

The Effect of Structured Education on Nurses' Ventrogluteal Injection Knowledge and Skills

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ABSTRACT

Objective: For a safe intramuscular injection, it is essential to provide nurses with knowledge and skills for using the ventrogluteal site. This study was conducted to determine the effect of structured education on the knowledge and skills of nurses on ventrogluteal injection and their ventrogluteal site preference for intramuscular injection.

Methods: The study was carried out between February and December 2021. The sample consisted of 81 nurses. While training was given to the experimental group (n=46), no training was provided for the control group (n=35). The data were collected using the Information Form, Determination Form of First-Choice Site for Intramuscular Injection, Knowledge Level Form for Ventrogluteal Injection Administration, Ventrogluteal Injection Skill Checklist, and Observation Form for Determining the Choice Site for Intramuscular Injection.

Results: The experimental group's follow-up test rates of choosing the ventrogluteal site for intramuscular injection were found to be higher than those of the control group. Besides, In the follow-up data, the knowledge and skill scores of the experimental group for administering injections into the ventrogluteal site were found to be higher than those of the control group ($p<0.05$).

Conclusions: Structured education for intramuscular injection into the ventrogluteal site was an effective method to increase the nurses' knowledge and skills on ventrogluteal injection and the rate of use of the ventrogluteal site.

Keywords: Intramuscular injection, gluteal region, patient safety, education

1. INTRODUCTION

Intramuscular (IM) injection administrations were introduced in nursing practices in the early 1960s. Today, IM injections are among the most frequently administered nursing practices (1,2). Unsafe injection administrations cause severe complications and increase patient morbidity and mortality (3,4). Therefore, to define safe injection practices, nurses have investigated IM injection complications, preferred injection sites, procedures to reduce injection-related pain and injection techniques since the early 1970s (2). According to the results of previous studies, it is known that the most important determinant of a safe injection is selecting the injection site (5-7).

The site chosen for injection is required to be away from nerves, vessels and bone structures, the target muscle tissue is required to be of a thickness suitable for injection, and the subcutaneous tissue needs to be thin enough to allow access to the muscle tissue. Recent studies have reported that nurses select the dorsogluteal (DG) site as their first choice for IM injection (8-10). Nevertheless, it has been recommended to choose a site safer than the DG site for IM injection due to reasons such as that the anatomical structure of the sciatic nerve is different from what is known (the proximal part of the nerve lies closer to the head

and is approximately in the midline of a line drawn in the ischial tuberosity with the great thoracic) (4), the majority of injections that are considered to be IM injections are actually made into the subcutaneous tissue (7), and the subcutaneous tissue is thick enough to prevent reaching the target muscle (6). As a result, the DG site is recommended to be avoided as the first choice (4,5,11). In the selection of the injection site, instead of DG, it is recommended to use the ventrogluteal (VG) site where large bony prominences are present, which is farther from the sciatic nerve (12), major blood vessels and where subcutaneous fat tissue is thinner (2,9). The usage rates of the VG site have been reported as 18% (13), 8.3% (9), and 7.4% (14,15) whereas the usage rates of the DG site have been reported as 64% (13), 85.4% (9) and 76.5% (14). As it may be understood from all these results, the DG site continues to be used as the first choice despite its high potential risk and the changing knowledge in the literature. The rates of using the VG site, which is a safe site, are quite low. Milutinovic et al. (9), and Arslan and Özden (13) concluded that nurses still prefer the DG site since they do not have sufficient knowledge regarding the individual elements of the application of IM injections into the ventrogluteal site, like locating the injection site by using

the V method or the G method. It was reported that the majority of nurses gave wrong answers to statements about the choice of injection site (80%) (13), in which age groups the VG site should be used (84.1%) and what kind of drugs should be administered to which site (74.9%) (15), and the researchers concluded that nurses should be trained on this issue (13,15). Salami et al. (16) reported that 14.0% of drug administration errors due to route errors were made during intramuscular drug administration.

Considering all these data, for safe intramuscular injections within the scope of patient safety, it is an important requirement to meet nurses' knowledge and skill needs regarding the use of the VG site and increase the rate of using the VG site.

This study was carried out to determine the effect of structured education on the knowledge and skills of nurses on VG injection and their preference for the VG site for intramuscular injection.

2. METHODS

2.1. Ethics Approval

Ethics committee approval and institution approval was obtained (Decision no 09.2019.161, dated 09.2019). The participants were informed about the purpose of the study, and their written consent was obtained. In the implementation of the research process, the World Medical Association (WMA) – Ethical Principles for Medical Research Involving Human Subjects were adhered to.

2.2. Design, Sample, and Setting

This study was conducted using a pretest-posttest randomized-controlled trial design and was carried out between February and December 2021.

The population included nurses working in a private university hospital. The sample consisted of those among this population who met the inclusion criteria (having at least one year of experience working in clinics where adult patients are cared for) and agreed to participate. The required sample size for the study was calculated by performing a power analysis. Based on the study by Amanak (17), the sample size was calculated to be 30 individuals in each group considering the effect size of 0.4, a confidence interval of 95%, and a test power of 95%. Considering the possibility of data loss, each group was planned to consist of 60 people. To create the sample, clinics that provide care for adult patients were determined. For the homogeneous distribution of the internal and surgical clinics in the experimental and control groups, the clinics were divided into two groups surgical and internal clinics. Among these groups, the clinics to be included in the experimental and control groups were determined by the randomization method. To prevent interaction between the participants, it was ensured that all nurses in the same clinic were assigned to the same group. As a result, 60 nurses were assigned to the experimental group, and 52 nurses were assigned to the control group (Figure 1).

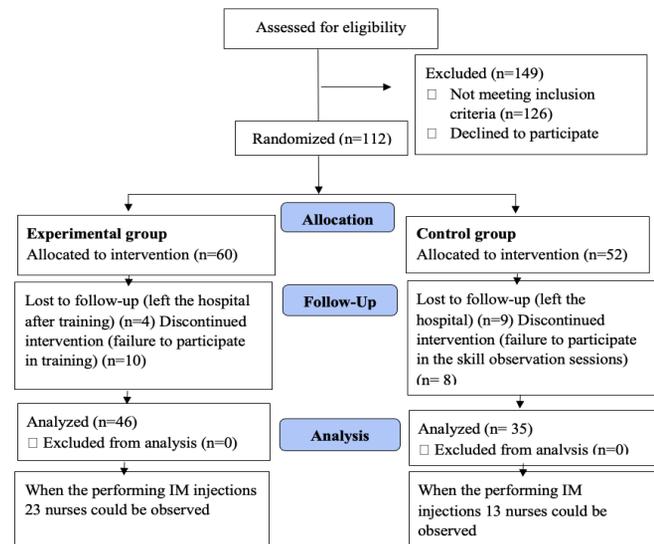


Figure 1. CONSORT diagram of the study

2.3. Study Questions

Does structured education on administering injections into the VG site increase the knowledge and skill levels of nurses for the use of the VG site?

Does structured education on administering injections into the VG site increase the use of the VG site?

2.4. Instruments

Data were obtained with an Information form, a Determination form of the first-choice site for IM injection, a Knowledge level form for VG injection administration, a VG injection skill checklist, and an Observation form for determining the choice site for IM injection.

Knowledge level forms for VG injection administration and VG injection skill checklist were submitted to three nurses, who are professors in nursing, and two clinical nurses in the hospital. After making necessary arrangements in line with the feedback that was received from these experts, the forms were finalized.

2.4.1. Information Form

The form consisted of six questions aiming to determine the demographic data of the participants.

2.4.2. Determination Form of First-Choice Site for IM Injection

The form consisted of seven questions aiming to determine the participants' use of the VG site and the sites they preferred in IM injection administration. In this form, there are questions about specifying the first preferred IM injection site and marking the first preferred site on a figure.

2.4.3. Knowledge Level Form for VG Injection Administration

This form, prepared to determine the participants' level of knowledge on VG injection, consisted of 28 statements that could be marked as "true" or "false." There were a total of 16 correct statements and 12 false statements. Each right answer was scored as 1 point, and each wrong answer was scored as 0 points, while the lowest and highest scores that could be obtained on the form were 0 and 28. The response time was 20 minutes. Form was prepared by reviewing the literature (10,14,18).

2.4.4. VG Injection Skill Checklist

The checklist consisted of 19 process steps aiming to evaluate the participants' ability to administer IM injection into the VG site. The lowest and highest scores that could be obtained on the checklist were 0 and 19. The form was prepared by reviewing the literature (10,14,18).

2.4.5. Observation Form for Determining The Choice Site for IM Injection

The form was prepared to determine the site chosen by the participants during their clinical applications of IM injection. In the form, the observer was asked to mark one of the two options; the nurse chose the VG region or not chose the VG region for IM injection.

2.5. Implementation

First interview the information form, the determination form of first-choice site for IM injection and the knowledge level form for VG injection administration were applied (pretest). One week after the first interview the participants who filled out the forms were invited for skill observations on scheduled dates. Skill observations were made in three sessions on three different days, with a maximum of 20 people per session. The participants were asked to administer an IM drug into the VG site on a manikin. In the meantime, they were evaluated with the VG injection skill checklist (pretest). The same researcher made all skill observations.

While collecting pretest data the participants were informed that they would be observed in the clinic during IM injection administrations in terms of selecting injection sites. However, they were not told when and by whom the observation would be made.

Following the pretest data collection, the participants included in the experimental group were given an invitation with the date and time they were going to attend the education program (two weeks after the first interview). The material of the education program was prepared in Microsoft PowerPoint and supported by images and videos taken by the researcher. The educational content covered the topics

of IM injection, IM injection sites, selection of the VG site, administration method of injection into the VG site, and pre-and post-procedure evaluation methods in injection. In terms of the conformity of the education content, opinions were obtained from five experts in relevant fields. The education program was held on three different days, two sessions per day, for six sessions. A checklist was also used to ensure that all components of the education program were provided in each education session. Each participant in the experimental group attended the education program once. Each session included 10-12 participants, and it lasted 40 minutes in total. Following the education program, the knowledge level form for IM injection administration (posttest) was applied. Then, the participants were asked to perform injection administration into the VG site on a manikin. These injection administration practices of the participants were evaluated with the VG injection skill checklist (posttest).

The IM site selections of the participants in both groups were determined by observing them with the observation form for determining the choice site for IM injection four weeks after their first interview. It was aimed to observe each participant once while they were performing IM injections. For this purpose, observations were made by visiting clinics at three different treatment hours (single-blind). Since no drug required IM injection in the treatment of the patients of some participants, or the BMI of their patient was not suitable for injection into the VG site (3 patients in the experimental group and 2 patients in the control group, $BMI > 25 \text{ kg/m}^2$), only 23 nurses could be observed in the experimental group, and 13 nurses could be observed in the control group.

Sixteen weeks after the first interview, all participants were asked to fill the knowledge level form for IM injection administration into the VG Site (follow-up test) and the determination form of first-choice site for IM injection (follow-up test). Following the filling of the forms (after one week), the participants were invited for skill observations, and their IM injections administered into the VG site were evaluated using the VG injection skill checklist (follow-up test) (Figure 2.)

In the literature, it is reported that at least three weeks should pass for the development of behavior change after the education aimed at gaining skills. The time required to measure the permanence of knowledge has been reported as 3-6 months (19,20). For this purpose, in this study, IM injection skill was assessed four weeks after the education and knowledge of IM injection at VG Site sixteen weeks after the education.

After the data collection process was completed, training was given to the nurses in the control group in order to ensure equal opportunity.

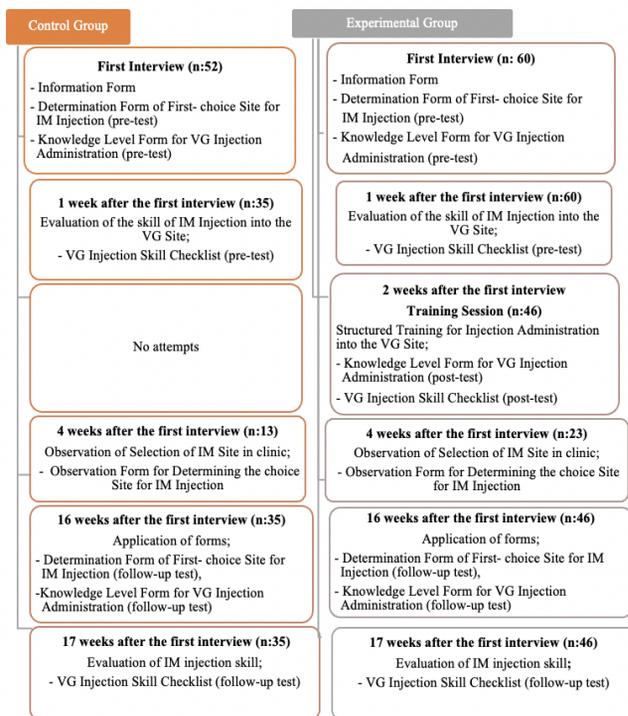


Figure 2. Flowchart of the research

2.6. Data Analysis

Descriptive statistical methods (percentage, mean, standard deviation) were used while analyzing the data obtained in the study. Pearson's Chi-Squared test was used for the categorical variables between the two groups. In the intergroup comparisons, the Mann-Whitney U test was used for the non-normally distributed data. Wilcoxon signed-rank test was used for the intragroup comparisons, and Friedman F-test for repeated measures was utilized for more than two groups.

2.7. Limitations

Besides, failure to observe all nurses in the groups during the clinical observation (since there was no IM injection in the treatment) is one of the limitations of this study.

3. RESULTS

Table 1 shows the demographic characteristics of the individuals participating in the study. When the experimental group and the control group were compared in terms of features that would affect the data of the study, no significant difference was found between the two groups (p>0.05) (Table 1).

Table 1. Demographic characteristics of the groups

Results		Experimental group (n:46)		Control group (n:35)		Test statistics	P
		n	(%)	n	(%)		
Age	Mean (±SD)	23.22(±4.23)		24.67(±1.90)		606.0*	0.052
Gender	Female	35	76.1	26	74.3	0.035**	1.000
	Male	11	23.9	9	25.7		
Educational Level	Medical-Vocational High School	16	34.8	12	34.3	0.513**	0.329
	Associate Degree	5	10.9	8	22.9		
	Undergraduate	24	52.2	13	37.1		
	Postgraduate	1	2.2	2	5.7		
Years of Work	0-1 year	17	37.0	15	42.8	0.415**	0.813
	2-5 years	13	28.2	10	28.6		
	Five and <5 years	16	34.8	10	28.6		
Field of Work	Surgical Units	22	71.0	12	46.2	3.617**	0.070
	Internal Units	9	29.0	14	53.8		
Status of Receiving Education for VG Injection	Yes	28	60.9	24	68.6	3.437**	0.494
	No	18	39.1	11	31.4		
*** How long ago was the education received?	0-1 year	16	57.1	15	65.2	0.913	0.613
	1-2 years	5	17.9	2	8.7		
	Two and < 2 years	7	25.0	6	26.1		
Number of Injections per week Median (IQR)		10 (5-30)		8 (4-28)		348.50*	0.572

Notes: * Mann-Whitney U, ** Pearson's Chi-Squared, ***Those who had received education previously were analyzed.

Abbreviations: VG: Ventrogluteal; IQR: interquartile range

The participants were evaluated in two ways: by asking participants to fill out the determination form of the first-choice site for IM injection and by making observations during IM injection with the observation form to determine the participants' site choice for IM injection. In line with the answers given to the form, in the pretest, it was found that 80.4% of the experimental group (n:37) and 88.6% of the control group (n:31) preferred the DG site as their first choice (p=0.539). In the follow-up test, it was determined that 82.6% of the experimental group (n=40) and 14.4% of the control group (n=5) preferred the VG site as their first choice (p=0.002). When the participants in the groups were observed in the clinic regarding the site they chose for IM injection, it was found that 87% (n: 20) of the 23 observed participants in the experimental group preferred the VG site. In comparison, 0% (n:0) of the 13 observed participants in the control group preferred the VG site (p=0.000) (Table 2).

Table 2. Comparison of the groups in terms first-choice site for IM injection

Results		Experimental group n:46 %		Control group n:35 %		Test statistics	P
First-Choice Site Pretest	VG	3	6.6	2	5.8	0.560	0.539
	DG	37	80.4	31	88.6		
	Deltoid	0	0	0	0		
	Femoral	4	8.7	1	2.8		
	Latero Femoral	2	4.3	1	2.8		
First-Choice Site Follow-up Test	VG	38	82.6	5	14.4	4.511	0.002
	DG	4	8.8	28	80.0		
	Deltoid	0	0	0	0		
	Femoral	2	4.3	1	2.8		
	Latero Femoral	2	4.3	1	2.8		
		N (23) %		N (13) %			
Clinical Observation	VG	20	87	0	0	25.435*	0.000
	DG	3	13	13	100		

Notes: * Pearson's Chi-Squared

Abbreviations: VG, Ventrogluteal; DG, Dorsogluteal

Comparing the groups in terms of their scores on the knowledge level form for VG injection administration, the experimental group's follow-up score was found to be higher than that of the control group (p=0.000). Besides, the follow-up knowledge level scores of the experimental group were higher than their posttest and the pretest scores, and their posttest scores were higher than their pretest scores (p=0.000). The follow-up test scores of the participants in the control group were found to be higher than their pretest scores (p=0.005) (Table 3).

Table 3. Comparison of the groups in terms of scores of knowledge level for VG injection administration

Results	Experimental group Median (IQR)	Control group Median (IQR)	Test statistics	P
Pretest (a)	19 (16-21)	19 (16-21)	760.0*	0.471
Posttest (b)	25 (25-27)			
Follow-up test (c)	26 (25-28)	21 (19-23)	0.000*	0.000
Test statistics	38.072**	-2.824***		
P	0.000	0.005		
Post hoc****	b>a, c>a, c>b			

Notes: * Mann-Whitney U test **Friedman F test *** Wilcoxon signed-rank test ****Wilcoxon signed-rank test -- Bonferroni correction was made and considered as p=0.001 significant.

Abbreviations: IQR=interquartile range

When the groups were compared in terms of their VG injection skill scores, the follow-up score of the experimental group was found to be significantly higher than that of the control group (p=0.000). The posttest score of the experimental group was found to be higher than their pretest score, and their follow-up test score was higher than their posttest and pretest scores (p=0.000) (Table 4).

Table 4. Comparison of the groups in terms of VG injection skill scores

Results	Experimental group Median (IQR)	Control Group Median (IQR)	Test statistics	P
Observation pretest (a)	10 (8-11)	10 (8-11)	795.50*	0.928
Observation posttest (b)	18 (8-20)			
Observation follow-up test (c)	19 (8-20)	8 (8-11)	242.00*	0.000
Test statistics	80.595**	-0.577***		
p	0.000	0.564		
Post hoc****	b>a, c>a, c>b			

Notes: * Mann-Whitney U test **Friedman F test *** Wilcoxon signed-rank test **** Wilcoxon signed-rank test -- Bonferroni correction was made and considered as p:0.001 significant.

Abbreviations: IQR=interquartile range

4. DISCUSSION

IM injection, one of the invasive procedures applied by nurses, has an essential place in treating patients. It is a safe way of administering drugs that are desired to be absorbed quickly (faster subcutaneously and orally, slower through the venous route) and has highly intense and irritating effects. However, the prerequisite for achieving the desired effect is that the administration should be made in the correct injection site, with the proper technique, into the right tissue (muscle) (2,9).

In the pretest data of this study, the majority of the participants in both groups stated that they chose the DG site as their first choice. The number of participants who stated that they preferred the VG site was very low in both groups ($p=0.539$) (Table 4). It was remarkable that although more than half of the participants were newly graduated and had received education to administer injections into the VG site in their undergraduate education, their usage rates of the VG site were low (Table 1). According to all these results, despite the knowledge gained in undergraduate education about the VG site, newly graduated nurses use traditional methods. It is believed that one of the reasons for this was the fact that although newly graduated nurses want to use the VG site in line with their education, they cannot find any opportunity. As stated in the literature, the rate of nurses using the VG site in clinics was found to be low due to the lack of sufficient knowledge about the use of the area, not having applied to this area before, and the area being close to the bones (8,9,15). In terms of patient safety, newly graduated nurses are not allowed to practice alone, and they are asked to perform all drug administrations under the guidance of a clinic nurse. It is possible that clinic nurses who did not have any knowledge about this issue might not have allowed newly graduated nurses to use the VG site. Thus, the knowledge and skills that are not used in the first years of the profession cannot turn into a settled behavior.

In the pretest, the knowledge and skill levels for injection into the VG site were intermediate in both groups ($p>0.05$) (Table 2-4). The knowledge and skill levels of the nurses were not sufficient for IM injection, which requires psychomotor skills and causes serious complications. Studies have reported that nurses have low levels of knowledge and skills to apply IM injection to the VG site and suggested planning structured education or in-service training initiatives on this topic (9,10,21). Our findings were compatible with the literature, and the necessity of attempts to increase the level of knowledge and skills about VG injection was revealed once again.

In the follow-up-test data, 16 weeks after the structured education program given to increase the nurses' use of the VG site, their knowledge and skill levels, it was determined that the majority of the experimental group chose the VG site, and the control group chose the DG site (observation form for determining the choice site for IM injection) ($p<0.005$). Moreover, the knowledge and skill levels of the experimental group for injection administration into the VG site were found to be significantly higher than those of the control group ($p>0.05$) (Table 3-4). In the intragroup comparisons, it was observed that the knowledge and skill level follow-up test scores of the experimental group were higher than their posttest scores, while their posttest scores were higher than their pretest scores, indicating improvement. In the control group, the knowledge level follow-up test scores were found to be higher than the pretest scores ($p=0.05$). However, no significant difference was found in the skill level scores of the control group ($p=0.564$) (Table 3-4). Based on these findings, it was thought that the education program contributed to the

increase in the experimental group's rate of using the VG site and the increase in their knowledge and skill levels, and the participants' adoption of knowledge and skills regarding the practice of IM injection into the VG site (Table 2) provided the increase in the follow-up test. The increase in the posttest knowledge level of the control group was accepted as the pretest effect.

These results clearly showed that the education program increased the rates of using the VG site among the participants. In the education program, it was emphasized that in addition to the technique of administering an injection into the VG site, complications related to the use of the DG site, the advantages of using the VG site, and safe IM injection are the responsibilities of the nurse. The nurses were recommended to use the VG site for IM injections. Furthermore, factors such as the fact that the education program was conducted in a clinical setting, theoretical education was reinforced with demonstration, the participants had the opportunity to apply the information right after the education program were considered essential in the effectiveness of the education program that was provided. It was concluded that these initiatives provide positive results in increasing the effectiveness of education. In the literature, there are some studies about nurses' choices of site for IM injection (8,9,10,22), pain control (23) and needle length to be used (6), whereas studies examining skill levels are limited (16,24). In this study, the skill levels of the nurses were objectively observed and evaluated. This situation increases the reliability of this study's data collected and analysed. The results obtained on this topic are also important in terms of their contribution to the literature.

5. CONCLUSION

Although injection into the VG site is presented in the nursing literature and taught in nursing curricula, nurses continue to use the DG site for intramuscular injection. Based on the findings in this study, it was observed that the education program conducted in the experimental group was an effective method to increase nurses' knowledge and skill levels in administering injections into the VG site and their rates of VG site use. Both for patient safety and for nurses not to be confronted with the law, recommendations are; Organizing and implementing similar education programs must be done, the region selections of the nurses working in the clinic should be observed at regular intervals and regulatory initiatives should be planned in line with the findings and training on site selection and administration methods in IM injection should be repeated at regular intervals.

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Author Contributions:

Research idea: AKŞ

Design of the study: AKŞ, GKO

Acquisition of data for the study: AKŞ, NÇ

Analysis of data for the study: AKŞ, NÇ

Interpretation of data for the study: AKŞ, GKO

Drafting the manuscript: AKŞ, ŞEA

Revising it critically for important intellectual content: ŞEA

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