

Decreasing the pain of finger block injection: level II evidence

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Abstract

Background There is level II evidence that volunteers prefer the single subcutaneous injection in the midline of the proximal phalanx with lidocaine and epinephrine (SIMPLE) finger block over the classic two dorsal injection block technique. The purpose of this study was to possibly further decrease the pain of digital block injection by examining the effect of the duration of injection on the pain felt by volunteers receiving the SIMPLE block at two different injection rates.

Methods Forty healthy blinded volunteers were injected 2 mL of lidocaine 1 % and epinephrine 1/100,000 in the digital palmar crease of both long fingers, one at a time. Two different rates of injection were used: 8 and 60 s. Pain scores were measured using a visual analogue scale and the volunteers were asked which of injection techniques they preferred.

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Results The visual analogue scale results revealed less pain with the slow injection ($p < 0.001$). Thirty three out of 40 volunteers preferred the slow injection rate. No difference could be attributed to sex of participants or to the first hand injected.

Conclusion Blinded volunteers preferred digital blocks injected over 60 s to the more rapid 8 s. Decreasing the pain of injection only takes a minute of our valuable time for finger blocks.

Keywords Digital block · Lidocaine · Epinephrine · Pain · Injection rate

Introduction

Many factors ultimately determine the level of pain associated with digital nerve block: the needle diameter, the angle of penetration, the number of needle pokes, the temperature and type of solution including pH, and finally, the rate of injection.

In 2006, Williams et al. introduced the acronym SIMPLE block (single subcutaneous injection in the midline of the proximal phalanx with lidocaine and epinephrine). They were able to demonstrate a preference for the SIMPLE block over the two dorsal web space injection technique in healthy volunteers [19].

The purpose of this study is to assess the pain of the rate of injection of the SIMPLE block. We hypothesized that a slower rate of injection would reduce pain and be preferred by healthy volunteers.

Methods

A prospective randomized single-blinded controlled study was designed with approval of the study protocol obtained by regional institutional review boards (Centre Hospitalier

de l'Université de Montréal, Hôpital Maisonneuve-Rosemont, Hôpital du Sacré-Coeur de Montréal, Montreal, Canada). Forty healthy volunteers were enrolled between October 2010 and April 2011. Written informed consent was obtained from each individual. Exclusion criteria were the following: active smoking or cessation less than 1 month; allergy to lidocaine, epinephrine or conservative agent; Raynaud's phenomenon or disease and any other vasospastic disorders; scleroderma; Buerger's disease; Dupuytren's disease; history of complex regional pain syndrome; pregnancy; history of major hand trauma or surgery.

Forty healthy volunteers (20 males and 20 females) were randomized for two variables: (1) which hand would receive the first injection and (2) which hand would receive the slow injection. Randomization was performed using a coin; it was tossed twice per volunteer and the sequence of injection with each rate was determined.

Two milliliters of lidocaine 1 % and epinephrine 1/100,000 (Xylocaine®, AstraZeneca Canada Inc, Mississauga, Canada) were injected into both long fingers of each volunteer using a 3-cc syringe and a #30 needle at rate of 8 s (fast) in one finger and 60 s (slow) in the other finger. All injections were performed on the long finger of each hand, subcutaneously at the level of the proximal digital crease. Care was taken not to enter the flexor tendon sheath. Subjects were behind a screen with a small opening large enough to introduce the tested hand (Fig. 1). They could not see any of the procedure. The zone of injection was



Fig. 1 Screen preventing the subject from observing the rate of injection during the experiment

disinfected with 70 % alcohol and a period of 30 s was allowed for complete evaporation. All injections were performed by a single investigator (NDH). For both injections, the needle was kept subcutaneous for a 60-s period with great care to stand still and minimize movement. Once one hand was injected, the subject was asked to introduce the second hand for the completion of the experiment.

Immediately after the procedure, volunteers were asked to evaluate the pain perceived in each hand using a visual analogue scale (VAS) from 1 (very mild pain) to 10 (worst pain ever). They were asked, if they had to have a digital nerve block in the future, which one they would prefer. After a minimum of 24 h, they were contacted by phone to inquire about persistent (>12 h) or adverse events. Also, they were again asked about the preferred method of injection.

Statistical analyses were performed using SPSS version 17 (IBM, Armonk, NY, USA).

A one-sample chi-square test was performed to determine a difference between the slow and fast pain scores. A two-way analysis of variance was used with one independent factor (injection) and one repeated factor (fast/slow) for the rate of injection. A *p* value of less than 0.05 was considered statistically significant.

Results

Forty healthy volunteers, 20 males and 20 females, with a mean age of 26 years (range 21–48 years) were recruited. Subjects recruited were medical students [19], residents [17], and nurses [4]; 37 were right handed and 3 were left handed. No subjects were excluded from the study.

A total of 80 finger blocks were performed, two in each subject. The slow injection was preferred by 33 subjects whereas the fast injection was preferred by 6 subjects. One individual saw no difference between the two methods. Table 1 contains the overall VAS pain score for the slow and fast injections, as well as the VAS pain score for each subgroup.

Table 1 Visual analogue scale pain score for the slow and fast injection

	VAS score	SD	Range
Type of injection (<i>n</i> =40)			
Slow injection	2.98	1.49	(1–8)
Fast injection	4.48	1.81	(1–8)
If slow preferred (<i>n</i> =33)			
Slow	2.74	1.31	(1–5)
Fast	4.71	1.71	(2–8)
If fast preferred (<i>n</i> =6)			
Slow	4.33	1.86	(3–8)
Fast	3.17	1.94	(2–7)

When surveyed 24 h later, volunteers subjectively reported all digital blocks performed as successful. No subject had persistent effects of the anesthesia. Adverse effects were described as a burning sensation [1], a persistent pain [1] that eventually resolved and anesthesia of the index and ring finger [2]. When asked about the preferred method of digital nerve block, only one subject changed his mind for the slow injection, having initially selected the fast injection. This subject had rated the fast injection as more painful but still selected it initially as preferred.

The preference toward the slow injection was statistically significant ($p < 0.001$). We also evaluated the data to determine if the first hand injected had a significant effect on pain score. No such difference could be established. We evaluated if sex had an effect on pain score. No such difference could be established.

Discussion

In this single-blinded study of injections of digital blocks of both long fingers of 40 volunteers, we attempted to eliminate all variables of a digital nerve block except for the rate of injection. Our study demonstrated that a 60-s injection rate for a digital nerve block is significantly less painful than an 8-s rate when using lidocaine 1 % and epinephrine 1/100,000. When asked which block they would prefer in the future, 33 of our 40 volunteers selected the slow injection. Sex of the volunteers and which hand was injected first had no bearing on the results.

The two dorsal web space injection block (Oberst) has been the classic finger block as it was the first one described in the first texts on local anesthesia by Braun in the early 1900s [1]. Those texts stated that the dorsal skin was less sensitive to needle stick pain than palmar skin, and the statement to this effect has been repeated in texts ever since. In 2011, a prospective randomized study showed that the palmar skin is not more sensitive than dorsal finger web space skin to needlestick pain [17].

The traditional two-injection dorsal block, the single injection volar subcutaneous and transthecal (flexor tendon sheath) blocks are all routinely involved in digital nerve anesthesia. The pain of injection of these techniques has been compared in various combinations in patients or healthy volunteers [2, 4, 8, 9, 12, 13, 19, 20]. While some studies have failed to demonstrate a significant difference between various sites, others have demonstrated a preference for the volar subcutaneous single injection [2, 8, 12, 19]. In a meta-analysis of the three methods of injection, Yin et al. showed that the single subcutaneous injection was equally painful to the traditional dorsal block, with the transthecal injection being more painful [20]. In a Level II study, comparing the single subcutaneous injection to the

traditional two-injection dorsal block technique, Williams found that the majority of volunteers preferred, the SIMPLE block [19]. Epinephrine is now recognized as a safe adjunct to lidocaine in finger block injection [5, 6, 11, 15, 16].

A similar study to ours in the dorsum of the hands of 29 volunteers showed more pain if it were injected rapidly, but the difference was not statistically significant [10]. Slow injection was found to be more comfortable in facial nerve blocks [18]. A systematic review of the temperature of local anesthetic injection has shown that warming of the solution results in a less painful injection [7]. A Cochrane review recommends adjusting the pH of lidocaine with epinephrine to 7.4 [3]. A prospective randomized controlled trial has shown that if the needle penetrates the skin at 90°, it is less painful than if the needle penetrates at 45° [14].

Possible limitations of this study include the fact that the 30-gauge needle was kept subcutaneously in the volunteer's skin for 60 s for both fingers even though the duration of injection was different in the two fingers. We felt volunteers might perceive the removal of the needle after 8 s, altering the single-blind component of the study. Also, the choice of 8 s, with a volume of 2 mL and a #30 needle, creates a relatively powerful pressure at the injection site. We had initially selected 6 s as a fast injection speed but preliminary testing revealed that it was difficult to inject 2 mL this quickly. A second limitation is the fact that it may be that a 25- or 45-s block hurts no more than a 60-s block. This work remains to be done.

The strength of our study is its prospective, randomized, controlled, single-blinded nature. Healthy volunteers injected in both hands permits comparison of the same procedure with a single variable, the rate of injection.

In conclusion, we provide level II evidence that a 60-s injection is significantly less painful than an 8-s injection of the SIMPLE block. The clinical impact for patient is simple but important. A SIMPLE block hurts less if injected slowly. It only takes a minute of our time to decrease the pain of a finger block.

Conflict of interest The authors declare that they have no conflicts of interest, commercial associations, or intent of financial gain regarding this research.

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