

## Original Article

# Evaluation of the Training Given to the Nurses on The Injection Application to the Ventrogluteal Site: A Quasi-Experimental Study

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## Abstract

**Background:** Intramuscular injections are one of the nursing interventions that nurses often practice, and nurses have important responsibilities especially for the preparation of medicines and application of them safely

**Aim:** The aim of this study is to assess the effectiveness which are given to nurses, about injection into ventrogluteal site.

**Methods:** Total of 219 nurses, 110 of which are experimental and 109 of which are control groups comprise sample of the study. Training was provided for the nurses in the experimental group and the nurses in the control group and training booklet were given to the experimental group after training.

**Results:** While VG injection site preference rates of nurses were 5.5% in the experimental group and 6.4% in the control group before training, it was seen that 63.6% of the nurses of experimental group and 55.1% of the control group preferred VG injection site after training. While the mean of knowledge scores of nurses in the experimental group regarding VG site was  $6.27 \pm 3.52$  before training, the mean of knowledge scores of them was  $14.35 \pm 3.52$  after training ( $p < 0.05$ ). The mean of knowledge scores of the nurses in the control group was  $5.93 \pm 3.53$  before training, and the mean of knowledge scores of them was  $12.90 \pm 2.09$  after training. While there was no significant difference between experimental and control groups according to the mean of knowledge scores before training ( $p < 0.05$ ).

**Conclusions:** Findings obtained from the study show that the training booklet given after training as well as face-to-face training, is effective in increasing the level of knowledge toward using the ventrogluteal site.

**Keywords:** intramuscular injection, ventrogluteal site, nursing education, face-to-face training, training booklet

## Introduction

Intramuscular injection (IM) which takes place in parenteral administrations is defined as application of medicine into the muscle tissue (Potter et al. 2017; Craven & Hirnle, 2009; Kaya & Pallos, 2012). World Health Organization (WHO) 2016 reports that it has been made about 16 billion

injection applications each year and 90 % of these injections have been applied for the purpose of treatment. However, WHO reports that safety precautions generally have not been followed at the injection applications in many countries in the last decade (WHO, 2016). Even though it is considered as a simple technique, IM injections may cause

serious complications such as abscess, necrosis, hematoma, ecchymosis, infection, pain, periostitis, vascular and nerve injury and even severe sepsis when they are not carefully done (Nicoll & Hesby, 2002; Dinc, 2011; Kim & Park, 2014).

IM injections are one of the nursing interventions that nurses often practice, and nurses have important responsibilities especially for the preparation of medicines and application of them safely (Malkin, 2008; Greenway, 2014). It is specified in the literature that the dorsogluteal (DG) site is the most risky site for intramuscular administration due to its rich in terms of blood vessels, close proximity to the sciatic nerve, and having thicker subcutaneous tissue compared to other sites (Gulseven, 2010; Cocoman & Murray, 2010; Kim & Park, 2014), in addition to this, it is a site which is frequently preferred by nurses in the IM injection applications (Šakić et al., 2012; Tugrul & Denat, 2014; Wynaden et al., 2015; Sari et al., 2017).

In recent years, it is emphasized in the literature that DG site which is one of the IM injection sites and used as the first choice should not be preferred in IM injection due to being very risky and incorrect practices, and the ventrogluteal (VG) site can be used as the safest application site and the curriculum and practices need to be directed in this way (Freitag et al., 2015; Gulnar & Ozveren, 2016; Sari et al., 2017). When it looks in terms of the historical process; The VG site which was first used as an IM injection site by Hochstetter in the early 1950s (Greenway, 2004), is also named as the anteriolateral site and contains gluteus medius and gluteus minimus muscles (Berman et al., 2016). The VG site has large blood vessels and nerve-free, thick muscle density and its usage are preferred in adults (Berman et al., 2016), the VG site is recommended for use for all infants from birth (Greenway, 2004; Gunes et al., 2016) and very poor patients. The subcutaneous tissue and fat layer in this site in which pain feel is less, are thinner than the DG site, and the thinner subcutaneous fat tissue in the VG region reduces the possibility of an accidental injection into subcutaneous tissue (Ogston, 2014; Kara et al., 2015; Berman et al., 2016). In many studies done; it is reported that the sciatic nerve injuries frequently develop due to application of drug to the DG site, and drugs should not be applied to the site because the

location of the sciatic nerve differs from individual to individual (Ramtahol et al., 2006; Kim and Park, 2014; Greenway, 2014), and it is recommended that VG site need to be preferred instead of the DG site in the IM injection administration. Additionally, the ease of measurement by palpating the bone structures in this site provides site locating safely, and that it allows of application in supine, prone and lateral positions facilitates preference of the VG site in IM injections (Gulseven, 2010; Kaya & Pallos, 2012; Coskun et al., 2016). When the literature is examined, it is seen that the knowledge levels of the nurses concerning to this subject are frequently evaluated (Gunes et al., 2009; Tugrul & Denat, 2014; Freitag et al., 2015, Gokbel & Midilli, 2017), but that studies on the effectiveness of the planned education program are in limited numbers draws attention (Gulnar & Ozveren, 2016; Zeyrek & Kurban, 2017). The aim of this study is to assess the effectiveness which are given to nurses, about injection into VG.

## Methods

### Design

The study was a quasi-experimental design, with a comparison between an experimental group and a control group.

### Study participants

The population of the study consists of 444 nurses working in the selected hospital. The 91 nurses working in surgery room and in outpatient clinic in which IM injection is not carried out were excluded from the study. The study was conducted with 219 nurses who agreed to participate in the research. A total of 110 of which are experimental and 109 of which are control groups.

### The Instruments

The data of the study was collected by Nurse Recognition Form, Knowledge Evaluation Form.

### Nurse Recognition Form

This form consists of three parts. Socio-demographic characteristics and occupational characteristics of the nurses are in the first part of the form, IM injection applications of the nurses are in the second part, their views about the injection into ventrogluteal site are in the third part, and totally 27 questions.

### Knowledge Evaluation Form

This form was prepared by the researchers in the direction of the literature (Rosdahl and Kowalski, 2008; Ay, 2016; Berman et al., 2016; Potter et al., 2017). It consists of 17 multiple choice questions that evaluate the knowledge of nurses regarding IM injection to the VG site. Each question was scored as 1 point if question is true and 0 points if it is false or empty. Nurses are expected to get the "0" as the lowest score and "17" as the highest score. The reliability of this form was calculated using with Kuder Richardson - 20 formula (KR-20). In this study, the reliability coefficient of the knowledge was enough (KR-20 = 0.764). The content validity indeks of the knowledge evaluation form was 0.96.

### Data Collection

The data of the study were collected from the 219 nurses who agreed to participate in the research between the dates of 03.10.2017 - 06.30.2017. After necessary arrangements had been made by being made the preliminary practice of the data collection forms that was prepared before starting to study, eight-week training program was applied at every other week by dividing the nurses into eight groups randomly when the nurses were available. The nurses were randomly divided into 4 experimental groups and 4 control groups in the research. 25 nurses participated in each training group, averagely. The face-to-face training about injection application into the VG site was applied to the nurses in experimental and nurses in control group. After training, as well as the training that was given to the experimental group, the training booklet which is in accordance with content was delivered to them.

The contents of presentation and training booklet were prepared by the researchers by reviewing the literature (Craven and Hirnle, 2009; Gulseven, 2010; Kaya and Pallos, 2012; Berman et al., 2016). The content of training consists of the definition of IM injection, injection sites, disadvantages of DG site, determine, application and advantages of VG site. After the presentation of the researcher regarding VG injection applications, determining of the site and application of IM injection were demonstrated by using medical anatomic model. The trainings that were given to the nurses conducted in education room of the hospital. The

trainings lasted 45 minutes on average. The pre-test had been applied by explaining the aim of the study to the nurses before the training was started and afterwards, it was started to the training. After the training, training booklet were delivered to the nurses who are in the experimental group. After 1 month, a final test was applied to the experimental and control group. The filling time of the form lasted 20 minutes on average.

### Ethical Considerations

Ethical approval (Date: 10.22.2015 Protocol No: 162, Decision No: 147) of the Muğla Sıtkı Koçman University Scientific Researches Publication Ethics Committee and institutional approval of hospital where the research was conducted, were obtained so as to be able to carry out the research. Additionally, the written consents of the nurses participating in the research were taken by explaining the aim of study.

### Data Analysis

The SPSS 20 package program was used for the evaluation of the data and the statistical significance level was accepted as  $p < 0.05$ . The Shapiro-Wilk test was used so as to determine whether the data of the study were normally distributed. The data regarding the socio-demographic characteristics of the individuals included in the study was evaluated by the number and percentage test. The Wilcoxon Signed Rank Test was used in order to determine the difference between the pre-training and post-training scores of the experimental and control groups on its own merits, and the Mann-Whitney U test was used so as to compare pre-training scores and post-training scores of the groups. The Mann-Whitney U test was used in the variables with two groups and the Kruskal-Wallis H test was used in the variables having more than two groups, in order to determine the difference between the scores getting from the scales according to the socio-demographic characteristics of the experimental and control groups.

### Results

The average age of nurses in the experimental group was  $39.72 \pm 7.22$ , 95.5% of them were female, 46.4% of them had bachelor's degree, and it was determined that 57.3% of them were between 17-27 years and 54.5% of them were working in

internal units. It was determined that the average age of the nurses in the control group was  $38.91 \pm 7.76$ , 96.3% of them were female, 49.6% of them had bachelor's degree, 42.6% of them were between 17-27 years and 52.3% of them were working in internal units. 19.1% of the participants in the experimental group and 13.8% of the control group were stated that they were trained about injection into the VG site. When comparing the demographic variables of the nurses and their mean of knowledge score related to VG injection applications, it was found that their mean of knowledge scores before training were statistically significant according to age, educational status and IM injection ( $p < 0.05$ ). It was found that the significance was stemmed from group of 21-34 ages in the age variable where significant difference was found, while it was stemmed from the associate degree and undergraduate level in the level of education and the group who was trained about IM injection. There was no statistically significant difference between VG mean of knowledge scores of participants before and after training and sex, working year, employment department, term of employment in department ( $p > 0.05$ ) (Table 1).

It was determined in the study that 75.5% of the nurses in the experimental group had made IM injection 1 to 10 times per week whereas this rate is 78.0% in the control group. After given training to the nurses; it was found that 79.1% of the nurses in the experimental group and 79.8% of the nurses in the control group had made IM injection 1 to 10 times per week. It was detected that 84.5% of the participants of the experimental group in the pre-training and 86.2% of the control group preferred the DG site as IM injection site. While in the post-training period, it was detected that 34.5% of the nurses in the experimental group, and 43.1% of the control group had preferred the DG site. Additionally, while 5.5% of the nurses in the experimental group and 6.4% of the control group preferred VG site before training, after the training, it was found that the 63.6% and 55.1% of the nurses in the experimental and control groups preferred VG site as an injection site respectively (Table 2).

When the views of the nurses about the injection application into the VG site was examined, before and after training, the participants in the

experimental group had views as follows respectively: not having enough knowledge (77.3%, 24.5%), being unaccustomed to injection (81.8%, 39.1%), being not safe (49.1%, 8.2%), fear of harm to the patient (61.8%, 25.5%), having difficulty in optimal positioning (50.0%, 13.6%), having difficulty in detection of injection site correctly (64.5%, 42.7%) and being more painful (68.2%, 9.1%). As for individuals in the control group had views as follows respectively; not having enough knowledge (69.7%, 24.8%), being unaccustomed to injection (78.9%, 46.8%), being not safe (52.3%, 13.8%), fear of harm to the patient (61.5%, 45.0%), having difficulty in optimal positioning (48.6%, 28.4%), difficulty in detection of injection site correctly (63.3%, 35.8%) and being more painful (61.5%, 17.4%) (Table 3).

The comparison of the mean of knowledge scores of the nurses in the experimental and control groups related to VG injection applications before and after training is seen in Table 4. While the mean of knowledge scores of the participants in the experimental group before training was  $6.27 \pm 3.52$ , mean of knowledge scores after training was  $14.35 \pm 3.52$ , ( $p < 0.05$ ). The mean of knowledge scores of the nurses in the experimental group before training was  $5.93 \pm 3.53$ , and the mean of knowledge scores after training was  $12.9 \pm 2.09$  ( $p < 0.05$ ). While it was found that there was no significant difference between the experimental and control groups according to the mean of knowledge scores before training ( $p > 0.05$ ), the difference between the mean of knowledge scores of two groups was found to be statistically significant ( $p < 0.05$ ) (Table 4).

## Discussion

This study was done with intent to assess the effectiveness of education which are given to nurses about injection into ventrogluteal site. When the sites that were preferred by the nurses for IM injection were examined, it was seen that 84.5% of the participants in the experimental group and 86.2% of the control group preferred the DG site before the training. The rate of preference for the DG site is between 60% and 89.7% in different studies that was done to reveal IM injection knowledge level and preference (Gunes et al., 2009; Walsh and Brophy, 2011; Šakić et al., 2012; Wynaden et al., 2015; Sari et al., 2017). In

addition, while the VG injection site preference rates of nurses in this study were 5.5% in the experimental group and 6.4% in the control group before training, the 63.6% of the nurses in the experimental group and 55.1% of the control group preferred the VG site after training (Table 2). As in furtherance of our study, It was found that the preference rates of the DG site as the IM injection site of the nurses reduced, thus it was determined that the VG site was preferred more (Gulnar and Ozveren, 2016; Zeyrek and Kurban, 2017). This finding of the study make us think that planned nursing education and afterwards providing the booklet in the sense of reminder have significant effect in ensuring the permanence of education.

When the views which affected the preference of nurses for selecting VG site as IM injection site is examined, Some views of the participants in the experimental group before and after training are as follows, respectively: not having enough knowledge (77,3%, 24,5%), being unaccustomed to injection (81.8%, 39.1%), being not safe (49.1%, 8.2%), fear of harm to the patient (61.8%, 25.5%), having difficulty in optimal positioning (50.0% 13.6%), having difficulty in detection of injection site correctly (64.5%, 42.7%) and being more painful (68.2%, 9.1%). As for individuals in the control group have views as follows respectively: not having enough knowledge (69.7%, 24.8%), being unaccustomed to injection (78.9%, 46.8%), being not safe (52.3%, 13.8%), fear of harm to the patient (61.5%, 45.0%), having difficulty in optimal positioning (48.6%, 28.4%), difficulty in detection of injection site correctly (63.3%, 35.8%) and being more painful (61.5%, 17.4%)(Table 3).

The results of another study which was done with the same purpose were as follows: not having enough knowledge (72.9%), being unaccustomed to injection (61.2%), being not safe (15.3%), fear of harm to the patient (24.7%), having difficulty in optimal positioning (23.5%), difficulty in detection of injection site correctly (30.6%) and being more painful (25.9%). It was determined in the study conducted by Gokbel and Midilli (2017) that 50% of the nurses do not know the VG site and 23.3% of them do not know how to make injection into the VG site. It was determined in various studies done that nurses do not have enough knowledge about the VG site and therefore do not prefer to inject into the VG site; and they think that they

may harm the patient and they do not believe that site is safe, and they also think that it is difficult to identify the area since the anatomical location of the VG site is small and it is hard to apply injection between index and middle finger; and they do not prefer to inject into the VG site for these reasons (Kilic et al., 2014; Tugrul and Denat, 2014; Kara et al., 2015). These findings show that nurses do not prefer VG site as IM injection site since they do not have enough knowledge and training about the VG site. VG site is agreed as the safest IM injection site in the literature since it is less painful (Gunes et al., 2013), it causes less sciatic nerve injury (Kim and Park, 2014), it is far from blood vessels (Greenway, 2004) etc. At the same time, the VG site has been proposed as a site which is needed to be preferred firstly in nursing education recently (Walsh and Brophy, 2011). In this sense, it makes us think that usage of the VG site as an injection site is given place more in curriculum of nursing education and giving regular in-service training programs for graduated nurses will be effective in increasing the selection of VG site as IM injection site.

While the pre-training mean of knowledge scores of participants in the experimental group related to the VG site in this study was  $6.27 \pm 3.52$ , the post-training mean of knowledge scores of them was  $14.35 \pm 3.52$ , ( $p < 0.05$ ). The pre-training mean of knowledge scores of the nurses in the control group was  $5.93 \pm 3.53$ , and the post-training mean of knowledge scores of them was  $12.9 \pm 2.09$  ( $p < 0.05$ ). While there was no significant difference between the experimental and control groups according to mean of knowledge scores before training ( $p > 0.05$ ), the difference between the means of knowledge scores of both groups was found to be statistically significant after training ( $p < 0.05$ ) (Table 4). Similarly, mean of knowledge scores before and after training in the different studies where the effectiveness of the training about the use of VG site is measured, are as follows respectively;  $13.53 \pm 2.50$ ,  $19.36 \pm 2.03$  in the study of Gulnar and Ozveren (2016) and  $10.4 \pm 2.17$  and  $14.7 \pm 1.48$  in the study of Zeyrek and Kurban (2017). As seen in this study and other studies, while the mean of knowledge scores of nurses before training regarding VG as IM injection site is low, it is seen that the mean of knowledge scores of them increases after training.

This finding shows that preparing the booklet which are reminder and are given for reading if required, will contribute significantly in order to update knowledge of nurses about IM injection sites after graduation.

When the mean of knowledge scores were compared according to some demographic variables about the use of the VG site in the study, it was found that pre - and post - training mean of knowledge points were statistically significant ( $p < 0.05$ ) according to the age, education status and training about IM injection. It was found that the significance was stemmed from group of 21-34 ages in the age variable where significant difference was found, while it was stemmed from the associate degree and undergraduate level in the level of education and the group who was trained about IM injection. These findings make us think that providing current and evidence-based knowledges in more comprehensive way in the training of nursing undergraduate curriculum about IM injection site is effective. Additionally, the difference in the study that was found in the 21-34 age group can be explained by the fact that the young people are more open to change, they newly graduate from the nursing program and they follow

10 the current scientific studies more closely and the current knowledge and literature based on evidence are not followed by the of other age groups. It was found that the difference of the group is stemmed from the group who got training, in case of training about IM injection as an important finding in the study. This situation shows that the planned trainings after graduation are effective in transferring of current information.

### Conclusions

Findings obtained from the study show that the training booklet given after training as well as face-to-face training, is effective in increasing the level of knowledge toward using the VG site as an IM injection site, and in turning it to behaviour.

That teaching IM injection into VG site to the nurses in practical and discussing the effectiveness of the training in the in-service training, and repeating of these trainings at certain intervals, sharing the results of the evidence-based study conducted about the VG site in the IM injection application with the nurses working in the clinic,

including the VG applications in the nursing curriculum, using of multiple training methods, and doing similar studies on a larger sample, can be suggested in the direction of the results obtained from the study.

### Limitation of the study

The limitation of this study is that it was done with nurses working in a hospital in a province center in Turkey, and it does not reflect other regions.

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|                                | Experimental Group |      |                                       |  |              | Control Group |      |                                       |  |       | Comparison of Experimental Group and Control Group (n=219) |  |            |       |
|--------------------------------|--------------------|------|---------------------------------------|--|--------------|---------------|------|---------------------------------------|--|-------|--|--|------------|-------|
|                                | n                  | %    | Pre-Training Mean of Knowledge Scores | Post-Training Mean of Knowledge Scores | p            | n             | %    | Pre-Training Mean of Knowledge Scores | Post-Training Mean of Knowledge Scores | p     | Pre-Training Mean of Knowledge Scores                      | Post-Training Mean of Knowledge Scores | Test value | p     |
|                                |                    |      |                                       |  |              |               |      |                                       |  |       |  |  |            |       |
| <b>Gender</b>                  |                    |      |                                       |  |              |               |      |                                       |  |       |  |  |            |       |
| Women                          | 105                | 95.5 | 6.25 ± 3.48                           | 14.35 ± 1.70                           | 0.776        | 105           | 96.3 | 5.84 ± 3.50                           | 12.88 ± 2.08                           | 0.546 | 0.422  | 0.515                                  | 0.148      | 0.699 |
| Men                            | 5                  | 4.5  | 6.60 ± 4.77                           | 14.20 ± 1.78                           |              | 4             | 3.7  | 7.50 ± 4.64                           | 13.50 ± 2.38                           |       |  |  |            |       |
| <b>Age</b>                     |                    |      |                                       |  |              |               |      |                                       |  |       |  |  |            |       |
| 21-34                          | 18                 | 16.4 | 7.55 ± 4.10                           | 14.44 ± 1.82                           | 0.341        | 26            | 23.9 | 7.69 ± 3.82                           | 13.50 ± 2.43                           | 0.101 | <b>9.348</b>   | <b>0.009</b>                           | 1.678      | 0.431 |
| 35-44                          | 71                 | 64.5 | 6.11 ± 3.23                           | 14.37 ± 3.23                           |              | 62            | 56.9 | 5.43 ± 3.04                           | 12.68 ± 1.88                           |       |  |  |            |       |
| 45 +                           | 21                 | 19.3 | 5.71 ± 3.86                           | 14.35 ± 1.70                           |              | 21            | 19.3 | 5.19 ± 3.93                           | 12.81 ± 2.18                           |       |  |  |            |       |
| <b>Education</b>               |                    |      |                                       |  |              |               |      |                                       |  |       |  |  |            |       |
| Medical vocational high school | 5                  | 4.5  | 9.20 ± 3.27                           | 15.00 ± 1.87                           | <b>0.037</b> | 7             | 6.4  | 6.57 ± 2.63                           | 11.71 ± 1.97                           | 0.290 | <b>9.146</b>   | <b>0.027</b>                           | 1.854      | 0.603 |
| Associate degree               | 50                 | 45.4 | 5.28 ± 3.22                           | 14.40 ± 1.59                           |              | 42            | 38.5 | 5.23 ± 3.33                           | 12.79 ± 1.90                           |       |  |  |            |       |
| Bachelor's degree              | 51                 | 46.4 | 6.84 ± 3.55                           | 14.27 ± 1.77                           |              | 54            | 49.6 | 6.22 ± 3.70                           | 13.04 ± 2.27                           |       |  |  |            |       |
| Master of Science              | 4                  | 3.7  | 7.75 ± 4.27                           | 13.75 ± 2.21                           |              | 6             | 5.5  | 7.33 ± 4.13                           | 13.83 ± 1.39                           |       |  |  |            |       |
| <b>Work Year</b>               |                    |      |                                       |  |              |               |      |                                       |  |       |  |  |            |       |
| 0-5 year                       | 9                  | 8.2  | 8.44 ± 4.77                           | 14.89 ± 1.45                           | 0.156        | 10            | 9.3  | 7.81 ± 4.11                           | 13.45 ± 2.58                           | 0.247 | 7.706  | 0.052                                  | 7.250      | 0.064 |
| 6-16 year                      | 26                 | 23.6 | 6.84 ± 2.88                           | 14.04 ± 1.90                           |              | 37            | 34.3 | 6.08 ± 3.31                           | 12.59 ± 2.25                           |       |  |  |            |       |
| 17-27 year                     | 63                 | 57.3 | 5.79 ± 3.39                           | 14.54 ± 1.60                           |              | 46            | 42.6 | 5.54 ± 3.49                           | 13.01 ± 1.86                           |       |  |  |            |       |
| 28 year +                      | 14                 | 12.7 | 5.91 ± 4.10                           | 13.58 ± 1.73                           |              | 16            | 13.8 | 5.33 ± 3.61                           | 12.90 ± 2.05                           |       |  |  |            |       |
| <b>Working Clinics</b>         |                    |      |                                       |  |              |               |      |                                       |  |       |  |  |            |       |

|  |            |            |             |              |              |            |            |             |              |   |               |              |       |       |
|--|------------|------------|-------------|--------------|--------------|------------|------------|-------------|--------------|---|---------------|--------------|-------|-------|
| Medical Clinics  | 60         | 54.5       | 6.73 ± 3.19 | 14.10 ± 1.63 | <b>0.031</b> | 57         | 52.3       | 5.94 ± 3.39 | 13.05 ± 2.21 | 0.658   | 1.357         | 0.243        | 0.102 | 0.749 |
| Surgical Clinics   | 50         | 45.5       | 5.72 ± 3.84 | 14.64 ± 1.74 |              | 52         | 47.7       | 5.90 ± 3.71 | 12.73 ± 1.95 |   |               |              |       |       |
| <b>Work Year in Clinics</b>                                      |            |            |             |              |              |            |            |             |              |   |               |              |       |       |
| 0-2 year   | 38         | 34.5       | 6.07 ± 3.41 | 14.21 ± 1.75 | 0.391        | 41         | 37.6       | 6.46 ± 3.53 | 12.93 ± 1.98 | 0.437   | 3.131         | 0.371        | 0.984 | 0.804 |
| 3-5 year   | 21         | 19.1       | 7.28 ± 3.91 | 14.19 ± 1.86 |              | 33         | 30.3       | 6.27 ± 3.97 | 13.12 ± 2.35 |   |               |              |       |       |
| 6-9 year   | 25         | 22.7       | 6.40 ± 3.41 | 14.60 ± 1.78 |              | 21         | 19.3       | 4.85 ± 3.10 | 12.48 ± 1.53 |   |               |              |       |       |
| 10 year +  | 26         | 23.6       | 5.61 ± 3.12 | 14.42 ± 1.44 |              | 14         | 12.8       | 5.92 ± 3.53 | 12.93 ± 2.55 |   |               |              |       |       |
| <b>Status of getting training about IM injection application</b> |            |            |             |              |              |            |            |             |              |   |               |              |       |       |
| Yes  | 21         | 19.1       | 7.23 ± 3.75 | 14.29 ± 1.70 | 0.456        | 15         | 13.8       | 9.13 ± 2.94 | 13.20 ± 2.11 | 0.724   | <b>13.408</b> | <b>0.002</b> | 0.404 | 0.524 |
| No   | 89         | 80.9       | 6.04 ± 3.45 | 14.36 ± 1.70 |              | 94         | 86.2       | 5.41 ± 3.35 | 12.85 ± 2.09 | *Wilcoxon Signed Ranks Test **Mann-Whitney U Test |               |              |       |       |
| <b>Total</b>   | <b>110</b> | <b>100</b> |             |              |              | <b>109</b> | <b>100</b> |             |              |   |               |              |       |       |

**Table 1 Demographic variables of nurses and their mean of knowledge scores in pre-training and post-training (n = 219)**

**Table 2 Intramuscular injection application status of nurses (n = 219)**

|  | Pre-Training               |            |                       |            | Post-Training              |            |                       |            |
|--|----------------------------|------------|-----------------------|------------|----------------------------|------------|-----------------------|------------|
|  | Experimental Group (n=110) |            | Control Group (n=109) |            | Experimental Group (n=110) |            | Control Group (n=109) |            |
|  | n                          | %          | n                     | %          | n                          | %          | n                     | %          |
| <b>Frequency of administering intramuscular injections</b> |                            |            |                       |            |                            |            |                       |            |
| 1-10 (times a week)  | 83                         | 75.5       | 85                    | 78         | 87                         | 79.1       | 87                    | 79.8       |
| 11 + (times a week)  | 27                         | 24.5       | 24                    | 22         | 23                         | 20.9       | 22                    | 20.2       |
| <b>Most frequently used site</b>                           |                            |            |                       |            |                            |            |                       |            |
| Dorsogluteal site  | 93                         | 84.5       | 94                    | 86.2       | 38                         | 34.5       | 47                    | 43.1       |
| Ventrogluteal site   | 6                          | 5.50       | 7                     | 6.4        | 70                         | 63.6       | 60                    | 55.1       |
| Vastus lateralis muscle                                    | 11                         | 10.0       | 8                     | 7.3        | 2                          | 1.8        | 2                     | 1.80       |
| <b>Complication living status</b>                          |                            |            |                       |            |                            |            |                       |            |
| Yes  | 11                         | 10         | 12                    | 11         | 7                          | 6.4        | 4                     | 3.7        |
| No   | 99                         | 90         | 97                    | 89         | 103                        | 93.6       | 105                   | 96.3       |
| <b>Total</b>   | <b>110</b>                 | <b>100</b> | <b>109</b>            | <b>100</b> | <b>110</b>                 | <b>100</b> | <b>109</b>            | <b>100</b> |

**Table 3 Views of nurses regarding injection into ventrogluteal site (n = 219)**

| Views of nurses regarding injection into ventrogluteal site                 | Experimental Group (n=110) |      |               |      | Control Group (n= 109) |      |               |      |
|---|----------------------------|------|---------------|------|------------------------|------|---------------|------|
|   | Pre-Training               |      | Post-Training |      | Pre-Training           |      | Post-Training |      |
|   | Yes                        |      | Yes           |      | Yes                    |      | Yes           |      |
|   | n                          | %    | n             | %    | n                      | %    | n             | %    |
| I do not think that I have enough knowledge about this site                 | 85                         | 77.3 | 27            | 24.5 | 76                     | 69.7 | 27            | 24.8 |
| I think that this site is not safe  | 54                         | 49.1 | 9             | 8.20 | 57                     | 52.3 | 15            | 13.8 |
| I have worries for I have not used it                                       | 77                         | 70.0 | 51            | 46.4 | 76                     | 69.7 | 59            | 54.1 |
| I do not prefer to use this site because I am not accustomed to             | 90                         | 81.8 | 43            | 39.1 | 86                     | 78.9 | 51            | 46.8 |
| I am afraid of hurting the patient  | 68                         | 61.8 | 28            | 25.5 | 67                     | 61.5 | 49            | 45.0 |
| I think that patients will not allow me to use this site                    | 69                         | 62.7 | 52            | 47.3 | 66                     | 60.6 | 53            | 48.6 |
| I think that it is hard to position the patient                             | 55                         | 50.0 | 15            | 13.6 | 53                     | 48.6 | 31            | 28.4 |
| I think that the muscles in the site have not well developed                | 61                         | 55.5 | 10            | 9.01 | 48                     | 44.0 | 16            | 14.7 |
| I think that I will not be able to detect the site correctly when injecting | 71                         | 64.5 | 47            | 42.7 | 69                     | 63.3 | 39            | 35.8 |
| I think that the anatomical structure of the site is small                  | 79                         | 71.8 | 29            | 26.4 | 75                     | 68.8 | 30            | 27.5 |
| I think that the site can not be used in weak patients                      | 86                         | 78.2 | 29            | 26.4 | 82                     | 75.2 | 45            | 41.3 |
| I think that the site can not be used in fat patients                       | 56                         | 50.9 | 42            | 38.2 | 51                     | 46.8 | 42            | 38.5 |
| I think that syringe needle will touch to bone tissue                       | 84                         | 76.4 | 29            | 26.4 | 67                     | 61.5 | 33            | 30.3 |
| I think that the patient will feel more pain                                | 75                         | 68.2 | 10            | 9.01 | 76                     | 69.7 | 19            | 17.4 |
| I do not know how the site to be detected exactly                           | 75                         | 68.2 | 34            | 30.9 | 76                     | 69.7 | 31            | 28.4 |

**Table 4 Mean of knowledge scores of nurses in pre-training and post-training (n = 219)**

| Mean of knowledge scores of nurses | Experimental Group (n= 110)   |                                |               |              | Control Group (n=109)         |                               |               |              | Comparison of Experimental Group and Control Group (n=219) |       |               |              |
|------------------------------------|-------------------------------|--------------------------------|---------------|--------------|-------------------------------|-------------------------------|---------------|--------------|--|-------|---------------|--------------|
|                                    | Pre-Training                  |                                | Post-Training |              | Pre-Training                  |                               | Post-Training |              | Pre-Training   |       | Post-Training |              |
|                                    | Mean of Knowledge Scores      | Mean of Knowledge Scores       | * Test value  | p            | Mean of Knowledge Scores      | Mean of Knowledge Scores      | * Test value  | p            | **Test value   | p     | **Test value  | p            |
|                                    | 6.27 ± 3.52<br>(Min=0-Max=16) | 14.35 ± 3.52<br>(Min=7-Max=17) | -9.072        | <b>0.000</b> | 5.93 ± 3.53<br>(Min=0-Max=14) | 12.9 ± 2.09<br>(Min=9-Max=17) | -9.030        | <b>0.000</b> | -0.704   | 0.481 | -4.742        | <b>0.000</b> |

\*Wilcoxon Signed Ranks Test \*\*Mann-Whitney U Test

Figure 1. Flow diagram of the study

