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Comparison of pain levels developed during intramuscular injections to laterofemoral and ventrogluteal regions in children: a randomized controlled study

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SUMMARY

OBJECTIVE: The aim of this study was to compare the levels of pain developed during intramuscular injections to the laterofemoral and ventrogluteal regions in children.

METHODS: The study population consisted of all children aged between 7 and 12 years who presented to the pediatric emergency clinic of a hospital. The sample consisted of 62 children who met the inclusion criteria and agreed to participate in the study, and the children were randomly assigned to each group (laterofemoral n=31, ventrogluteal n=31). "Buzzy" and "deep breathing" were applied to children in both groups to relieve pain during the procedure. The data were obtained using an Information Form, a visual analog scale, and the Facial Pain Scale-Revised.

RESULTS: It was determined that the children in the ventrogluteal group during the intramuscular injections had lower visual analog scale and faces pain scale-revised scores immediately after the procedure compared with the vastus lateralis group, that is, they experienced less pain, and the difference between the two groups was significant (p<0.001).

CONCLUSION: In children, it is recommended to choose the less painful ventrogluteal region for intramuscular injection and to inform health professionals about it.

KEYWORDS: Pain. Child. Nurses. Injections, intramuscular.

INTRODUCTION

The regions used for intramuscular (IM) injection in children are the deltoid, ventrogluteal, and laterofemoral regions. Although the laterofemoral (vastus lateralis muscle) region is the most frequently preferred region in children, it is emphasized that the safest region for IM injection is the ventrogluteal region[1-4].

It is recommended to use the laterofemoral region in newborns and children younger than 3 years of age, and the ventrogluteal or deltoid region in children aged 3 years and over[1]. In addition, it is reported that the laterofemoral region can be used safely in children aged 3–18 years, if large amounts of drugs are to be injected[1,5,6].

The vastus lateralis muscle in the laterofemoral region is a safe region for IM injections due to its distance from nerves and blood vessels, the low risk of administering the drug to the subcutaneous tissue, multiple injections, easy access, and easy location[4,7]. In contrast, the ventrogluteal region is a region that does not contain large blood vessels and nerves, has a thick muscle density, is preferred for the application of irritating and oily solutions, and is less painful during injection[1]. Since this region is the thickest, consisting of both gluteus medius and gluteus minimus muscles, it can be used safely in all adults and small children who can walk[8].

Ensuring timely and effective pain control during procedures that cause pain and discomfort, such as IM injections applied to children, will increase the tolerance to pain in later applications[1,9,10]. It is estimated that the fear of injections, which is present in approximately 25% of adults, develops during childhood. Reducing injection-related pain in childhood can prevent stress and avoidance of healthcare-seeking behavior in later periods[10]. For this reason, in IM injections, it is very important to choose the right application and the right region in children to experience less pain.

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METHODS

Objective

This research was conducted to compare the levels of pain developed during IM injections to the laterofemoral and ventrogluteal regions in children.

Design

This is an experimental randomized controlled study.

Research hypothesis

Hypothesis 1 (H1): There would be a difference between laterofemoral and ventrogluteal regions in terms of pain during IM injections in children.

Participants

The population of the study consisted of children aged between 7 and 12 years who presented to the pediatric emergency clinic-injection room of a state hospital in Turkey. To use parametric tests in statistical evaluation and to obtain safer results, it was planned to include a total of 60 children, at least 30 in each group, as the sample of the study. A total of 70 children were included in the study by adding 5 more children to each group, considering that there might be losses. To determine which patient would be in which group, numbers from 1 to 70 were randomly distributed to two groups through a computer program without repeating any numbers. During the study, a total of eight children, four from each group, stated that they wanted to leave immediately after the procedure and did not evaluate their pain. Thus, the study was conducted with a total of 62 children (*laterofemoral* n=31, *ventrogluteal* n=31). Power analysis was performed using the Power (v3.1.7) program to determine the adequacy of the sample size of the study. With a significance level of 0.05, a confidence interval of 0.98, and a high effect size of 0.40, the power of the study was determined as 0.98.

The inclusion criteria were as follows: children aged between 7 and 12 years, being admitted to the emergency unit for penicillin (procaine) administration, absence of a disease causing chronic pain, absence of a neurodevelopmental disorder, not taking analgesics in the last 6 h, no history of fainting during injections, absence of mental retardation, families, and children agreeing to participate in the research.

Data collection

Information form

The information consisted of a total of nine open- and closed-ended questions about the introductory characteristics of the child and their family and the injection procedure.

Visual analog scale

This scale consisted of a 10-cm line drawn either vertically or horizontally (0–10 cm or 0–100 mm). A line of 0 on the scale indicates "no pain," and a line of 10 indicates "unbearable pain[11]." The child is asked to put a mark on the line to indicate the intensity of pain.

Faces pain scale-revised

The faces pain scale-revised (FPS-R) consists of six facial expressions graded from 0 to 10 according to the presence and severity of pain. It is a valid and reliable self-report scale for painful situations in children[11].

Buzzy®

Buzzy is an 8×5×2.5 cm, 8×5×2.5-cm, noninvasive, plastic pain control device with a battery and vibration motor, developed by pediatrician Ammy Baxter. A cold ice pack is placed under Buzzy. It is effective in reducing pain with local cold application and vibration effect (Figure 1) (http://www.buzzy4shots.com/).

Application

The procedure was explained to the parents and children, and verbal and written consent was obtained from the families and children before the application. The Information Form was completed by the researcher. According to the randomization, the group of children was determined and the children who came every day were treated accordingly. During this period, the nurse practitioner prepared the materials. Injectors with a needle size of 25 gauge[6] were used in children and adolescents. The mothers of all the children participating in the study stayed with the children throughout the injection procedure, which was administered by the researcher in all groups.

Figure 1. Buzzy®.

Ventrogluteal region injections

The child was placed in the lateral position, the left hand on the right hip, and the right hand on the left hip were used to determine the injection site. The lower part of the palm was placed in the greater trochanter. The index finger was placed on the anterior superior iliac spine, the middle finger was extended dorsally to reach the iliac crest, and the thumb was positioned to point to the inguinal region. The injection was performed in the triangle formed by the index finger, middle finger, and iliac crest[2,7].

Laterofemoral region injections

The child was placed in the supine position. The vastus lateralis muscle, located on the anterior lateral aspect of the thigh, is the best-developed muscle in children. The distance between the knee and the greater trochanter was divided into three, and an injection was performed in the middle third[7].

To alleviate the pain during the procedure, children in both groups were given "deep breathing" and "Buzzy." Buzzy was placed 3–5 cm above the region for 60 s before and during the procedure. After penicillin was administered to the children in both groups (at 1 min), pain conditions were evaluated and recorded using the VAS and FPS-R. All these processes took approximately 15–20 min for each child.

Statistical analysis

Data were evaluated using the χ^2 test, Kruskal-Wallis test, Mann-Whitney U test, one-way analysis of variance, and Spearman's correlation analysis. The statistical significance level was set at $p<0.05$.

Ethical considerations

The study was approved by the University Clinical Research Ethics Committee (2015,21347889-774.991), and written permission was obtained from the institution where the study was conducted (2015,26857650-047).

RESULTS

The comparison of demographic characteristics by groups is presented in Table 1.

DISCUSSION

Pain in IM injections can be reduced by a good injection technique and by administering the drug to the correct injection site, which is determined by considering the characteristics of the drug and the individual[12]. In the literature, studies are comparing the dorsogluteal and ventrogluteal regions for IM injections, and there are a few comparative studies on the laterofemoral region, which we use frequently in children. For this reason, evaluating the effectiveness of these two regions, which we use safely in children, on pain will contribute to this field.

It was emphasized that it was important to evaluate the body mass index (BMI), weight, and age of the child in the

Table 1. Comparison of demographic characteristics by groups (n=62).

		Ventrogluteal (n=31)	Vastus Lateralis (n=31)	Test	p
Age	Mean±SD	9.39±2.12	7.87±1.48	**z=-2.785**	[a] ***0.005***
	Min-Max (Median)	7–12 (9.0)	7–12 (7.0)		
BMI	Mean±SD	16.70±2.83	15.53±2.33	**t=1.779**	[b] ***0.080***
		n (%)	**n (%)**		
Sex	Girl	14 (45.2)	14 (45.2)	**χ^2=0.001**	[c] ***0.999***
	Boy	17 (54.8)	17 (54.8)		
How the child felt after the procedure	Very good	10 (32.3)	9 (29.0)	χ^2=0.305	[d] ***0.999***
	Good	13 (41.9)	13 (41.9)		
	Neutral	4 (12.9)	4 (12.9)		
	Bad	4 (12.9)	5 (16.1)		
Child's reaction	Very positive	6 (19.4)	1 (3.2)	χ^2=5.061	[d] ***0.164***
	Positive	19 (61.3)	20 (64.5)		
	No reaction	3 (9.7)	3 (9.7)		
	Negative	3 (9.7)	7 (22.6)		

[a]Mann-Whitney U test; [b]Student's t-test; [c]Yates's continuity correction test; [d]Fisher-Freeman-Halton test. Bold values indicate statistical significance at the $p<0.05$ level. The comparison of the mean VAS and faces pain scale-revised scores of the groups is presented in Table 2.

selection of the region for IM injections because subcutaneous tissue and adipose tissue vary according to age. It is very important to know the BMI value because it affects the quality of the IM injection and the delivery of the drug to the tissue[3]. In the research, it was seen that the BMI values were similar in both groups. This would minimize the risk of being affected by pain that might result from BMI in children.

In the study, very painful IM injections of penicillin were performed in different regions in the two groups, and it was seen that the children in the ventrogluteal region group felt less pain immediately after the penicillin injection than the laterofemoral group, and this difference was statistically significant. In addition, in the study, two pain scales based on two different personal expressions with high validity and reliability and were easy to understand were used in determining the severity of pain, and similar results were obtained with both scales ($p<0.05$; Table 2). The children in both groups were asked how they felt about the injection immediately after the procedure, and it was found that the children mostly felt good, and according to the mothers' statements, the children showed similar positive reactions during the procedure ($p>0.05$; Table 1). This result showed that the children were mostly positive about both methods, but the pain experienced in the ventrogluteal region was less. In the literature[1,13], it was stated that this region was less painful because it did not contain large blood vessels or nerves and was far from bone tissue. The results of our research show parallelism with the literature and *Hypothesis 1* is supported.

In a study by Moharreri et al. (2007), when pain severity and bleeding status were evaluated after the IM injections in the dorsogluteal and ventrogluteal regions, it was found that patients who were injected into the ventrogluteal region felt less pain and had less bleeding compared with the dorsogluteal region[14].

In studies conducted in adults, pain and bleeding occurring in injections performed in the ventrogluteal region[5,7,13] were less than those performed in the dorsogluteal region, and the ventrogluteal region was preferred for IM injections[13].

In a study, nurses expressed that the dorsogluteal region was the most frequently used IM injection region; they did not use the ventrogluteal region although, they defined it as the safest injection region, and their knowledge about injections in the ventrogluteal region was insufficient[15]. Isseven et al. (2020) compared the dorsogluteal and ventrogluteal regions in their study of adults[7]. They found the satisfaction level of the patients from the ventrogluteal region to be higher than in the dorsogluteal region. In our study, it was observed that children were satisfied at similar rates in both regions (Table 1). The ventrogluteal region is safer for injections and causes less pain because there are no large blood vessels and nerves. This region has advantages such as the low possibility of transferring the drug to the subcutaneous tissue due to the thin subcutaneous layer and easier positioning of the patient[2,5]. In addition, as a painful procedure was performed in the study, "deep breathing" and "Buzzy" were performed on the children in both groups to experience less pain. It has been reported that these methods reduce pain in children during painful procedures[9,16]. In addition to these methods, it is seen that regional preference also further reduces pain. However, although the ventrogluteal region is defined as the safest area for IM injections in the literature, it has been found that the majority of nurses do not use this area and are reluctant to change[15].

In our study and other studies, it was determined that the ventrogluteal region was less painful[12,17]. For this reason, health professionals should be informed in this direction and the importance of using this region more frequently, which causes children to experience less pain in practice, should be emphasized.

CONCLUSION

It is seen that both sites can be used in IM injections in older children, but IM injections performed in the ventrogluteal region are less painful than those performed in the vastus lateralis region.

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Table 2. Comparison of visual analog scale and faces pain scale-revised mean scores of the groups immediately after the procedure (n=62).

		Ventrogluteal (n=31)	Laterofemoral (n=31)	Test	[a]p
VAS	Mean±SD	2.39±2.01	4.58±3.56	z=-2.500	**0.012**
	Min-Max (Median)	0–8 (2.0)	0–10 (4.0)		
FPS-R	Mean±SD	2.45±1.98	4.58±3.59	z=-2.419	**0.016**
	Min-Max (Median)	0–8 (2.0)	0–10 (4.0)		

[a]Mann-Whitney U test. Bold values indicate statistical significance at the $p<0.05$ level.

AUTHORS' CONTRIBUTIONS

SB: Conceptualization, Formal Analysis, Methodology, Project administration, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **BBS:** Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Resources, Supervision, Validation, Visualization, Writing – original draft.

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