

Review on Subcutaneous Low Molecular Weight Heparin Injection Impact in the Occurrence, Extent of Bruising

Rajini Shireen, Dr Eyjolfsson Atli, Rajpali Saima

King Faisal Specialist Hospital & Research Center, Riyadh, Saudi Arabia

Email: Shireen.rajani@gmail.com

Abstract:

Subcutaneous injections often cause pain and bruising. It is noted that site-pain causes the patient physical and psychological discomfort. Several methods to prevent bruising and pain of subcutaneous heparin injection have been widely studied but duration of the pain and the extent of bruising is little documented. The aim of this study is to evaluate the low molecular weight subcutaneous heparin injection time of 10 seconds versus 20 seconds on the occurrence and extent of bruising and pain in a Research Hospital in KSA. Quasi Experimental design was adopted in consecutive admission of patients to Cardiovascular Division under services of post cardiovascular surgery, medical cardiology & vascular cases in King Faisal Specialist Hospital and Research Centre, Riyadh-KSA. The data analysis was performed in a blind fashion. Out of one hundred and ninety-four (194) patients, 6.2% (n=12) patients had bruises of 10-150mm at 48 hours and 6.7% (n=13) patients had bruises of 20-150 mm at 60 hours within group A. During the injection duration of 20 seconds, 3.1% (n=6) patients had bruises of 10-100mm at 48 hours which was further observed until 60 hours. Out of one hundred and ninety-four (194) patients, 70.6% (n=137) patients had site pain (score of 1-6) with injection technique of 10 seconds and 37.6% (n=73) patients had site pain (score of 1-5) with injection technique of 20 seconds.

Keywords: Administration, Bruise, Case-crossover, Duration, Injection, Low-molecular-weight heparin, Quasi-experimental.

I. INTRODUCTION

Deep Vein Thrombosis (DVT) is a leading cause of preventable death in the United States. The possibility of developing a DVT is one major complication for the patient population with damaged blood vessels, decreased circulation problems or restricted mobility. DVTs can eventually lead to strokes, myocardial infarctions or pulmonary embolisms, these are often preventable complications that not only harm the patient but increase the resources needed to treat and rehabilitate the individual (Todd E. Chenicek, 2004).

For years, the common method for prevention of a VTE, or treatment of a DVT, has been unfractionated heparin (Thompson-Ford, 1998). Heparin does not dissolve a clot; it only facilitates the body's own mechanism to dissolve the clot (Pavlovich-Danis, 2002). Heparin's anticoagulant effect is achieved by combining with antithrombin III, which is already present in the body (Hovannisian, 1999; Pavlovich-Danis, 2002). The result is a state of increased anticoagulation. Subcutaneous injections often cause pain and bruising (Chan, 2001; Kuzu & Ucar, 2001; Venketasubramanian & Chua, 1998). When nurses give injections as part of the medical care, it can cause patients to become apprehensive about receiving future subcutaneous medications, anxious about the nursing staff, or even noncompliant with medical care. Kuzu & Ucar (2001). Noted that site-pain causes the patient physical and psychological discomfort and bruising limits possible sites for subsequent injections (Kuzu & Ucar, 2001).

The safe and accurate administration of medication is one of the most important responsibilities of nurses (Hall, 2004; Hogan, 2000). Although subcutaneous heparin administration is a frequently performed nursing intervention, it often causes problems such as bruise, hematoma, induration and pain at the injection site (Kuzu, 1999). Bruise occurs when a force causes blood vessels to burst. Blood leaks into areas under the skin resulting in pain, swelling, and skin discoloration. A bruise is an area of skin discoloration that is $\geq 2\text{mm}^2$ (Chan, 2001; McGowan and Wood, 1990).

II. LITERATURE REVIEW

According to the study of Reva Balci Akpinara and Ayda Celebioglu, (2008), 20 second duration while administration of enoxaparin left with fewer and smaller bruises as compare to 10 second duration. This study provides new information for nursing practice about bruising associated with subcutaneous heparin

According to Harriet Chan (2001), the bruise incidence at the 10-seconds injection technique sites was approximately double that of the 20-seconds injection technique sites, clearly indicating that slow administration of subcutaneous heparin injections had lesser impact on bruising.

In the literature, slow administration of subcutaneous heparin injection is recommended (Van Bree et al. 1984, Tucker et al. 1996, Akyol 1998, McConnell 2000, Potter & Perry 2005). It is stated that when an injection is administered slowly, tissue damage can be reduced due to the reduction of giving strength of drug to the tissue (Beyea & Nicoll 1996, Kuzu 1999).

According to the finding of the research study of Ayten Zaybak & Leyla Khorshid (2008), the use of a 20 seconds duration for administering heparin injections reduces the incidence or size of bruising. 20 seconds duration injection technique should be used for subcutaneous heparin injections in clinical practice. This study allocated patients from several specialties, where 50% of the patients were taken from the cardiology unit, 36% from the orthopedics unit and 14% from the neurology unit. The sample for the study consisted of 50 patients to whom subcutaneous heparin was administered All subjects were alert and conscious enough to answer questions. The percentage of bruising occurrence was 64% with the control injection technique and 42% with the experimental injection technique.

According to Tayebe Pourghaznein, Amir Vahedian Azimi and Mohammad Asghari Jafarabadi (2013), the quasi-experimental study was conducted on 90 patients with COPD hospitalized in two ICU wards at two teaching hospitals in Iran. They were injected heparin subcutaneously, being given a dosage of 4000 units every 12 hours. In the method; 15 seconds injection duration and waiting for 5 seconds before withdrawing the needle, the number of bruising was significantly lower and size of bruising was significantly smaller. The method 15 seconds injection duration and waiting for 5 seconds before withdrawing the needle is recommended to be used for

subcutaneous heparin injection by clinical nurses. As to the results, the severity of pain in abdomen was lower than in thighs.

According to Harriet Sau Ching Chan (2001), subcutaneous heparin over a longer duration may reduce injection site-pain and bruising. A convenience sample of 34 subject receiving 5000 units of a subcutaneous Fragmin injection twice a day were recruited from a large teaching hospital. Subjects rated the level of perceived site-pain intensity during injection using the vertical Visual Analogue Scale. Injection-site bruising was measured at 48 and 60 hours after injection. Results indicated that 20-seconds injection duration resulted in significantly less intense site-pain during administering the injection and fewer and smaller bruises.

Considering the investigative findings within the limitations, the following conclusions can be drawn. The 20-seconds duration injection significantly reduces site-pain during injection and results in fewer and smaller bruises. This technique, therefore, is worth considering in developing nursing practice guidelines (Harriet Chan, 2001)

III. RESEARCH DESIGN

A quasi-experimental study design was adopted. A consecutive admission/transfer to the cardiovascular nursing units (A4, CVT, CCU, CVSD and CSICU) under adult cardiovascular, adult cardiology and vascular service in King Faisal Specialist Hospital & Research Centre, Riyadh-KSA was eligible for enrollment as these patients receive low molecular subcutaneous heparin.

The exposure/intervention variable was the duration of the administration time of injection, 10 seconds (treatment A) versus 20 seconds (treatment B). According to the evidence available, indicating that bruises usually peaks at 48 hours and begin to disappear within 72 hours after injection. The evaluation of bruising was performed exactly 48 hours and 60 hours after injection by an expert nurse who received specific instructions and was blinded to the duration of injection. He/she evaluated the skin at the circled site, at a distance of 1 cm with nontoxic water-removable colored ink on both the left and right sides.

When there was bruising, its extent was measured with a measure tape. The maximum diameter of the bruise was recorded (in millimeters) regardless of whether the bruise was regular or uneven in shape at the time of measurement. The site of each treatment was known only by the nurse administering the injection.

The area decided (left upper quadrant / right upper quadrant / left lower quadrant / right lower quadrant) for each treatment (treatment A; 10 seconds; treatment B; 20 seconds) was written on a paper, placed in an envelope and kept in a locker. The nurse evaluating the bruising did not know which treatment had been performed, either on the left or right side of the abdomen. The data analysis was also performed in a blinded fashion.

<p>Treatment A =</p> <p>rapid subcutaneous heparin injection (10-s)</p>	<p>Treatment B =</p> <p>slow subcutaneous heparin injection (20-s)</p>
<p>Site: left upper quadrant / right upper quadrant / left lower quadrant / right lower quadrant</p> <p>↓</p>	<p>Site: left upper quadrant / right upper quadrant / left lower quadrant / right lower quadrant</p> <p>↓</p>
<p>Site of injection at least 5 cm from the navel</p> <p>↓</p>	
<p>Use pre-filled syringes of enoxaparin sodium</p> <p>(4,000UI/0.4 ml, according to the prescription received)</p> <p>↓</p>	
<p>Disinfect the skin with antiseptic (Alcohol Swab)</p> <p>waiting until the skin is dry before inserting the needle</p>	

↓	
Remove the safety cap of the needle and do not remove the air bubble contained in the syringe	
↓	
Hold a fold of skin with your non dominant hand during needle insertion	
↓	
Introduce the needle along the whole of its length at an angle of 90°	
↓	
Do not aspirate before injecting	
↓	↓
Inject the drug in 10 seconds using a digital stopwatch ↓	Inject the drug in 20 seconds using a digital stopwatch ↓
Be careful about accuracy, a steady hand, the absence of tremor and a calm environment ↓	
Remove the needle while maintaining the same angle of insertion release the skin fold	

↓

Apply gentle pressure(10 sec) with an antiseptic to the site

without further massage

↓

Circle the site and record the procedure on the patient's sheet

SAMPLE SIZE

We performed study of 10 seconds and 20 seconds of heparin injection on the same patient. 194 subjects were studied in order to reject the null hypothesis that this relative risk equals 1 with probability (power) 0.8. The Type I error probability associated with this test of this null hypothesis is 0.05.

OUTCOMES MEASURE

To measure the occurrence, extent of bruises after two different injection durations.

To measure the pain score at the site of injection with two different injection durations.

BLIND PROCEDURE

The location of each treatment was known only to the nurse who injected it. The location was written on paper, placed in an envelope and stored in a locked safe. Nurses who examined the bruises did not know which treatments were performed on either location. Data analysis was also performed blindly. An envelope containing this information was opened after the analysis was completed.

STUDY VARIABLES

Independent Variables collected include age, gender, diagnosis and size of bruising in mm. Investigators were trained to perform the two types of injection according to the below protocol.

Surgery, past medical history, neurologic status, current medication, and admission date. Dependent Variables collected include site of injection, self-reported pain scores using the Adult Verbal Pain Scale at the time of injection and site measurement at 48 hours and 60 hours after administration for occurrence of bruising using the measure tape.

ETHICAL CONSIDERATION

This research project was conducted in accordance with the ethical principles contained in the Declaration of Helsinki (2000), the ICH Harmonized Tripartite Good Clinical Practice Guidelines, the policies and guidelines of the RAC at KFSH&RC and the laws of Saudi Arabia.

Informed written consent was also obtained from all participants of this study.

Research subjects were assigned an identification number separate from the Medical Record Number to ensure that patients remain anonymous during data analysis subsequent to its collection. The list of patients' identification number with its respective Medical Record Number was kept under lock and key. Data was collected using a pre-designed form that indicated the patients' serial number only. The database and all computer files relevant to this research were password protected and known to the investigators and research coordinator only.

V. RESULTS

A total of three hundred & eight (308) patients were enrolled during the last 5 years (March 2015 – June 2020) of this research study and 62.98% (n=194) patients received 1st and 2nd subcutaneous LMWH injection (388 injections) and completed the assessment of 48 and 60 hours.

Remaining 37.02% (n=114) patients were excluded due to discontinuation of the medication or discharged before completion of the assessment within 48 and 60 hours.

The study included 194 subjects on whom both 10 seconds and 20 seconds injection (at two distinct points in time) were administered. A total of 85.57% (n=166) subjects had the 10 seconds first followed by the 20 seconds, and the remaining 14.43% (n=28) had the 20 seconds first followed by the 10 seconds.

OCCURRENCE AND EXTEND OF BRUISE

A total of 183 subjects had similar amounts of bruising for the two injections – 179 with no bruising from the 10 seconds and no bruising from the 20 seconds injection, and 4 with bruising from both injections (and of similar sizes). Among the remainder (11), nine had bruising from the 10 seconds injection and no bruising from the 20 seconds and two had bruising from the 20 seconds injection and no bruising from the 10 seconds. This suggests a stronger propensity for bruising following the 10 seconds injection versus the 20 seconds injection. Based on the finding of the research, the p-value of the analysis was found to be 0.0002 using Fishers Exact Test.

Contingency Table

10 Sec Injection (Bruise60h) By 20 Sec Injection (Bruise60h)

Count			
Total %			
Col %	No	Yes	Total
Row %			
No	179	2	181
	92.27	1.03	
	95.21	33.33	
	98.90	1.10	
Yes	9	4	13
	4.64	2.06	
	4.79	66.67	

	69.23	30.77	
Total	188	6	194
	96.91	3.09	

Fisher's Exact Test	Probability	Alternative Hypothesis
Left	1.0000	Prob (20 Sec Ijnec (Bruise60h) = Yes) is greater for 10 Sec Ijnec (Bruise60h) = No than Yes
Right	0.0002*	Prob (20 Sec Ijnec (Bruise60h) = Yes) is greater for 10 Sec Ijnec (Bruise60h) = Yes than No
2-Tail	0.0002*	Prob (20 Sec Ijnec (Bruise60h) = Yes) is different across 10 Sec Ijnec (Bruise60h)

INTENSITY OF PAIN

In terms of pain during the injection, 113 subjects were able to discern a differential amount of pain from the two injections – 8 subjects reporting more pain from the 20 seconds injection and 105 subjects reporting more from the 10 seconds injection. This did not seem to vary according to the initial pain as illustrated in the table below.

Initial Pain Score

Pain comparison	0	1	2	3	4	5	6
20 seconds more pain	5	0	2	1	0	0	0
10 seconds same as 20 seconds	52	21	8	0	0	0	0
10 seconds more pain	7	31	38	18	6	3	2

Interestingly, when only the initial pain scores were compared between the 166 for whom the initial injection was a 10 seconds with the 28 for whom the initial injection was a 20 seconds, no difference was found in the level of pains ($p = 0.2321$ using Chi Square Approximation).

Contingency analyses of pain comparison were conducted while adjusting for age, gender, type of diagnosis/surgery, and past medical history. No differential relationships in pain score comparisons were noted across these adjusting variables.

VI. CONCLUSION

Our research study provides new knowledge regarding administration of subcutaneous low molecular weight heparin that in 20 seconds injection, it reduces the occurrence of bruise compared to 10 seconds injection. There was no difference found in the pain level of the patients receiving 10 seconds versus 20 seconds injection.

REFERENCES

1. Beyea SC & Nicoll LH (1996). Sub-cutaneous administration of heparin: an integrative review of the research. The Online Journal of Knowledge Synthesis for Nursing.
2. Available at: [http:// www.blackwell-synergy.com/doi/abs/10.1111/j.1524-475x.1996.00001.x?journalcode=wvn](http://www.blackwell-synergy.com/doi/abs/10.1111/j.1524-475x.1996.00001.x?journalcode=wvn) (accessed on 3 May 2003).
3. Chan, H. (2001). Effects of injection duration on site-pain intensity and bruising associated with subcutaneous heparin. Journal of Advanced Nursing, 35(6), 882-892.

4. Hall, A.M., (2004). Administration of injections. In: Elkin, M.K., Perry, A.G., Potter, P.A. (Eds.), *Nursing interventions and clinical skills*. St. Louis Missouri. pp. 471–474
5. Hogan, M.A., 2000. Administering a subcutaneous injection. In: Harkreader, H. (Ed.), *Fundamentals of Nursing: Caring and Clinical Judgment*. Saunders, Philadelphia, pp. 567–569.
6. Hovanessian, H.C. (1999). New-generation anticoagulants: The low molecular weight heparins. *Annals of Emergency Medicine*, 34(6), 768-779.
7. Kuzu, N., (1999). (Subcutaneous Heparin Injections: How to prevent the occurrence of pain, echymosis and hematoma?). *Cumhuriyet Universities Hems-irelik Yu' ksekokuluDergisi* 3 (2), 40–46.
8. Kuzu N & Ucar H (2001) The effect of cold on the occurrence of bruising, Hematoma and pain at the injection site in subcutaneous low molecular weight heparin. *International Journal of Nursing Studies* 38, 51–59.
9. McConnell EA (2000) Do's & don'ts: administering subcutaneous heparin. *Nursing*, 30, 17–18.
10. McGowan, S., Wood, A., (1990). Administering heparin subcutaneously: an evaluation of techniques used and bruising at the injection site. *The Australian Journal of Advanced Nursing* 7, 30–39.
11. Palese A., Aidone E., Dante A., Pea F., (2013). Occurrence and Extent of Bruising according to Duration of Administration of Subcutaneous Low-Molecular-Weight Heparin - A Quasi-experimental Case-Crossover Study. *Journal of Cardiovascular Nursing*. Vol. 28, No. 5, pp 473-482.
12. Pavlovich-Danis, S.J. (2002). *Advances in DVT treatment and prophylaxis*. Myfreece.com. Retrieved May 27, 2002, from http://www.myfreece.com/Public/Course_Take.asp?CourseId=82
13. Potter PA & Perry AN (2005) *Fundamentals of Nursing, Concepts, Process and Practice*, 6th edition. The C.V. Mosby Company, St Louis
14. Reva Balci Akpinar & Ayda Celebioglu, *International Journal of Nursing Studies* 45 (2008) 812–817

15. Tayebe Pourghaznein, Amir Vahedian Azimi and Mohammad Asghari Jafarabadi, 2013 John Wiley & Sons Ltd, Journal of Clinical Nursing
16. Thompson-Ford, J.K. (1998). Low molecular weight heparin for the treatment of deep vein thrombosis. *Pharmacotherapy*, 18(4), 748-758.
17. Todd E. Chenicek, RN, BSN, A Thesis submitted to the School of Nursing in partial fulfillment of the requirements for the degree of Masters of Science in Nursing, year 2004
18. Tucker SM, Canobbia MM, Paguette EV & Wells MF (1996) Patient Care Standards, Collaborative Practice Planning Guides, 6th edition. Mosby-Year Book Inc., St Louis.
19. VanBree N, Hollerbach AD & Brooks GP (1984) Clinical evaluation of three techniques for administering low-dose heparin. *Nursing Research* 33, 15–19.
20. Venketasubramanian, N., & Chua, H.C. (1998).Subcutaneous low molecular weight heparin in place of heparin infusion during warfarin dose optimization in cerebral ischemia. *Clinical Neurology and Neurosurgery*, 100, 193-195.
21. Zaybak A., Khorshid L. (2008). A study on the effect of the duration of subcutaneous heparin injection on bruising and pain. *Journal of Clinical Nursing*, 17 (3), 378-385