

## Original Article

## The Effect on Nurses' Knowledge and Skills of Planned Training Given on the Administration of Intramuscular Injection to the Ventrogluteal Site

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### Abstract

**Aim:** The research was aimed to examine the effect of nurses on the knowledge and skills of planned training given to the use of the ventrogluteal (VG) site in intramuscular injection.

**Methods:** The research was conducted with a single group using a semi-experimental pre-test, post-test design. The sample of the research was composed of 30 nurses.

**Results:** The mean score of the knowledge about intramuscular injection of the nurses to the VG site 1st follow-up  $45.57 \pm 18.502$ ; 2nd follow-up  $85.13 \pm 7.157$ ; 3rd follow-up  $79.37 \pm 6.239$ ; and 4th follow-up was  $76.53 \pm 5.588$ . First and 2nd, 1st- 3rd, and 1st-4th follow-ups were a significant difference between the knowledge mean scores ( $p < 0.05$ ). It was found that while the administering injection of the nurses in the 3rd follow-up to the VG site was 66.7%, it was 96.7% in the 4th follow-up to the VG site. There was a statistically significant difference between the numbers of intramuscular injections performed in the 3rd and 4th follow-ups ( $p < 0.05$ ).

**Conclusions:** The knowledge of nurses after training was higher than before the education. Training increased the number of intramuscular injections into the VG site of the nurses.

**Key words:** intramuscular injection, nurse, training, ventrogluteal site

### Introduction

Drugs can be administered to patients by many ways, such as orally and parenterally (Kilic et al., 2014; Potter & Perry 2009). In all institutions where health services are provided, providing the use of oral and parenteral drugs by patients and administering these drugs to patients is the responsibility of nurses (Kara et al., 2015). When a drug is administered parenterally by intramuscular (IM) injection, it is delivered to deep muscular tissue (Sagkal et al., 2014; Vicdan et al., 2015). This is the most commonly used method of injection (Ay, 2019; Lynn, 2015). The most important factor in intramuscular

injection complications is the injection site used (Kaya et al., 2015; Wynaden et al., 2015). According to the results of many evidence-based studies recently, it has been accepted that the safest site for IM injection is the Ventrogluteal (VG) injection site (Arslan & Ozden 2018; Larkin et al., 2017). The reasons why this site is the safest for the administration of injections have been set out as follows. (1) The VG site is far from any bony projections, there are no nerves or blood vessels in the site, and the possibility of delivering the drug to the subcutaneous (SC) tissue is low (Coskuret al., 2016; Sendir & Coskun, 2016). (2) The most important factor

in the safety of the VG site as an injection site is that it is far from the sciatic nerve (Arslan & Ozden, 2018; Brown et al., 2015). (3) It has been found that the muscular tissue at the VG site is thicker than at the dorsogluteal site (DG) and the SC fat tissue is thinner, (Elgellaie et al., 2018; Gulnar & Ozveren, 2016), so that less discomfort and pain is caused by SC irritation which may occur as a result of the administration of IM injections (Dogu, 2016). (4) Possible complications resulting from IM injections are not seen in IM injections administered to the VG site (Gunes et al., 2016; Kilic et al., 2014). (5) It is reported that the only complications with injections to the VG site are those associated with the drug administered (Dogu, 2016; Vicdan et al., 2015). Complications arising from nurses' deficiencies in knowledge and errors in administration regarding IM injection can be prevented by training (Sagkalet al., 2014). Therefore, improvements should be made in the levels of information and skill relating to the VG site of nurses whose knowledge of this site is deficient from the point of view of its use by nurses in administering IM injections. Lasting behavior changes should be developed in nurses concerning IM injection to the VG site. In order for this to happen, nurses should be given regular and organized training (Tugrul & Denat, 2014). In the literature, very few studies were found either in Turkey (Gulnar & Ozveren, 2016) or in other countries in which knowledge and skills concerning the use of the VG site were determined and planned training was given in line with needs. This study will contribute to teaching why the VG site should be preferred, what its advantages and disadvantages are, and how a site should be determined for the correct administration of an injection, and to inform and develop a guidance material for in-service training.

The aim of the study was to determine the effect on nurses' knowledge and skills of planned training given on the administration of IM to the VG site.

## The research hypotheses

H<sub>1</sub>: There is a difference between nurses' knowledge levels before and after training in IM injection.

H<sub>2</sub>: After training, there is an increase in nurses' use of the VG site in administering IM injections.

## Method

**Research type:** The research was a semi-experimental study with a single group and a pre-test post-test organization.

**Population and Sample:** The population of the study was the 35 nurses working at a state hospital in Turkey between 14 July and 31 October 2016, and the sample consisted of 30 nurses who were working at the hospital as nurses between 14 July and 31 October 2016, who fitted the criteria for sample selection, and who consented to take part in the research. The research was started with the 35 nurses working at the hospital, but 30 nurses were finally included in the study because one of the nurses was working in a place where injections were not applied, three did not wish to participate in the study, and one had a high level of knowledge and therefore did not wish to take part in the study. Thus the rate of participation in the study was 85.7% of the population (Figure 1. Flow Chart).

The criteria for inclusion in the research were (1) accepting to participate in the study, (2) working as a nurse, and (3) working in a place where injections were applied. Exclusion criteria were (1) not accepting to participate in the study, (2) working with emergency medicine techniques or as a midwife or health official, and (3) working in a unit where injections were not given.

## Data Collection Instruments

The following were used to collect data: an individual description form for nurses, a questionnaire containing statements on the VG site, an assessment form for skills relating to the VG site, and a form of frequency of administering intramuscular injections to the VG site.

**Individual description form for nurses:** This form was prepared by the researcher according to the literature and taking into consideration similar studies providing training to nurses (Berman et al., 2012; Hopkins & Arias, 2013). It consisted of 15 questions on nurses' descriptive characteristics and administration of IM injections.

**Questionnaire containing statements on the VG site:** This form consisted of 22 questions, and was prepared by the researcher according to the literature (Ay, 2019; Oliveira et al., 2015). The questions on the form contained statements of basic knowledge on the administration of IM injections to the VG site such as locating the VG site, reasons why the VG site is not used, structure of the VG site, and techniques of administering IM injections. Eleven of the statements were true, and 11 were false, and the nurses were asked to choose "true", "false", or "I have no opinion" for each one. Correct responses were given one point, and incorrect responses or "no opinion" were given no points. The total knowledge score was calculated out of 22. Each question was given 4.55 points to give a score out of 100.

**Assessment form for skills relating to the VG site:** This form, prepared by the researcher according to the literature (Lynn, 2015; Potter & Perry, 2009), contained 45 steps assessing nurses' skills. The nurses carried out procedures on a model by the demonstration method, while the researcher observed, and filled in the form according to whether the procedures were correctly performed, selecting "yes" or "no" for each step.

**Form of frequency of administering intramuscular injections to the VG site:** This form was developed by the researcher, and consisted of one question, asking nurses how many IM injections they had administered to which sites since their training.

The views of ten experts in the field were taken on the questionnaire containing statements on the VG site and the assessment form for skills relating to the VG site before the study was commenced. Necessary revisions were made to the forms in accordance with these views.

**Materials used in the training:** In training the nurses in this research, a VG hip model,

Powerpoint presentation, and brochure materials were used.

**VG hip model:** The full life-sized male model used was made of PVC and sourced from abroad. On the model there were injection sites on the arms, the thighs, the buttocks and the side of the hips. These injection sites were covered with foam material.

Power point presentation material was prepared to give nurses information on the use of the VG site in IM injection. The content of the presentation was prepared by the researcher in line with the literature (Ay, 2019; Greenway, 2004).

**Powerpoint presentation:** This covered such topics as a description of IM injection, IM injection complications, IM injection sites, the reasons why DG injection is risky, general information on the VG site, the amounts of drugs administered to the VG site, the advantages of the VG site, the procedure for administering an IM injection to the VG site, general rules for the injection procedure, reasons for choosing the VG site, and reasons for nurses not to use the VG site.

**Brochure:** A brochure entitled "Why the Ventrogluteal Site?" was developed as a short summary of IM injection to the VG site, including important information, with that aim of giving nurses information on injections to the VG site. Its contents were decided by the researcher according to the literature (Hopkins & Arias, 2013; Vicdanet et al., 2015).

**Data Collection:** Research data was collected in four follow-ups.

**First observation (Days 1-7) (Pre-test):** After the nurses who accepted to participate completed an informed voluntary acceptance form, they were asked to complete the individual description form for nurses and the questionnaire containing statements on the VG site as a pre-test. Steps were taken to prevent the nurses from influencing each other while completing the form. It took approximately 20 minutes to complete each form.

**Second observation (Days 8-12) (Post-test):** Nurses who answered more than half of the statements wrongly and those who accepted planned training were taken into the training. Training was given to groups of ten persons. Nurses who could not come on the training day were given training on the fourth day.

Training was given in the training hall of the teaching hospital. A 30-45 minute presentation was made with explanations, demonstrations and practice, and Powerpoint material. After the presentation, nurses individually carried out the procedures on the model patient while the researcher completed the assessment form containing skills relating to the VGsite. After the training, the nurses completed the questionnaire containing statements on the VGsite. In order to reinforce knowledge and skills, the brochures prepared by the researcher were handed out. In addition, after the nurses had completed all the training, the CD of the Powerpoint material used in the training was loaded on to computers in the wards where the nurses could access it.

**Third observation (Days 42-46) (Retention test 1):** One month after the training, the nurses were again brought together in groups of ten in order to determine the knowledge and skills which they had acquired. Nurses who could not come on the training day were taken into training on the fourth day. The nurses were asked to complete the questionnaire containing statements on the VGsite and the form of frequency of administering intramuscular injections to the VGsite. After completion of the forms, the nurses' skills in administering IM injections to the VG site were once again tested by asking them to carry out the steps of the IM injection process on the model while the researcher completed the assessment form containing skills relating to the VGsite.

**Fourth observation (Days 106-110) (Retention test 2):** Two months after the third observation, the nurses again participated in training in groups of ten. Nurses who could not come on the training day were taken for training on the fourth day. First, the nurses were again asked to complete the questionnaire containing statements on the VGsite and the form of frequency of administering intramuscular injections to the VGsite. After completing the forms, the nurses again carried out the procedures on the model, and the researcher completed the assessment form containing skills relating to the VGsite.

**Data Analysis:** Analysis of the data obtained in the study was performed using the program

Statistical Package for Social Science (SPSS) 16.0. For continuous variables, characteristics focused on were mean, standard deviation, and minimum and maximum values, while for categorical variables they were numeric and percentage values. In comparing the means of two groups in terms of continuous variables, the independent *t* test (Student's *t* test) was used, while One Way Variance Analysis (ANOVA) was used to compare more than two groups. Also, the Paired Sample *t* test was used to determine whether there was a difference between the follow-ups in terms of score change. The level of statistical significance in the calculations was taken as  $p < 0.05$ .

**Ethical Considerations:** Written permission to conduct the research was obtained from the Health Sciences Ethics Committee (Decision No. 20478486-218 dated 15 June 2016), and from the Ethics Committee of the General Secretariat of the hospital association. The purpose of the research and what would be done were explained to the individuals participating in the study, and their permission was obtained orally, and in writing by means of an Informed Voluntary Approval Form.

## Results

**Nurses' descriptive characteristics:** Table 1 shows the distribution of the nurses included in the study according to their descriptive characteristics. It was found that 50% ( $n=15$ ) of the nurses were female and 50% ( $n=15$ ) were male, 60% ( $n=18$ ) were in the 24-29-year age group and their mean age was  $25.03 \pm 3.011$  years (min: 19, max: 31); 60% ( $n=18$ ) were single, 70% ( $n=21$ ) were bachelor's degree, 73.3% ( $n=22$ ) had been working for 1-3 years and their mean duration of working as nurses was  $2.75 \pm 1.633$  years (min: 1, max: 8); 63.3% ( $n=19$ ) worked in the inpatient services, 60% ( $n=18$ ) had worked for 0-1 years in the service where they were currently working, and the mean number of years for which they had worked in that service was  $1.82 \pm 1.013$  (min: 1, max: 4). When the nurses were asked to put five IM injection sites (DG, VG, lateral femoral, rectus femoris and deltoid) in order of use, 90% put the DG site in first place, 6.7% put the VG site in first place, and 60% put the VG site in fifth place.

**Nurses' mean scores on statements concerning the VG site:** Table 2 shows the findings related to the nurses' mean scores on the statements. Their mean knowledge scores on administering IM injections to the VG site were  $45.57 \pm 18.502$  for the first observation,  $85.13 \pm 7.157$  for the second observation,  $79.37 \pm 6.239$  for the third observation, and  $76.53 \pm 5.588$  for the fourth observation. A statistically significant difference in mean knowledge scores was found between follow-ups 1 and 2, follow-ups 1 and 3, and follow-ups 1 and 4 ( $p < 0.05$ ), but no statistically significant difference was found in mean knowledge scores between follow-ups 2 and 3, follow-ups 2 and 4, or follow-ups 3 and 4 ( $p > 0.05$ ).

**Nurses' skills relating the VG site:** The forms assessing the nurses' skills covering the 45 procedure steps concerning the VG site were examined in follow-ups 2, 3 and 4. Two skills were found which the nurses collectively performed correctly with the highest frequency in follow-ups 2 and 3. Of these skills, the skill "Disposable gloves are worn" was performed correctly by 90% in observation 2, and by 86.7% in observation 3. The skill "The skin at the injection site is stretched with the thumb and forefinger of the passive hand" was performed correctly by 90% in observation 2 and by 86.7% in observation 3. One skill was found which the nurses collectively performed correctly with the lowest frequency in follow-ups 2, 3 and 4. This skill, "Muscles are relaxed", was performed correctly by 23.3% in observation 2, by 26.7% in observation 3, and by 53.3% in observation 4. In follow-ups 2 and 3, the skill which the nurses performed second least correctly overall was "Hands are washed", which was performed correctly by 26.7% in observation 2 and by 40% in observation 3.

**The number of intramuscular injections applied by the nurses to the VG site:** Table 3 shows the number of IM injections to the VG site given by nurses after the training. It was found in the third observation that 66.7% of the nurses ( $n=20$ ) had administered IM injections to the VG site an average of  $3.65 \pm 2.700$  times, and in the fourth observation that 96.7% ( $n=29$ ) of the nurses had administered IM injections to the VG site an average of  $9.93 \pm 18.328$  times. A statistically

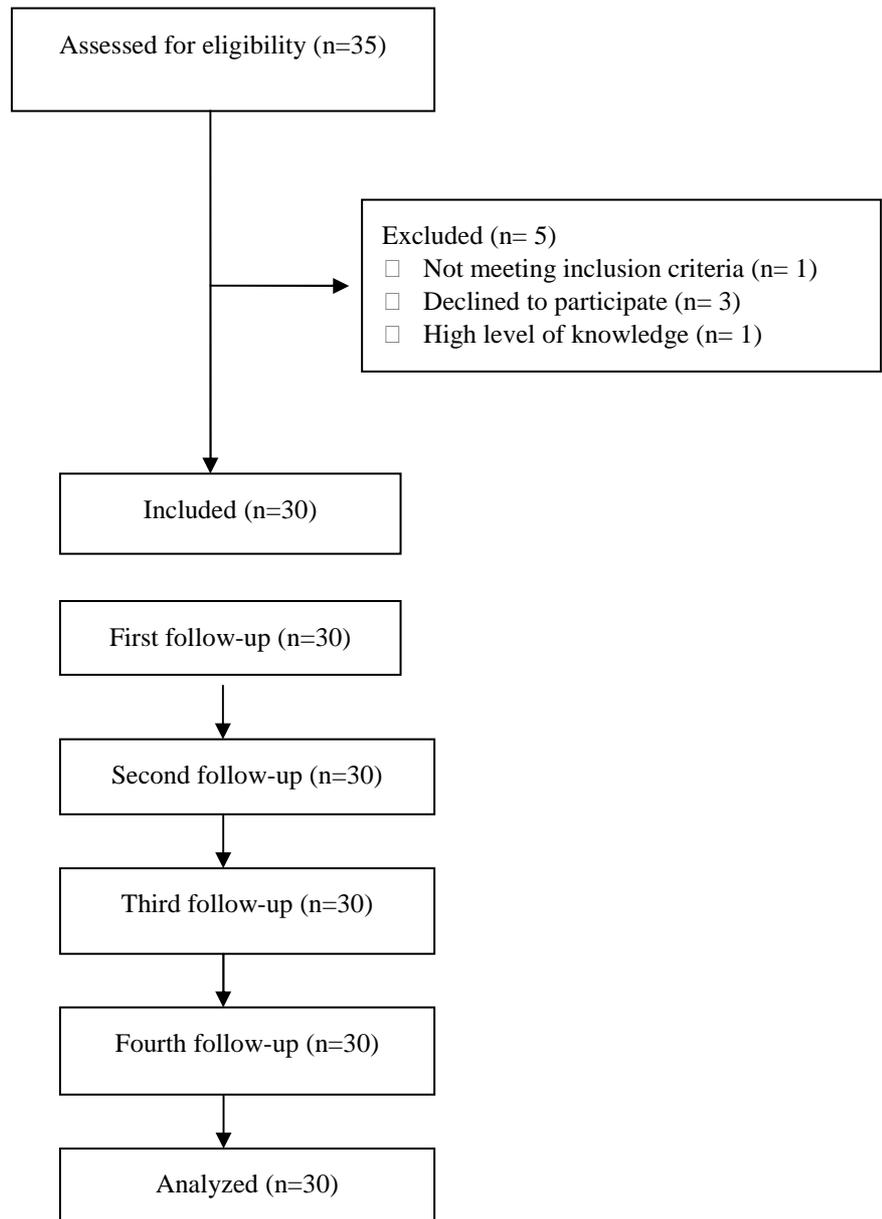
significant difference was found between the results of the third and fourth follow-ups in terms of the number of IM injections administered to the VG site ( $p < 0.05$ ). No statistically significant difference was found for other injection sites ( $p > 0.05$ ).

### Discussion

The VG site has been accepted in the nursing literature of recent years as the safest site for IM injections (Arslan & Ozden, 2018; Brown et al., 2015), and it is recommended that IM injections should be administered to this site (Hopkins & Arias, 2013; Vicdan et al., 2015). However, before training, nine out of ten nurses in this study ranked the DG site as first choice, and six nurses out of ten ranked the VG site last. The findings indicate that the VG site is less frequently used for IM injections. Many studies argue that the first choice of nurses for IM injection is the DG site, and the least chosen site is the VG site (Tugrul & Denat, 2014; Walsh & Brophy, 2011). Maybe the reason for this is that even though nurses are taught injection to the VG site in nursing training, they do not see it used by working nurses in the clinical environment or in practice, and nurses are unwilling to change.

**Nurses' statements of knowledge on the VG site:** Comparing the follow-ups before and after the training, a difference was found between follow-ups 1 and 2, 1 and 3, and 1 and 4 ( $p < 0.05$ ). This shows that after training, the increase in mean scores of knowledge statements was at the expected level and that nurses' knowledge levels could be increased by training. As stated in the literature, many studies found that nurses' knowledge levels were increased after training programs planned for them on the administration of IM injections to the VG site (Altun et al., 2010; Gulnar & Ozveren, 2016; Zeyrek & Kurban, 2017). Sari et al., (2017) assessing the frequency and knowledge of IM injections to the VG site by Turkish nurses, knowledge questions consisting of 24 statements were given to nurses, and it was found that the proportion of correct responses was 14.37%. This shows that the nurses' level of knowledge concerning the VG site was low and that they had not been sufficiently informed on this subject.

Figure 1. Flow Chart



**Table 1. Nurses' descriptive characteristics (n=30)**

Descriptive Characteristics	n	%
<b>Sex</b>		
Female	15	50.0
Male	15	50.0
<b>Age groups</b>		
18-23	9	30.0
24-29	18	60.0
30-34	3	10.0
<b>Mean age</b>	<b>Mean±SD= 25.03 ± 3.011</b>	<b>Min= 19</b>
		<b>Max= 31</b>
<b>Marital status</b>		
Married	12	40.0
Single	18	60.0
<b>Education level</b>		
Health vocational high school	5	16.7
Two-year degree	4	13.3
Bachelor's degree	21	70.0
<b>Duration of working (years)</b>		
1-3	22	73.3
4-8	8	26.7
<b>Mean of working years</b>	<b>Mean±SD= 2.75 ± 1.633</b>	<b>Min= 1</b>
		<b>Max= 8</b>
<b>Working service</b>		
Inpatient services	19	63.3
Intensive care	4	13.3
Emergency service	7	23.4
<b>Working years in working service</b>		
0-1	18	60.0
2-3	10	33.3
4	2	6.7
<b>Working years' mean in working service</b>	<b>Mean±SD= 1.82 ± 1.013</b>	<b>Min= 1</b>
		<b>Max= 4</b>

X: Mean, Sd: Standard deviation, Min: Minumum, Max: Maximum

**Table 2. Nurses' knowledge mean scores on administering IM injectionthe VG site (n=30)**

Follow-ups	Knowledge Mean Scores		
	Min-Max	X± SD	Test <sup>a</sup>
<b>First follow-up</b>	9-77	45.57±18.502	t= -12.910
<b>Second follow-up</b>	68-95	85.13±7.157	p=0.000*
<b>First follow-up</b>	9-77	45.57±18.502	t= -10.346
<b>Third follow-up</b>	68-95	79.37±6.239	p=0.000*
<b>First follow-up</b>	9-77	45.57±18.502	t= -9.220
<b>Fourth follow-up</b>	68-91	76.53±5.588	p=0.000*
<b>Second follow-up</b>	68-95	85.13±7.157	t=4.443
<b>Third follow-up</b>	68-95	79.37±6.239	p=0.061

<b>Second follow-up</b>	68-95	85.13±7.157	t=6.743
<b>Fourth follow-up</b>	68-91	76.53±5.588	p=0.079
<b>Third follow-up</b>	68-95	79.37±6.239	t=3.862
<b>Fourth follow-up</b>	68-91	76.53±5.588	p=0.075

IM: Intramuscular, VG: Ventrogluteal, X: Mean, SD: Standard deviation, Min: Minimum, Max: Maximum, \*p<0.05  
a: Paired Sample t-testi

**Table 3. The number of intramuscular injections applied by the nurses to the VG site**

Sites of IM Injections	Number of Nurses	Number of IM injections	Test <sup>a</sup>
<b>Third follow-up</b>			
	<b>n**</b>	<b>%</b>	<b>Mean±SD</b>
Ventrogluteal	20	66.7	3.65±2.700
Dorsogluteal	27	90.0	24.15±30.102
Lateral femoral	20	66.7	7.75±7.643
Rectus femoris	11	36.7	4.09±3.419
Deltoid	16	53.4	14.00±13.948
			<b>Min-Max</b>
			<b>3.-4.follow-ups</b>
Ventrogluteal			t=2.918 p=0.012 *
Dorsogluteal			t=-0.786 p=0.645
Lateral femoral			t=-0.873 p=0.781
Rectus femoris			t=-0.773 p=0.255
Deltoid			t=-0.883 p=0.125
<b>Fourth follow-up</b>			
	<b>n**</b>	<b>%</b>	<b>Mean±SD</b>
Ventrogluteal	29	96.7	9.93±18.328
Dorsogluteal	28	93.4	27.11±36.291
Lateral femoral	21	70.0	11.33±11.249
Rectus femoris	7	23.4	5.29±8.826
Deltoid	16	53.4	19.75±25.687
			<b>Min-Max</b>
Ventrogluteal			1-10
Dorsogluteal			1-100
Lateral femoral			1-30
Rectus femoris			1-12
Deltoid			1-40

IM: Intramuscular, VG: Ventrogluteal, X: Mean, SD: Standard deviation, Min: Minimum, Max: Maximum, \*p<0.05 \*\* It was chosen one than more sites. A: Paired Sample t-testi

### Discussion contin.

**Nurses' statements of knowledge on the VG site: (contin.)** : Comparing the nurses' mean knowledge scores, no difference was found between follow-ups 2 and 3, 2 and 4, or 3 and 4 ( $p>0.05$ ). There was no serious reduction between the results of the second observation, conducted immediately after the training, and the third observation, conducted one month later, or the fourth observation, made two months after observation 3, but the fact that knowledge which is not repeated is more quickly forgotten may be the reason why some knowledge was forgotten in the three-month period and that the scores fell a little. From this, it is thought that repeating the follow-ups twice, and between follow-ups either using PowerPoint presentations or distributing brochures, may result in a relatively small information loss. In fact, a

reduction in scores in retention tests 1 and 2 was expected, and the small size of this reduction shows that the nurses had retained knowledge. Thus, the planned training given to the nurses on the use of the VG site was effective, and the training given was retained.

**Nurses' skills relating to the VGsite:** At the second and third follow-ups, the two skills which were performed correctly the most were found to be "Disposable gloves are worn" and "The skin at the injection site is stretched between the thumb and the forefinger of the passive hand." The logical reason for the step "Disposable gloves are worn" when giving an IM injection is for protection against blood or bodily fluids to which nurses may be accidentally exposed (Ay, 2019; Bektas, 2015), and the reason for the step "The skin at the injection site is stretched between the thumb and the

forefinger of the passive hand” is to reduce discomfort, to stretch the tissue, to allow the needle to enter the tissue more easily, and to cause less pain to the patient (Ay, 2019).

The two skills least correctly performed in each observation were found to be “The muscles are relaxed” and “Hands are washed”. During in IM injection, the nurse talks to patients and tells them to breathe in and out deeply, thus diverting patients’ attention away from the injection, and this logical rule provides muscle relaxation at the injection site (Ay, 2019). The logical rule of washing the hands before starting on the steps of the IM injection process prevents the spread of micro-organisms by ensuring hand hygiene (Lynn, 2015). It was concluded from these findings that nurses were putting on non-sterile gloves and not washing their hands before the procedure, and they were not sufficiently applying procedures to relax patients’ muscles and reduce pain.

**The number of intramuscular injections applied by the nurses to the VG site:** Even though the VG site is the one recommended for most frequent use, the behavior of the nurses in this study showed that they were unwilling to use the site in the clinical environment, whether because they did not know how to identify and use the site, because identifying it was difficult, or because patients did not want it. The proportion of nurses in the study using the VG site to administer injections was 6.7% before training; after training it was 66.7% in the third observation and 96.7% in the fourth observation. The results of Gulnar & Ozveren (2016) and Zeyrek & Kurban (2017) are similar to those of the present study. Also, an increase was seen in the number of persons to whom IM injections were delivered to the VG site. However, it was also seen that the number of nurses who preferred the DG site and the number of injections to that site remained high from one observation to another. Thus, it is thought that the nurses still preferred the DG site. This shows that the training given was effective, and is pleasing in that the proportion of use of the VG site increased. This expected result meant that those who had never used this site for injections started to use it, and those who used it started to use it

more frequently. It was seen that the study reached its desired aim.

**Limitations and difficulties with the research:** Results cannot be generalized because the number of subjects was small, and the study was conducted in a single institution. A difficulty experienced in the study was that the nurses showed unwillingness to participate in the third and fourth follow-ups after the training.

**Conclusion and Recommendations:** It was determined as a conclusion of this study that planned training given to nurses had an effect on their knowledge and skills, and that their rate of use of the VG site increased, while the follow-ups showed that the training given formed retained behavior in the nurses.

Nurses working in the field of health services should be given in-service training on the use of the VG site and be supported in performing this; in order for them not to forget this knowledge after training, they should be given visual material which they can read at any time, and in order for nurses to keep up with current topics in their field after graduation, they should be encouraged to follow scientific journals, periodic broadcasts and articles and be supported in this. In addition, in order for knowledge to be retained after training is given, it is recommended that in-service training should be repeated at regular intervals, that nurses should be observed when making IM injections to the VG site and that their deficiencies in training should be remedied.

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