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ORIGINAL RESEARCH

Effect on pain of changing the needle prior to administering medicine intramuscularly: a randomized controlled trial

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Abstract

Aim. This paper is the report of a study to determine whether changing the needle before administering an intramuscular injection could reduce pain, and to investigate gender differences in pain perception.

Background. A skilled injection technique can make the patient's experience less painful and avoid unnecessary complications, and the use of separate needles to draw up and administer medication ensures that the tip of the needle is sharp and free from medication residue.

Method. A randomized controlled trial was carried out between January 2009 and May 2009 with 100 patients receiving diclofenac sodium intramuscularly in an emergency and traffic hospital in İzmir, Turkey. The primary outcome was pain intensity measured on a numerical rating scale. Each patient received two injections by the same investigator using two different techniques. The two techniques were randomly allocated and the patients were blinded to the injection technique being administered. After each injection, another investigator who had no prior knowledge of which injection technique was used immediately assessed pain intensity using a numerical rating scale. Descriptive statistics, paired *t*-test and *t*-test were used to evaluate the data.

Results. Findings demonstrated that changing the needle prior to intramuscular medication administration significantly reduced pain intensity. A statistical difference in pain intensity was observed between the two injection techniques.

Conclusion. The results supported the hypothesis that changing the needle prior to administering the medicine significantly reduced pain intensity.

Keywords: drawing-up, intramuscular injection, one-needle technique, pain intensity, randomized controlled study, two-needle technique

Introduction

Intramuscular injection is a common but painful experience for many people. Although considered a basic technique, it is far from innocuous. Traditionally, nurses have used one of two drawing up techniques for the administration of intramuscular injections. In the first, the injectable is drawn up using one needle, which is then discarded before administration using a new needle. Alternatively, the injectable is drawn up and administered without changing the needle. Although

the literature suggests that the two-needle technique reduces pain at the injection site, only very limited research-based studies of changing needles have been carried out.

Background

Pain is defined as 'an unpleasant sensory and emotional experience arising from actual or potential tissue damage or described in terms of such damage' (Potter & Perry 2005). The emphasis of this definition is on both the sensory and emotional experiences of an individual in pain. Undoubtedly, pain is an unpleasant sensation from which we instinctively try to escape. The administration of intramuscular injections is an important part of medication management and a common nursing intervention in clinical practice. Injection causes pain and discomfort to the recipient in addition to having healing and treatment properties (Campbell 1995, Floyd & Meyer 2007, Hunter 2008). A skilled injection technique can make the patient's experience less painful and avoid unnecessary complications (Beyea & Nicoll 1995). Over the years, clinicians have tried to explore various methods to reduce pain, and pain because of injection is of no exception.

Hay (1995) and Murphy (1991) suggested that one of the factors associated with increased client discomfort was the injection technique used by clinicians. Further strategies highlighted in the literature to minimize pain during the procedure are to have a good technique, to give clients appropriate information, to be a calm and confident nurse, to use a drawing-up needle, to use the smallest diameter needle, to flick the skin or tap the injection site before swabbing, to stretch the skin, to enter the skin quickly, to distract the client and to inject the medication slowly (Campbell 1995, Workman 1999, Rodger & King 2000, Schechter *et al.* 2007).

In the literature, there are a limited number of studies which investigate the reduction of pain in intramuscular injection. The option of the use of some kind of topical anaesthesia can give some control to the patients over this aspect of care (Zappa & Nabors 1992). In addition, the use of ice packs prior to the injection may help reduce pain (Murphy 1991). Barnhill *et al.* (1996) examined the effect of manual pressure on perceptions of pain from intramuscular injections and the study was repeated and refined by Chung and Wong (2002). These studies advocated the use of manual pressure on the injection site for 10 seconds before needle insertion to reduce pain. Rock (2000) recommended that a two-needle process should be used to reduce consumer discomfort – one needle for preparation and one for administration. There is agreement in the literature as to the use of drawing-up needles prior to injecting the medication (Beyea & Nicoll 1995, Workman 1999, Engstrom *et al.* 2000, Nicoll & Hesby 2002). The use of separate needles to draw up and administer medication ensures that the tip of the needle is sharp and free from medication residue (Beyea & Nicoll 1995, Workman 1999, Al Awaidy *et al.* 2006). However, Rock's (2000) study of 70 subjects, who were asked to complete a pain scale post administration of depot neuroleptics, found that there was no significant reduction in injection pain using the two-needle technique.

There has been little research in Turkey into the effect of different injection techniques, and nurses demonstrate a variety of techniques and disparate knowledge.

The study

Aim

The aim of the study was to determine if changing the needle before administering an intramuscular injection could reduce the pain. As gender can influence the perception of pain, we aimed to investigate gender differences in pain perception.

Design

An experimental randomized controlled trial was designed using repeated measures.

Participants

The population of the research was formed by the patients who were admitted to a trauma centre and prescribed diclofenac sodium intramuscularly. This centre is located in İzmir, Turkey. The study participants were those who had been admitted to the hospital after traffic accidents and had already been prescribed diclofenac sodium by the attending physician to be administered intramuscularly at least every 24 hours; they were 18 years of age or older, and conscious enough to answer questions about their pain. Patients diagnosed with a disease that influenced pain perception such as sensory-motor deficiencies, diabetes, peripheral vascular diseases and peripheral neuropathy were excluded from the study. Using pain scores as the primary outcome, a power calculation showed that 46 participants were needed in each technique to detect a difference in pain scores using 90% power and 5% significance level. Assuming that approximately 10% of the participants would have incomplete data or would not complete the survey, 50 study participants for each technique were required, for a total of 100 participants.

Data collection

Data were collected by the researchers between January and May 2009.

Instruments

A structured, self-administered questionnaire was used for data collection. This questionnaire consisted of two parts. The first part contained items on age, gender and injury type. The second part contained a Numerical Rating Scale (NRS) that was used to measure the perceived pain intensity during the intramuscular injection. Immediately following each injection, the patients were given an NRS and asked to rate the intensity of the site pain experienced at the time of injection. The NRS was administered by asking the patient to estimate pain verbally on a scale of 0–10, with 0 representing no pain, 5 representing moderate pain and 10 representing the worst imaginable pain. Ratings between 0 and 5 would correspond to pain that was moderate, mild or nonexistent, while ratings between 5 and 10 would express moderate to severe pain. The NRS has been used extensively in adults, showing good evidence of acceptability, reliability and validity (Bijur *et al.* 2003, Hollen *et al.* 2005).

Injection techniques

Technique A (two-needle technique): The injectable was drawn from a glass ampoule, using a 21G × 38 mm needle. This needle was then replaced with a new 21G × 38 mm needle and air was expressed from the barrel, after which the injection was administered intramuscularly into the dorsogluteal site.

Technique B (one-needle technique): The injectable was drawn from a glass ampoule, any air was expressed from the barrel, and then the injection was administered intramuscularly in the dorsogluteal site, employing the same 21G × 38 mm needle for both drawing-up and administration.

Procedure

Patients who satisfied the criteria were recruited, and were required to receive two doses of diclofenac sodium. Both were injected intramuscularly in the dorsogluteal site. The left and right buttocks of each patient were randomized to either technique A (two-needle technique) or to technique B (one-needle technique). Each patient received two injections from the same investigator using the two different techniques. The patients were blinded to the injection technique being administered. After each injection, another investigator, who had no prior knowledge of which injection technique was used, immediately assessed pain intensity using NRS and recorded the result on the data collection form.

Table 1 Intramuscular injection protocol for all participants and techniques

Diclofenac sodium	3 mL
Syringe size	5 mL
Needle size	21 gauge
Air lock	0·2 mL air lock inserted
Site	Right and left dorsogluteal site
Wipe	Area cleanses with alcohol and allowed to air dry before needle insertion
Insertion angle	90°
Aspiration	Aspirated
Injection duration	1 mL per 10 seconds
Needle withdrawal	At the same angle as insertion
After the injection	Applying a light pressure at the injection site after the injection and not massaging the site
Data recorded	Another investigator assessed pain intensity and recorded

Intramuscular injection protocols were similar for all participants and techniques. The researcher administered all the injections according to the injection protocol. The protocol was design as listed in Table 1.

Ethical consideration

The study was approved by the appropriate ethics committees. All participants received an explanation of the study before participating, and gave written informed consent before voluntary participation.

Data analysis

In the evaluation of the demographic data, descriptive statistics were used. A paired *t*-test was used to explore the statistical differences in perceived pain intensity between techniques A and B. The effect of gender on pain was also explored using *t*-test. The level of significance was set at $P < 0{\cdot}05$.

Results

One hundred study participants were recruited to the main study, with ages ranging from 18 to 54 years, mean age 43·2 years (SD = 9·8). Thirty-five of them (35%) were women and 65 (65%) were men. Of the 100 trauma patients, 71% had been involved in car accidents, 17% in motorcycle accidents and eight (12%) in pedestrian accidents. All patients were alert and conscious enough to answer questions about their pain.

The mean score for perceived pain intensity for technique A (two-needle technique) was 5·53 (SD = 1·64) and the mean score for technique B (one-needle technique) was 6·43 (SD = 1·35) (Figure 1). There was a significant difference in mean pain intensity between techniques A and B (t = 8·27, P < 0·001).

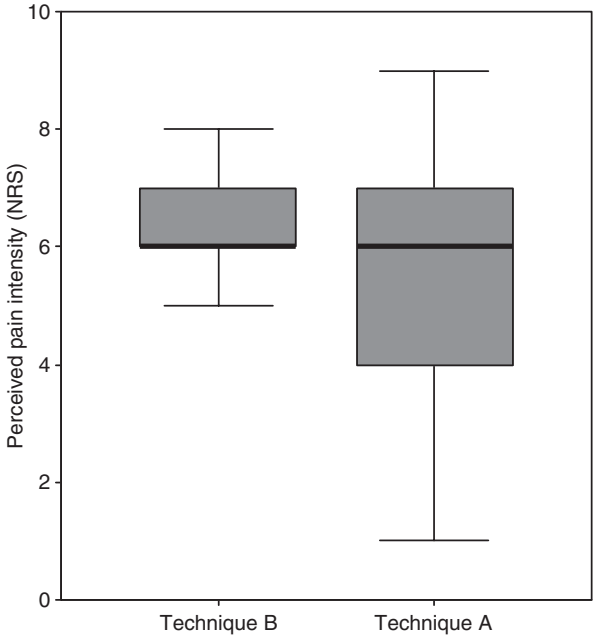

Figure 1 A comparison of the mean perceived pain intensity between technique A (two-needle technique) and technique B (one-needle technique) (n = 100).

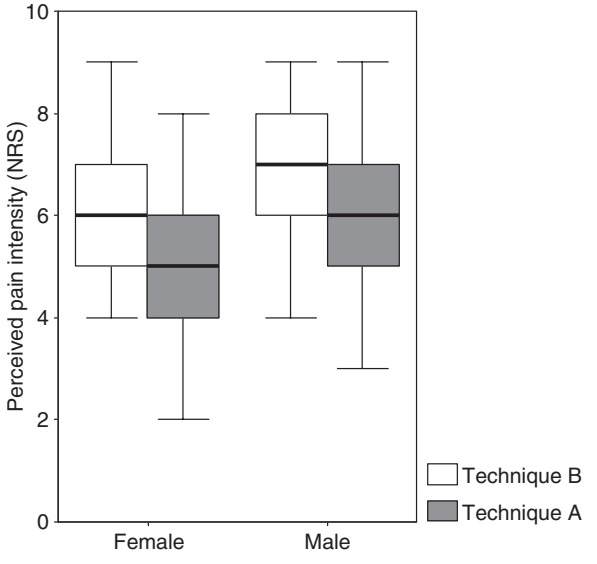

Figure 2 A comparison of the mean perceived pain intensity for males and females under the technique A (two-needle technique) and technique B (one-needle technique).

Although the gender effect on pain intensity associated with the one-needle technique was significant (t = 2·54, P < 0·05), there was no significant difference on pain intensity for the two-needle technique (t = 1·61, P > 0·05). Males reported higher pain intensity than females in the one-needle technique (Figure 2).

Discussion

The findings revealed that the overall pain intensity perceived by the patients was moderate, with a mean of 5·53 in the two-needle technique and 6·43 in the one-needle technique. The extent of the perceived pain intensity was not similar to that obtained by Rock (2000). His study of 70 patients, who were asked to complete a pain scale post administration of depot neuroleptics, found that there was no significant reduction in injection pain using the two-needle technique. There have been no studies on changing the needle in intramuscular injection and hence we were unable to compare results. Therefore, more studies are needed to provide conclusive results.

The results supported the literature, which indicates that a two-needle process should be used to reduce consumer discomfort – one needle for preparation and another for administration (Rodger & King 2000, Nicoll & Hesby 2002, Wynaden *et al.* 2006, Ismail *et al.* 2007). There is agreement in the literature as to the use of drawing up prior to injecting the medication (Beyea & Nicoll 1995, Workman 1999, Engstrom *et al.* 2000, Nicoll & Hesby 2002).

The findings of this study also demonstrated that females reported lower pain intensity than males in the one-needle technique. No statistical difference was observed between males and females in the two-needle technique. These findings were not in congruence with the literature. Compared with men, women have more subcutaneous tissues in the buttocks. Pain receptors are located within the subcutaneous layer, not in muscle tissue. Thus, women consistently report more pain from all intramuscular injections (Chan *et al.* 2003). In addition, our results are not supported by Mitchell and Whitney (2001), who reported that women consistently had higher mean pain scores in intramuscular injection. This result could be due to the lower number of females than males in this study. It seems that this finding needs more investigation.

Study limitations

Our study had some limitations. Although all the patients were conscious, they may have been affected by post-traumatic stress, and this factor could have affected the results of the study. We also failed to equalize the numbers of women

What is already known about this topic

- Intramuscular injection often causes pain at the injection site.
- A skilled injection technique can make the patient's experience less painful and avoid unnecessary complications.
- Decreasing pain associated with intramuscular injection by using the two-needle technique could be a simple way to decrease pain intensity.

What this paper adds

- This study provided empirical data for evidence-based nursing practice.
- Changing the needle prior to administering the medicine significantly reduced pain intensity.
- This research has a contribution to make in helping healthcare professionals reduce injection pain.

Implications for practice and/or policy

- If further research confirms the efficacy on pain of changing needles, it should be used to relieve pain in intramuscular injection.

and men. In addition, there was no randomized-controlled study on the participants to compare the findings of the study.

Conclusion

The results supported the application of the two-needle technique when administering an intramuscular injection. The findings demonstrated that changing the needle before injecting the medicine significantly reduced the pain intensity. The two-needle technique should be a part of routine practice as it reduced patient discomfort and minimized possible complications. It also highlights the need for further research with a larger sample and with healthy human subjects so as to establish the generalizability of the results.

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Conflict of interest

No conflict of interest has been declared by the authors.

Author contributions

UYG and EA were responsible for the study conception and design. EA performed data collection. UYG performed data analysis, was responsible for drafting the manuscript, made critical revisions to the paper for important intellectual content, and provided statistical expertise.

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