Original Article

Assessment of Three Sites in Terms of Bruising in Subcutaneous Heparin Administration

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Abstract

Aim: The purpose of this study is to investigate the occurrence of bruising after subcutaneous heparin injection administered to three sites.
Material and Method: This study used quasi-experimental design and randomized. The sample group of the study consisted of 60 patients who met the inclusion criteria in the defined population between specified dates. Throughout the study, subcutaneous heparin injections were administered in the arm, abdominal and thigh areas of 60 patients. The injection sites were assessed in terms of bruise sizes by using the bruise measurement tool 48 and 72 hours after the injection. In evaluation of the data percentage, one-way ANOVA and independent sample t-test were used.
Results: According to the results of the study, the average size of the bruise that occurred after 48 hours was 62.5±202.2 mm^2 at the abdominal site, 13.6±35.7 mm^2 at the arm site, and 28.9±185.2 mm^2 at the thigh site. It was determined that the difference between the sites in terms of bruise sizes that occurred 48 and 72 hours after the injection was statistically insignificant.
Conclusion: These three sites (abdomen, arm, and thigh) showed no differences in terms of occurrence of bruise, and no particular site is superior.

Key words: Subcutaneous heparin injection, medication, bruising in subcutaneous heparin injection, patient safety, nursing

Introduction

Medication administration, which is a primary responsibility of nurses, is a process that involves numerous disciplines (Salerno, 2003; Abrams, 2000). This process begins with the request of the doctor after examining the patient and ends with the administration and recording of the medication by a nurse, doctor, patient or his/her relatives and observation of the correct response (Aygin and Cengiz 2011; Oztunc, 2012). Medication administration involves oral and parenteral drug administrations. A method of parenteral drug administration is subcutaneous administration. The subcutaneous method is generally used to administer vaccines, insulin, hormones, and heparin types (Pope, 2002; Gray and Miller, 2008).

In subcutaneous heparin administrations, local complications, such as bruising, hematoma, and pain, may develop at the injection site based on the subcutaneous injection technique in addition to the problems emerging as a result of the systemic effect of heparin depending on the properties of the drug (Chan, 2001; Hirsh et al., 2001; Karabacak, 2010; Avsar and Kasikci, 2012). Due to the local side effects of heparin injection, the patient physically experiences the psychological effect of body trauma, loses his/her trust towards the nurse and also restricts the injection site for the injections that must be

administered subsequently due to a bruise/hematoma (Chan, 2001; Rizalar et al., 2007).

There have been numerous studies conducted on prevention of the complications that develop based on the injection technique. Although literature states that the abdominal site is preferred in heparin administration and recurring subcutaneous injections due to the excess of subcutaneous fat tissues and the width of the injection site allowing the rotation and the lack of muscle activities (Chan, 2001; Potter and Perry, 2007; Hunter, 2008; Zaybak and Khorshid 2008; Gray and Miller, 2008), other literature reports that any of three sites could be used (Fash and Kinney 1991, Kuzu and Ucar 2001, Zeraatkari et al. 2005). Among numerous studies conducted on subcutaneous heparins; the incidence of bruising was reported by Rizalar et al. (2007) as 82% and by Woldridge and Jackson (1988) as 88%. The literature reports that the factors affecting bruise formation are the selection of the injection site, size of the needle, aspiration, massage on the injection site after injection, and injection time (Chan, 2001; Avsar and Kasikci, 2012). There have been various studies on preventing bruise development at the injection site. In the study conducted by Gorgulu and Kazan (2009), they determined that nurses were not able to select the appropriate injection site, they performed the injection without making an accurate aspiration and they did not maintain sufficient records after the procedure and they did not assess the patient. In the study by Senturan et al. more than half of the nurses preferred only the outer side of the upper arm as an injection site.

In the study by Klingman (2000), changing the needle tip before subcutaneous heparin administration had no effect on the occurrence of bruising. The studies conducted by Rizalar et al., (2007), Zaybak and Khorshid (2008) revealed that the diameter of the bruise widened as the volume of subcutaneously administered heparin increased. In the studies conducted by Kuzu and Ucar, it was stated that ice application on the injection site was effective to decrease and prevent pain, bruising, and hematoma developing at the injection site. In the studies of Chan (2001) and Zaybak and Khorshid (2008) it was determined that in subcutaneous heparin administrations, administering the drug for a longer time slightly worsened the bruising and also decreased the duration of pain.

Although numerous studies have been conducted to reduce local complications developing after subcutaneous heparin administrations, there have been only three studies that investigate whether subcutaneous heparin differs between the sites in terms of local complications. In the study conducted by Akyol Durmaz (1988), the bruising developed both in the abdominal and arm sites after subcutaneous heparin injection, and the size of this bruising was smaller in the abdominal site compared to the arm site. However, in this study, only two sites were examined. In the study conducted by Fash and Kinney (1991), no difference was found between the abdominal, thigh and arm sites in terms of prevalence of bruising after subcutaneous heparin injections. However, in this study, the characteristics of the patient groups injected for each site were not exactly equalized. In the study conducted by Zeraatkari et al., (2005) they assessed subcutaneous heparin administration at abdominal, thigh and arm sites in terms of the bruising and pain, and no significant difference was found in the three sites in terms of occurrence of the bruising. However, due to the substantially low pain intensity in the abdomen compared to the arms and thigh, the abdominal site is recommended for subcutaneous heparin administration.

As a result of subcutaneous heparin injection, the local side effects, such as bruising, hematoma, and pain, caused by the injection technique must be minimized, and subcutaneous heparin administrations must be standardized in all nursing practices.

Material and Method

Study Design

The study was conducted on patients hospitalized in Neurology and Chest Diseases within the body of Erzurum Regional Training and Research Hospital.

Setting and sample

The population of the study consisted of all the patients who were hospitalized in Neurology and Chest Diseases of Erzurum Regional Training and Research Hospital between October 2012 and February 2013 and were receiving heparin treatment. The sample group of the study consisted of 60 patients who met the inclusion criteria within the defined population between specified dates.

Inclusion criteria of the study were the following: age between 30 and 65 years; no scar, incision, lipodystrophy or infection symptom at the sites where the injection is performed; no allergy history; and receipt of clexane (0.6 cc or 0.4 cc) treatment.

Instruments

Enoxaparin (Ommaty, 2002; Clexane, 2016) (commercial name Clexane) was used as the intervention material. A patient information form, administration and follow-up chart and Opsite Flexifix were used to collect the data.

Data Collection

Data were collected by the researcher. Subcutaneous heparin administration and follow-up of each patient were performed and controlled by the researcher for six days. For subcutaneous heparin administration, a total of 3 injections were performed in the abdominal, arm and thigh sites of each patient. Heparin was administered subcutaneously to the patients by the researcher during their treatments in the morning and/or evening. Heparin was administered to the arm, abdominal and thigh sites of each patient. Nursing interventions were conducted based on the standard method of subcutaneous injection administration prepared by the researcher based on the literature review (Table 1) (Gray and Miller, 2008; Chan, 2001; Potter and Perry, 2007, Hunter, 2008; Klingman, 2000). During administrations and measurements, no administration was performed at the sites used by the researcher. The patient and his/her relatives were informed that this site should not be scratched or rubbed. It was reported that the bruising induced by the subcutaneous heparin injection was most significant at 48 hours after injection, and the bruising decreased by 72 hours (Potter and Perry, 2007). Therefore, bruising measurements were performed at 48 and 72 hours after injection. The assessment was made by the researcher.

Ethical Consideration

Required permissions were granted by the relevant institutions to conduct the study. Furthermore, the research proposal was submitted to the Ethics Committee was approved (Number: 2012/2/43). To conduct the study, permission was granted by the Association of Public Hospitals Regional Training and Research Hospital Head Physician and the clinics where the study was conducted. Before administration, the purpose and benefits of the study were explained to the patients and their relatives. Their verbal consents were received. During the study, the questions asked by the participants were answered.

Data Analysis

Data were analyzed using SPSS. Percentage, one-way ANOVA, and independent sample t-tests were used to assess the data.

Results

The descriptive characteristic analysis revealed that 83.3% of the patients were aged 48-65 years, and 50% were female. 31.7% of the patients were illiterate (Table 2). Forty eight hours after the injection, the least amount of bruising occurred at the thigh site (18.3%) and most bruising was observed at the arm site (31.7%). 72 hours after the injection, the least amount of bruising occurred at the thigh site (13.3%) and most bruising occurred at the abdominal site (26.7%) (Table 3). Table 4 illustrates the sizes of the bruises that developed 48 and 72 hours after the injection according to the age and gender of the patients. The average size of the bruising in women 48 hours after the injection was the largest at the abdominal site (94.5±264.0) and the smallest at the arm site (21.1±47.2). However, the average size of the bruising in men was largest at the abdominal site (30.5±106.59) and smallest at the thigh site (2.0±6.1). The difference between bruise sizes 48 and 72 hours after the injection was not statistically significant in terms of gender ($p>0.05$). Forty-eight hours after the injection, the average bruise size in the 30-47 age group was the largest at the abdominal site (139.0±439.5) and the smallest at the thigh site (2.0±6.3). The average bruise size in the 48-65 age group was the largest at the abdominal site 847.2±111.0) and the smallest at the arm site (11.9±30.3). The difference between bruise sizes 48 and 72 hours after the injection was not statistically significant in terms of age ($p>0.05$)

Table 5 illustrates the largest and the smallest bruise sizes 48 and 72 hours after the subcutaneous injections administered to the three sites. 48 hours after the injection, the smallest average bruise size was observed at the arm site (13.6±35.7), and largest average bruise size occurred at the abdominal site (62.5±202.2). 72 hours after the injection, the smallest average bruise size was at the arm site (6.2±17.7), and the largest average bruise size was at the abdominal

site (42.6±156.8). The bruise sizes 48 and 72 hours after the injection did not significantly differ between the sites (p>0.05) (Table 5).

Table 1. Standard Method of Subcutaneous Injection Administration

Materials	**Drug (ready-to-use clexane injector), alcohol, cotton pack, waste container, drug tray**
Method:	Hands are washed.
	Drug tray is prepared and the drug is controlled.
	Correct patient is specified and the patient is informed about the procedure.
	Verbal consent of the patient is received for the administration.
	The patient is positioned for the injection. While the patient gets the supine position for abdominal site, semifowler position is given for arm and femoral sites.
	The site is cleaned by pressing an alcohol cotton pack with circular movements starting from 2.5 cm-diameter injection point and waited for a minute for the alcohol to dry.
	Injector is taken to the active hand and the needle is carefully removed from its sheath. The skin and subcutaneous tissue to be injected are compressed between the fingers of the passive hand to form a cushion.
	Injector is held like a pen and inserted from the flabby point of the tissue with 90^o degrees.
	After the needle is inserted, the drug is administered by counting to ten without releasing the compressed tissue.
	The needle is retracted after counting to ten without changing the insertion angle. Before retracting the needle, the compressed tissue is released and the inserted point of the tissue is compressed slightly with a dry cotton pack.
	The pressure is applied with a dry cotton pack by counting to ten (in order to standardise the pressure applied; the whitening of nail of the pressuring finger is accepted as a criterion).
	After the injection procedure, a circle of approximately 5 cm^2 is drawn around the insertion point of the needle.
	The patient is assisted to get a comfortable position

Table 2. Distribution of the patients based on their descriptive characteristics

Characteristics	n(%)
Age	
30-47	10(16.7)
48-65	50(83.3)
Sex	
Female	30(50.0)
Male	30(50.0)
Education	
İlliterate	19(31.7)
primary school graduates	22(36.7)
secondary school graduates	11(18.3)
High school graduated	7(11.7)
College	1(1.7)
Services	
Chest Service	27(45.0)
Neurology Service	33(55.0)

Table 3. Incidence of the bruising 48 and 72 hours after the injections

Injection site	The occurrence of bruising at 48h		The occurrence of bruising at 72 h	
	Bruise present	No bruise	Bruise present	No bruise
	n(%)	n(%)	n(%)	n(%)
Abdomen	18(30.0)	42(70.0)	16(26.7)	44(73.3)
Arms	19(31.7)	41(68.3)	11(18.3)	49(81.7)
Thigh	11(18.3)	49(81.7)	8(13.3)	52(86.7)
At least one region	30(50.0)	30(50.0)	20(33.3)	40(66.7)

Table 4. Comparison of sizes of the bruising 48 and 72 hours after the injection based on age and gender of the patients

Characteristics	48 hours after injection size of bruising (mm^2)			72 hours after injection size of bruising (mm^2)		
	Abdomen mean ± SD	Arm mean ± SD	Thigh mean ± SD	Abdomen mean ± SD	Arm mean ± SD	Thigh mean ± SD
Sex						
Female	94.50±264.05	21.13±47.22	55.83±261.31	60.63±199.02	8.93±22.23	51.13±256.83
Male	30.50±106.59	6.13±16.11	2.00±6.17	24.67±98.76	3.57±11.36	0.93±5.11
The Test Value and Significance	t=1.231 p=.226	t=1.646 p=.108	t=1.128 p=.269	t=0.887 p=.379	t=1.177 p=.244	t=1.070 p=.293
Age						
30-47	139.00±439.55	22.00±57.39	2.00±6.32	108.00±341.52	13.80±35.45	1.80±5.69
48-65	47.20±111.01	11.96±30.33	34.30±202.83	29.58±84.51	4.74±11.52	30.88±199.19
The Test Value and Significance	t=0.656 p=.528	t=0.807 p=.423	t=-0.500 p=.619	t=1.722 p=.488	t=0.800 p=.444	t=-0.458 p=.648

Table 5. Comparison of sizes of the bruising 48 and 72 hours after subcutaneous heparin administration to different sites

Injection Site	48 Hours After İnjection Size of Bruising*			
	Min.	Max.	Mean	The Test Value and Significance
Abdomen	4	1390	62.52±202.21	F= 1.47
Arms	5	183	13.62±35.73	p=.233
Thigh	8	1435	28.91±185.20	
Injection Site	**72 Hours After İnjection Size of Bruising***			
	Min.	**Max.**	**Mean**	**The Test Value and Significance**
Abdomen	12	1080	42.63±156.84	F= 1.03
Arms	8	112	6.23±17.74	p=.359
Thigh	7	1410	26.00±181.82	

***in terms of mm^2**

Discussion

In this study, we examined the incidence of bruising 48 and 72 hours after subcutaneous injection of heparin. Bruising occurred the most at the arm site (31.7%, n:16), and the least amount of bruising occurred at the thigh site (18.3%, n:8). In accordance with these results, it was determined that minimum number of bruising developed in the thigh site. Bruising incidence was 82% in the study by Rizalar et al., (2007) and 88% in the study by Woldridge and Jackson (1988). Bruising incidence in this study was lower than other relevant studies. The reason for this result may be because the injections were performed at three different sites (abdomen, arm, thigh) in this study.

In comparing the average bruise size 48 and 72 hours after the injection, the overall average bruise size was larger in women compared to men. However, the difference between the groups was not statistically significant (Table 4). The studies by Rizalar et al., (2007), Avsar and Kasikci (2012) revealed that there was a significant difference between the bruise sizes in terms of gender, and women had larger average bruising size compared to men. In comparing the average bruise size according to age, the average largest bruise size in the 30-47 age group was at the abdominal site, and the average smallest bruise size was at the thigh site. In the 48-65 age group, the average bruise size was largest at the abdominal site, and the smallest average bruise size was at the arm site. The difference between the sites was not statistically significant (Table 4). In previous studies (Rizalar et al., 2007; Zaybak and Khorshid 2008; Avsar and Kasikci 2010), age had no effect on the occurrence of bruising and bruise size. The results obtained from this study are consistent with the results of previous studies.

Previous studies demonstrated that the selection of injection site can affect the occurrence of bruising. Although the average bruise sizes at 48 hours after injection were 62.5±202.2, 28.9±185.2, and 13.6±35.7 at the abdominal site, thigh site and arm site, respectively, the difference between the sites was not statistically significant (Table 4). Thus, smallest average bruising size measured after the injection was 13.6 mm^2 in the arm site. The largest average size was 62.5 mm^2 in the abdominal site (Table 5). Bruise size measurements after subcutaneous heparin injection administered to the abdominal site was 1.84-6.77 mm^2 in the study by Kuzu and Ucar, 3.8-8.4 mm^2 in the study by Avsar and Kasikli (2010) and 109.20-218.76 mm^2 in the study by Zaybak and Khorsid (2008). The smallest average bruise size in the study by Zeraatkari at al., (2005) was 133.2 mm^2 at the

abdominal site, and the largest average size was 158.2 mm^2 at the thigh site. In previous studies, the variables that affected bruising included heparin type and dosage, size of the needle used, injection period, pressure application after injection, ice application before or after injection. These variables differed from this study, which might have caused the bruise sizes to be larger.

In this study, the largest bruising occurred at the abdominal site because of the wider subcutaneous heparin administration size and the subcutaneous tissue thickness of the abdominal site. Due to the subcutaneous tissue thickness at the abdominal site and the wider subcutaneous heparin administration area; the drug might not have sufficiently reached the deep subcutaneous tissue during the subcutaneous injection and might have remained close to the surface. As a result because the drug could not be administered to the deep subcutaneous tissue, it might have reached to the subcutaneous layer more rapidly and caused enlargement of the bruise at the abdominal site. Furthermore, the bruise size may have been larger at the abdominal site because the abdominal site was wider than the other sites (arm, thigh). Similarly, due to thin subcutaneous tissue in the thigh and arm sites, the heparin might have diffused properly into deep subcutaneous tissue, and subcutaneous penetration of the drug might have been prevented.

Although literature states that the abdominal site is preferred for heparin administration and recurring subcutaneous injections due to the excess of subcutaneous fat tissue, ability to rotate and lack of muscle activities, other literature demonstrates that three possible sites could be used. Among the literature only one study demonstrated that the abdominal site is preferred for subcutaneous injection (Akyol Durmaz, 1998). Two studies have demonstrated that the three sites could be used and not one site was better than the others (Fash and Kinney, 1991; Zeraatkari et al., 2005). The results of our study are consistent with the results of these studies.

Conclusion

In this study, the largest average bruise size 48 and 72 hours after subcutaneous heparin injection was at the abdominal site, and the smallest average bruise size was at the arm site. The most amount of bruising was at the arm site 48 hours after the subcutaneous heparin injection, and the highest amount of bruising 72 hours after the injection was at the abdominal site. Forty-eight and 72 hours after the heparin injection, the least amount of bruising was at the thigh site.

At 48 and 72 hours after the subcutaneous heparin injection, the largest average bruise size was observed at the abdominal site in both women and men and the smallest average bruise size was at the arm site in women and at the thigh site in men. Similarly, at 48 and 72 hours after the subcutaneous heparin injection, the largest average bruise size was at the abdominal site in the 30-47 age group, and the smallest average bruise size was at the thigh site.

According to the results in this study, we recommend further study on larger sample groups to determine the most reliable site to reduce bruising after subcutaneous heparin injection.

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