Received: 2 June 2019 | Revised: 27 November 2019 | Accepted: 4 December 2019

DOI: 10.1111/jjns.12325

JAPAN JOURNAL OF NURSING SCIENCE WILEY

ORIGINAL ARTICLE

The effect of duration of pressure on bruising and pain in the subcutaneous heparin injection site

Dilek Yılmaz[1] | **Fatma Düzgün**[2] | **Havva Durmaz**[2] | **Hava Gökdere Çinar**[1] | **Yurdanur Dikmen**[3] | **Habibe Kara**[2]

[1]Department of Nursing, Bursa Uludağ University Faculty of Health Sciences, Bursa, Turkey

[2]Bursa Uludağ University Hospital, Bursa, Turkey

[3]Department of Nursing, Sakarya University Faculty of Health Sciences, Sakarya, Turkey

Correspondence
Dilek Yılmaz, Department of Nursing, Bursa Uludağ University Faculty of Health Sciences, 16059 Nilüfer/Bursa, Turkey.
Email: dilekk@uludag.edu.tr

Ethics committee approval number: 2017-13/24.

Funding information
The author(s) received no financial support for the paper, authorship, and/or publication of this article.

Abstract

Aim: The aim of this study was to determine the effect on pain and bruising of pressure applied for different durations after subcutaneous heparin injection.

Methods: This research was a quasi-experimental study. The research was performed with 60 patients. Two different injection techniques were applied at an interval of 24 hr to each patient taking part in the study. Method A: after the low molecular weight heparin (LMWH) injection, pressure was applied with dry cotton for 10 s directly after the needle was withdrawn. Method B: after the LMWH injection, pressure was applied with dry cotton for 60 s directly after the needle was withdrawn. After the injection process was completed, the dimension of the bruising formed were evaluated. Also, after the injection process was completed, the patients were asked to show on a visual analog scale the severity of pain felt during the injection. Statistical analysis of the research data was performed with the statistics package IBM SPSS 22.0. The Wilcoxon signed rank test and the Mann–Whitney *U* test were used in the analysis of the data.

Results: The results of the statistical analysis showed no statistically significant difference between the mean size of bruising and pain level according to the duration of pressure applied to the injection area ($p > .05$).

Conclusions: It was concluded in this study that the duration of pressure applied to the injection site after subcutaneous LMWH injection did not affect the size of bruising or the severity of pain, and, unlike in the literature, that 60 s of applied pressure did not have a positive effect. Also, it was found that gender had an effect on the formation of bruising and the severity of pain, and body mass index had an effect on pain severity. Ten seconds of pressure applied to the injection site after subcutaneous LMWH injection may be enough to reduce complications.

KEYWORDS

bruising, duration of pressure, pain, subcutaneous heparin injection

1 | INTRODUCTION

Subcutaneous injections are an important part of drug administration, and are a frequently performed nursing duty in clinical practice (Babaieasl, Yarandi, Moosazadeh, & Kheradmand, 2018). Protecting patients from avoidable side effects by using correct injection technique is one of the basic responsibilities of nurses (Avşar & Kaşikçi, 2013; Çit & Şenturan, 2018).

Bruising, hematoma, and pain are reported as frequently occurring local side effects at the injection site following subcutaneous injections (Akbari, Janani, Mohammady, & Nedjat, 2014; Pourghaznein, Azimi, & Jafarabadi, 2014; Şendir, Büyükyılmaz, Çelik, & Taşköprü, 2015; Zaybak & Khorshid, 2008). Various factors cause the bruising, hematoma and pain which may develop at the injection site after subcutaneous injections (Avşar & Kaşikçi, 2013). These factors mainly derive from injection technique, and many studies have been conducted with the aim of preventing complications developing in connection with injection technique. Various techniques have been recommended in these studies such as giving preference to the abdominal region (Avşar & Kaşikçi, 2013; Ciftci & Avsar, 2016; Heise et al., 2014; Pourghaznein et al., 2014; Yılmaz et al., 2016) administering the drug over 30 s (Akpınar & Çelebioğlu, 2008; Palese, Aidone, Dante, & Pea, 2013; Zaybak & Khorshid, 2008), using the aspiration technique (Avşar & Kaşikçi, 2013), applying the air lock technique (Avşar & Kaşikçi, 2013; Babaieasl et al., 2018), and applying ice to the injection site (Avşar & Kaşikçi, 2013; El-Deen & Youssef, 2018; Kilic & Midilli, 2017; Şendir et al., 2015).

When there is a risk of thromboembolism or when a thromboembolic event occurs in the clinic, low molecular weight heparin (LMWH), a derivative of heparin which is frequently used for treatment and prevention (Amaniyan, Varaei, Vaismoradi, Haghani, & Sieloff, 2016; Yi et al., 2016) can be used (Yi et al., 2016). When LMWH injections are performed, bruising may frequently be seen as a result of the leakage of blood from the vessels to the tissues under the skin (Akpınar, 2013). Pain resulting from subcutaneous LMWH injection occurs because of the presence of pain receptors in the subcutaneous tissue, and when LMWH solution is administered to the tissue, the resulting damage to the tissue causes pain (Kuzu & Uçar, 2001). These side effects which occur in connection with subcutaneous LMWH injections have both a physical and a psychological negative effect on the patient, limiting the choice of injection sites (Şendir et al., 2015; Zaybak & Khorshid, 2008). This also has a negative effect on adherence to treatment and lowers the quality of life (Annersten, 2005).

It is reported in the literature that the application of pressure without massage at the injection site after subcutaneous LMWH injection prevents the leakage of blood from the injection site and reduces complications occurring in connection with the injection (Çit & Şenturan, 2018; Dursun & Akpınar, 2014; Zaybak, 2008). However, there is no definite information as to how long pressure should be applied. In Turkey, Zaybak (2008) conducted a study to determine the effect of pressure applied after subcutaneous heparin injection on the formation of bruising in the injection area. Ten seconds of pressure was applied after the drug was injected to the right abdominal area of the patient, and 60 s was applied after injection to the left abdominal area. It was concluded that pressure applied for 60 s after the injection resulted in bruising of average size 26.1 ± 54.4 mm^2, while pressure applied for 10 s after the injection produced bruising of average size 46.1 ± 133.5 mm^2. It was established as a result of the research that the duration of pressure applied following heparin injection had no effect on the formation of bruising at the injection site; the variables of age, gender and thickness of subcutaneous tissue also had no effect on the development of bruising, but the volume of the drug administered affected the formation of bruising. Recently, it was reported in a similar study by Çit and Şenturan (2018) that pressure applied for 60 s following subcutaneous heparin injection was effective in reducing bruising. Aside from these studies, no similar published studies were found, and it was seen that these studies did not deal with pain variables.

Observing the administration of LMWH in the clinical field, it can be said that nurses only apply pressure for a few seconds after administering heparin in order to reduce bruising and pain. However, there is no agreement on the length of time needed for this pressure to be applied. Therefore, it was felt to be necessary to conduct this study, and the numbers of studies on the topic are very limited. It is thought that the results of the study will contribute to safe subcutaneous injection by nurses by reducing or preventing side effects arising from the administration of subcutaneous LMWH injections. The purpose of this study was to determine the effect of the application of pressure for different periods of time following subcutaneous LMWH injection on bruising and pain at the injection site.

Accordingly, the research hypotheses are as follows:

H_0 = pressure applied for 10 and 60 s to the injection point after LMWH injection has no effect on bruising and pain at the injection site.

H_1 = pressure applied for 10 s to the injection point after LMWH injection has an effect on bruising and pain at the injection site.

H_2 = pressure applied for 60 s to the injection point after LMWH injection has an effect on bruising and pain at the injection site.

1.1 | Research question

The research question was as follows. Does pressure applied for different periods of time to the injection point after subcutaneous LMWH injection affect pain and the formation of bruising?

2 | METHODS

2.1 | Purpose

The purpose of this study was to determine the effect of the application of pressure for different periods of time following subcutaneous LMWH injection on bruising and pain at the injection site.

2.2 | Design

This research was a quasi-experimental study.

2.3 | Setting and participants

The study was conducted between August 2017 and December 2018 at the chest diseases clinic affiliated to a university hospital in Turkey.

The research was performed with 60 patients who were over the age of 18 years, who had been prescribed 0.6 mL subcutaneous LMWH by means of a ready-to-use syringe, who had been diagnosed with pulmonary embolism, who had no known coagulation disorder, no scar tissue, incision, lipodystrophy or symptoms of infection in the skin of the abdomen where the injection was given and no disease which would affect the perception of pain, who were conscious and had no problems in communication, and who agreed to voluntary participation in the study. In the selection of the research sample, patients were included in the study group by the use of the simple random sampling method of probability sampling. The size of the research sample was determined statistically by power analysis using the program PASS 13.0 (PASS, Kaysville, UT, USA). A sample size of 60 was determined for .80 power and .05 type I error. Four patients for whom the first injection administration was unsuccessful were excluded from the study. Figure 1 shows the research flow chart according to the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND).

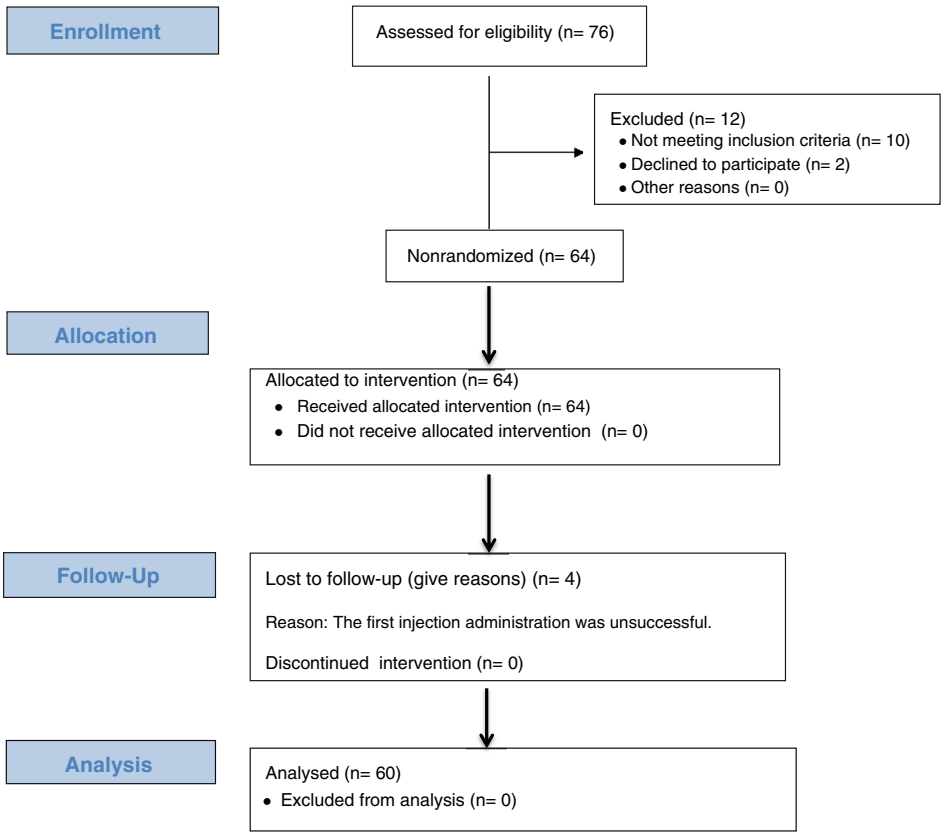

FIGURE 1 Flow chart of the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) shows the number of the participants through each stage of the study

2.4 | Instruments

A Patient Description Form and a visual analog scale (VAS) were used to collect research data.

2.4.1 | Patient description form

This form, prepared by the researchers to determine the patients' socio-demographic characteristics, collected information on patients' age, gender, height, weight and body mass index (BMI). BMI was classified according to the World Health Organization (WHO) classification: below 18.50 kg/m^2 was classified as underweight, 18.5–24.99 kg/m^2 as normal weight, 25–29.99 kg/m^2 as overweight, and 30 kg/m^2 or more as obese (WHO, 2019).

2.4.2 | VAS

In evaluating the severity of pain felt by patients during the injection, a 10 cm VAS was used. One end represented no pain, and the other end the most severe pain possible (Kahl & Cleland, 2005).

2.5 | Ethical considerations

The necessary legal permission to conduct the research was obtained from the Local Ethics Committee (Decision No 2017-13/24). In addition, the patients who were to participate in the research were given information concerning the study, after which their agreement to participate voluntarily was obtained orally and in writing.

2.6 | Data collection

First of all, patients who fitted the research criteria were determined by checking patient files in the nursing records of the chest diseases ward where the research was conducted. Patients who fitted the research criteria were generally in single-bed rooms. Information concerning the aim of the research was given to these patients by the researchers, who visited them in their rooms. In order for the patients not to feel that participation in the research was compulsory, attention was paid to the nurses who gave the explanations not being nurses working in that clinic.

After obtaining the patients' voluntary consent to participate in the research, their descriptive characteristics were recorded on the Patient Description Form. After that, the patients were instructed on the use of the VAS. The same registered nurse who had 10 years clinical experience applied all subcutaneous LMWH injections.

All injections were administered once a day at 12:00 hours. It is reported in the literature that subcutaneous injections should preferentially be administered in the abdominal region (Avşar & Kaşikçi, 2013; Heise et al., 2014; Pourghaznein et al., 2014), and injections were given on the left or the right side of the lower abdominal area outside a 5 cm^2 area around the navel. The left or right side of the lower abdominal area of each patient was randomized for one of the two injection methods. After the first injection was given, the left or right lower abdominal area was marked. The other injection was administered to the unmarked right or left lower abdominal area. Table 1 shows the standard subcutaneous LMWH injection administration protocol, which was applied to all patients.

Two different injection techniques were applied at an interval of 24 hr to each patient taking part in the study.

Method A: after the LMWH injection, pressure was applied with dry cotton for 10 s directly after the needle was withdrawn.

Method B: after the LMWH injection, pressure was applied with dry cotton for 60 s directly after the needle was withdrawn.

After the injection process was completed, the patients were asked by another researcher who did not know which injection method had been used to show on the VAS the severity of pain felt during the injection. The numerical value equivalent to the point which the patient indicated on the VAS was recorded on the data form.

After the injection procedure was completed, a circle of approximately 5 cm diameter was drawn around the needle insertion point. The patient was told not to scratch or rub this area, and no further injections were given in this area

TABLE 1 Subcutaneous low molecular weight heparin injection administration protocol

Injection area	Lower abdomen outside a 5 cm^2 area around the navel
Heparin volume	0.6 mL
Needle size	27 gage
Syringe type	Prefilled single dose
Wipe	Area cleansed with alcohol and allowed to air-dry before needle insertion
Air lock	0.2 mL air lock inserted
Insertion angle	90°
Aspiration procedure	Not performed
Duration of drug administration	10 s

until bruising evaluation had been performed. Evaluation of the areas of bruising was carried out by a clinical nurse who was blinded to the injection method applied.

It has been reported that bruising developing as a result of subcutaneous heparin injection is at its clearest 48 hr after the administration of the injection (de Campos, da Silva, Beck, Secoli, & de Melo Lima, 2013; Yi et al., 2016; Zaybak, 2008), and therefore bruising measurements in this study were performed 48 hr after the injection procedure. If bruising had occurred, a transparent measurement instrument was placed over the bruising, the bruising was delineated with an acetate pen, and the size of the bruising was recorded in mm^2.

2.7 | Data analysis

Statistical analysis of the research data was performed with the statistics package IBM SPSS 22.0 (IBM, Armonk, NY, USA). Numerical data was examined by the Shapiro–Wilk test for whether it showed normal distribution. Distributions of descriptive information on patients obtained as a result of the study were given as means and *SD*s. Because the research data did not show normal distribution, the non-parametric Wilcoxon signed rank test was used in dependent groups and the Mann–Whitney *U* test was used for two independent variables. The level of statistical significance was determined as $p < .05$.

3 | RESULTS

Table 2 shows the characteristics of the patients who took part in the study. It is seen that 53.3% of the patients were male, their mean age was 65.26 ± 13.63 years, and their mean BMI was 25.29 ± 4.19 kg/m^2. Examining mean BMI by gender, it was found that the BMI of females was 25.46 ± 0.79 kg/m^2, and that of males was 25.15 ± 0.75 kg/m^2.

The proportion of bruise formation was found to be 23.3% in patients with pressure applied for 60 s to the injection site, and 38.3% in patients with pressure applied for 10 s. The size of the bruising and the levels of pain following the injection are shown in Table 3. This shows that after 10 s of pressure, mean bruise size was 20.00 ± 47.72 mm^2, and mean pain level was 7.75 ± 15.79 mm, while after 60 s of pressure, mean bruise size was 13.01 ± 47.98 mm^2, and mean pain level was 9.75 ± 16.37 mm. The results of the statistical analysis showed no significant difference between the mean size of bruising and pain level according to the duration of pressure applied to the injection area ($p > .05$, Table 3). Hypothesis H_0 was accepted, and hypotheses H_1 and H_2 were rejected.

Table 4 shows mean bruising size and pain level according to patients' gender and BMI. In the result of the statistical analysis, it was found that the size of bruising and pain level means of female patients after 10 s of pressure applied to the injection site were statistically higher than those of male patients ($p = .023$). Also, while as expected the mean level of pain occurring after a 10-s application of pressure in overweight or obese patients was higher than in underweight or normal weight patients ($p = .041$), no difference was found between mean bruising sizes ($p > .05$, Table 4).

TABLE 2 Findings concerning patients' descriptive characteristics

Variables	Method A and Method B n	Method A and Method B %
Gender		
Female	28	46.7
Male	32	53.3
Total	60	100.0
Mean age (years)	65.26 ± 13.63	
Mean body mass index (kg/m^2)	25.29 ± 4.19	

4 | DISCUSSION

The subcutaneous administration of LMWH increases the responsibilities of nurses because of the complications. Wrong or incomplete administration of an injection causes pain or the appearance of unsightly bruises. It has been reported that the application of pressure to the injection site after the injection has been beneficial in reducing complications which may develop in connection with subcutaneous LMWH injections (Çit & Şenturan, 2018; Dursun & Akpınar, 2014; Zaybak, 2008; Zaybak & Khorshid, 2008). However, observing the administration of LMWH in the clinical field, it is seen that there is no

TABLE 3 Comparison of bruising size and pain levels of patients by pressure duration ($N = 60$)

	Method A	Method B	Statistical value
Bruising size (mm^2)	20.00 ± 47.72	13.01 ± 47.98	Z = −1.780, $p = .075$
Visual Analog Scale (mm)	7.75 ± 15.79	9.75 ± 16.37	Z = −1.393, $p = .164$

Note: Z, Wilcoxon signed range test.

TABLE 4 Comparison of mean bruising sizes and pain levels by patients' gender and BMI (n = 60)

	Bruising size		Pain severity	
	Method A	**Method B**	**Method A**	**Method B**
Gender				
Female	27.85 ± 58.14	21.42 ± 67.97	12.28 ± 21.33	12.91 ± 17.21
Male	13.12 ± 35.87	5.65 ± 15.42	3.21 ± 5.75	7.53 ± 15.52
	Z = −2.275	Z = −1.648	Z = −2.123	Z = −1.854
	p = .023*	p = .099	p = .034*	p = .064
BMI				
Underweight / normal	13.63 ± 34.26	4.87 ± 11.47	4.81 ± 9.60	8.39 ± 14.41
Overweight / obese	27.77 ± 60.08	22.96 ± 69.82	11.33 ± 20.70	11.40 ± 18.63
	Z = −1.309	Z = −1.017	Z = −2.045	Z = −1.192
	p = .191	p = .309	p = .041*	p = .233

Note: Z, Mann–Whitney *U* test.
Abbreviations: BMI, body mass index.
*$p < .05$.

clear information on the length of time pressure should be applied to the injection site. Thus, in the results of this study, no significant difference was seen in patients between mean bruising size and pain levels according to the length of time pressure was applied to the injection site. In a study relating to this topic, Zaybak (2008) conducted a similar study with 38 adult patients admitted to a neurology department in order to determine the effect of pressure applied after subcutaneous heparin injection on bruising in the area where the injection was given. Each patient formed part of both the experimental and the control group: after the injection, 10 s of pressure was applied to the right abdominal area (the control group) and 60 s of pressure was applied to the left abdominal area (the experimental group). No significant difference was found between the experimental and control groups in terms of the formation of bruising according to the pressure technique. The results of this study are similar to those of our study. However, Çit and Şenturan (2018) reported that 60 s of pressure applied after subcutaneous heparin injections was effective in reducing bruising. The results of this study are not similar to those of our study. This difference between results is thought to derive from differences in injection technique and dose, such that in the Çit and Şenturan (2018) study, 3–4 s of pressure was applied to the injection site in the control group rather than 10 s, the drug was given over a period of 20 s, and the heparin dose was 0.4 mL.

In a study by Dursun and Akpınar (2014), it was concluded that in order to reduce bruising developing after subcutaneous heparin injection, it was unnecessary to apply topical agents (adrenaline, vitamin K and aluminum potassium sulfate) to the area, and that only 10 s of support of the injection area with dry cotton was sufficient. It is reported in the literature that the application of pressure to the injection site following subcutaneous heparin injection prevents leakage of blood from the injection site and reduces the development of bruising (Çit & Şenturan, 2018; Zaybak, 2008; Zaybak & Khorshid, 2008). In our study also, we reached the opinion that the application of 60 s of pressure to the injection area after subcutaneous heparin injections did not have a significant effect on complications of pain and bruising, and that the application of 10 s of pressure would be sufficient to reduce complications, particularly pain.

It was found that the mean size of bruising and intensity of pain when pressure was applied to the injection site for 10 s was significantly greater for female patients included in the study than it was for males. It has been reported that the administration of subcutaneous heparin injections carries a higher risk of the development of bruising in connection with the injection in women over the age of 60 than in men (Yılmaz et al., 2016; Zaybak, 2008; Zaybak & Khorshid, 2005). It has also been reported in the literature that the severity of pain perceived by female patients is greater than in males (Kara & Güneş, 2016; Tuğrul & Khorshid, 2014). The findings of our study are similar to the results of that study. On the other hand, various studies have reported that gender does not affect the size of bruising (Çit & Şenturan, 2018; Pourghaznein et al., 2014; Yılmaz et al., 2016) or the severity of pain (Yılmaz et al., 2016; Zaybak & Khorshid, 2008) developing after subcutaneous heparin injections. It is thought that the difference between the results of these studies and ours arises from differences between injection technique and the region where the injection was given. The mean BMI of the female patients in our study (25.46 ± 0.79 kg/m^2) was not significantly different from that of the males (25.15

$\pm$ 0.75 kg/m^2). Therefore, it is thought that the reason why the size of bruising and the intensity of pain was greater in the female participants than in the males cannot arise from the variable of BMI. It was thought that the reason for the difference by gender in the severity of the mean size of bruising and severity of pain may be affected by individual variables such as differences in the thickness of subcutaneous tissue or in pain thresholds in male and female patients.

It was seen in the results of the study that mean pain severity occurring in overweight or obese patients after pressure applied for 10 s was significantly greater than in underweight or normal weight patients, but that there was no difference between their mean size of bruising. It is reported in other studies that BMI did not affect pain intensity (Pourghaznein et al., 2014; Zaybak & Khorshid, 2005). Also, it has been found that BMI (Çit & Şenturan, 2018; Pourghaznein et al., 2014) and subcutaneous tissue thickness (Zaybak, 2008; Zaybak & Khorshid, 2005) did not affect the development of bruising in patients. It is seen that the results of the present study bear similarity to these studies.

5 | CONCLUSION

It was concluded in this study that the duration of pressure applied to the injection site after subcutaneous LMWH injection did not affect the size of bruising or the severity of pain, and, unlike the literature, that 60 s of applied pressure did not have a positive effect and that 10 s might be sufficient. In addition, it was determined that gender affected bruising and pain severity, while BMI affected pain severity. It may be recommended that this research be repeated with different volumes of subcutaneous LMWH.

5.1 | Relevance to clinical practice

LMWH given subcutaneously is an uncomfortable procedure for patients, which frequently leads to complications such as bruising and pain. Ten seconds of pressure applied to the injection site after a subcutaneous LMWH injection can be sufficient to reduce complications, particularly pain, which patients may experience. Therefore, this result may be of benefit as a technique which is simple, free of cost and easy to apply for health professionals, especially nurses working in the clinical field and nursing students.

5.2 | Limitations

This study has a number of limitations. An important limitation is that a dose of 0.6 mL was used in the subcutaneous LMWH injections, so that the results cannot be generalized for different doses.

CONFLICT OF INTEREST

The authors declare they have no conflict of interest.

AUTHORS' CONTRIBUTIONS

D.Y., F.D., H.D., Y.D. designed the study, analyzed the data, and drafted the manuscript; H.D. and H.G.Ç. conducted the data collection and drafted the manuscript; D.Y., F.D., H.D. and H.K. conducted the study and data collection. All the authors read and approved the final manuscript.

ORCID

Dilek Yılmaz https://orcid.org/0000-0001-7269-8493

REFERENCES

Akbari, S. A., Janani, L., Mohammady, M., & Nedjat, S. (2014). Slow versus fast subcutaneous heparin injections for prevention of bruising and site-pain intensity. *Cochrane Database Systematic Review*, *18*, CD008077.

Akpınar, R. B. (2013). The effect of local dry heat pack application on recovering the bruising associated with the subcutaneous injection of heparin. *Journal of Clinical Nursing*, *22*, 2531–2535.

Akpınar, R. B., & Çelebioğlu, A. (2008). Effect of injection duration on bruising associated with subcutaneous heparin: A quasi-experimental within-subject design. *International Journal of Nursing Studies*, *45*, 812–817.

Amaniyan, S., Varaei, S., Vaismoradi, M., Haghani, H., & Sieloff, C. (2016). Effect of local cold and hot pack on the bruising of enoxaparin sodium injection site: A randomized controlled trial. *Contemporary Nurse*, *52*, 30–41.

Annersten, M. (2005). Performing subcutaneous injections: A literature review. *Worldviews on Evidense-Based Nursing*, *2*, 122–130.

Avşar, G., & Kaşikçi, M. (2013). Assessment of four different methods in subcutaneous heparin applications with regard to causing bruise and pain. *International Journal of Nursing Practice*, *19*, 402–408.

Babaieasl, F., Yarandi, H., Moosazadeh, M., & Kheradmand, M. (2018). Low-molecular weight heparin and complications of subcutaneous injection: How important is injection site selection? *Medsurg Nursing*, *27*, 191–201.

Ciftci, B., & Avsar, G. (2016). Assessment of three sites in terms of bruising in subcutaneous heparin administration. *International Journal of Caring Sciences*, *10*, 285–293.

Çit, N., & Şenturan, L. (2018). Pressure application to prevent bruising in subcutaneous heparin injection. *International Journal of Health Sciences and Research*, *8*, 159–165.

de Campos, J. D. F., da Silva, J. B., Beck, A. R. M., Secoli, S. R., & de Melo Lima, M. H. (2013). Subcutaneous administration technique of low-molecular weight heparins: An integrative review. *Clinical Nursing Studies*, *1*, 36–44.

Dursun, M., & Akpınar, R. B. (2014). The effect of topical applications performed after subcutaneous heparin injection on development of bruise and hematoma. *The Medical Bulletin of Şişli Etfal Hospital*, *48*, 296–302 (in Turkish).

El-Deen, D. S., & Youssef, N. F. A. (2018). The effect of cryotherapy application before versus after subcutaneous anticoagulant injection on pain intensity and hematoma formation: A quasi-experimental design. *International Journal of Nursing Sciences*, *5*, 223–229.

Heise, T., Nosek, L., Dellweg, S., Zijlstra, E., Praestmark, K. A., Kildegaard, J., … Sparre, T. (2014). Impact of injection speed and volume on perceived pain during subcutaneous injections into the abdomen and thigh: A single-Centre, randomized controlled trial. *Diabetes, Obesity and Metabolism*, *16*, 971–976.

Kahl, C., & Cleland, J. A. (2005). Visual analogue scale, numeric pain rating scale and the McGill pain questionnaire: An overview of psychometric properties. *Physical Therapy Reviews*, *10*, 123–128.

Kara, D., & Güneş, U. Y. (2016). The effect on pain of three different methods of intramuscular injection: A randomized controlled trial. *International Journal of Nursing Practice*, *22*, 152–159.

Kilic, E. K., & Midilli, T. S. (2017). Effects of cold application on pain and bruising complications associated with subcutaneous heparin in intensive care patients. *International Journal of Health Sciences and Research*, *7*, 173–183.

Kuzu, N., & Uçar, 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.

Şendir, M., Büyükyılmaz, F., Çelik, Z., & Taşköprü, İ. (2015). Comparison of 3 methods to prevent pain and bruising after subcutaneous heparin administration. *Clinical Nurse Specialist*, *29*, 174–180.

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*, *28*, 473–482.

Pourghaznein, T., Azimi, A. V., & Jafarabadi, M. A. (2014). The effect of injection duration and injection site on pain and bruising of subcutaneous injection of heparin. *Journal of Clinical Nursing*, *23*, 1105–1113.

Tuğrul, E., & Khorshid, L. (2014). Effect on pain intensity of injection sites and speed of injection associated with intramuscular penicillin. *International Journal of Nursing Practice*, *20*, 468–474.

WHO, Mean Body Mass Index (BMI). Retrieved from https://www.who.int/gho/ncd/risk_factors/bmi_text/en/. 2019.

Yılmaz, D. U., Korhan, E. A., Yönt, G. H., Dikmen, Y., Düzgün, G., & Erem, A. (2016). Effect of subcutaneous injection applied to two different areas on formation of pain and ecchymoses. *İzmir Katip Çelebi University Faculty of Health Science Journal*, *1*, 15–20 (in Turkish).

Yi, L., Shuai, T., Tian, X., Zeng, Z., Ma, L., & Song, G. (2016). The effect of subcutaneous injection duration on patients receiving low-molecular-weight heparin: Evidence from a systematic review. *International Journal of Nursing Sciences*, *3*, 79–88.

Zaybak, A. (2008). The effect of pressure applied after subcutaneous heparin injection on the formation of bruising. *Journal of Cumhuriyet University School of Nursing*, *12*, 1–8 (in Turkish).

Zaybak, A., & Khorshid, L. (2005). The examination of the effect of injection duration on ecchymosis, hematoma and pain associated wıth subcutaneous heparin. *Journal of Ege Medical*, *44*, 95–99 (in Turkish).

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*, 378–385.

How to cite this article: Yılmaz D, Düzgün F, Durmaz H, Çinar HG, Dikmen Y, Kara H. The effect of duration of pressure on bruising and pain in the subcutaneous heparin injection site. *Jpn J Nurs Sci*. 2020;17:e12325. https://doi.org/10.1111/jjns.12325