The reliability of site determination methods in ventrogluteal area injection: A cross-sectional study

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A B S T R A C T

Background: While administering medication through intramuscular injection, the ventrogluteal site must be used instead of the dorsogluteal site, and it is of great significance to locate the ventrogluteal site correctly.

Objective: To determine the reliability of two different methods used to determine the ventrogluteal site in intramuscular injection practice.

Design: A cross-sectional study.

Settings: A university hospital in Istanbul.

Participants: The study population comprised 120 randomly selected healthcare personnel at a university hospital.

Methods: The ventrogluteal site was determined using the geometric (G method) and V method and these sites were scrutinized under ultrasonography. It was investigated whether there was any anatomic vessels or neural structure present, and also determined the thickness of subcutaneous tissue, musculus gluteus medius, and musculus gluteus minimus.

Results: Of the participants, 65.8% were female and the average age was 32.30 years and body mass index was 25.31 kg/m². The results showed that G and V methods were statistically significant in terms of variables. It was also found that sex affects subcutaneous tissue thickness and the skin-bone margin in the G and V method, and that body mass index determines subcutaneous tissue, musculus gluteus medius thickness and skin-bone margin.

Conclusion: When the ventrogluteal site is used for intramuscular injection purposes, the site must be determined in line with the geometric method.

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What is already known about the topic?

- Intramuscular injection (IMI) is one of the most used practices in healthcare institutions.
- The textbooks and references contain inconsistencies regarding IMI techniques. Currently, IMIs are most often administered at the dorsogluteal site. However, some studies state that the dorsogluteal site should not be used for IMI and other literature does not recommend the use of this site.
- The dorsogluteal site is said to be the riskiest site for IMI because it is rich with vessels, is close to the sciatic nerve, and its subcutaneous tissue is thick.
- The ventrogluteal site is recommended instead of the dorsogluteal site for administering medication.

What this paper adds

- This study is thought to hold great significance in that it provides the basis for an alternative method to determine the ventrogluteal site.
- This study will contribute to the literature about IMI to the ventrogluteal site.

1. Introduction

In the last few decades, several advances have been made in healthcare and therefore in healthcare implementation. To adapt to such changes and advancements, it is imperative that healthcare professionals use such scientific advances as the basis for standard operating protocols and implement evidence-based practices. Intramuscular injection (IMI) is one of the frequently performed tasks in the healthcare institutions.

Although IMIs appear easy to administer, they can lead to complications such as abscess, necrosis, infection, tissue irritation, contracture, hematoma, chronic pain, periostitis, and injuries to the blood vessels, bone, and nerves. The most serious complication is nerve injury (Nicol and Hesby, 2002; Potter and Perry, 2009; Small, 2004; Wynaden et al., 2005). Injection practices that are not evidence-based can cause peripheral nerve injuries, such as when the needle is inserted between a nerve and its sheath/fascicle, which leads to the development of a mass lesion after an injection is administered. Although the nerve is not directly injured in the latter case, the medication itself could cause neuronal damage. The same situation may occur if medication is injected near a nerve or if it accumulates at the epineural level, i.e., injecting medication in or adjacent to a peripheral nerve is one of the most important factors in nerve continuity impedance and should thus be avoided in IMI (Kaya et al., 2012).

Individuals’ sex and body mass index (BMI) should be taken into account with IMI techniques. The correct needle length is important in order to reach muscle tissue. The needle length should be chosen that is appropriate for the IMI injection site, the weight of the individual, muscle mass, and subcutaneous fat at the injection site (Boyd et al., 2013; Burbridge, 2007; Kroger et al., 2012; Malkin, 2008; Palma and Strohhus, 2013).

IMI is known to predispose individuals to many risks. Therefore, it is vital to decide whether IMI is necessary. Common IMI sites include the vastus lateralis/lateral femoral, ventrogluteal, and deltoid muscles. Currently, IMIs are most often administered at the dorsogluteal site (Beyea and Nicoll, 1995; Carter-Templeton and McCoy, 2008; Nicoll and Hesby, 2002; Potter and Perry, 2009; Small, 2004). However, some studies state that the dorsogluteal site should not be used for IMI (Nicol and Hesby, 2002; Potter and Perry, 2009; Small, 2004), and other literature does not recommend the use of this site (Craven and Hirnle, 2009; Walsh and Brophy, 2011). The dorsogluteal site is considered to have the highest risk of complications when used for IMI because it contains a denser concentration of blood vessels, is close to the sciatic nerve, and has thicker subcutaneous (SC) tissue (Nicol and Hesby, 2002; Small, 2004). Sciatic nerve injuries are often caused by the administration of medication to the dorsogluteal site (Beyea and Nicoll, 1995; Small, 2004). The ventrogluteal site is suggested as an alternative site for medication administration (Nicol and Hesby, 2002; Potter and Perry, 2009; Small, 2004).

The ventrogluteal site is identified (V method) for IMI as follows: If the injection is to be administered to the left side, (1) the nurse positions their wrist parallel to the patient’s left femur and places the palm of their right hand over the patient’s greater trochanter. When using this method, nurses use their right hand for the left side of the groin, and vice versa. (2) The thumb is positioned on the patient’s groin, and the index finger is placed on the anterosuperior iliac spine; the middle finger is then pointed toward the gluteal site in the opposite direction of the iliac osteophyte. (3) The index and middle fingers create a V-shape, and the injection site is the middle of the V-shape (Fig. 1; Berman et al., 2008; Craven and Hirnle, 2009; Potter and Perry, 2009; Taylor et al., 2008).

Meneses (2007) proposed the geometric method (G method) for locating the ventrogluteal site, reporting that it had 100% reliability. The bony prominences are taken as reference, and imaginary lines are drawn in between the bone ends to determine the puncture point for IMI according to the G method. With this, an imaginary line is drawn from the greater trochanter to the iliac crest of the iliac tubercle, then to the anterosuperior iliac spine, and from the greater trochanter to the anterosuperior

![Location of Gluteus Medius](image)

**Injection Point**

(between the knuckle of the index & middle finger)

**Greater Trochanter**

Fig. 1. Determination according to the V method of intramuscular injection site in ventrogluteal area.
iliac spine. Thus, a triangle is created by imaginary lines. After that, median lines are drawn for every single corner of the triangle. As shown in Fig. 2, the convergence point of the three median lines is the barycenter for the triangle. In other words, this barycenter is the needle entry point for IMIs.

2. Materials and methods

2.1. Objective and design of the study

This was a cross-sectional study aimed at comparing and contrasting two methods (G and V method) for locating the ventrogluteal site, an IMI site. At the same time, the effect of sex and BMI on SC tissue, gluteus medius, and gluteus minimus thickness was investigated. Data were collected between September 2011 and November 2012.

2.2. Study population and sampling method

The study population comprised 120 randomly selected healthcare personnel at a university hospital.

2.3. Data collection tools

A two-part questionnaire was developed comprising 14 questions to collect relevant data. The first part contained questions about the socio-demographic characteristics of the respondents (age, sex, height, weight, and BMI). The second part contained questions aimed at obtaining ventrogluteal site data acquired through ultrasonography (SC tissue, gluteus medius, and gluteus minimus thicknesses and the presence of nerve and blood vessels as determined using the V and G methods).

2.4. Procedure

The participants, from whom consent was obtained in written and verbal form, disclosed their weight, height, and sociodemographic data. One researcher located the ventrogluteal site using the V method and marked it with a “V” using a dermatograph. The ventrogluteal site was also located using the G method as previously described (Meneses, 2007) and marked with a “G.” Ultrasonography was used to determine whether the gluteus medius and gluteus minimus, or any blood vessel or neural structure, were present under the marked sites, and also to determine the thickness of the gluteus medius, gluteus minimus, and SC tissue. The data were recorded during the ultrasonography. In addition, each result was documented using an ultrasonography printout. The physician who performed the ultrasonography was blinded to the methods used to determine each site. Comparing the acquired data, the following was investigated: the method that identified the injection site with greater reliability, the length of the needle to be used on the gluteus medius, and the effect of sex and BMI on these variables.

2.5. Ethical considerations

The investigation was conducted in accordance with the principles outlined in the Declaration of Helsinki. Written permission was obtained from the ethics committee and management board of the hospital as well as from the head of the department of radiodiagnosis. Participants were informed of the aim and benefits of the study and their roles in the study. Written and verbal consent was obtained from the participants that indicated that they had been informed of the relevant aspects of the study.

2.6. Data analysis

The SPSS 17 for Windows (version 11.0; SPSS Inc., Chicago, IL, USA) was used to analyze the data. Median, minimum, maximum rates and arithmetic mean (standard deviation [SD]) were used for ordinal data evaluation. Frequency and percentages were used for nominal data evaluation. The Kolmogorov–Smirnov test was used to determine whether there was abnormal distribution. As some distributions were not normal, non-parametric methods were preferred for statistical analysis. When comparing qualitative data, the Mann–Whitney U-test was used to compare parameters between two groups. The Kruskal–Wallis test was used to compare parameters across groups when there were more than two groups. Spearman correlation analysis was used to determine correlation between scales.

3. Results

The ventrogluteal injection site was identified using the G and V methods, and these sites were marked with a dermatograph. The gluteus medius was present under the sites located by both methods. In addition, the thickness of the SC tissue, gluteus medius, and gluteus minimus under the injection site was determined using ultrasonography. The skin–bone margin was derived by totaling the thicknesses of the SC tissue, gluteus medius, and gluteus minimus (Table 1). The mean SC tissue thickness was significantly greater under sites identified using the V method than those identified using the G method (p < 0.001). The mean gluteus medius thickness under the sites identified using the G method was statistically lesser than that under the sites identified using the V method (p < 0.001). However, the mean gluteus minimus thickness under the sites identified using the G method was greater than that under sites identified with the V method, and this difference was
Table 1
The distribution of thickness rates of subcutaneous tissue, gluteus medius and gluteus minimus in the site determined through G and V methods.

<table>
<thead>
<tr>
<th></th>
<th>G method</th>
<th>V method</th>
<th>Z&lt;sup&gt;WSR&lt;/sup&gt;</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min.–Max. Median</td>
<td>Mean ± SD</td>
<td>Min.–Max. Median</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Subcutaneous</td>
<td>3.30–62.20 14.55</td>
<td>17.43 ± 9.72</td>
<td>4.40–58.50 18.70</td>
<td>21.26 ± 10.93</td>
</tr>
<tr>
<td>Gluteus medius</td>
<td>2.90–39.90 23.25</td>
<td>22.97 ± 6.53</td>
<td>1.70–48.10 24.45</td>
<td>24.75 ± 7.52</td>
</tr>
<tr>
<td>Gluteus minimus</td>
<td>6.50–35.40 16.50</td>
<td>17.01 ± 5.51</td>
<td>1.10–38.60 14.70</td>
<td>15.99 ± 7.28</td>
</tr>
<tr>
<td>Total</td>
<td>31.10–102.30 55.90</td>
<td>57.41 ± 13.22</td>
<td>18.00–99.10 60.75</td>
<td>61.99 ± 14.13</td>
</tr>
</tbody>
</table>

Z<sup>WSR</sup>, Wilcoxon signed ranks test.

The skin–bone margin was significantly greater under the sites identified using the V method than under sites identified using the G method (p < 0.001).

Statistically significant (p < 0.05). The skin–bone margin was significantly greater under the sites identified using the V method than under sites identified using the G method (p < 0.001).

Of 120 participants, 65.8% (n = 79) were women, the mean age was 32.30 years (SD = 9.12), and the mean BMI was 25.31 (SD = 5.00) kg/m² (Table 2). The SC tissue, gluteus medius, and gluteus minimus thicknesses and skin–bone margin were analyzed in terms of sex and BMI (Table 2).

When the injection site was identified using the G method (Table 2), the SC tissue thickness (p < 0.001) and skin–bone margin (p < 0.05) were greater in women than those in men.

On the other hand, there was a significant difference between SC tissue, gluteus medius thicknesses and skin–bone margin in terms of the BMI (Table 2). When correlations between the BMI and the thicknesses of the SC tissue; the BMI and the thicknesses of gluteus medius; the BMI and the skin–bone margin were evaluated in the G method, it was found that the values increased in tandem with that of the BMI, and there was a statistically significant relationship (Table 2).

When the injection site was identified using the V method (Table 2), the SC tissue thickness (p < 0.001) and skin–bone margin (p < 0.01) of women were greater than those in men.

There was a significant difference in the SC tissue, gluteus medius, gluteus minimus thicknesses, and the skin–bone margin in terms of BMI. In addition, the correlation between BMI and SC tissue thickness; BMI and gluteus medius thickness; BMI and skin–bone margins was found statistically significant (Table 2).

When the injection site was identified using the G method, the presence of a blood vessel under the site was noted in 15% of the cases (n = 18). With the V method, the presence of a blood vessel under the injection site was noted in 19.2% of cases (n = 23). This showed that statistically, the G method was significantly more reliable (Table 3; χ² = 8.734; p = 0.003).

Nerves were not present under the injection site when the site was identified using either method.

4. Discussion

This study tested the reliability of two different determination methods used for IMI to the ventrogluteal site. IMI sites for ventrogluteal injection were identified using the V and G methods; the thicknesses of the SC tissue, gluteus medius, and gluteus minimus under these sites were determined using ultrasonography. The skin–bone margin was derived by totaling the thicknesses of the SC tissue, gluteus medius, and gluteus minimus. This knowledge is crucial for preventing the tip of the needle from being injected into SC tissue. The effect of sex and BMI was investigated on SC tissue, gluteus medius, and gluteus minimus thicknesses. Whether blood vessels or nerves were present under the IMI sites identified using the two methods was examined.

Nicoll and Hesby (2002) stated that the efficacy of medication can increase or decrease depending on the injection site; therefore, the choice of the IMI site is of great importance. The literature shows that the ventrogluteal site can be used instead of the dorsogluteal site (Craven and Hirnle, 2009; Nicoll and Hesby, 2002; Potter and Perry, 2009; Small, 2004). The gluteus medius muscle was first identified as an injection site by Hochstetter in 1954 (cited in Nicoll and Hesby, 2002); medication should be administered into this muscle when ventrogluteal IMI is administered. In contrast to the gluteus maximus, the gluteus medius is well developed in children and young adults. In particular, the gluteus medius is more developed than the gluteus maximus in children before they learn to walk (Potter and Perry, 2009).

Muscle tissue in the ventrogluteal site is thicker than that in the dorsogluteal site, and the SC adipose tissue is thinner. Because the SC adipose tissue is thinner in the ventrogluteal site, the likelihood of injecting medication into SC tissue by mistake is lower. Although this site does not contain major nerves or blood vessels, nerve damage can occur due to injury to minor nerves, and hemorrhage can occur from the branches of blood vessels present in the site. Therefore, this site would prevent further serious injuries. In addition, the ventrogluteal site is preferred because it is easy to position the patient to gain access to the site, and it is easily located because the osteophytes can be felt by hand (Cocoman and Murray, 2010; Kaya et al., 2012). In summary, the ventrogluteal site should be used instead of the widely used dorsogluteal site for IMI.

A variety of equipment is used to administer medication through IMI. Needles and syringes are each designed to administer a certain volume of medication into tissues that possess specific features. It should be
The distribution of thickness rates of SC tissue, gluteus medius and gluteus minimus in the site determined through G and V methods according to sex and BMI variables.

<table>
<thead>
<tr>
<th>Individual characteristics</th>
<th>G method</th>
<th>V method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SC tissue</td>
<td>Gluteus medius</td>
</tr>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>19.57 ± 9.01</td>
<td>23.20 ± 6.21</td>
</tr>
<tr>
<td>Male</td>
<td>13.33 ± 9.82</td>
<td>22.51 ± 7.15</td>
</tr>
<tr>
<td>p</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>BMI (Mean ± SD)</td>
<td>25.31 ± 5.00</td>
<td>23.49 ± 4.05</td>
</tr>
<tr>
<td>(Min.–Max.)</td>
<td>(15–41)</td>
<td>(15–41)</td>
</tr>
</tbody>
</table>

\(Z_{\text{MWU}}\) = Mann–Whitney test. 
\(X^{2}_{\text{KW}}\) = Kruskal–Wallis test.

Table 2
The distribution of thickness rates of SC tissue, gluteus medius and gluteus minimus in the site determined through G and V methods according to sex and BMI variables.

5. Conclusions and practical implications

According to the results of this study, the gluteus medius was present under the sites located using the G method, and the gluteus minimus was present under the sites located using the V method. Also, the thickness of the vessels identified by the V method was less likely to be higher than that of the vessels identified by the G method. The SC tissue thickness was greater at those sites identified by the V method. Therefore, the V method was considered more reliable for identifying the vessels under the sites identified by the V method. The SC tissue thickness was greater at those sites identified by the V method.

Table 3
Comparing the existence of vessel in G and V methods in ventralgluteal area

existence of vessel site

<table>
<thead>
<tr>
<th>Method</th>
<th>G method</th>
<th>V method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site</td>
<td>Yes – n (5)</td>
<td>Yes – n (5)</td>
</tr>
<tr>
<td>No – n (5)</td>
<td>5 (62)</td>
<td>5 (62)</td>
</tr>
<tr>
<td>Total – n (10)</td>
<td>10 (125)</td>
<td>10 (125)</td>
</tr>
</tbody>
</table>

existence of vessel in the site of G

<table>
<thead>
<tr>
<th>Method</th>
<th>G method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site</td>
<td>Yes – n (5)</td>
</tr>
<tr>
<td>No – n (5)</td>
<td>15 (125)</td>
</tr>
<tr>
<td>Total – n (10)</td>
<td>20 (125)</td>
</tr>
</tbody>
</table>

existence of vessel in the site of V

<table>
<thead>
<tr>
<th>Method</th>
<th>V method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site</td>
<td>Yes – n (5)</td>
</tr>
<tr>
<td>No – n (5)</td>
<td>22 (125)</td>
</tr>
<tr>
<td>Total – n (10)</td>
<td>30 (125)</td>
</tr>
</tbody>
</table>
the sites identified with the V method. These results indicated that risk of injection to SC tissue of medication in the G method is lower than those V methods. Thus if medication is to be administered by IMI into the gluteus medius at a ventrogluteal site, the site should be identified using the G method. Moreover, an individual’s sex and BMI should be considered in the IMI management to the ventrogluteal site.

It was suggested that the G method tested in this study should be included in textbooks on basic skills and be integrated into health professionals’ education curricula. Also the G method should be included as a course in postgraduate continual development or in-service education programs and that IMI skill modules based on the G method be developed.

6. Limitations of study

The dorsogluteal site is preferred in clinical practice for IMI (Cocoman and Murray, 2010; Greenway, 2004; Rodger and King, 2000; Walsh and Brophy, 2011). There are a number of reasons for this: (1) textbooks contain inconsistencies regarding IMI techniques (Carter-Templeton and McCoy, 2008), (2) sections regarding injection management in publications remain vague (Cocoman and Murray, 2008), (3) the presence of muscle tissues at the ventrogluteal site has been doubted (Cocoman and Murray, 2010), (4) basic nursing skills modules regarding IMI have not been updated (Ellis and Bentz, 2007; Wynaden et al., 2005), and (5) nursing education programs do not include changes in IMI practices (Walsh and Brophy, 2011). It is also thought that nurses avoid the ventrogluteal site because they do not trust the method used to locate the site, and that the hand size of the person administering the injection influences the injection site location.

Questions that have not been addressed in the present study are nurses preference of IMI site and the factors that influencing this choice. Studies examining the current situation in IMI techniques should be made for the widespread use of ventrogluteal site for IMI.

Conflict of interest

None of the authors has any potential conflicting interest in this study.

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Ethical approval

This study was approved by Istanbul University Medicine Faculty Dean’s Office of the Ethics Review Committee (B.30.2.İST.02.00.01/Y1.728).

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References


