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## Subcutaneous Injection Techniques of Anticoagulant Therapies

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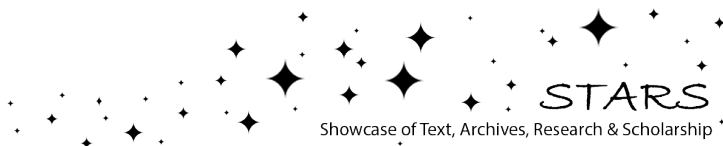
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# SUBCUTANEOUS INJECTION TECHNIQUES OF ANTICOAGULANT THERAPIES

by

LEAH M. MORISSETTE

A thesis submitted in partial fulfillment of the requirements  
for the Honors in the Major Program in Nursing  
in the College of Nursing  
and in the Burnett Honors College  
at the University of Central Florida  
Orlando, Florida

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Thesis Chair: Paul Desmarais, PhD

## ABSTRACT

Subcutaneous anticoagulant medications like Heparin and Low-Molecular Weight Heparin are injections that readily cause bruising, pain, induration, and hematoma formation at the injection site. It is known that these adverse reactions can be correlated to the technique used to administer these medications; however, there is no established technique that reduces bruising, pain, induration, and hematoma formation at the site. Currently, the only protocol for subcutaneous Heparin and Low-Molecular Weight Heparin is that it is to be administered subcutaneously in the abdomen and when using a prefilled syringe, the air bubble should not be removed. The purpose of this study was to identify current nursing practice for the administration of these medications and to compare the results to researched techniques that resulted in less adverse site reactions. A total of 33 participants were recruited. The survey targeted six researched techniques found, after a comprehensive literature review, to have reduced site adverse effects associated with subcutaneous Heparin and Low-Molecular Weight Heparin. After completing the survey, it was found that current practice does not reflect techniques researched to reduce bruising, pain, induration, and hematoma formation at the site. In fact, very few completed one of the six research techniques that were questioned, which included: a two minute application of a cold compress/pack before and/or after the injection, an injection duration lasting 30 seconds, slow removal of the needle over five seconds, application of pressure after the injection for a minimum of 30 seconds, use of a hot pack/compress after the injection, and the use of a 3 mL syringe. It was also found that there were inconsistencies in techniques that have been previously established as current protocol for these medications.

## **DEDICATION**

For my mother and father, who continued to push me to excel and become a better version of myself throughout nursing school; who have supported me in any endeavor I have wished to pursue.

For my significant other, who never failed to remind me how proud I have made him. Thank you for your encouragement.

## ACKNOWLEDGEMENTS

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I would also like to thank Sigma Theta Tau's Theta Epsilon Chapter and the University of Central Florida's graduate program committee for the support given to this study.

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## CHAPTER 1: INTRODUCTION

A venous thromboembolism is a clot that develops in at risk patients and can lead to a pulmonary embolism, pulmonary hypertension, chronic venous insufficiency, stroke, or myocardial infarction, which can ultimately result in death (Wipke-Tevis & Rich, 2011). Heparin and Low Molecular Weight Heparins (LMWH) (i.e Enoxaparin, Reviparin, and Nadroparin) are prophylactic anticoagulant injections administered subcutaneously for the prevention of such thrombi. Heparin works by activating the enzyme antithrombin III, while LMWH's potentiate the effects of antithrombin on factor Xa and thrombin. Both inhibit thrombin and prolong coagulation time, ultimately preventing the enlargement of pre-existing clots and the formation of new clots (Adams & Urban, 2013; Vallerand, Sanoski, & Deglin, 2011).

Administration of subcutaneous Heparin and LMWH can lead to hematoma formation, local site induration, and often causes bruising and pain at the injection site (Prater, Lenox, Renner, Tallmadge, & Von Lunen, 2013; Zaybak & Khorshid, 2008). Bruising, induration, and hematoma formation at the injection site can consequently limit the availability of that site for future injections and cause physiological discomfort to the patient (Kuzu & Ucar, 2001). Pain and bruising can also cause anxiety, disruption of body image, and patient rejection of subsequent injections (Avsar & Kasikci, 2013).

Akpinar and Celebioglu (2008), Palese, Aidone, Dante, and Pea (2013), and Pourghaznein, Azimi, and Jafarabadi (2014) agree that these adverse reactions at the injection site are directly related to the technique used to administer these medications; however, there is no standard technique to administer Heparin and LMWH that reduces the likeliness of these adverse reactions from occurring. Current protocol is that Heparin and LMWH medications are



to be administered subcutaneously, preferably in the abdomen, and if the medication is provided via a prefilled syringe from the pharmacy, the air bubble is not to be removed; no further instructions are provided. The abdomen is used for proper absorption, and air bubbles are in the provided prefilled syringes to prevent leaking of Heparin or LMWH through the subcutaneous tissue and onto the skin surface (Wooldridge & Jackson, 1988).

Standard subcutaneous injection techniques include: washing hands and cleansing the injection site prior to administration, angle insertion of needle between 45 and 90 degrees depending on the amount of subcutaneous tissue that is able to be pinched, insertion of needle into subcutaneous tissue without aspiration, and application of gentle pressure, ensuring the site is not rubbed or massaged after medication is injected slowly (Hall, 2013). How long pressure should be held and over how many seconds the medication should be injected for subcutaneous injections is not indicated.

Injection techniques that reduce bruising, pain, induration and hematoma formation at the injection site have been researched. They have not been adopted as the standard practice for administering these medications. Therefore, the purpose of this study is to identify what current nursing practice is for administering Heparin and LMWH, and how current techniques compare to researched techniques that reduce site adverse reactions. This study was conducted via an emailed electronic and voluntary survey administered to nurses on the University of Central Florida's Theta Epsilon chapter of Sigma Theta Tau Honor Society of Nursing list-serve and the University of Central Florida's graduate nursing program list-serve.

## CHAPTER 2: REVIEW OF LITERATURE

### **Injection Duration and Needle Removal**

Zaybak and Khorshid (2008) studied the effect of duration of the injection on bruising and pain on 50 patients who were hospitalized on neurology, orthopedic and cardiology units. Heparin was injected for 10 seconds on the right side of the abdomen and for 30 seconds on the left side. Bruising occurred in 64% (32) of the patients who received the injection over 10 seconds compared to only 42% (21) who received the 30-second injection time. The mean bruising size for the control group was 109.20 mm<sup>2</sup> 48 hours after the injection and 110.12 mm<sup>2</sup> 72 hours after the injection. The mean bruising size for the experimental group was, respectively, 18.76 and 21.72 mm<sup>2</sup>. Pain was significantly reduced in intensity and length in those who received the experimental injection.

Palese, Aidone, Dante, and Pea (2013) conducted a similar study that also looked at injection duration effects on bruising and pain on 15 patients with 300 injections total. They too compared a 10 second injection to a 30 second injection. Out of 300 injections, 87 bruises were observed: 57 of 150 occurred after injecting the medication over 10 seconds and 30 of 150 occurred after injecting the medication over 30 seconds. Palese, Aidone, Dante, and Pea, however, found no difference in bruise size between the two treatments. The average size difference between the 10 second injection and the 30 second injection was 0.095 mm<sup>2</sup>.

Pourghaznein, Azimi, and Jafarabadi (2013) conducted a study that analyzed injection duration and also needle removal time on 90 patients on two intensive care units (ICU). Using four different methods, each patient received four injections in the thighs and abdomen. The abdomen was divided into four quadrants and one out of the four methods (A, B, C, D) was used

in each of the quadrants. The thighs were sectioned into upper and lower parts. Methods A and B were in the right thigh and methods C and D were in the left.

Method A included injecting the medication over 10 seconds, method B included injecting the medication over 10 seconds and waiting 10 seconds before withdrawing the needle, method C included injecting the medication over 15 seconds and waiting five seconds before withdrawing the needle, and method D included injecting the medication over five seconds and waiting 15 seconds before withdrawing the needle. Method C resulted in the lowest frequency of bruising in the abdomen (24), compared to method A in the thigh that resulted in bruising in 40. The researchers found no significant difference in number and size of bruising in the injection methods between the abdomen and thighs; however, pain was significantly more severe in the thighs than the abdomen.

Akpinar and Celebioglu (2008) did a similar study that also looked at injection duration and also needle removal time effects on bruising in 36 patients. Method A included injecting the medication over 10 seconds, method B included injecting the medication over 30 seconds, and method C included injecting the medication over 10 seconds, but waiting 10 seconds before withdrawing the needle. Bruising occurred in 22 patients with the use of method B and 23 patients using method C, compared to 32 bruises in method A. Bruising diameter was also reduced in methods B and C with an average of 35-55 mm<sup>2</sup>, while the average diameter for method A was 110 mm<sup>2</sup>.

#### **Indications for use.**

The reduction in pain that is observed when administering an injection slowly (over 30 seconds) occurs because tissue damage is reduced. The giving strength of the drug is reduced

during a slower injection. Also, injecting these medications under lower pressure (over 30 seconds) may result in less tissue trauma, contributing to lower occurrence of bruising (Zaybak & Khorshid, 2006). The reduced occurrence and extent of bruising that is seen when needle removal is prolonged (five seconds) occurs because it allows proper time for heparin absorption and prevents drug backflow, which results in bruising (Akpınar & Celebioglu, 2008). It is protocol to give Heparin and LMWH in the abdomen, unless contraindicated.

### **Cold and Hot Application**

Kuzu and Ucar (2000) investigated the effects of a dry cold application on the occurrence of bruising, hematoma formation, and pain on 63 patients. Method A there was no cold application (17), method B a cold application was applied to the injection site five minutes prior to the injection (16), method C a cold application was applied to the injection site five minutes after the injection (15), and in method D a cold application was applied to the injection site five minutes prior to the injection and five minutes after (15). A total of 466 injections were evaluated at the 48 hour mark and 421 injections were evaluated at the 72 hour mark for bruising. A total of 539 injections were evaluated for pain immediately after injection.

With regards to bruising, there was no statistical difference among the methods; however, with regards to pain, pain intensity and duration was significantly less in methods B and D. In method B, only 26 out of 119 (21.8%) experienced moderate pain, while, in method A, 47 out of 156 experienced moderate pain (30.1%). In method D, 27 out of 106 (25.5%) actually experienced no pain compared to only 9 out of 119 (5.8%) in method A.

The previous study was based on Ross and Soltes' (1995) study of ice and its effects on hematoma formation and patient discomfort in 70 patients. The population was used as their own

control as each were given two injections 12 hours apart. For one of the injections, ice was applied for two minutes prior and after the injection. Their results showed no significant difference in incidence or size of hematoma, though, perception of pain was severely reduced.

Conversely, Akpinar (2013) studied the effects of a local dry heat application on bruising incidence and recovery in 33 patients. LMWH was injected into both of the upper arms. One of the patient's upper arms with bruising was used as the control group, and the other arm with bruising was the experimental with an application of a dry heat pack 72 hours after the injection.

In the experimental arm, the mean size of bruising sites was  $4.54 \pm 4.33 \text{ cm}^2$  before the heat application and was  $3.21 \pm 3.78 \text{ cm}^2$  after the heat application, respectively compared to the control arm which was  $6.01 \pm 5.47 \text{ cm}^2$  and  $5.22 \pm 4.45 \text{ cm}^2$ .

#### **Indications for use.**

The application of a dry cold pack for a minimum of two minutes before and after injection is believed to create an ice analgesia effect locally on the injection site (Ross & Soltes, 1995); thereby, altering pain perception. The use of a hot pack on the injection site can speed bruising recovery. Furthermore, decreasing patient anxiety, improving body image, and increasing adherence to treatment. It is believed that the use of a heat application after 48-72 hours past the time of injection increases blood circulation to the affected area via vasodilation, ultimately accelerating cell metabolism rate, the inflammation process, and tissue recovery time (Akpinar, 2013).

#### **Application of Pressure**

McGowan and Wood (1989) investigated the application of pressure and aspiration effects on bruising incidence in 95 patients using four different methods. Aspiration is not

included in current protocol for administration of Heparin and LMWH, because these medications are given subcutaneously. This study was conducted prior to this adopted standard. For method A pressure was applied to the injection site for two minutes after the injection, method B no pressure was applied, method C the syringe was aspirated and pressure was applied for two minutes after the injection, and method D the syringe was aspirated. It was concluded that the evidence did not significantly support the hypothesis that the application of pressure reduced bruising size or occurrence. Despite the results of this study, Akpinar and Celebioglu (2008), Pourghaznein, Azimi, and Jafarabadi (2014), and Kuzu and Ucar (2001) included applying light pressure without rubbing the site after injections in their control groups for their studies of administration techniques.

Available textbooks for nursing students include instructions on how to administer Heparin and LMWH with the only significant difference from standard subcutaneous injections being to apply pressure for an extended period of time. Prater, Lenox, Renner, Tallmadge, and Von Lunen (2013), in *RN Pharmacology for Nursing*, instruct students to apply pressure to the injection site for one to two minutes after the injection. Potter, Perry, and Desmarais (2015), in *Mosby's Pocket Guide to Nursing Skills & Procedures* place significance for the student nurse to administer these medications over several seconds without moving the syringe, and to apply pressure for 30 to 60 seconds.

#### **Indications for use.**

McGowan and Wood (1989) believe that the application of pressure causes manual vasoconstriction, and prevents the leakage of blood from superficial blood vessels that are traumatized during needle insertion. Potter, Perry, and Desmarais (2015) also provide a rationale

for extended pressure application. They, too, state that pressure significantly reduces bruising at the injection site. Because it is included in standard subcutaneous injection protocol, pressure should be applied after injection. For Heparin and LMWH, the amount of time to apply pressure can be concluded to a minimum of 30 seconds.

### **Syringe Size**

Hadley, Chang, and Rogers (1996) studied the effects of syringe size on bruising in 29 patients. Subjects received injections in a 1 mL or 3 mL syringe in a randomized sequence, and sites were assessed for bruises 24, 48, and 72 hours after injection. Bruising occurred in 69% of patients who received injections in a 3 mL syringe compared to 79% in a 1 mL syringe. Bruising size was also significantly larger with the use of the 1 mL syringe and over-time the sizing of the bruise increased compared to the 3 mL syringe. The mean bruise size for the 3 mL syringe was about 20 mm<sup>2</sup>, while the 1 mL syringe produced an average bruise size of 38 mm<sup>2</sup> 24 hours after the injection. 72 hours after the injection, the size of the bruising for the 1 mL syringe increased to 70 mm<sup>2</sup> and decreased for the 3 mL syringe to about 10 mm<sup>2</sup>.

Wooldridge and Jackson (1988) studied the effects of syringe size, change of needle and the use of an air bubble on bruising and induration occurrence on 50 patients with cardiovascular disorders. Method A included the use of a 3 mL syringe, an air bubble, and changing of needle, and method B included the use of a 1 mL syringe, without an air bubble or changing of needle for drawing Heparin into the syringe. Induration occurred twice in each of the methods, and bruising frequency was not found to be significantly different. The size of bruising, however, was different. For method A, mean bruising size for females was 38 mm<sup>2</sup>, while method B

resulted in a mean of 50 mm<sup>2</sup>. For men, bruising was smaller but there was a still a statistical difference. Respectively, bruising mean was 0.036 mm<sup>2</sup> and 2.1 mm<sup>2</sup>.

### **Indications for use.**

Previously, it was recommended to use a tuberculin syringe (1 mL) to provide accurate dosing for Heparin and LMWH, currently, Heparin is typically provided in prefilled syringes distributed by hospital pharmacy. However, there is a possibility of having to manually draw up Heparin and LMWH. The use of a 3 mL syringe when prefilled Heparin and LMWH syringes are not distributed results in less tissue trauma. When the area of a syringe is increased, the force of the substance within the syringe decreases causing less blunt trauma to vessels and tissue. This ultimately results in a decrease in bruising size (Hadley, Chang, & Rogers 1996).



## CHAPTER 3: METHODS

### Design and Instrument

This descriptive exploratory correlational study was conducted using an electronic, voluntary and anonymous survey. Survey questions were created from researched techniques, standard subcutaneous injection protocol, and current Heparin and LMWH protocol and allowed for multiple choice answering and free-text answers. The survey analyzed the six different researched techniques discussed in Chapter 2 and are as follows:

1. Corresponds to question 7: The use of a cold pack for two minutes before and/or after injection to reduce site pain.
2. Corresponds to question 12: Injection duration over 30 seconds to reduce pain and tissue trauma.
3. Corresponds to question 13: Slow removal of needle (five seconds) to allow absorption of medication to occur to prevent bruising.
4. Corresponds to question 15: Applying pressure for a minimum of 30 seconds to reduce bruising by providing manual vasoconstriction.
5. Corresponds to question 16: Applying a hot pack to site after injection to promote quicker healing of bruises.
6. Corresponds to questions 17 and 18: The use of a 3 mL syringe if the employer does not offer prefilled syringes with Heparin and LMWH to reduce bruising.

Questions one through four ask non-identifying demographic data. Other questions not included in the above explanation were deemed to be standard protocol for subcutaneous

injections and/or current protocol for subcutaneous Heparin and LMWH injections or were placed to enhance survey fluidity and consistency.

A copy of the survey can be found in Appendix C.

A table comparing standard techniques for administration versus researched suggested techniques can be found in Appendix D.

### **Human Subjects**

Approval was requested from the University of Central Florida's Institutional Review Board (IRB), and the study was determined as not human research. Participants remained anonymous throughout the study and surveys were not linked with any identifying information. Participants were able to withdraw from the study at any time without penalty.

### **Sample and Setting**

A convenience sample of nurses from the Theta Epsilon chapter of the nursing honor society Sigma Theta Tau at the University of Central Florida and from the graduate nursing program at the University of Central Florida were invited to participate in the survey. Nurses were required to be at least 18 years of age, to have administered subcutaneous Heparin or LMWH before, and to have worked directly in patient care within the past five years. 37 participants started the survey and 33 completed the survey. Surveys that were not completed were not included in the study. The participants were able to complete the survey once at a computer that allowed access to the email invitation.

### **Procedures**

A draft email with an invitation to participate in this study was sent to the leading representative of each organization. The leading representatives emailed the invitation with a

web-link to the self-administered survey and an explanation of research (Appendix B) on the researchers' behalfs to the nurses on the list-serves for the Theta Epsilon chapter of Sigma Theta Tau and graduate nursing program at the University of Central Florida. The survey was closed electronically after two weeks.

### **Measurements**

The measure used in this study was a survey created by the researchers adapted from researched techniques and standard protocols.

The survey was divided into two sections with the first section including demographic data, educational background, and years of experience as a nurse. The second section of the survey allowed for multiple choice answering and/or free-text to assess what current practice is for administering subcutaneous injections of Heparin and LMWH.

Descriptive statistics of the survey were completed in 2015 Research Suite, Qualtrics.

## CHAPTER 4: RESULTS

### Demographic Data

A total of 33 nurses from both list-serves participated in this study. The sample was 9% (n=3) male and 91% female (n=30) with ages ranging from less than 35 years of age (55%; n=18), 35-50 years of age (30%; n=10), and greater than 50 years of age (15%; n=5). Results indicated 24% (n=8) of the nurses had been practicing for 6-12 months, 6% (n=2) had been practicing for 1-2 years, 42% (n=14) of the nurses had been practicing for 2-10 years, and 27% (n=9) of then nurses had been practicing for greater than 10 years. None of the nurses had a Diploma or an Associate's Degree in nursing, 67% (n=22) had a Bachelor's of Science Degree in Nursing, 30% (n=10) had a Master's Degree in Nursing, and one nurse (3%) had a Doctor of Philosophy in Nursing.

### Quantitative Analysis

In regards to standard nursing practice for the administration of subcutaneous injections, question five asked about hand washing prior to injection, question six asked about cleansing of the injection site prior to the injection, question 10 asked if the nurse aspirated, and question 14 asked if the nurse rubbed the site after injecting the medication. Results indicated 91% (n=30) stated that they did wash their hands prior to administering the injection, 97% (n=32) clean the site with an alcohol swab prior to injection, and 3% (n=1) clean the site with a chlorhexidine swab, 9% (n=3) indicated that they do aspirate for this injection and 91% (n=30) stated that they do not aspirate for this injection, and 100% (n=33) stated that they do not rub the site after giving the injection.

The survey asked two questions about standard protocol for administering Heparin and LMWH subcutaneously, including: question eight that asks about where the nurses administer these medications and question 11 that asks if they remove the air bubble prior to administering these medications if the nurses are using a prefilled syringe. Results indicated 100% (n=33) administer this medication in the abdomen, and 67% (n=22) do not remove the air bubble when using a prefilled syringe, 30% (n=10) stated that they do remove the air bubble, and one (3%) nurse said they were not sure if they removed the air bubble.

For fluidity, question nine was inserted and asked about how quickly or slowly does the participant insert the needle into the subcutaneous tissue. Results indicated 73% (n=24) stated quickly averaging less than three seconds, 3% (n=1) stated they insert the needle slowly over three seconds, and 24% (n=8) indicated that they inject the needle without regard for time.

Researched injection techniques that were reported to reduce pain, bruising, hematoma formation and/or pain at the injection site were asked and included: application of an ice pack (question seven), time taken to inject the medication (question 12), needle removal time (question 13), application of pressure after administration of the medication (question 15), application of a hot pack after the injection (question 16), and syringe size (questions 17 and 18).

Results indicated 100% (n=33) stated that they do not use any type of cold application pre- or post-injection. A total of 79% (n=26) inject the medication over 10 seconds or less, 9% (n=3) stated that they inject the medication between 11-29 seconds, 3% (n=1) indicated that they inject the medication over 30 seconds, and 9% (n=3) were unsure for how many seconds they inject the medication. A total 64% (n=21) stated they remove the needle quickly averaging less

than three seconds, 15% (n=5) stated they remove the needle slowly averaging between two to five seconds, and 21% (n=7) remove the needle without regard for time.

A total of 15% (n=5) stated they apply pressure for less than 10 seconds, 6% (n=2) apply pressure for 10-29 seconds, 6% (n=2) apply pressure for 30-59 seconds, 0% apply pressure for 60 seconds or longer, and 73% (n=24) stated that they do not apply pressure to the site after injection. A total of 100% (n=33) stated they do not apply a dry heat pack/compress to the injection site after administering the injection.

A total of 91% (n=30) stated that at their work place, subcutaneous Heparin and LMWH medications are administered in a prefilled syringe, and 9% (n=3) said no. A total of 67% (n=22) stated they use a prefilled syringe and that self-preparation of the medication was not available, 9% (n=3) stated that when prefilled syringes are not available, they use a 1 mL syringe, 21% (n=7) stated that when prefilled syringes are not available, they use a 3 mL syringe, and one (3%) nurse stated they were not sure what syringe size they use when a prefilled syringe is not available.

## CHAPTER 5: DISCUSSION

### Current Practice

A breakdown by question is provided below to identify current nursing practice for the administration of subcutaneous Heparin and LMWH. It begins with five, corresponding to the number of the question on the survey. Current practice was determined by what the majority of nurses selected as the answer for each question.

5. Nurses wash their hands prior to the administration of subcutaneous anticoagulant medications.
6. Nurses cleanse the injection site with an alcohol swab prior to injecting these medications.
7. Nurses do not apply an ice-pack, cold compress, or cold-pack to the injection site prior/post medication injection.
8. Nurses administer these medications in the subcutaneous tissue of the abdomen.
9. Nurses insert the needle quickly into the subcutaneous tissue, averaging less than three seconds.
10. Nurses do not aspirate.
11. Nurses do not remove the air bubble.
12. Nurses inject the medication into the tissue over 10 seconds or less.
13. Nurses remove the needle quickly from the tissue after injection, averaging less than three seconds.
14. Nurses do not rub the site after injecting these medications.
15. Nurses do not apply pressure after administering these medications.

16. Nurses do not use a dry heat-pack or compress on the site after injecting the medication.

17 & 18. Lastly, most nurses work at a facility in which prefilled syringes are used; however, if prefilled is not available, a majority of nurses will use a 1 mL syringe.

### **Subcutaneous Injection Techniques**

A majority of the nurses participating in the survey understood what techniques are used when administering subcutaneous injections. This is considered fundamental nursing knowledge and is typically taught early in nursing curriculum. All of the nurses cleansed the injection site prior to injection and did not rub the site after administering the injection. Depending on area of practice, nurses administer subcutaneous injections daily and are expected (despite area of practice) to administer subcutaneous injections per protocol; however, three nurses stated that they do aspirate and three separate nurses stated that they do not wash their hands prior to administering LMWH and Heparin. This means 18% (n=6) of the nurses taking the survey do not administer LMWH and Heparin per standard subcutaneous injection protocol.

### **Heparin and LMWH Injection Protocol**

All nurses who participated in the survey administer Heparin and LMWH in the subcutaneous tissue of the abdomen; however, there was discrepancy as whether or not to remove the air bubble found in prefilled syringes. As stated previously, the air bubble is to not be removed as general protocol for Heparin and LMWH. Of the 33 participants, 30% (n=10) remove the air bubble, 67% (n=22) do not remove the air bubble, and one nurse was unsure if they remove the bubble. There was no demographic correlation among participants with similar answers for this question.



## **Researched Techniques**

A majority of nurses are not administering Heparin and LMWH according to previously researched techniques to reduce bruising, pain, induration and hematoma formation at the site of injection; therefore, increasing the likelihood of the occurrence of these adverse reactions.

All participants stated that they do not use any type of cold or hot application to the injection site. A cold application is recommended prior/after the injection to provide an analgesic effect, and a hot application is recommended several hours after the injection to promote healing of bruises. A majority of the nurses stated that they inject the medication over 10 seconds or less, contrary to the recommended 30 second researched technique, and majority of the nurses also stated that they do not apply any sort of pressure compared to the recommendation of applying pressure for a minimum of 30 seconds. Also, a majority of the nurses stated that they remove the needle quickly from the tissue after injection (averaging less than three seconds), compared to the recommended technique of slow removal after five seconds. Lastly, a majority of the nurses use a prefilled syringe at their employer institution, and when asked if prefilled syringes were not used, a majority stated they used a 1 mL syringe. A 3 mL syringe is recommended to reduce blunt trauma to surrounding tissue.

There were no correlations among age, years as a nurse, or degree type that suggested a relationship among answers.

## **Limitations**

The sample size was small and included nurses from one University institution, limiting the generalizability of the study results. Due to limited time available, only 33 nurses participated in the study and their employer institution was not known. Nurses surveyed from a hospital unit

that regularly gives Heparin and LMWH would have been beneficial, but not plausible due to time constraints. A larger sample size that targets nurses who administer Heparin and LMWH at a national level would yield more accurate results.

### **Recommendations for Practice and Education**

In regards to standard administration protocol for subcutaneous injections and subcutaneous Heparin and LMWH, there was apparent discrepancy and possible confusion. It would be beneficial to provide continuing education about standard subcutaneous injections and infection control. Minimally, areas of practice should also provide education about established techniques for subcutaneous anticoagulant medications, including not to remove the air bubble.

In regards to researched techniques, nurses are not administering Heparin and LMWH medications using techniques that are suggested to reduce bruising, pain, induration, and hematoma formation at the injection site. It is important for nurses to be educated about research that enhances evidence based practice. Introduction to techniques that can reduce bruising should be provided to nurses and providers administering subcutaneous anticoagulant therapies since reduction of bruising, induration, and hematoma formation at the site enhances the ability for the site to be used in future injections.

Also, by reducing pain experienced with Heparin and LMWH, nurses can build more trusting relationships with patients, reduce anxiety, and promote a healthy body image in the patient. Techniques that should be included are: injecting the medication over 30 seconds and prolonging the removal of the needle by five seconds, applying a cold pack to the injection site prior and/or post injection for two minutes, application of a heat pack 48-72 hours after injection,

application of pressure at the site for 30 seconds after medication injection and needle removal, and the use of a 3 mL syringe when prefilled syringes are not available.

Finally, because there was no correlation among demographic data and answers, evaluation of course material about Heparin and LMWH injection technique education in schools should be evaluated. Findings thus suggest that because there is no discrepancy among demographic data, current education about these medications are insufficient. As stated previously, student nurses should be minimally taught the standard practice for administering these medications; however, introduction to researched techniques should be incorporated into the curriculum.

### **Recommendations for Future Research**

There is much research that can be conducted to provide evidence to support the best practice for administration of subcutaneous Heparin and LMWH. Further research of the above stated techniques should be completed for validity and for clarity (i.e. how long to apply pressure for). Furthermore, a technique that encompasses all of the techniques stated above should be examined and considered for adoption as the established practice for these medications. Results would indicate whether or not these practices do in fact result in a decrease of injection site adverse reactions associated with Heparin and LMWH.

Research should also be conducted to see why there is confusion about current established protocol for subcutaneous Heparin and LMWH. Results can be used to provide clarity as to why there is confusion and provide a way of means for reducing the confusion. Research should also be conducted about standard subcutaneous injection technique knowledge in nurses. This study indicated that 18% of nurses do not administer Heparin and LMWH as a

standard subcutaneous injection, and further research is warranted to establish why this has occurred.

Lastly, research should be conducted about current educational requirements that include subcutaneous Heparin and LMWH to identify reasoning as to why nurses are not administering this medication according to standard protocol. Results would indicate needed interventions in the educational curriculum that would promote the use of the standard techniques as these techniques are recommended per manufacturer protocol.

## CHAPTER 6: CONCLUSION

Current nursing practice for the administration of subcutaneous anticoagulant medications reflects proper subcutaneous injection technique, but yields some confusion about current Heparin and LMWH protocol. Current protocol includes administering the medication as a standard subcutaneous injection, specifically in the abdomen, and to not remove the air bubble that is found when using a prefilled syringe. Current nursing practice when compared to researched techniques suggested to reduce site adverse reactions does not reflect researched best practice. In fact, very few nurses actually completed any one of the recommended techniques. The suggested techniques included: using a cold application before and/or after the injection to provide an ice analgesic effect, injecting the medication over 30 seconds to cause less tissue trauma, slowly removing the needle over five seconds to reduce medication leaking onto skin surface, application of pressure for a minimum of 30 seconds to create manual vasoconstriction, using a hot application/pack 48-72 hours after the injection to speed up the healing process of the damaged tissue from the injection, and using a 3 mL syringe when prefilled syringes are not provided. Lastly, generally nurses are administering subcutaneous Heparin and LMWH similarly to each other.

Recommendations include providing educational courses, seminars, etc. on standard protocol for the administration of subcutaneous Heparin and LMWH, and introduction of researched techniques suggested to reduce site adverse reactions to current nurses to enhance evidence based practice. Another recommendation includes modification of student nursing curriculum and/or education to include proper administration techniques of these medications

and introduction to the researched techniques so that they may become familiar with it after becoming a practicing nurse.

Research should be conducted on the six different techniques to enhance the techniques' validity in reduction of site adverse reactions. Research should also be conducted to determine why there is confusion about standard subcutaneous injections and standard protocol for the administration of subcutaneous Heparin and LMWH, and to identify why student nurses are not learning the proper techniques for these medications and, consequently, not administering this medication properly once they have become a nurse.

## **APPENDIX A: UCF IRB APPROVAL**



University of Central Florida Institutional Review Board  
Office of Research & Commercialization  
12201 Research Parkway, Suite 501  
Orlando, Florida 32826-3246  
Telephone: 407-823-2901, 407-882-2012 or 407-882-2276  
[www.research.ucf.edu/compliance/irb.html](http://www.research.ucf.edu/compliance/irb.html)

## NOT HUMAN RESEARCH DETERMINATION

From : **UCF Institutional Review Board #1  
FWA00000351, IRB00001138**

To : **Kelly D. Allred and Co-PI: Leah Morissette**

Date : **February 09, 2015**

Dear Researcher:

On 02/09/2015 the IRB determined that the following proposed activity is not human research as defined by DHHS regulations at 45 CFR 46 or FDA regulations at 21 CFR 50/56:

Type of Review: Not Human Research Determination  
Project Title: Injection Techniques of Subcutaneous Anticoagulant Therapies  
Investigator: Kelly D Allred  
IRB ID: SBE-15-10982  
Funding Agency:  
Grant Title:  
Research ID: N/A

University of Central Florida IRB review and approval is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are to be made and there are questions about whether these activities are research involving human subjects, please contact the IRB office to discuss the proposed changes.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Signature applied by Patria Davis on 02/09/2015 09:23:08 AM EST

IRB Coordinator



## **APPENDIX B: EXPLANATION OF RESEARCH**



## EXPLANATION OF RESEARCH

**Title of Project:** Injection Techniques of Subcutaneous Anticoagulant Therapies

**Principal Investigator:** Kelly Allred, PhD, RN-BC, CNE

**Other Investigators:** Co-Investigator- Leah Morissette, Undergraduate Nursing Student

**Faculty Supervisor:** Principal Investigator

You are being invited to take part in a research study. Whether you take part is up to you..

- There is currently no universal technique to administer subcutaneous anticoagulant therapies (i.e Lovenox) that results in the reduction of the possible adverse reactions pain and bruising at the injection site. The purpose of this survey is to identify current techniques being utilized by nurses for the administration of anticoagulant therapies.
- The survey is electronic and can be accessed by following the provided link. Please fill out the demographic data for the first part of the survey. The second part of the survey will require you to answer questions about administering anticoagulant therapy. Please answer as to what **you** do when administering this medication. There are **no correct answers**. Select the best answer possible.
- The questionnaire should take no more than 5 minutes to complete.
- The survey will be available for two weeks, at the end of this time period all participants who provide their email address within the survey will be entered into a drawing to **receive 1 of possible 20 available \$5 Starbucks gift cards**.

You must be 18 years of age or older, a Registered Nurse, have provided direct patient care (i.e. being a floor nurse) within the past five years, and have administered subcutaneous anticoagulant therapies (i.e Lovenox, Low-Molecular Weight Heparin, etc.).

Completion of the survey will imply your consent to participate in this research study.

**Study contact for questions about the study or to report a problem:** If you have questions, concerns, or complaints, contact Dr. Kelly Allred, Faculty Supervisor, College of Nursing at 407-823-0160 or by email at Kelly.Allred@Ucf.edu

**IRB contact about your rights in the study or to report a complaint:** Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). This research has been reviewed and approved by the IRB. For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901.

## APPENDIX C: SURVEY

## Demographics

1. Gender:

- Male
- Female

2. Age in years:

- <35
- 35-50
- >50

3. Years as a nurse:

- 6-12 Months
- 1-2 Years
- 2-10 Years
- >10 years

4. Educational background:

- Diploma
- Associate Degree in Nursing
- Bachelor of Science in Nursing
- Master Degree in Nursing
- Other (Please Specify Below)

## Survey Questions

5. Prior to administration of this medication, do you wash your hands?

- Yes
- No

6. How do you prepare the injection site prior to administering the medication?

- I clean the area with an alcohol swab
- I clean the area with soap and water
- Other
- I do not prepare the site prior to injection

7. Do you apply an ice-pack, cold compress, or cold-pack to the site prior or after injecting the medication?

- Yes, before (please specify type and for how long)
- Yes, after (please specify type and for how long)
- I do not use any type of cold application pre- or post- injection

8. Where do you administer this medication?

- In the subcutaneous tissue of the arm
- In the subcutaneous tissue of the leg
- In the subcutaneous tissue of the abdomen

9. With regards to time, how do you insert the needle into the subcutaneous tissue?

- Quickly (please specify in seconds)
- Slowly (please specify in seconds)
- I inject the needle without regard for time
- Other

10. Do you aspirate?

- Yes
- No

11. Do you remove the air bubble prior to administering the medication when using a pre-filled syringe?

- Yes, I remove the air bubble
- No, I do not remove the air bubble
- I'm not sure

12. For how long do you inject the medication from the syringe into the subcutaneous tissue?

- For 10 seconds or less
- Between 11-29 seconds
- For 30 seconds or longer
- I'm not sure for how long I inject the medication

13. With regards to time, how do you remove the needle from the subcutaneous tissue?

- Quickly (please specify in seconds)
- Slowly (please specify in seconds)
- I remove the needle without regard for time
- Other

14. Do you rub the site after injecting the medication?

- Yes, for less than 30 seconds
- Yes, for 30 seconds or longer
- No

15. Do you apply pressure to the injection site after administering the medication?

- Yes, for less than 10 seconds
- Yes, for 11-29 seconds
- Yes, for 30-59 seconds
- Yes, for 60 seconds or longer
- No, I do not apply pressure

16. Do you apply a dry heat-pack or compress to the injection site after injecting the medication?

- Yes (please specify type and for how long)
- No

17. At your work place, are subcutaneous anticoagulant therapies distributed in a prefilled syringe?

- Yes
- No
- I'm not sure

18. If therapies are not distributed in a prefilled syringe, what syringe size (mL) do you use?

- N/A (Use prefilled syringe)
- 3 mL
- 1 mL
- Other
- I'm not sure

## **APPENDIX D: TABLE COMPARISON OF TECHNIQUES**



<b>Standard Techniques for Administering Subcutaneous Heparin and LMWH</b>	<b>Researched Techniques Suggested to Reduce Site Adverse Reactions</b>
<ul style="list-style-type: none"> <li>• Standard subcutaneous injection protocol</li> <li>• To not remove the air bubble before administration of the medication when using a prefilled syringe</li> <li>• Administer subcutaneously in the abdomen</li> </ul>	<ul style="list-style-type: none"> <li>• Two minute cold pack/compress before and/or after injecting the medication</li> <li>• Injecting the medication over 30 seconds</li> <li>• Slowly removing the needle from the tissue for over 5 seconds</li> <li>• Application of pressure at the injection site after removing the needle from the tissue for a minimum of 30 seconds</li> <li>• Application of a hot pack/compress 48-72 hours after the injection</li> <li>• Use of a 3 mL syringe when prefilled syringes are not available</li> </ul>

## **APPENDIX E: DEMOGRAPHIC DATA**

### 1. Gender:

Selection	Answer	Response	%
1	Male	3	9%
2	Female	30	91%
	Total	33	100%

### 2. Age in years:

Selection	Answer	Response	%
1	18-34	18	55%
2	35-50	10	30%
3	>50	5	15%
	Total	33	100%

### 3. Years as a nurse:

Selection	Answer	Response	%
1	6-12 Months	8	24%
2	1-2 Years	2	6%
3	2-10 Years	14	42%
4	>10 years	9	27%
	Total	33	100%

### 4. Educational background:

Selection	Answer	Response	%
1	Diploma	0	0%
2	Associate Degree in Nursing	0	0%
3	Bachelor of Science in Nursing	22	67%
4	Master Degree in Nursing	10	30%
5	Other (Please Specify Below)	1	3%
	Total	33	100%

Other (Please Specify Below)

PhD

## APPENDIX F: SURVEY DATA

**5. Prior to administration of subcutaneous anticoagulant therapies, do you wash your hands?**

Selection	Answer	Response	%
1	Yes	30	91%
2	No	3	9%
	Total	33	100%

**6. How do you prepare the injection site prior to administering the medication?**

Selection	Answer	Response	%
1	I clean the area with an alcohol swab	32	97%
2	I clean the area with soap and water	0	0%
3	Other	1	3%
4	I do not prepare the site prior to injection	0	0%
	Total	33	100%

Other  
clorohexidine swab

**7. Do you apply an ice-pack, cold compress, or cold-pack to the site prior or after injecting the medication?**

Selection	Answer	Response	%
1	Yes, before (please specify type and for how long)	0	0%
2	Yes, after (please specify type and for how long)	0	0%
3	I do not use any type of cold application pre- or post-injection	33	100%

**8. Where do you administer this medication?**

Selection	Answer	Response	%
1	In the subcutaneous tissue of the arm	0	0%
2	In the subcutaneous tissue of the leg	0	0%
3	In the subcutaneous tissue of the abdomen	33	100%
	Total	33	100%

## 9. With regards to time, how do you insert the needle into the subcutaneous tissue?

Selection	Answer	Response	%
1	Quickly (please specify in seconds)	24	73%
2	Slowly (please specify in seconds)	1	3%
3	I inject the needle without regard for time	8	24%
4	Other	0	0%
	Total	33	100%

Quickly (please specify in seconds)	Slowly (please specify in seconds)
	3 s
15	
1	
.5	
1	
1	
2 seconds	
1	
1	
0.5	
1-3	
1-2 seconds	
1	
3	
1-2	
5	
1	
1	
2	
1	

### 10. Do you aspirate?

Selection	Answer	Response	%
1	Yes	3	9%
2	No	30	91%
	Total	33	100%

### 11. Do you remove the air bubble prior to administering the medication when using a pre-filled syringe?

Selection	Answer	Response	%
1	Yes, I remove the air bubble	10	30%
2	No, I do not remove the air bubble	22	67%
3	I'm not sure	1	3%
	Total	33	100%

### 12. For how long do you inject the medication from the syringe into the subcutaneous tissue?

Selection	Answer	Response	%
1	For 10 seconds or less	26	79%
2	Between 11-29 seconds	3	9%
3	For 30 seconds or longer	1	3%
4	I'm not sure for how long I inject the medication	3	9%
	Total	33	100%



### 13. With regards to time, how do you remove the needle from the subcutaneous tissue?

Selection	Answer	Response	%
1	Quickly (please specify in seconds)	21	64%
2	Slowly (please specify in seconds)	5	15%
3	I remove the needle without regard for time	7	21%
4	Other	0	0%
	Total	33	100%

Quickly (please specify in seconds)	Slowly (please specify in seconds)
	5
15	2
1	3
1	3 s
2	2
2 seconds	
1	
1-3	
2	
1 second	
2 seconds	
2	
1	
2	
1	
1	
2	
1	

**14. Do you rub the site after injecting the medication?**

Selection	Answer	Response	%
1	Yes, for less than 30 seconds	0	0%
2	Yes, for 30 seconds or longer	0	0%
3	No	33	100%
	Total	33	100%

**15. Do you apply pressure to the injection site after administering the medication?**

Selection	Answer	Response	%
1	Yes, for less than 10 seconds	5	15%
2	Yes, for 10-29 seconds	2	6%
3	Yes, for 30-59 seconds	2	6%
4	Yes, for 60 seconds or longer	0	0%
5	No, I do not apply pressure	24	73%
	Total	33	100%

**16. Do you apply a dry heat-pack or compress to the injection site after injecting the medication?**

Selection	Answer	Response	%
1	Yes (please specify type and for how long)	0	0%
2	No	33	100%
	Total	33	100%

**17. At your work place, are subcutaneous anticoagulant therapies distributed in a prefilled syringe?**

Selection	Answer		Response	%
1	Yes		30	91%
2	No		3	9%
3	I'm not sure		0	0%
	Total		33	100%

**18. If therapies are not distributed in a prefilled syringe, what syringe size (mL) do you use?**

Selection	Answer		Response	%
1	N/A (Use prefilled syringe)		22	67%
2	3 mL		3	9%
3	1 mL		7	21%
4	Other		0	0%
5	I'm not sure what syringe size I use		1	3%
	Total		33	100%

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