	df	Critical χ^2	Result
Age	4.59	6	12.592	Not significant
Gender	2.45	2	7.82	Not significant
Education	5.17	12	21.02	Not significant
Occupation	11.10	16	26.296	Not significant
Previous pain/ecchymosis experience	1.96	2	5.91	Not significant
Site of injection	2.51	8	15.50	Not significant
Body build	1.86	6	12.59	Not significant

Table 7: Association between ecchymosis score and selected sociodemographic variables in the experimental group (n=50).

Variables	χ^2	df	Critical χ^2	Result
Age	2.25	4	9.48	Not significant
Gender	0.14	2	5.991	Not significant

Continued.

Variables	χ^2	df	Critical χ^2	Result
Education	6.07	12	21.02	Not significant
Occupation	11.17	16	26.296	Not significant
Previous pain & ecchymosis experience	0.55	2	5.991	Not significant
Site of injection	1.58	8	15.507	Not significant
Body build	4.55	6	12.592	Not significant

The experimental group had a substantially lower mean pain score (2.38 ± 2.24) than the control group (8.32 ± 1.50). The mean difference was 5.94 and the independent t-test showed a statistically significant difference ($t=15.57$, $p<0.001$). The experimental group had a lower mean ecchymosis score (1.76 ± 0.96) than the control group (3.18 ± 0.96), with a mean difference of 1.42. The independent t-test demonstrated a statistically significant difference ($t=7.39$, $p<0.001$). All calculated chi-square values were lower than their respective critical values. Therefore, there was no statistically significant association between pain score or ecchymosis score and the selected sociodemographic variables in the experimental group.

DISCUSSION

The present study demonstrated that participants who received ice application before subcutaneous enoxaparin injection experienced substantially less pain than those who received routine injection administration. The mean pain score was 2.38 ± 2.24 in the experimental group compared with 8.32 ± 1.50 in the control group, and the difference was statistically significant. The finding is consistent with previous research cited in the thesis, including studies by Taghlili et al and Tresa et al as well as systematic reviews by Wang et al and Mohammady et al which reported beneficial effects of cold application on injection-related pain and bruising. A marked reduction in ecchymosis was also observed. Sixty percent of participants in the experimental group had no ecchymosis, whereas only 4% of the control group had no ecchymosis. Grade III ecchymosis was absent in the experimental group but occurred in 52% of the control group. The lower mean ecchymosis score in the experimental group further supports the effectiveness of the intervention.

The reduction in pain and ecchymosis may be related to the local physiological effects of cold application. Local cooling may produce vasoconstriction and reduce blood flow, potentially limiting tissue bleeding and discoloration. Cold may also reduce sensory nerve conduction and increase pain threshold, thereby decreasing pain perception. These explanations are consistent with the mechanisms discussed in the thesis and with the findings of previous cold-application studies. No significant association was found between pain or ecchymosis scores and age, gender, education, occupation, previous experience, injection site or body build in the experimental group. This suggests that the

beneficial effect of ice application was observed across the selected participant characteristics in this study.

CONCLUSION

The study concluded that ice application before subcutaneous enoxaparin injection was effective in reducing pain intensity and minimizing ecchymosis compared with routine injection administration. The statistically significant differences in both pain and ecchymosis scores support the use of ice application as a simple, economical and practical supportive nursing intervention. The findings may contribute to evidence-based nursing practice and improvement of patient comfort during repeated enoxaparin therapy.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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