

Review Article

Ventrogluteal Site Injection: A Systematic Review

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Abstract

Intramuscular injections are most often administered at the dorsogluteal site. However the ventrogluteal site is recommended instead of the dorsogluteal site for administering medication via intramuscular injection. This study is conducted as a systematic literature review in order to determine (1) the preferability of ventrogluteal site in intramuscular injection, (2) the method used in determination of ventrogluteal site, (3) the length of injection used when administering medication to the ventrogluteal site, (4) the type and amount of medications administered to the ventrogluteal site, and (5) the requirement of aspiration when administering injection to the ventrogluteal site. A systematic approach to searching the literature was undertaken using identified academic databases Medline, Scopus, PubMed and Cumulative Index to Nursing and Allied Health Literature (CINAHL) from 2005 to May 2015, and used “intramuscular injection” and “ventrogluteal site” keywords. It was reached a total of 52 studies, and eight studies met the search criteria. The dorsogluteal site is commonly used for intramuscular injection. Young nurses prefer the ventrogluteal site. When determining this site, while the “V” and “G” method is reliable, subcutaneous tissue thickness varies depending on sex and body mass index. Therefore, when a medication is administered to the ventrogluteal site, injection length should be determined and administrable amount of medication should be calculated depending on the sex and body mass index. Before administering the medication, aspiration should be applied taking into account of the characteristics of ventrogluteal site. In this context, there are a limited number of studies on injection application to ventrogluteal site in nursing literature. In these researches, it is found that nurses do not have enough knowledge neither about the method to determine ventrogluteal site nor the choice of the site, and they do not use ventrogluteal site at their applications.

Key Words: adverse effects, intramuscular, injection, dorsogluteal site, reliability, ventrogluteal site.

Background

Muscles have a greater number of vessels, allowing faster absorption in intramuscular (IM) injections than with subcutaneous injections. However, intramuscular injections have many risks. For this reason, nurses should confirm whether it is required to administer intramuscular injection when they are about to administer intramuscular injection (IMI). In many cases, there is no alternative way to administer the injection, as in influenza or pneumonia vaccines (Kaya & Pallos 2012). Therefore, IMI is a

nursing function that is commonly applied by nurses. More than 12 billion IM injections are administered annually throughout the world (Jordan et al. 2004, Nicoll & Hesby 2002).

One of the parenteral injections, the IMI, is the process of administering the drug into deep muscular tissue. Although it is perceived as a simple nursing practice, IMI may cause many serious complications such as abscess, necrosis, infection, tissue irritation, contracture, hematoma, chronic pain, periostitis, and blood vessel, bone and nerve injuries. It's most severe

complication which may affect the entire life of an individual is the nerve injury (Nicoll & Hesby 2002, Small 2004, Malkin 2008, Potter & Perry 2009). On the other hand, studies suggest that sciatic nerve injuries commonly develop due to injections to the dorsogluteal (DG) site (Small 2004). Today, the IMI is mainly administered to deltoid, lateral femoral and gluteal sites. IMI to gluteal area is applied to DG or ventrogluteal area (VG). Although the VG site is suggested as the most secure site for IMI, drugs are still administered to the DG site in many countries. It is known that the rate of complication incidence is very high in injections administered to that site (Cook & Murtagh 2006, Kaya et al. 2012).

The VG site is an injection site including the muscles gluteus medius and gluteus minimus. This site is used in adults and children and suggested as the most reliable site for the IMI (Berman et al. 2008, Cook & Murtagh 2006, Junqueira et al. 2010, Potter & Perry 2009). Located away from major nerves and blood vessels, the VG site also has a deep muscular tissue. Therefore, this site is safely used in babies, children, and high risk walking disabled adults. Also, the muscular tissue of VG site is thicker than that of DG site and subcutaneous fat tissue is thinner. That this site has a thinner subcutaneous fat tissue minimizes the probability of accidentally administering the injection to the subcutaneous tissue (Kaya et al. 2015, Nicoll & Hesby 2002, Small 2004). The VG site should be used for IMI because it has much superiority over other sites (deltoid, laterofemoral, DG). However, administration of IMI to the VG site is understudied in the literature. This study is conducted to review the studies recently conducted on administration of IMI to the VG site and offer a source for the nurses by summarizing the results of these studies.

Method

Purpose

Main purpose of this study is to determine (1) the preferability of ventrogluteal site in IMI, (2) the method used in determination of ventrogluteal (VG) site, (3) the length of injection used when administering medication to the VG site, (4) the type and amount of medications administered to the VG site, and (5) the requirement of aspiration when administering injection to the VG site and

reveal literature-based concrete results in the light of these findings.

Literature Review

In this study, a total of 52 studies published in the last ten years (2005-2015) were accessed using the keywords “intramuscular injection” and “VG site” in the Medline, Scopus, Pubmed and Cumulative Index to Nursing and Allied Health Literature (CIHANL) databases. Since 4 of these studies are joint studies, 48 studies were reviewed and 8 articles were examined based on the included and excluded criteria. Information on inclusion of articles in the study is given in prism model (Figure 1).

Included Criteria

Descriptive, cross-sectional and experimental studies, the full texts of which were accessed in the databases and which use the VG site for IMI, were included in the scope of study.

Excluded Criteria

Studies, books and excerpts which are not systematic review, not in English, and evaluate the efficiency of attempts to decrease pain before administration of injection were excluded from the scope of study.

Results

Eight articles that were included in the scope of study were examined under the following headings:

- (1) the preferability of ventrogluteal site in IMI,
- (2) the method used in determination of ventrogluteal (VG) site,
- (3) the length of injection used when administering medication to the VG site,
- (4) the type and amount of medications administered to the VG site, and
- (5) the requirement of aspiration when administering injection to the VG site.

The preferability of ventrogluteal site in intramuscular injection

When the results on preferability of DG or VG site as the injection site are considered, Wynaden et al. (2006) stated that majority of mental health nurses mostly prefer the DG site, and Walsh & Brophy (2011) revealed that majority of nurses between 25-29 years of age mostly prefer the VG site as the injection site (Table 1).

Cook & Murtagh (2006) stated that the VG site can be used safely in administration of injection in children. Junqueira et al. (2010) administered the Hepatitis B vaccine to the VG and Anterolateral (ALT) site in children less than 8 months. In that study, immunological response and side effects were observed. Results of the study indicated that the VG site can be used for the Hepatitis B vaccination (Table 1).

The method used in determination of ventrogluteal site

In the study conducted by Kaya et al. (2015) on determination of VG site for IMI, they established the efficiency of V method, a method commonly covered in the literature, and the G method, also called geometrical method, in the determination of VG site. In that study, it is stated that gluteus medius can be used reliably in administration of injection as it is away from major nerves and both methods are reliable in the determination of that site. On the other hand, it is recommended that studies on determination of injection site through the G method be increased and integrated into nursing education programmes (Table 1).

The length of injection used when administering medication to the ventrogluteal site

Muscle tissue and subcutaneous tissue thickness are important factors in determination of VG site in IMI. In this context, Zaybak et al. (2007) measured subcutaneous tissue thickness of DG and VG site in individuals with a Body Mass Index higher than 30, and found that average subcutaneous tissue thickness of VG site is 38.2 mm in fat individuals, 43.1 mm in obese individuals, and 53.8 mm in excessively obese individuals. When it comes to the DG site, these figures were 34.5 mm in fat individuals, 40.2 mm in obese individuals, and 51.4 mm in excessively obese individuals. Also, it was observed that tissue thicknesses vary between genders and subcutaneous tissue in both DG site and VG site in women is thicker in overweight, obese and excessively obese individuals compared with men. Accordingly, it is underlined that the length of needle in administration of injection to the VG site should be 1.5 inch (Zaybak et al. 2007). Nisbet (2006) found that subcutaneous tissue thickness is different between female and male individuals, there is no significant correlation between age and subcutaneous tissue thickness in

the VG site and subcutaneous tissue thickness varies depending on age. In that study, it is stated that subcutaneous tissue thickness in the VG site increases with age (Table 1).

The type and amount of medications administered to the ventrogluteal site

There is no sufficient number of studies conducted in the last ten years on the type and amount of medications administered to the VG site through the IMI. Cook & Murtagh (2006) and Junqueira et al. (2010) stated that VG site can be used to administer injection in all infants. Tugrul & Korshid (2014) used penicillin as a medication in their study where they correlate the administration time with the level of pain. In that study, it was found that the level of pain does not change with the injection administration time in both DG and VG site. Therefore, the study indicated that penicillin can be administered to the VG site (Table 1).

The requirement of aspiration when administering injection to the ventrogluteal site

In the last ten years, no study has been conducted on the requirement of aspiration during an IMI to the VG site. In their study, Kaya et al. (2015) examined the availability of blood vessel and major nerve in the VG site. In that study, it is stated that aspiration should be made during an IMI to the VG site (Table 1).

Discussion

This study is conducted in order to reveal research results on the administration of IMI to the VG site and recommendations covered in the literature on this topic. In this context, eight studies were evaluated and the content of each study was evaluated together with the literature and concrete findings were developed accordingly.

The preferability of ventrogluteal site in intramuscular injection

The DG site is commonly used for IMI. There are a number of reasons for this: [1] textbooks on nursing principles contain inconsistencies regarding IMI techniques (Carter-Templeton & McCoy 2008), [2] sections regarding injection management in nursing publications remain vague (Cocoman & Murray 2008), [3] nurses have doubts regarding the presence of muscle tissues in the VG site (Cocoman & Murray

2010), [4] basic nursing skills modules regarding IMI have not been updated (Ellis & Bentz 2007, Wynaden et al. 2005), and [5] nursing education programs do not include changes in IMI practices (Walsh & Brophy 2011).

Also, results of the study conducted by Wynaden et al. (2015) were parallel with the literature

showing that the nurses prefer the DG site for IMI. According to the study of Wynaden et al. (2015), 81.6% of nurses preferred the DG site, 9.8% preferred the VG site and average age of nurses who prefer using the DG site is higher.

Table-1: Summary of findings

Authors, Year, Country	Aims	Study Design	Sample Size/Age	Main findings
Kaya N, Salmashoglu A, Terzi B, Turan N, Acunas B, (2015), Turkey	To determine the reliability of two different methods used to determine the ventrogluteal site in intramuscular injection practice	A cross-sectional study	120 Healthy people / Age average 32,30 years	Ventrogluteal site is safe for intramuscular injection. The new method was suggested to determine ventrogluteal site.
Wynaden D, Tohotoa J, Omari OA, Happell B, Heslop K, Barr L, Sourinathan V, (2015), Australia	To determine intramuscular injection practice choices made by nurses working in the mental health.	A descriptive cross sectional study	336 Nurse / Age average 41.92 years	The site selection changed significantly from 2006, where only 69 (74.2%) selected the dorsogluteal whilst 210 (86.1%) selected this site in 2012: χ^2 (3, 331)=17.787, $p < 0.001$. Needle size: increased use of 21 G (38 mm) in 2012: χ^2 (2, 338) = 23.613, $p < 0.001$ and the decreased use of 23 G (32 mm) needles since 2006: χ^2 (2, 338) = 30.228, $p < 0.001$.
Tugrul E, Korshid L, (2013), Turkey	To assess patient pain levels associated with IM penicillin injection over the two different durations of 5 s and 10 s. it was administered at the DG site or VG site.	One-group quasi experimental design	60 patients / Age average 31.5 years	Pain intensity scores did not differ depending on the injection duration (5 s vs. 10 s) for injections at the DG and VG sites.
Walsh L, Brophy K., (2011), Canada	To determine intramuscular injection sites presently being used by acute care nurses.	Descriptive, correlational study	264 nurses / 30-39 age years %36	DG site was used significantly more often than other sites. But younger nurses, 66.7% in the 20- to 24-year age group and 28% in the 25- to 29-year age group, were more likely to administer IM injections in the VG site compared with 9.5% of nurses in the 30- to 39-year age group, 5.0% of nurses in the 40- to 49-year age group and 7.7% of nurses in the 50+-year age group.
Junqueira ALN, Tavares VR,	Younger than 8 months old receiving the hepatitis	Randomized, controlled trial	774 children / Younger	VG site for hepatitis B vaccine administration and

Martins RMB, Frauzino KV, Costa eSilva A M, Minamisava R, Teles SA., (2010), Brazilya	B vaccine in ventrogluteal site developed similar immunogenic responses and experienced fewer adverse events than those vaccinated into anterolateral thigh muscle.		than 8 months old (224-VG, 250-ALT)	highlights this site as suitable for intramuscular injection in infants.
Zaybak A, Gunes UY, Tamsel S, Khorshid L, Eser I, (2007), Turkey	To measure SCT thickness in the dorsogluteal and ventrogluteal sites in obesity individuals	Descriptive study	119 people / Age average 38,6 years	Significant difference in SCT thickness at the ventrogluteal site between women and men
Cook IF, Murtagh J, (2006), Australia	To measure tissue Ventrogluteal area in children 2,4,6 and 18 months	Descriptive study	643 children / 161: 2 months, 162: 4 months, 171: 6 months, 149: 18 months	Ventrogluteal area is clearly defined and suitable area for intramuscular injection
Nisbet AC, (2006)	To examine depth of subcutaneous fat at gluteal intramuscular injection sites.	Retrospective study	100 people / Age average 47.8 years	Site depth was markedly different in men and women.

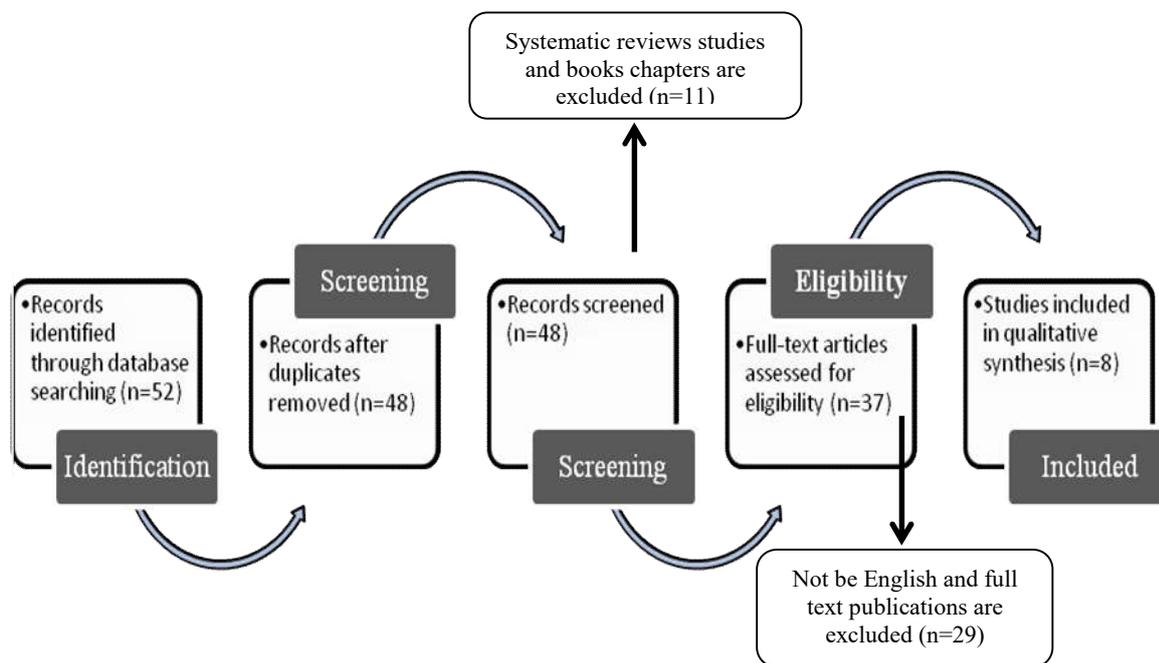


Figure 1. Study selection process for the systematic literature review

Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(6): e1000097

Floyd & Meyer (2007) stated that in some nursing schools, injection techniques on VG site has been taught, but students rarely observed this technique in practice. Walsh & Brophy (2011) found that the rate of preferability of VG site by nurses increases as the average age decreases. These studies can be accepted as an indicator that the VG site is now effectively taught in nursing education.

In children, IMI is administered in different sites. Accordingly, Vastus Lateralis (VL) is recommended for children under 2 years of age, while deltoid is recommended for children over 2 years of age (for immunization), and it is suggested that IMI administration to the VG site should be decided depending on physical structure of the child (Barron & Cocoman 2008). Cook & Murtagh (2006) and Junqueira et al. (2010) stated that VG site can be used when administering IMI to children in all age groups.

The method used in determination of ventrogluteal site

The V method is commonly used in determination of VG for IMI. The VG site is identified (V method) as follows: If the injection is to be administered to the left side, [1] the nurse positions the wrist parallel to the patient's left femur and places the palm of the right hand over the patient's greater trochanter. When using this method, the nurse uses the 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 (Berman et al. 2008, Craven & Hirnle 2009; Kaya et al. 2015, Potter & Perry 2009, Taylor et al. 2008). The injection site identified could differ according to the size of the nurse's hand. This issue is considered more important in children (Junqueira et al. 2010). It is also believed that nurses avoid the VG site because they do not trust the method used to locate the site, and the hand size of the person administering the injection influences the injection site location (Kaya et al. 2015).

Meneses (2007) found that G method, called the geometric method, is 100% reliable. 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 iliac spine. Thus, a triangle is created by imaginary lines. After that, median lines are drawn for every single corner of triangle (Kaya et al. 2015, Meneses 2007). Meneses (2007) developed the geometric method as an alternative to the V method to determine the needle puncture point in the VG site for IMI and Kaya et al. (2015) tested reliability of this method.

The length of injection used when administering medication to the ventrogluteal site

When muscle tissue is evaluated in terms of VG and DG site, muscle tissue is thicker in VG site than in the DG site, while subcutaneous tissue is thinner. Therefore, the possibility of making a mistake in IM injection to the VG site is lower, because this site is away from major blood and nerve vessels and nerve injury is lower. Also, it is easier to determine this site (Cocoman & Murray 2010, Kaya et al. 2012).

In the literature, it is stated that muscle tissue and subcutaneous tissue thickness vary depending on site, sex and body mass index. Accordingly, subcutaneous tissue in VG site of women is thicker than that of men (Kaya et al. 2015, Nisbet 2006, Zaybak et al. 2007).

As much as in adults, administration of IMI in children is important for the selection of site as well as amount of medication to be administered. In the literature, it is stated that vastus lateralis muscle should be preferred for IMI up to 2 years of age (Royal College of Paediatrics and Child Health 2002). Cook & Murtagh (2006) conducted a study to determine the tissue thickness in VG site in children aged 2, 4, 6 and 18 months. According to this study, subcutaneous tissue thickness and muscle thickness in babies aged 2 months are 9.3 mm and 11.9 mm, respectively. In babies aged 4 months, subcutaneous tissue thickness and muscle thickness are 9.2 mm and 12.8 mm, respectively. In babies aged 6 months, subcutaneous tissue thickness and muscle

thickness are 9.3 mm and 13.3 mm, respectively. In babies aged 18 months, subcutaneous tissue thickness and muscle thickness are 8.4 mm and 18.4 mm, respectively. When these figures are compared with the muscular tissue thickness in the Anterolateral (AL) site, it is observed that muscular tissue in the VG site is thicker than muscular tissue in the anterolateral (AL) site. It is also observed that muscle thickness increases with age. Similarly, Junqueira et al. (2010) determined immunological response and post-vaccination side effects of Hepatitis B vaccine that is administered to the VG site in babies less than eight months. In the randomized controlled experimental study, babies on whom the vaccine was administered to the Anterolateral (AL) site formed the control group and babies on whom the vaccine was administered to the VG site formed the experimental group. The rate of incidence of post-IMI side effects, such as local side effect and fever, was found 17.9% in experimental group and 23.7% in control group.

Therefore, it is suggested that the VG site can be used easily in vaccination in babies. As a result, the VG site can be used for IMI in children.

On the other hand, studies on adults focus on the subcutaneous tissue thickness in use of VG site for IMI. However, thickness of muscle tissue is also important in terms of amount of medication that can be administered.

The type and amount of medications administered to the ventrogluteal site

Knowing the type and amount of medication that can be administered to the muscle for IMI injection is one of the most important factors in reducing the mistakes related to this practice. It is recommended that medications which have high volume, low viscosity and cause irritation (e.g. antibiotics) be administered to the VG site in the babyhood, childhood and adulthood (Berman et al. 2008, Hunter 2008, Potter & Perry 2009, Taylor et al. 2008).

In administration of IMI, reliable medication volumes vary depending on age of individual and site where injection is to be administered. A medication with a volume of 0.5 ml can be administered to VG site in babies less than 18 months and this volume is 1 ml in children under 3 years of age, 1.5 ml in pre-school period under the age of 6.2 ml in school period under the age of 13, and 2.5-3 ml in adolescence and adulthood

(Craven & Hirnle 2009, Kaya & Pallos 2012). These data is obtained from the book and there is no study on the volume of medication that the muscular mass in VG site can tolerate.

The requirement of aspiration when administering injection to the ventrogluteal site

Aspiration is one of the most basic steps of IMI and it is a completely established procedure in practice. Serving as a method of risk reduction, this procedure aims to administer injection to the right site and prevent artery, vein and nerve injuries (Chernecky et al. 2002, Perry et al. 2014).

Aspiration procedure is defined as an application of negative pressure by pulling the piston of injector for 5-10 seconds before the injection (Perry et al., 2014).

The aspiration procedure during IMI is discussed since 1900s. Malkin (2008) states that aspiration is not useful unless an IMI is administered at a DG site. The author also specified that syringes with safety needles do not allow aspiration and that it is no longer practiced in many countries. Nicoll & Hesby (2002) propose that when the needle penetrates into muscle tissue in IMI, aspiration should be performed for 5-10 seconds.

This duration is of great importance for determining whether the needle has been inserted into a low-flow blood vessel (Sisson 2015, Thomas et al. 2015). Very serious complications might occur when medication intended for intramuscular administration is administered intra-arterially or intravenously.

The needle must be removed if blood is aspirated into the syringe, the medication should be discarded, and the procedure repeated anew. Thereafter, the injection must be administered into a different site. Kaya et al.'s (2015) findings also show that aspiration should be performed when administering IMI to the VG site.

Greenway (2014) reported that if the nurse does not see blood in the injector after 5-10 seconds from aspiration, she should administer each 1 ml of medication within 5-10 seconds. Although Greenway (2014) suggested this procedure as a ritual, there is no study conducted with focus on VG site.

Conclusion

In this systematic review, 8 studies which were conducted in the last ten years with the topic “Use of VG Site for IMI”, and the following conclusions were derived:

- DG site is commonly used for IMI. However, it is observed that nurses prefer the VG site more as their average age decreases.
- The VG site can be used reliably when administering IMI to children in all age groups.
- There is alternative geometric method to the V method (also called hand method; it is considered that the size of nurse’s hand may cause mistakes especially in children) to determine the needle puncture point in VG site for IMI.
- The muscular tissue of VG site is thicker than that of DG site and subcutaneous fat tissue is thinner.
- Subcutaneous tissue thickness varies depending on sex and body mass index. Subcutaneous tissue in women compared with men and subcutaneous tissue thickness increases as the BMI increases. Therefore, when a medication is administered to the VG site, injection length should be determined depending on the sex and BMI but there is no evidence-based study on this issue.
- Studies on adults focus on the subcutaneous tissue thickness in use of VG site for IMI. However, thickness of muscle tissue is also important in terms of amount of medication that can be administered.
- There is no study on the volume of medication that the muscular mass in VG site can tolerate.
- Aspiration should be made during an IMI to the VG site.
- Data on period of aspiration and speed of administration during an IMI to the VG site is based on experiences and there is no methodologically solid study on this issue.

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