Original Article

Effect of subcutaneous Enoxaparin injection duration on bruising size in acute coronary syndrome patients

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Abstract

Background: Bruising is an unpleasant result of subcutaneous injection of Enoxaparin, which causes physical discomfort, limitation of injection site, patient's refusal of treatment, and distrust in nurses' ability. The application of techniques which reduce patients' fear, anxiety, and physical damage is one of the tasks of nurses. This clinical trial investigated the effect of duration of subcutaneous Enoxaparin injection on the bruising size in acute coronary syndrome patients.

Materials and Methods: Seventy 35-75-year-old acute coronary syndrome patients hospitalized in Coronary Care Units were selected randomly. Each subject received 10- and 30-sec duration of injections by a single researcher on both sides of the abdomen in 12-h intervals. The bruising size was measured using a transparent millimeter measuring paper, 24 and 48 h after each injection. Data were gathered by a data recording form (demographic and measurements data) and analyzed by descriptive statistics and non-parametric tests through SPSS.

Results: Results showed that the mean bruising sizes at 24 h after 10- and 30-sec injection were 33.26 mm^2 (72.77) and 48.96 mm^2 (99.91), respectively, and at 48 h were 15.61 mm^2 (142.02) and 52.48 mm^2 (143), respectively. There was no significant relationship between the two techniques ($P > 0.05$), although the effect of age on bruising size was significant ($P = 0.01$).

Conclusion: According to the findings of the present study, length of Enoxaparin subcutaneous injection has no effect on the bruising size.

Key words: Acute coronary syndrome, bruising, Enoxaparin, subcutaneous injection

Introduction

Cardiovascular diseases are among the most serious threats for human health. Acute coronary syndrome refers to a collection of clinical signs resulting from myocardial acute ischemia that also includes acute myocardial infarction and unstable angina.[1] Direct and indirect burden of coronary diseases was reported to be $ 142.1 billion in the US in 2005.[2] In Iran, cardiovascular diseases are the first cause for mortality in adults.[3] Anticoagulants are vastly used in patients with acute coronary syndrome to prevent further occlusion of coronary arteries, and are available in two forms of regular heparin and low-molecular-weight heparin.[1,2] Research shows that Enoxaparin is more useful in the treatment of acute coronary diseases compared to regular heparin.[4-9] Research has also shown that lower hospitalization costs due to earlier discharge and no need for partial thromboplastin time (PTT) control have made the use of Enoxaparin more economical compared to regular heparin.[10-12] Anticoagulants have side effects such as purpura, bruise, pain, hematoma, melena, hematuria, osteoporosis, and thrombocytopenia.[13-16] Bruise refers to a color change in skin, of ≥2 mm^2 in size.[17] It results from blood leakage from the injured veins into the subcutaneous tissue, leading to pain, inflammation, and color change which usually reach their maximum within 48 h and are lowered 60-72 h after their formation.[18,19] The bruise caused by injection restricts the injection area, causes anxiety and a disturbance in body image, results in lack of treatment acceptance by the patient and treatment rejection, and finally, patient's distrust in nurses' efficiency.[19,20] Therefore, nurses should use techniques which lead to modification of patients' fear and anxiety and diminish further injury to the patients.

Literature review shows that reduction of bruising has always been considered by the researchers. In Australia, Chan evaluated two methods of Deltaparin injection (within 10 and 30 sec) to investigate the effect of injection duration on the bruise occurring in the injection site among 34 hospitalized stroke patients. Both lengths of duration of the injection were administered for each patient with a 12-h

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interval and the bruise size was measured 48 and 60 h after the injection was given. Their obtained results showed that the size of bruise was less in 30-sec injection compared to 10-sec injection.[17] Chenicek investigated the effect of two injection durations of Enoxaparin (10 and 30 sec) on the bruising size in 34 hospitalized patients in Florida. They obtained no significant difference between the two methods of injection with regard to bruise size.[20] Akpinar and Celebioglu examined three techniques of Tinazaparin administration and measured the bruise size in 36 hospitalized patients in Turkey. Their techniques comprised injection for 10 sec (technique A) followed by injection for 30 sec after 24 h (technique B), and technique C in which there was a 10-sec delay in the removal of needle after injection duration of 10 sec. Results showed that the bruise was of bigger size in technique A compared to the other two techniques.[21] Nair *et al.* investigated the duration of subcutaneous injection of heparin on the bruise size in two methods of routine injection (for 4-10 sec in the control group) and injection for 30 sec (study group). Bruise size was calculated by multiplication of the length and width of bruise, 24, 48, and 60 h after injection. Results showed a significant difference in bruise size in the study group, compared to control, 24 and 60 h after injection ($P < 0.05$), but 48 h after injection, the difference was not significant.[22] Babaie *et al.* investigated two injection techniques of 10- and 30-sec subcutaneous heparin injection in the right and left arms of the patients to evaluate the related bruise size in 80 patients hospitalized in two university hospitals in Babol. Indurations were measured by a rubber ruler, 48 and 60 h after injection. The obtained results showed that the bruise size that resulted from injection for 30 sec was significantly smaller than that of 10 sec injection ($P = 0001$).[23] The controversial results that have been obtained and lack of adequate research on Enoxaparin led the researcher to conduct the present study to promote the quality of nursing care and provide the patients with peace and comfort.

Materials and Methods

This clinical trial aimed to define the effect of Sodium Enoxaparin subcutaneous injection on the bruise size. Inclusion criteria were acute coronary syndrome patients aged 35-75 years, newly hospitalized in the coronary care unit (CCU), receiving 60-80 mg Enoxaparin every 12 h, and expected to stay in the ward at least for 3 days. Pregnant women, those with coagulation problems, hematologic diseases, having an injury at the injection site, with dark color of skin, dermatological problems, as well as those patients >75 years of age who needed medication dosage adjustment were excluded from the study. This was a one-group study in which each patient underwent two techniques of subcutaneous injection (10 sec as the control method and 30 sec as the experimental method). Researcher selected 70 qualified patients through convenient sampling on the first 3 days of the week for 6 months in Afshar Hospital after obtaining approval from the ethics committee of Shahid Sadoughi University of Medical Sciences in Yazd and an informed consent from the subjects. Firstly, subjects' demographic characteristics such as age and sex were recorded in a data collection form from through interviews. Then, each patient was given a code on their questionnaire and those with odd and even code numbers underwent 30- and 10-sec injections, respectively, either on the right or left part of their abdomen. Prefilled syringes of Enoxaparin, made by Sanofi-aventis Company, France were used.

The injection technique used was as follows. An appropriate site of injection was selected in the lateral part of the abdominal area, about 5 cm around the navel. Alcohol was sprayed and the injection site was disinfected outward and left to dry. After removal of the needle cap, the needle was inserted at 90° angle after pinching up the skin on the injection site. Then, the injection duration was calculated using a wrist watch. After injection, the needle was smoothly removed and the site was slightly pressed by cotton wool. Next, the injection site was marked with a waterproof marker in a circle with radius 2.5 cm in order to prevent further injections on that site and to be able to evaluate the bruise size. Blue and red markers were used to mark 30- and 10-sec injection sites, respectively. The subject was educated to prevent rubbing, touching, or pressing the injection site. Next injection was administered after 12 h on the other side in such a way that in patients for whom the first injection was of 10 sec duration, the next injection (after 12 h) was administered for 30 sec and vice versa. Finally, 24 and 48 h after injection, the size of bruising was marked on a transparent paper and measured by a checked paper (mm^2). A bruise $<2\ mm^2$ was ignored. All injections, measurements, and bruise size calculations were conducted by the principle researcher. Obtained data were analyzed by descriptive and non-parametric statistical tests (Mann-Whitney and Wilcoxon) and Spearman correlation coefficient through SPSS 18 with a significance level of $P \leq 0.05$. This research was registered in Iranian Clinical Trial Center (IRCT 201110267909N1).

Results

Most of the subjects (38.6%) were in the age group 65-75 years, and the lowest percentage (12.9%) was in the age group 35-44 years. About 51.48% and 48.52% of the subjects were males and females, respectively. Our obtained results of mean bruise size based on sodium Enoxaparin subcutaneous injection showed that the mean bruise sizes at 24 and 48 h after 10-sec injection

duration were 33.26 and 48.9 mm^2, respectively, while these values were 15.61 and 52.84 mm^2, respectively, after 30-sec injection. Wilcoxon test showed no significant difference in the bruise sizes in the two methods of 10 and 30-sec injection duration [Table 1]. Mann-Whitney test showed no significant association between bruise size and subjects' gender [Table 2]. Spearman correlation coefficient showed a significant association between bruise size and age ($P = 0.01$) such that the bruise grew bigger with subjects' increasing age [Table 3].

Discussion

Our obtained results showed that there was no significant difference in the bruising size that resulted from 10- and 30-sec injection duration. Chenicek investigated the effect of duration of subcutaneous injection of Enoxaparin on the size of the bruise. Their obtained results showed no significant difference in the mean size of bruise 48 h after 10- and 30-sec injection duration.[20] Akpinar and Celebioglu showed a significant difference between three methods of 10- and 30-sec injection duration and a 10-sec delay in removal of the needle after an injection of 10-sec duration ($P < 0.05$), and found that the bruise size was smaller in 30-sec injection method, compared to the other two methods. In the above-mentioned study, the extent of bruise was measured 48 h after injection by a rubber ruler, and the longest diameter of the bruise was considered instead of calculating the bruise surface.[21] In Italy, Palese *et al.* showed that an increase in the duration of subcutaneous injection of Enoxaparin for 30 sec can reduce the number of bruises, but not their size. They divided the bruises into groups of minor, moderate, and major.[24] Nair compared the size of bruises formed in the routine method of injection by the nurses (between 4 and 10 sec) in the control group and by injection administered for 30-sec duration in the study group. In their study, there were 100 subjects in each group of study and control. Bruise surfaces were calculated by multiplication of their widths by their lengths 24, 48, and 60 h after injections. There was a significant difference in bruise sizes between the experimental and control groups 24 and 60 h after injection ($P < 0.05$), but the difference was not significant 48 h after injection.[22] The controversial results obtained can be due to the various measurement methods used to measure bruising size in different studies. Although various studies showed that an increase in duration of subcutaneous heparin injection can reduce the size of the bruise, longer time of injection necessitates careful administration by the nurses. They should keep their hands stable to prevent dislocation of the needle during the procedure. On the other hand, the physical environment should also be peaceful and quiet to prevent patients' excitation and sudden movements to lower the risk of bruise in injection site.[24] In the present study, there was a significant association between subjects' age and the bruise size, such that an increase in age increased the bruising size. In the study of Zaybak and Khorshid, there was no significant association between the two methods of 10- and 30-sec injections.[18]

The rate of collagen synthesis in skin markedly decreases with age by about 1% and the subcutaneous layer gets thinner due to loss of fat. This affects the elasticity of the vascular system and elastic fibers are changed into thinner fragile fibers. The process of aging causes a reduction in the number of fibroblasts, which are responsible for the synthesis of protein and collagen, leading to fragility of vascular walls. These changes can lead to more hemorrhage, hematoma, and bruising in the elderly.[25] In the present study, no significant difference was observed in the bruise size in relation to subjects' gender, although the mean of bruise size was more in females compared to that of male subjects. Results on the association between gender and bruise size are controversial. Chan showed that the association between the bruise size and gender was significant just in the 10-sec method, such that the women developed a bigger bruise compared to men.[17]

Table 1: Mean bruise size (mm^2) 24 and 48 h after subcutaneous Enoxaparin injection

Bruise investigation time	Injection techniques	Mean	SD	Bruise size		Wilcoxon *P* value
				Min.	Max.	
24 h after injection	10 sec	33.26	72.77	0.00	420	0.287
	30 sec	51.97	142.02	0.00	830	
48 h after injection	10 sec	47.96	99.91	0.00	560	0.208
	30 sec	52.84	143.00	0.00	950	

SD: Standard deviation

Table 2: Bruise size based on sex 24 and 48 h after subcutaneous Enoxaparin injection for 10- and 30-sec duration

Sex	No.	Mean (SD) (Injection)			
		24 h after 10-sec	24 h after 30-sec	48 h after 10-sec	48 h after 30-sec
Female	34	44.39 (88.72)	73.39 (174.27)	66.27 (118.46)	74.67 (181.99)
Male	36	22.75 (52.78)	31.04 (101.19)	30.66 (76.24)	32.22 (90.45)
Total	70	33.26 (72.77)	51.61 (142.02)	47.96 (99.91)	52.85 (143.0)
Mann-Whitney *P* value		0.934	0.133	0.247	0.350

SD: Standard deviation

Table 3: Association between bruise size and age in two methods of subcutaneous enoxaparin injection

Variable		Spearman correlation coefficient (injection)			
	No.	24 h after 10-sec	24 h after 30-sec	48 h after 10-sec	24 h after 30-sec
Age	70	0.01	0.014	0.014	0.012

Zaybak and Khorshid showed a significant association between bruise size and gender just in the 10-sec injection technique and found that the bruise was more among men compared to women ($P < 0.05$), but the association was not significant in the 30-sec duration method.[18] Trimarchi suggested the role of estrogen on the vascular structure of women and argued that women have more fragile veins compared to men.[26]

Conclusion

The results obtained in this study show that duration of subcutaneous injection has no effect on the size of the bruise, but based on other studies, bruise size can be diminished by an increase in injection duration. During longer injection time, nurses should prevent dislocation of the needle and help the patient keep stable to lower the risk of a bruise resulting from the injection. Controversial results obtained in this context can be due to the various measurement methods used. Therefore, further studies with a unique measurement method are recommended. An investigation on the association between the bruise size that resulted from Enoxaparin subcutaneous injection and body mass index (BMI) is suggested.

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