Internal MedicineToday
Gonabad University of Medical Sciences

January 2023. Vol 29. Issue 1

Research Paper

Effect of Enoxaparin Injection Duration on its Complications in Myocardial Infarction Patients

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Citation Aghakhani N, Ghaderi B, Alinezhad V, Baghaei R, Hazrati M. [Effect of Enoxaparin Injection Duration on its Complications in Myocardial Infarction Patients]. Internal MedicineToday. 2023; 29(1): 27-33.

doi:https://doi.org/10.32592/imtj.2023.29.1.27

Received: 24 Apr 2023
Accepted: 12 Jun 2023
Available Online: 19 Jun 2023

Key words:
Bruises
Duration
Enoxaparin
Infarction
Myocardial
Pain

ABSTRACT

Aims Enoxaparin is a subcutaneous anticoagulant that has some side effects, including bruising and pain at the injection site. The incidence of the side effects can prevent the patient from continuing the treatment. Since one of the most important duties of nurses is the safe and low-complication injection of drugs, such as enoxaparin, this study aimed to examine the effect of the duration of enoxaparin subcutaneous injection on the intensity of pain and the incidence of bruising, as well as the size of it, in injection site among patients with myocardial infarction.

Materials & Methods This semi-experimental research was conducted on 56 patients treated with enoxaparin and hospitalized in the cardiac care unit of Shahid Madani Medical Training Center in Tabriz, Iran, in 2021. After an initial convenience sampling, the samples were divided into 2 groups by random allocation. Enoxaparin injections were done in all patients by the researcher. The injection was done within 10 and 30 s for the control and experimental groups, respectively. The intensity of pain was measured by a numerical pain rating scale immediately after each injection, and the incidence and size of bruising were assessed with a transparent ruler in square millimeters 48 hours after each injection. Data analysis was conducted in SPSS V. 22 at a significance level of 0.05.

Findings In the present study, the mean scores of pain intensity (P=0.0001), the incidence of bruising (P=0.029), and the size of the injection site bruise (P=0.044) were significantly lower in enoxaparin injection within 30 s than 10 s.

Conclusion Due to the significant reduction in pain intensity and the incidence and size of bruises after increasing the duration of enoxaparin subcutaneous injection and, therefore, the improvement of the quality of care and reduction of the unpleasant and stressful experiences of patients, it is suggested to increase the duration of injection to 30 s.

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مقاله پژوهشی

بررسی تأثیر مدت تزریق زیر جلدی انوکساپارین بر روی شدت درد، بروز و اندازه کبودی محل تزریق در بیماران مبتلا به انفارکتوس میوکارد

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تاریخ دریافت: ۱۴۰۲/۰۲/۰۴
تاریخ پذیرش: ۱۴۰۲/۰۳/۲۲
تاریخ انتشار ۱۴۰۲/۰۳/۲۹

چکیده

هدف انوکساپارین نوعی داروی ضدانعقادی زیرجلدی است و عوارضی مثل درد و کبودی در محل تزریق دارد. بروز این عوارض ممکن است سبب ادامه ندادن درمان از جانب بیمار شود. با توجه به اینکه یکی از وظایف مهم پرستاران تزریق ایمن و کم‌عارضه‌ی داروهایی مثل انوکساپارین است، این مطالعه با هدف تعیین تأثیر مدت تزریق زیرجلدی انوکساپارین بر شدت درد، بروز و اندازه‌ی کبودی در محل تزریق در بیماران مبتلا به انفارکتوس میوکارد انجام شد.

مواد و روش ها این پژوهش نیمه‌تجربی در سال ۱۴۰۰، درباره‌ی ۵۶ بیمار تحت‌درمان با انوکساپارین و بستری در بخش‌های مراقبت‌های ویژه‌ی قلب مرکز آموزشی‌درمانی شهید مدنی تبریز انجام شد. نمونه‌ها ابتدا به روش دردسترس انتخاب و سپس، به‌صورت تخصیص تصادفی به دو گروه تقسیم شدند. پژوهشگر به هر بیمار یک بار انوکساپارین تزریق کرد، به‌طوری که در گروه کنترل، تزریق در مدت ۱۰ ثانیه و در گروه مداخله، در مدت ۳۰ ثانیه صورت گرفت. شدت درد بلافاصله پس از هر تزریق، با استفاده از مقیاس رتبه‌بندی عددی درد سنجیده شد و بروز و اندازه‌ی کبودی ۴۸ ساعت پس از هر تزریق، با خط‌کش شفاف برحسب میلی‌مترمربع اندازه‌گیری شد و سپس، داده‌ها با استفاده از نرم‌افزار SPSS نسخه‌ی ۲۲، در سطح معنی‌داری ۰/۰۵ تجزیه‌وتحلیل شدند.

یافته‌ها در مطالعه‌ی حاضر، میانگین شدت درد (P=۰/۰۰۰۱)، بروز کبودی (P=۰/۰۲۹) و اندازه‌ی کبودی محل تزریق (P=۰/۰۴۴) به‌طور معنی‌داری، در تزریق انوکساپارین در مدت ۳۰ ثانیه کمتر بود.

نتیجه گیری با توجه به کاهش چشمگیر شدت درد، بروز و اندازه‌ی کبودی به‌دنبال افزایش مدت تزریق زیرجلدی انوکساپارین و نیز به‌منظور ارتقای کیفیت مراقبتی و به حداقل رساندن تجربیات ناخوشایند و استرس‌زای بیماران، افزایش مدت تزریق انوکساپارین به ۳۰ ثانیه توصیه می‌شود.

کلیدواژه‌ها:
انوکساپارین
انفارکتوس
درد
کبودی
مدت
میوکارد

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Introduction

Myocardial infarction, commonly known as a heart attack, occurs when there is a sudden blockage of blood flow to a part of the heart muscle, leading to the death of heart muscle cells and tissue necrosis due to the lack of oxygen and nutrients [1]. According to a report by the American Heart Association, every 40 seconds, an American suffers from a myocardial infarction. In 2017, approximately 580,000 new cases and 210,000 cases of recurrent myocardial infarction occurred in the United States [2]. In addition, the possibility of serious cardiovascular disorders, such as stroke and myocardial infarction, is also high in Iran [3]. Since blood clot construction in the coronary artery is the main cause of myocardial infarction, these patients are treated with anticoagulant drugs, such as heparin [4].

Enoxaparin, which is a low molecular weight heparin, by binding to antithrombin III and increasing its effect, inhibits the activated factor X, thereby reducing thrombin and ultimately preventing the formation of fibrin and blood clots [5]. Enoxaparin has potential benefits over heparin, such as a longer half-life, a higher bioavailability, and a better response without the need for laboratory investigation. Such factors have caused this drug to be injected into patients 1-2 times per day [6]. However, enoxaparin subcutaneous injection has some side effects, including pain and bruising, whose control and reduction at the injection site are highly critical for the patients [7].

Pain can be defined as an unpleasant experience with real or potential tissue damage [8]. One of the sources of pain in hospitalized patients is related to the subcutaneous injection of enoxaparin, which can cause fear of being injured, anxiety, and distrust in healthcare providers [9]. Therefore, nurses should play an active role in the control of pain by assessing pain intensity and performing appropriate interventions to manage it [10]. The extravasation of blood into the subcutaneous tissues as a result of trauma to the underlying blood vessels or the fragility of vessel walls may result in bruising of the skin [11]. Bruising is one of the local side effects of subcutaneous injection of enoxaparin. The largest size is formed 48 h after the injection and starts to disappear after 72 h [12]. The incidence of bruising caused by subcutaneous injection of enoxaparin can cause the patient to lose his/her trust in the nurse and decrease the available area for subsequent injections [13].

Considering the adverse effects at the subcutaneous injection site of enoxaparin in patients, nurses should use a correct and safe method when injecting enoxaparin subcutaneously to reduce pain and bruising, improve the quality of nursing care, and increase patient satisfaction [14], which can be done by vertical injection while lifting the skin, lack of aspiration, prevention of syringe movement during injection, changing the injection site, and several other methods. There is no recommendation about the duration of subcutaneous injection of enoxaparin in nursing or clinical sources. Currently, the 10-second injection is used as a conventional and controlled method in comparison to other ones [15].

Considering the insufficient research in this field and the need to investigate new, affordable, and non-invasive methods with the aim of alleviating pain and controlling bruising caused by subcutaneous injection of enoxaparin, this study aimed to determine the effect of the duration of subcutaneous injection of enoxaparin on the intensity of pain and the incidence of bruising, as well as the size of it, in injection site in patients with myocardial infarction.

Materials and Methods

The present study was a semi-experimental research that was carried out in 2021 in the cardiac intensive care units of Shahid Madani Medical Training Center in Tabriz. Having obtained ethical permission, the researcher introduced himself to the newly admitted patients meeting the inclusion criteria. The procedure of the research was explained to the interested patients and their written consent was obtained to participate in the study. After an initial convenience sampling of 56 patients, they were divided into control and experimental groups of 28 individuals by random allocation via selecting envelopes with the injection method written inside. The injection was performed within 10 and 30 s in the control and experimental groups, respectively. According to the information reported by Rupam et al. [16], a sample size of 25 individuals was considered for each group. Thus, 28 individuals were selected for each group by considering around a 10% attrition rate.

The inclusion criteria were having a sound orientation of place and time to express the intensity of pain; lacking diabetes; being in the age range of 40 to 70 years; lacking swelling, scarring, or redness at the injection site; lacking coagulation disorder; lacking significant drop in ejection fraction; lacking pain; lacking drug addiction; not taking painkillers in the last 8 hours; a body mass index (BMI) of 18.5-35; as well as having a written prescription by a doctor to inject enoxaparin with a dose of 60 mg twice a day. On the other hand, the patient's withdrawal from the study during the intervention period, performing an angiography that required heparin injection, and dying during the study period were the exclusion criteria of this study. In this research, due to coronary artery angiography, 1 individual from each group was excluded from the study process.

Each patient received one injection of enoxaparin 60 mg, all of which were manufactured by the same pharmaceutical company. All injections were

administered by the same person in the abdomen through a standard method in which the injection site was disinfected with alcohol cotton. Enoxaparin was prepared with needle number 27, and an airlock of 0.2 ml was used in the injections. Other factors included creating a skin fold at the time of needle entry and relaxing it during drug injection, a 90-degree needle entry angle, avoiding aspiration, waiting 10 s before withdrawing the needle, and withdrawing the needle at the same entry angle. After each injection, a circle with a diameter of 5 cm with a waterproof pen was drawn to avoid another injection in that place. The patient was also instructed to avoid rubbing, scratching, and manipulating the injected site.

Necessary information such as age, gender, BMI, and platelet count were collected by asking patients or referring to their hospital records. A stopwatch was used to accurately measure the injection duration. Pain intensity was assessed immediately after each injection with a numerical pain rating scale as a criterion of choice in examining pain intensity [17], and because of its simplicity and ease of use, it is frequently used for self-reporting of pain intensity [18]. To determine the intensity of pain, the patient was asked to express the intensity of the felt pain as a score from 0 to 10, with 0 indicating painless feeling and 10 the most severe pain [19]. The incidence and size of bruises were measured in square millimeters 48 hours after each injection with a transparent ruler. The data analysis was done in SPSS V. 22 at a significance level of 0.05. Table 1 is a schematic representation of the research design.

Table 1. Schematic representation of research design

Group	Number	Day-1		Day-3
Experimental	27	Injection of enoxaparin within 30 seconds in the abdomen	Observation of pain perception immediately after withdrawing the needle	Observation of Ecchymosis by transparent ruler after 48 hours
Control	27	Injection of enoxaparin within 10 seconds in the abdomen	Observation of pain perception immediately after withdrawing the needle	Observation of Ecchymosis by transparent ruler after 48 hours

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Results

In this study, the percentage of male participants in the control and experimental groups was 55.6% and 59.3%, respectively. As a result, genders were distributed similarly in the two groups, and results of the Chi-square test showed no significant difference in the frequency distribution of genders (Table 2). All patients in both groups were married. The results of this research showed that the oldest patient, 69 years old, was in the control group. The mean scores of the patients' ages in the control and experimental groups were 60.3±5.59 and 60.74±5.52 years, respectively. According to the results of the Kolmogorov-Smirnov test, the variables age, BMI, and platelet count had a normal distribution. The results of this research showed that both of the studied groups were homogeneous in terms of age, BMI, and platelet count, and there were no significant differences in the independent t-test (Table 3).

Table 2. Comparison of genders in the control and experimental groups

Gender	Experimental group		Control group		P-value
	Frequency	Percentage	Frequency	Percentage	
Male	16	59.3	15	55.6	0.783
Female	11	40.7	12	44.4	

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Table 3. Comparison of age, BMI, and platelet count in the control and experimental groups

Variable	Experimental group	Control group	P-value
	Mean±SD	Mean±SD	
Age	60.74±5.523	60.3±5.587	0.77
BMI	28.656±2.27	28.993±1.654	0.627
Platelet count	301.52±62.071	298.52±66.749	0.865

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The group with the highest pain intensity in this study was the control group, with a score of 9. The mean values of pain intensity were 6.15±1.35 and 3.78±1.7 in the control and experimental groups, respectively. According to the results of the Kolmogorov-Smirnov test, the pain intensity variable was not normally distributed. According to the results of the non-parametric Mann-Whitney U test, the intensity of pain was significantly lower in the experimental group, compared to the control group (Table 4).

Table 4. Comparison of pain intensity in the control and experimental groups

Group	Mean±SD	P-value
Experimental	3.78±1.7	0.0001
Control	6.15±1.35	

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Based on the findings of this study, 48 hours after enoxaparin injection, the incidence of bruising was 63% and 33.3% in the control and experimental group, respectively. According to the Chi-square test results, the occurrence of bruising was significantly lower in the experimental group than in the control group (Table 5).

In this study, 48 hours after enoxaparin injection, the mean bruise size was 125.1±26 mm^2 in the control group and 60.74±18.23 mm^2 in the experimental group. According to the results of the Kolmogorov-Smirnov test, the variable of bruise size at the injection site did not have a normal distribution. Based on the results of the non-parametric Mann-Whitney U test, the size of the bruise in the experimental group was significantly lower than that in the control group (Table 6).

Table 5. Comparison of the frequency of bruising in the control and experimental groups

Group	Frequency	Percentage	P-value
Experimental	9	33.3%	0.029
Control	17	63%	

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Table 6. Comparison of bruise size (mm^2) in the control and experimental groups

Group	Mean±SD	P-value
Experimental	60.74±18.23	0.044
Control	125.1±26	

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Discussion

A subcutaneous injection of enoxaparin can cause some side effects, such as pain and bruising at the injection site, preventing patients from continuing the treatment. Various factors may contribute to these side effects. The results of this research showed that the intensity of pain and the incidence and size of bruises were significantly lower in enoxaparin injections within 30 s than within 10 s. It has been stated that the slow injection of enoxaparin may reduce the intensity of pain and bruising by decreasing the pressure on and damage to the tissue at the injection site and giving the tissue more opportunity to better absorb the drug [20].

Regarding how the duration of the subcutaneous enoxaparin injection impacts the intensity of pain and the incidence of bruising, as well as the size of it, at the injection site, Sendir et al. have shown that the injection of enoxaparin in 30 s has a lower intensity of pain and a lower incidence and size of the bruise than the injection in 10 s [21]. Uzun et al. reported that an enoxaparin injection given in 30 s causes a significant reduction in the incidence and size of bruises compared to 10 s [22]. Vishakha et al. showed that the injection of enoxaparin in 30 s has a lower intensity of pain and a smaller bruising, compared to the injection in 10 s [23]. Sarani et al. reported that the injection of enoxaparin within 30 s significantly reduced pain intensity and bruise size [15]. Ahmadi et al. stated that injecting unfractionated heparin for 30 s caused a significant reduction in pain intensity and the incidence and size of bruises compared to 10 s [24]. Bijani et al. confirmed that the size of the bruise in injections within 30 s was significantly less than those in 10 s [25]. Dadaeen et al. reported that the intensity of pain and the size of the bruise in injections within 30 s were significantly less than those in 10 s [26]. These findings are in line with the findings of the current study.

Palese et al. reported that, in comparison with injections within 10 s, those in 30 s caused a significant decrease in the incidence of bruising but did not have a significant effect on the size of the bruise [27]. The results of their study on reporting the size of bruises are inconsistent with those of this study. Dehghani et al. pointed out that the duration of the enoxaparin injection had no effect on the size of the injection site bruise [28], which is inconsistent with this study. These discrepancies between the findings of the mentioned previous studies and those of the present research can be attributed to the small number of samples in some studies and the employment of two different dosages of enoxaparin or different tools to measure the intensity of pain and the size of bruises.

Conclusion

Increasing the duration of subcutaneous injection of enoxaparin from the routine method of 10 s to 30 s has a significant effect on reducing the intensity of pain and the incidence and size of injection site bruises. This can be used to train nurses and reduce the side effects of enoxaparin subcutaneous injection, which results in boosting the efficiency of nurses, improving the quality of nursing care, and increasing patients' satisfaction with good nursing services. The results of this research can be employed as a background for further studies in the field of nursing.

Ethical Considerations

Compliance with ethical guidelines

This research was approved by the Ethics Committee of the Urmia University of Medical Sciences, Urmia, Iran (IR.UMSU.REC.1398.322).

Funding

This research did not receive any grant from funding organizations in the commercial, public, or not-for-profit sectors.

Authors' contributions

NA and MH: Overall supervision, write-up, and literature review; editing and supervision; and help with the write-up.
VA: Write-up and statistical analysis. All authors contributed to editing and controlling the final version of this manuscript.

Conflicts of interest

The research project did not have a conflict of interest.

Acknowledgments

The authors consider it necessary to give special thanks to the officials and staff of the Shahid Madani Educational and Medical Centre in Tabriz, Iran, as well as the inpatients participating in this research, who participated in this study with interest and sincerity.

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