

## An assessment of intramuscular injection practices among nursing students and nurses in hospital settings: is it evidence-based?

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### ABSTRACT

**Aim** To analyze general aspects of intramuscular injection (IM) procedure and its compliance with current recommendations.

**Methods** The study was conducted in the form of a cross-sectional study. The sample consisted of 294 respondents (149 were students of final year of the secondary nursing school, and 145 nurses). Data were collected from February to April 2012. The instrument used to assess the IM injection procedure was a questionnaire designed for the purpose of this study. Statistical analysis included descriptive and inferential analysis. Statistically significant values were considered to be at the level of  $p < 0.05$ .

**Results** Dorsogluteal site to administer intramuscular injections was preferred for use by 139 (88.0%) students and 130 (89.7%) nurses. Regarding the selection of a needle for IM injection, 103 (68.2%) students and 118 (72.0%) nurses preferred to use 21 g needle (green). A total number of 112 (75.2%) students would immediately give an injection after disinfection of the skin, while 79 (54.5%) nurses allow skin to dry, and then give an injection. The Z-technique would be applied by only 29 (20.0%) nurses. Most respondents, 129 (86.6%) students and 109 (75.1%) nurses withdrew needle immediately after administering the drug. The injection site was not massaged by 95 (63.8%) students and 46 (31.7%) nurses.

**Conclusion** Based on our results, we have concluded that in Serbia IM administration procedures are carried out traditionally and this confirms the need for written instructions for implementing this procedures in all health institutions in order to carry it out uniformly and to prevent adverse events. This study has shown positive progress in implementing the procedure, but it is just a beginning.

**Key words:** needle size, skin disinfection, Z-technique.

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## INTRODUCTION

Intramuscular (IM) injection is an administration of medications parenterally through a skin puncture by a syringe and a needle deep into a large muscle of the body for prophylactic or curative purposes (1,2). Injections are among the most frequently used medical procedures in nursing practice (1). According to existing data between 12 and 16 billion injections are administered throughout the world on an annual basis (1-5). Although intramuscular (IM) injections are frequently referred to as a 'basic skill' they involve a complex series of considerations relating to type and volume of injectate, medication to be given, technique, site selection and equipment (6).

Proper performance of these procedures according to current best practice guidelines which are evidence – based, means precise positioning of the injection. This procedure prevents damage to the radial nerve and brachial artery when administering the medication in the deltoid muscle, or ischial nerve and gluteal artery when administering the medication in the upper outer gluteal muscles - gluteus maximus (7-9). Although five muscles are currently advocated for as possible sites for IM injection drug application (6,8,10), they are not all ideal for this purpose. Two recommended sites are ventrogluteal and vastus lateralis muscle (9-12). By using ventrogluteal site the major nerves and blood vessels are avoided (8,10,12-16) and the thickness of subcutaneous adipose tissue is thinner than the dorsogluteal site (8,15). Anterolateral thigh muscle, *m. vastus lateralis*, is recommended as a choice of site for intramuscular injection in infants up to seven months of age (2,3,8,15) because it is well developed at birth (1).

Selecting the right needle, and in particular its length is crucial for properly performed procedures (6,9). The needle for intramuscular injection must be long enough to reach the muscle. Needles which are commonly used are of 21g (green) or 23g (blue) (8,15), ranging in length from 1.25 to 2 inches (i.e. 3 to 5 cm) (8). Selection of needles depends on drug volume, muscle size, thickness of subcutaneous tissue and the patient's age (17,18). The re-

commendations are to use two needles in the IM injection procedure. One needle is used to prepare the drug and the other for injection (2,8,10,17,19-21), which prevents the discomfort, pain and potential complications (8,15,19).

One of the issues is disinfection of the skin at the needle insertion site. Recent studies have shown that it is not necessary to disinfect the skin unless the skin is visibly dirty (1,22,23). In this case, the cleansing of the skin with soap and water is advocated for (1). The World Health Organization also no longer recommends practice of disinfection (22). If the skin is disinfected, however, depending on the used antiseptics, it is necessary to allow a certain contact time so that the bacteria were inactivated (23).

Intramuscular injections are inserted at an angle of 72 ° to 90 ° to ensure the needle reaches the muscle (1, 2, 9, 12, 17, 24), and Z track technique is preferred (3, 8, 10, 15). Using the Z-technique reduces the pain, as well as the incidence of leakage of the medication into the needle track (3, 15). Regarding the procedure of drug injection, it is recommended to inject medication steadily and slowly: about 1 mL per 10 seconds to reduce the pain and allow the muscle to absorb the drug (6, 10, 15, 17, 25, 26). After completion of injection, it is also advocated to allow 10 seconds and then withdraw needle at the same angle as it entered and not to massage the site afterwards, but apply gentle pressure with a gauze swab (1, 5, 8, 17).

Since the use of this procedure is associated with complications, discomfort and painful experience of many patients (19), it is essential that every health care institution has best clinical practice guidelines for IM administration of the drug, and it is reasonable to expect the nurses to implement the new recommendations in clinical practice (5).

Therefore, the aim of this study was to analyze the general aspects of IM injection procedure and its compliance with current recommendations, and more specifically, to determine whether nurses use this recommendation in practice. As nurses worldwide often perform this procedure, we believe that this study is of an international significance.

### EXAMINEES AND METHODS

The survey was conducted in the Secondary Nursing School in Novi Sad, in the General Hospitals of Sombor and Šabac, in the form of a cross-sectional study. General hospitals are medical institutions of the secondary level of health care. The sample consisted of 294 respondents, of whom 149 were students of final year of the secondary nursing school, and 145 nurses. Data were collected from February to April 2012.

The instrument used in this study to assess the IM injection procedure was a questionnaire designed for the purpose of this study. The questionnaire contained 32 questions and consists of two parts. The first part was related to general information, and the second part to the data related to the procedure of intramuscular administration. General questions for the students were related to gender and educational profile, and for the nurses to the gender, the unit they work in and educational level. The second part of the questionnaire contained specific questions concerning the preparation and administration of intramuscular injections.

The study was approved by the Ethics Committee of the School of Medicine in Novi Sad, administration of Secondary Nursing School and the administration of both hospitals. Participation in the survey was voluntary and anonymous. Before proceeding to complete the questionnaire, respondents were given information about the research in writing and signed an agreement on voluntary participation in the research. Anonymity was protected by unenumerated and unmarked questionnaires. Survey data were analyzed in SPSS 17. Statistical analysis included descriptive and inferential analysis. Descriptive analysis included a total value expressed in absolute and relative numbers. Differences between groups were tested by Mann-Whitney U test. Statistically significant values were considered to be at the level of  $p < 0.05$ .

### RESULTS

Out of total 325 distributed questionnaires, 294 (90.5%) were filled in and returned.

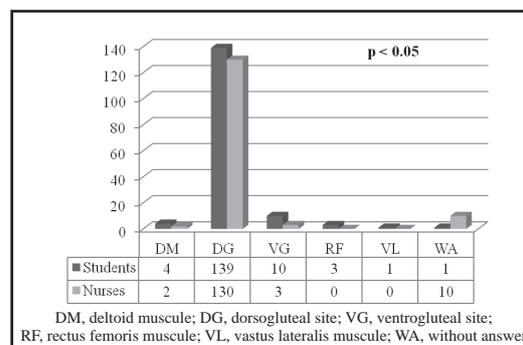
**Table 1. Structure of respondents**

		No (%) of respondents
Gender	Male	45 (15.3)
	Female	249 (84.7)
	Total	294 (100)
Students-educational profile	General nurse	90 (60.4)
	Pediatric nurse	32 (21.5)
	Midwife	27 (18.1)
	Total	149 (100)
Nurses	General Hospital Sombor	76 (52.4)
	General Hospital Šabac	69 (47.6)
	Total	145 (100)
Frequency of IM injection	Very frequently (>5 per a day)	56 (38.6)
	Frequent (1-4 per a day)	40 (27.6)
	Occasionally (<5 per month)	27 (18.6)
	Seldom ( $\leq 1$ per month)	19 (13.1)
	Never	3 (2.1)
	Total	145 (100)

Structure of respondents is shown in Table 1. As it was expected, female gender (84.7%) dominated among respondents since this profession has been a traditionally female-dominated from its onset.

Dorsogluteal site (*m. gluteus maximus*) to administer intramuscular injections preferred to use almost the same number of students, 139 (88.0%), and 130 nurses, (89.7%), while the data obtained using other sites for IM injection indicate that there was a significant difference between the two groups ( $p < 0.05$ ) (Figure 1).

A total of 18 (56.3%) students of the educational profile of the pediatric nurse would give IM injection in infants and children in dorsogluteal site, whereas almost all the pediatric nurses practitioners, 22 (91.7%) used dorsogluteal site for that age group. Not a single respondent chose the muscles of rectus femoris or vastus



**Figure 1. Anatomical sites for IM injections**

**Table 2. The selection of a needle for IM injection**

Needle type	No (%) of respondents			
	Students	Students – PN	Nurse	Pediatric nurse
	Adults	Children	Adults	Children
18 g (pink)	11 (7.3)	11 (34.4)	1 (0.6)	0
20 g (yellow)	2 (1.3)	4 (12.5)	28 (17.0)	3 (10.7)
21 g (green)	103 (68.2)	5 (15.6)	118 (72.0)	20 (71.3)
22 g (black)	2 (1.3)	1 (3.1)	0	0
23 g (blue)	0	0	0	1 (3.6)
25 g (orange)	0	1 (3.1)	0	0
26 g (brown)	4 (2.7)	0	2 (1.2)	2 (7.2)
27 g (gray)	3 (2.0)	6 (18.8)	0	0
Without answer	26 (17.2)	4 (12.5)	15 (9.2)	2 (7.2)
Total answer	151 (100)	32 (100)	164 (100)	28 (100)

PN, pediatric nurse; g, gauge

lateralis as injection sites. Ventrogluteal site would be chosen by eight (25.0%) students in the educational profile of a pediatric nurse while no pediatric nurse practitioner used this site for giving IM injections to children.

Regarding the selection of a needle for IM injection, 103 (68.2%) respondents of the group of students preferred to use a needle 21 g (green), while only five (15.6%) students in the educational profile of the pediatric nurses preferred to use this needle in children. Unlike 118 students (72.0%) nurses practitioners use a needle of 21 g in adult population, whereas a nearly identical percentage of 20 (71.3%) pediatric nurses use the same needles to administer injections in children (Table 2).

During the procedure of performing intramuscular injection of the drug, which includes preparing and administering medication, 123 (82.6%) students would use two needles, 22 (14.8%) one, and two students (1.3%) more than two needles. Most nurses practitioners, 130 (89.7%), used two needles, while two (1.4%) respondents used one needle, and more than two needles, 12 (8.3%) ( $p < 0.001$ ).

A total number of 106 (66.2%) students would use the 70% ethyl alcohol for disinfection of skin, and 47 (29.4%) the 70% isopropanol. Unlike the students, almost all nurses practitioners, 142 (95.3%), used the 70% ethyl alcohol, and only three (2.0%) the 70% isopropanol. None of the respondents chose 60–70% propanol, and 2% chlorhexidine ( $p < 0.001$ ).

The three quarters of the students, 112 (75.2%) would immediately give an injection after disinfection of the skin, while only a qu-

arter, 36 (24.2%) would allow the skin to dry. As for the nurses practitioners more than half of 79 (54.5%) nurses allowed the skin to dry before an injection applying. Less than half of nurses, 60 (41.4%), immediately gives an injection while three (2.0%) did not disinfect the skin ( $p < 0.001$ ).

Out of 149 respondents, 139 (92.7%) students would administer IM injection at 90°, nine (6.0%) at 45°. Out of 145 respondents, 128 nurses (85.3%) used an angle of 90°, while 15 (10.0%) nurses provided an injection angle of 45°. One participant in each group would give IM injection at an angle of 10–15° ( $p > 0.05$ ).

A total number of 112 (75.2%) responded affirmatively to the question of whether the Z-technique can be used for IM injection, while 16 (10.7%) students had contrary opinion, and 18 (12.1%) students were not familiar with the Z-technique. In contrast to the students, 29 (20.0%) nurses practitioners applied this method, 29 (20.0%) did not apply, while 14 (9.7%) sometimes applied. Half of the nurses, 73 (50.3%) did not answer this question, which confirms the fact that they are not familiar with the Z-technique ( $p < 0.001$ ).

Half of the students surveyed, 78 (52.0%) and 74 (50.7%) nurses injected 1 mL of the drug per 10 seconds, 33 (22.0%) students and one nurse (0.7%) injected 1 mL per 1 second ( $p < 0.001$ ) (Figure 2).

Most students, 129 (86.6%), and 109 (75.1%) nurses withdrawn needle immediately after administering the drug. After 10 seconds, which would be correct, 19 (12.7%) students and 33

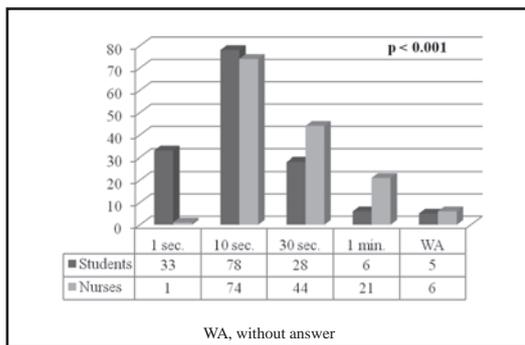


Figure 2. Speed of 1mL drug injection

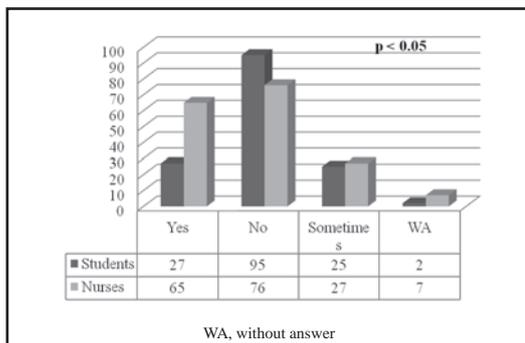


Figure 3. Massaging the injection site after IM injection

(22.8%) nurses would withdraw ( $p < 0.05$ ).

The largest number of students, 95 (63.8%) chose the recommendation not to massage the injection site, while 27 (18.1%) would do it. Less than half of the nurses, 65 (44.8%) made massage of the injection site, while 46 (31.7%) did not ( $p < 0.05$ ) (Figure 3).

## DISCUSSION

The results obtained by conducted research showed that IM administration procedures were carried out traditionally, and guidelines for best clinical practice were not used. In our study, dorsogluteal site was for nearly all respondents the primary site for giving intramuscular injections, although it is not a desirable place for IM injection (1,4). These results are consistent with other estimation studies of IM injection practices that confirm that dorsogluteal site, is also used significantly more than other sites (4,7,9,11). Ventrogluteal site (*m. gluteus medius*), which is a recommended site of choice for IM injection route (4,8,10,12-16), would be used by a significantly small number of nurses and students in our study. Selection of the sites for administering of IM

injections in children in this study was also not in line with current recommendations (1, 2, 8, 15).

In our research, most of the students and nurses responded they use a needle of 21 g for giving IM injections in children and adult population, which is a good choice (8). Also, most of our respondents respect the rules of use two needles in the IM injection procedure as well as in a study conducted by Engstrom et al (7). Specifically, in their study, 63.3% to 84.5% nurses responded that they change the needle for drug preparation and administration, depending on which drugs they were administering.

The results of this study have shown poor practice in the process of disinfection of the injection site, speed of drug injection and procedure after completion of injection.

If one does not allow the skin to dry, insertion of the needle is more painful for the patient and the bacteria are not inactivated (8, 22). Furthermore, as already mentioned, WHO no longer recommends the practice of disinfection of the skin (22, 23) citing research findings that indicate that risk of infection is not increased if the skin is disinfected prior to IM injection. This is explained by the fact that most of the bacterial flora that is not pathogenic to the skin and the amount of bacteria that can enter, is lower than the minimum infectious dose required for the development of pus formation (23). Cocoman and Murray (27) state that the practice of disinfecting the skin before administering injections is a routine procedure that will be difficult to eliminate. Through the answers of our research we concluded that the process of disinfection of skin before IM injection is also deeply rooted in Serbia. It is necessary to do additional research to confirm or reject a recommendation for or against routine skin disinfection. Until then, it is necessary to follow the national guidelines for best clinical practice to disinfect the skin before injections (22).

Analysing the speed of drug injection into the tissue under the current recommendations and speed of drug injection used in practice (10), based on the obtained results, we can conclude that the presented results of our study confirm the findings of the study conducted by Eng-

strom et al (7), in which nurses do not express accurately the speed of injection but choose amongst “as quickly as possible” or, “very slowly”, or, “neither fast nor slow.”

Another usual practice for IM administration must be corrected. Specifically, we found that more than three-quarters of respondents withdrew the needle immediately after completion of IM administration, which is not recommended. Recommendation is that it is necessary to wait 10 seconds after administering the drug, and then withdraw the needle (1,2,8,15), because it allows the medication to diffuse into the surrounding muscle tissue (2,15). The results of our and similar studies (7) indicate that in most cases, nurses are still massaging the site with gauze swab after injection of the drug, which is not recommended because this procedure can cause the drug to leak from the needle entry site into subcutaneous tissue (10,15).

In relation to the technique of giving IM injections, the results of our study indicate that nurses and students used the proper needle insertion angle (8,12). However, the Z-technique is rarely used. Unfortunately, the results of other studies indicate that nurses do not often apply this technique in practice (3), despite all its advantages (7,10).

The traditional approach of IM administration

is rooted and it will be difficult to change, however, this study has shown positive progress in implementing the procedure, but it is still only the beginning. Bearing in mind that students who are still in the process of education have outdated information, it is necessary to harmonize the literature from which to educate the new recommendations based on evidence-based practice. Nurses also apply this procedure in practice in the way they learned from their older colleagues. All this confirms the need for written instructions for implementing the procedures of IM injection of drugs in all health institutions in order to carry out these procedures uniformly and to prevent the adverse events.

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#### TRANSPARENCY DECLARATIONS

Competing interests: none to declare.

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## Procena veštine intramuskularne injekcije koju sprovode učenici i medicinske sestre u hospitalnim uslovima - da li je zasnovana na dokazima?

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### SAŽETAK

**Cilj** Analizirati opšte aspekte procedure intramuskularne injekcije i njenu usaglašenost s aktuelnim preporukama.

**Metode** Istraživanje je sprovedeno u obliku studije preseka. Uzorak je činilo 294 ispitanika, odnosno 149 učenika završnih razreda medicinske škole i 145 medicinskih sestara. Podaci su prikupljeni od februara do aprila 2012. godine. Instrument koji se koristio za procenu procedure intramuskularne injekcije bio je anketni upitnik posebno dizajniran za potrebe ove studije. Statistička obrada podataka obuhvatala je deskriptivnu i inferencijalnu analizu. Statistički značajne smatrale su se vrednosti na nivou verovatnoće od  $p < 0.05$ .

**Rezultati** Dorsoglutealno mesto administriranja intramuskularnih injekcija koristilo je 139 (88.0%) učenika i 130 (89.7%) sestara. Kada je u pitanju odabir igala za IM injekciju 103 (68.2%) učenika i 118 (72.0%) medicinskih sestara u praksi je koristilo igle od 21 G (zelene). Od ukupnog broja, 112 (75.2%) učenika, nakon dezinfekcije kože, odmah je dalo injekciju, dok je 79 (54.5%) sestara sačekalo da se koža osuši, pa tek onda dalo injekciju. Z-tehniku u praksi je primenilo samo 29 (20.0%) sestara. Većina ispitanika, 129 (86.6%) učenika i 109 (75.1%) sestara, izvuklo je iglu odmah nakon IM administriranja leka. Ubodno mesto, nakon ubrizgavanja leka, nije masiralo 95 (63.8%) učenika i 46 (31.7%) sestara.

**Zaključak** Na osnovu naših rezultata možemo zaključiti kako se u Srbiji procedura IM injekcije sprovodi tradicionalno što potvrđuje neophodnost postojanja pisanih uputstava za sprovođenje ove procedure u svim zdravstvenim institucijama, kako bi se ona obavljala uniformno i kako bi se prevenirali neželjeni događaji. Ova studija je pokazala i pozitivne pomake u sprovođenju procedure intramuskularne aplikacije leka, ali je to još uvijek sve u začetku.

**Ključne reči:** dimenzije igle, dezinfekcija kože, Z-tehnika.