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ORIGINAL ARTICLE

The Effect of Different Lying Positions on Regional Pain and Comfort Levels in Intramuscular Drug Administration

İntramusküler İlaç Uygulamasında Farklı Yatış Pozisyonlarının Bölgesel Ağrı ve Konfor Düzeyi Üzerine Etkisi

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Abstract

Objective: This study was planned to evaluate the effect of different lying positions (prone and lateral) on regional pain and comfort level in intramuscular (IM) drug administration.

Method: This is a single-group, quasi-experimental study in the emergency department in İstanbul, Turkey in which 100 adults (200 injections). The first IM injection was performed according to the patient's preference of lying position (lateral or prone). For the second injection, the patient was rotated to the remaining position. After the IM injections, the patients' pain, and comfort levels were assessed by self-report. This study was created in accordance with TREND Statement Checklist.

Results: According to verbal reports by the patients, the mean pain intensity level was 4.12±1.67 and the mean comfort level was 6.09±1.86 after IM injections in the prone position. For the lateral position, the mean pain intensity level was 5.22±1.91, and the mean comfort level was 4.80±2.00.

Conclusion: Since it provides the least pain intensity and the highest comfort, the "prone lying position" appears to be the safest and most comfortable patient position during an IM injection.

Keywords: Drug administration, intramuscular injection, pain, comfort

Öz

Amaç: Bu çalışma intramusküler (IM) ilaç uygulamasında farklı yatış pozisyonlarının (prone ve lateral) bölgesel ağrı ve konfor düzeyine etkisini değerlendirmek amacıyla planlandı.

Yöntem: Araştırma, İstanbul, Türkiye'de acil serviste 100 erişkin (200 enjeksiyon) ile tek gruplu, yarı deneysel tasarım türünde gerçekleştirildi. İlk IM enjeksiyon hastanın tercihine göre (lateral veya prone) yapıldı. İkinci enjeksiyon ise, diğer pozsiyona uygulandı. IM enjeksiyonlardan hemen sonra hastaların ağrı ve konfor düzeyleri kendi bildirimleri ile değerlendirildi. Bu çalışma TREND Bildirimi Kontrol Listesi'ne uygun olarak oluşturuldu.

Bulgular: Prone pozisyonda yapılan IM enjeksiyonlardan sonra hastaların sözlü ifadelerine göre ortalama ağrı şiddet düzeyi 4,12±1,67 ve ortalama konfor düzeyi 6,09±1,86 olarak saptandı. Lateral pozisyon için ise, ağrı şiddeti düzeyi 5,22±1,91, ortalama konfor düzeyi 4,80±2,00 olarak belirlendi.

Sonuç: Elde edilen sonuçlara göre, IM enjeksiyon sırasında en az ağrı şiddeti ve en yüksek konforu sağladığı için, "prone yatış pozisyonu" en güvenli ve en rahat hasta pozisyonu olarak değerlendirilmektedir.

Anahtar Kelimeler: İlaç uygulaması, intramusküler enjeksiyon, ağrı, konfor

*This study was presented as master science thesis of Fundamentals of Nursing Department in İstanbul University-Cerrahpaşa Institue of Graduate Studies.

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Introduction

Intramuscular (IM) injection is the administration of large amounts of drugs into the deep muscle layer. Since muscle tissue contains a large amount of blood vessels, drug absorption is rapid here. The systemic effect begins within 20-30 mins. In the IM drug administration, the determination of the injection site is crucial. IM injection is often performed into the ventrogluteal (VG), dorsogluteal (DG), vastus lateralis, and deltoid muscles (1,2).

Apart from practices to reduce pain and increase comfort during IM injection or the individual characteristics of patients, many other factors also affect pain intensity and comfort levels. These include the patient preparation before the procedure, the suitability of the chosen site, the structure of the drug, the speed of drug administration, the position, and the fear of injection. Accurately identifying the injection site is essential for a safe IM injection (1,2). Coskun et al. (3) conducted on cadavers and found that, despite the large muscle tissue at the DG site, it contains large blood vessels and nerves and the subcutaneous tissue thickness is greater than the VG site. The authors recommended that the VG site should be the primary choice for IM injections (3). Similarly, Kara and Yapucu Güneş (4) reported that the DG site was risky, hence using the VG site was advantageous, and it should be the priority for IM administrations. Kaya et al. (5) investigated the reliability of the G and V methods for determining the injection site in the VG region. For both injection sites identified by the G and V methods, the gluteus medius muscle was located under the sites, but the subcutaneous tissue thickness was lower in the G method, with larger involvement of the gluteus minimus muscle. Therefore, the authors highlighted that drug injection risks were lower for the subcutaneous tissue compared to the V methods. They also suggested that the patient's sex and body mass index (BMI) should be considered when managing IM injections into the VG region (5). Similarly, Elgellaie et al. (6) examined the effect of muscle and subcutaneous tissue thickness on IM injection sites and reported that, despite the larger gluteus medius muscle at the DG site, the VG site was more reliable for the drug to reach the muscle tissue, particularly in overweight patients, due to the greater subcutaneous tissue thickness. Considering the muscle thickness at both sites identified by the G and V methods, the authors recommended the G method to determine the VG site for a successful IM injection (6). Moreover, Larkin et al. (7) showed that sex, BMI, and body shape directly affected the injection into the DG and VG regions, where the subcutaneous tissue was thicker in women, obese patients, and those with the endomorph body type. Apaydın and Öztürk (8) reported lower levels of pain, bleeding, and hematoma at the VG site compared to the DG site. Öçal (9) highlighted that no hematoma developed at the VG site, with lower pain and bleeding levels than the DG site. Kemaloğlu (10) observed more severe pain and bleeding in injections into the DG region compared to the VG region, with more frequent hematoma and ecchymosis.

If the needle tip is not of sufficient length for an IM injection, the drug can be injected into the subcutaneous tissue with more nerves, causing more pain (11). Masuda et al. (12) compared the distance from the epidermis to the under-fascia and the distance from the epidermis to the iliac bone at the DG and VG sites. There was no significant difference in terms of the distance from the epidermis to the under-fascia, however, the distance from the epidermis to the iliac bone was shorter at the VG site in both the right and left gluteal regions. Hence, the authors emphasized the importance of the patient's body shape, the subcutaneous tissue thickness, the foreseen injection sites, the angle-depth of the injection, and the patient's position for injections into the VG region (12). Dadaci et al. (13) demonstrated that using short needle tips and the posterior gluteal site for the IM administration of non-steroidal anti-inflammatory drugs caused Nicolau syndrome (local ischemic necrosis of the cutaneous and deep subcutaneous tissues at the injection site). To prevent this, the authors recommended using a long needle tip, the anterior gluteal site, and shifting the adipose tissue by the Z technique (13). Similarly, Shehata (14) recommended the Helfer Skin Tap and Z techniques for reducing pain during IM injections.

IM injections involve serious risks like administering the drug into the vein by accident, causing nerve damage, post-injection pain, ecchymosis, and swelling. To reduce such risks and undesirable effects, the literature highlights appropriate identification of the injection site and the needle size based on the amount of drug. Furthermore, research shows lower regional pain intensity after administration into the VG region compared to the DG region (10). Besides, numerous studies have found that using the Z technique, using a long needle tip, applying pressure on acupressure points, applying manual pressure before/after the injection, applying cold-vibration (Buzzy), using the 0.5 mL airlock method, and performing the injection for at least 10 seconds are some effective methods for reducing undesirable effects in injections at the VG site (15-20). Another consideration to reduce injection-related fear and position-related muscle tension in VG injections is using different lying positions (21,22).

Main Points

- In the literature, there is sufficient information about safe drug administration via intramuscular (IM) route. However, there is insufficient evidence to provide patient comfort during the IM injections.
- The research provides evidence for identifying the safest and most comfortable patients' position during an IM injection in the emergency department.
- Key implications for nursing practice from this research are as follows: Since it provides the least pain intensity and the highest comfort, the "prone lying position" appears to be the safest and most comfortable patient position during an IM injection.

Purpose of the Study

This study was planned to evaluate the effect of different lying positions (prone and lateral) on regional pain and comfort level in IM drug administration. It is considered that

this research will provide evidence for identifying the most comfortable patient position during IM injections.

The two research hypotheses were as follows:

H_1. Patients will report lower regional pain intensity and higher comfort level after IM drug administration in the lateral position.

H_2. Patients will report lower regional pain intensity and higher comfort level after IM drug administration in the prone position.

Material and Methods

Type
This was a single-group, single-blind, quasi-experimental, pre-test and post-test study. This single-group procedure was preferred by performing the injection on the same anatomical structure to avoid differences arising from the individual characteristics of the patients.

Place and Time
This study included inpatients from the emergency department of a state hospital in İstanbul, Turkey between January 2021 and April 2021.

Research Population and Sample
The patients were required to meet the following inclusion criteria: (a) Being aged 18 years or over, (b) having no cognitive-perceptive problem, (c) having a physician's prescription for only diclofenac sodium by the IM route, (d) being at the beginning of treatment, (e) having no inconvenience for applying different lying positions (lateral and prone), (f) having a BMI of normal weight to obesity based on the World Health Organization classification, (g) having had no IM injection at the DG or VG site in the last 6 months, (h) and having no scar, scar tissue, etc. at the VG site (5,8,22-24).

Power analysis was performed based on previous research with a large cohort to estimate the sample size (5,8,15,22-24). Assuming a power of 80% and an α risk of 0.05, a sample size of 100 (200 injections) was found to be appropriate. After obtaining the necessary permission from the ethics committee and the relevant institution, the data collection process began. Before IM administration, we explained to the patients the purpose, content, scope, and data collection tools of the research and obtained their written and verbal consent for voluntary participation. This study was created in accordance with TREND Statement Checklist.

Data Collection Instruments
The data collection tools consisted of a patient information form, developed by the researcher, inquiring about patients' individual and disease characteristics (age, sex, height-weight, chronic disease, vital signs, etc.). Regional pain intensity and comfort level after IM injection were determined using the visual analog scale (VAS). Patient information forms and VAS forms were filled in by the researcher nurse (with 5 years of clinical experience and have master's degree in fundamentals of nursing science) in the injection room.

- VAS: The VAS was used immediately after the IM injection to evaluate the patient's pain intensity and positional comfort level during the injection. The 10 cm vertical line includes subjective descriptive statements at both ends (0 cm: Lowest pain/comfort level and 10 cm: Highest pain/comfort level). The patient was instructed to place a mark on this line, corresponding to their pain intensity and comfort level. The distance from the lowest level on the scale to the patient's mark was measured with a ruler, obtaining a numerical value for the patient's pain intensity and comfort level in cm or mm.

Data Collection
The first IM injection was performed according to the patient's preference of lying position (lateral or prone). For the second injection, the patient was rotated to the remaining position. Accordingly, if a patient preferred the lateral position for their first IM injection, the second injection was performed in the prone position. If they preferred the prone position for the first IM injection, the second injection was performed in the lateral position. All IM injections were performed on a patient stretcher in the injection room. According to the literature, using the Z technique, using the 0.5 mL airlock method, and performing the injection for at least 10 seconds per 1 cc/mL of the drug are some effective methods to reduce undesirable effects during injection (5,22,24). Hence, the Z technique and the airlock method were implemented during the injection (14). To perform the Z technique effectively, we preferred to first practice these two lying positions (prone and lateral) on the patients before the injection.

The researcher nurse ensured that the patient was in a suitable position for IM injection, the administration site was open, and the necessary safety precautions were taken. In the lateral position, we requested slight flexion of the upper leg over the lower leg. In the prone position, we passed the patient's arms through a thin pillow under the head, and asked to turn their head sideways and their feet inward with their big toes facing each other (2,5,24). To ensure patient confidentiality, the practice was limited to one patient at a time, keeping the door of the injection room closed.

The IM injections were performed by a nurse (practitioner) working in the emergency department, with a bachelor's degree in nursing and 5 years of clinical experience. The same practitioner nurse prepared all the drugs and performed and recorded all IM injections for the whole sample. Accordingly, the nurse prepared the drugs at the nurse's counter, drew air into the syringe using the 0.5 mL airlock method, and followed the steps below for the IM injection (5,14,18,24).

- Washed hands and wore gloves,
- Put the patient into position (lateral or prone),
- Opened the injection site, ensuring patient confidentiality,
- Checked skin/tissue integrity when determining the injection site,
- Palpated the VG injection site as identified by the G method, checked for any stiffness, mass, or lesion, and determined the injection site,
- Cleaned the administration site from inside to outside using a sterile, cotton pad, impregnated with the appropriate antiseptic solution,
- Tucked cotton between the 3rd and 4th fingers of the free hand,
- Removed the cap of the injector needle,
- Shifted the cutaneous and subcutaneous tissue to the outer edge by 2.5 cm using the outside of the free hand, in accordance with the Z technique,
- Quickly penetrated the site at a 90° angle,
- After inserting the needle, pulled the plunger and checked for blood using the passive hand. If there was no blood, administered the drug was slowly (30 seconds) and performed the 0.5 mL airlock method,
- Pressed the sterile, cotton pad impregnated with antiseptic solution on the injection site, removed the needle rapidly, and released the stretched tissue,
- Applied gentle pressure to the site for 10 seconds,
- Helped the patient take a comfortable position,
- Disposed of the syringe and needle in their appropriate waste bins,
- Removed the gloves and washed the hands. Recorded the procedure.

After the procedure, the patients' pain, and comfort levels were assessed by self-report.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) for Windows version 21.0 (IBM Corp, Armonk, New York). Demographic and outcome variables are described using frequency distributions for categorical variables, and means and standard deviations for continuous variables. Chi-square was used to examine differences in categorical variables. Outcomes data such as the intensity of pain and comfort levels in patients were compared using independent t-test, and Wilcoxon signed-rank test. The level of significance was set at $p \leq 0.05$.

Ethics

Approval for this study was received from the Okmeydanı Training and Research Hospital's Ethics Committee and Institution (number: 48670771-514.10). Prior to the study, patients were informed of the purpose of the research and were assured of their right to refuse to participate in the study or withdraw their consent at any stage.

Results

The sample had a mean age of 48.49±20.73 years, 59% of the patients were male, the mean BMI was 25.64±3.07 kg/m^2 (normal weight), 43% of the patients applied to the emergency department for IM injection as requested by their physician for the diagnosis of upper respiratory tract infection, and 77% had a chronic disease (Table 1).

Pain Intensity and Comfort Level

According to verbal reports by the patients, the mean pain intensity level was 4.12±1.67 and the mean comfort level was 6.09±1.86 after IM injections in the prone position. For the lateral position, the mean pain intensity level was 5.22±1.91, and the mean comfort level was 4.80±2.00 (Table 2). The mean pain intensity level was lower after IM injection in the

Table 1.
Patients Characteristic (N=100)

Patients characteristic		**n (%)**
Age	Mean ± SD	48.49±20.73
	Median (min-max)	44 (18-97)
Gender	Women	41 (41)
	Men	59 (59)
Body mass index	Mean ± SD	25.64±3.07
	Median (min-max)	25.61 (18.96-36.20)
Medical diagnosis	Acute gastroenteritis	28 (28)
	Dental abscess	12 (12)
	Upper respiratory tract nfection	43 (43)
	Low back pain	17 (17)
Chronic disease*	Yes	77 (77)
	No	43 (43)

** More than one option has been ticked, SD=standard deviation*

prone position compared to the lateral position (1.1±0.24 units of difference), with very high significance (p=0.001; p<0.01) (Table 2, Figure 1). Moreover, the mean comfort level was higher after IM injection in the prone position compared to the lateral position (1.29±0.14 units of difference), again with very high significance (p=0.001; p<0.01) (Table 2, Figure 2).

Discussion

Parenteral drug administration covers a significant part of nurses' daily schedule. This research explores the comfortable of two different lying positions (prone and lateral) on regional pain and comfort level in IM drug administration. This research provides evidence for identifying the safest and most comfortable position for patients during an IM injection.

The mean pain intensity after IM injection in the prone position was lower than the lateral position (4.12±1.67 vs. 5.22±1.91, 1.1±0.24 units of difference), with very high significance (p<0.01) (Table 2, Figure 1). In this regard, the mean pain intensity levels after IM injection are "mild" for the prone position and "moderate" for the lateral position. Also, the mean comfort level after IM injection in the prone position was higher than the lateral position (6.09±1.86 vs. 4.80±20, 1.29±0.14 units of difference), again with very high significance (p<0.01) (Table 2, Figure 2). Accordingly, the mean comfort levels after IM injection are "high/very satisfied" for the prone position and "moderate/satisfied" for the lateral position. With these findings, the prone position appears to be the safest and most comfortable patient position to ensure minimum pain and maximum comfort during an IM injection. In line with these results, the H_2 hypothesis was confirmed.

Research on adult patients reports lower regional pain intensity after drug administration to the VG site compared to the DG site (24). Similarly, Apaydın and Öztürk (8) compared findings for bleeding, pain, and hematoma after IM injection among the VG and DG sites and found lower mean scores for pain intensity and hematoma at the 48th and 72nd hours in the VG region. Kara and Yapucu Güneş (4) evaluated three different methods for pain intensity after IM injection in the prone position and reported that the internal rotation of the extremities, turning the toes toward each other, and using the Z technique caused the least pain. Another research compared pain intensity levels among the standard IM injection and IM injection with the Z technique, finding lower pain intensity for IM injection with the Z technique (25). However, Yilmaz et al. (18) performed IM injections of diclofenac sodium with the Z technique and highlighted

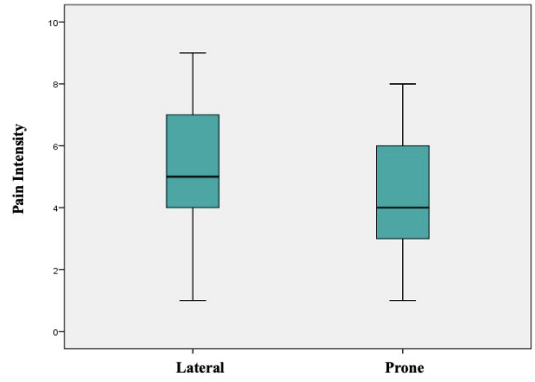

Figure 1.
Pain Intensity (immediately after IM injections)
IM=intramuscular

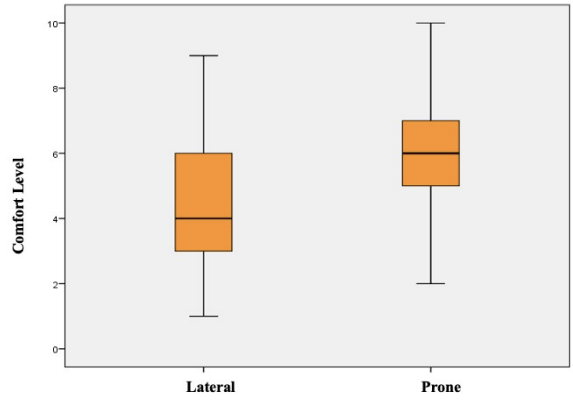

Figure 2.
Comfort Level (immediately after IM injections)
IM=intramuscular

Table 2.
Pain Intensity and Comfort Level

			Lying positions		***Statistical analysis***
Measurements			**Prone (n=100)**	**Lateral (n=100)**	
Pain intensity	**Immediately after IM injection**	Mean ± SD	4.12±1.67	5.22±1.91	t=4.533
		Median (min-max)	4 (1-8)	5 (1-9)	**p=0.001[a]**
Comfort level	**Immediately after IM injection**	Mean ± SD	6.09±1.86	4.80±2.00	t=-4.729
		Median (min-max)	6 (2-10)	4 (1-9)	**p=0.001[a]**

[a]Paired samples test, p<0.01, SD=standard deviation, IM=intramuscular

that the technique prevented the drug from leaking out, but had no effect on reducing pain. The authors, also found that the airlock method reduced pain intensity in IM injection of diclofenac sodium at the DG and VG sites (18). Summarizing from the literature, using the Z technique, using a long needle tip, applying pressure on acupressure points, applying manual pressure before/after injection, using the 0.5 mL airlock method, and performing the injection for at least 10 seconds per 1 cc/mL of the drug are some effective methods for reducing undesirable effects during IM injection at the VG site in adult patients (14,18,22,23). Another consideration to reduce injection-related fear and position-related muscle tension in VG injections is using different lying positions (18,21,26). As stated in the materials and methods section, we adhered to the current evidence and used a long needle tip (size 1-2, 2.54-3.75 cm) and applied both the Z and airlock techniques for safe IM injection into the VG region. Besides, during IM injection in the prone position, we asked the patients to internally rotate their legs and to turn their feet inward, big toes facing each other.

There are also numerous studies on the effectiveness of non-pharmacological interventions and tools in the biomedical market on IM injections. In this context, Kant and Akpinar (27) observed that listening to music during an IM injection reduced injection-induced pain intensity. However, the authors found no difference between the standard injection and applying pressure to the injection site in terms of pain (27). Çelik and Khorshid (28) highlighted that the Shotblocker method reduced pain intensity but increased anxiety during IM injection. Aydin and Avşar (29), on the other hand, reported that the Shotblocker method was effective in reducing pain during IM injection. Şahin and Eşer (20) found that the cold-vibration (Buzzy) method reduced injection-induced pain intensity and increased satisfaction levels during IM injection.

Study Limitations

The first limitation of the current research is that pain intensity and comfort levels during IM injection were evaluated based on verbal reports from the patients. Second, pain intensity and comfort levels were determined immediately after IM injection. Moreover, we only included adult patients who were given IM injections of diclofenac sodium. Thus, the results obtained here cannot be generalized to all age groups and all drug administrations. The third limitation was the preference for a single group design. More than one group design can be tested by controlling the anatomical and individual characteristics of different groups.

Conclusion

Position changing that reduced IM injection pain and increased comfort in emergency units is a safe, easy-to-use, economic, and potentially comfortable non-pharmacological method in adults. This intervention can be used in combination with other evidence based non-pharmacologic pain management strategies for added benefit. It is also recommended to examine the effect of position change in different age and drug groups on pain intensity and comfort level. In addition, a repeated measures analysis is recommended, including patient responses (pain intensity, comfort level, hematoma, ecchymosis, etc.) after injection.

Since it provides the least pain intensity and the highest comfort, the "prone lying position" appears to be the safest and most comfortable patient position during an IM injection. We suggest that nurses who are responsible for IM injections put patients in the prone position for minimum pain intensity and maximum comfort.

Ethics Committee Approval: Approval for this study was received from the Okmeydanı Training and Research Hospital's Ethics Committee and Institution (number: 48670771-514.10).

Informed Consent: Prior to the study, patients were informed of the purpose of the research and were assured of their right to refuse to participate in the study or withdraw their consent at any stage.

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Declaration of Interests: The authors declare that they have no competing interest.

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