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Ice reduces needle-stick pain associated with a digital nerve block of the hallux

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Abstract

Background: Digital nerve blocks are widely used prior to minor surgery to the digits but the injections are associated with some degree of unwanted pain and anxiety. Methods to reduce the pain associated with injection, such as cryotherapy, are therefore worthwhile. However, cryotherapy (e.g. ice) applied prior to digital injections has received little scientific evaluation.
Objective: This study aimed to assess whether there was any change in pain associated with an injection into the hallux, if the site of injection was first refrigerated using ice.
Method: Twenty participants each received two injections of lignocaine into the hallux (one each on the medial and lateral sides) as a standard digital nerve block. Prior to each injection, participants were randomized to receive either no-ice or a six-minute application of ice over the injection site. The primary outcomes were needle-stick pain and infiltration pain measured on a visual analogue pain scale.
Results: The application of ice significantly reduced needle-stick pain, with the median scores for the no-ice and ice injections being 57 and 16 mm, respectively ($P < 0.001$). With respect to infiltration pain, however, there was no significant difference in the median scores (49 and 47 mm, respectively, $P = 0.204$). Nevertheless, 16 out of 20 participants preferred ice prior to the injection. Only four indicated no preference and none indicated a preference for no-ice.
Conclusion: Icing the digit prior to injection is an effective and inexpensive method to reduce the discomfort of a local anaesthetic injection.

Keywords: Ice; Injection; Local anaesthetic; Digit; Pain

1. Introduction

Digital nerve blocks are widely used in clinical practice to induce regional anaesthesia to toes. They involve infiltration of local anaesthetic into the subcutaneous tissues around the nerve in order to produce anaesthesia distal to the injection site. Digital nerve blocks are often employed to facilitate the performance of minor surgery such as the removal of ingrown toe nails. However, as with most injections, digital blocks are associated with some degree of unwanted pain and anxiety.

A range of methods have been developed to decrease the discomfort of injection, including localised refrigeration of the skin [1] and topically applied analgesics such as EMLA [2]. EMLA provides effective pre-injection analgesia [2], but must be applied for approximately 1 hour prior to injection, thus making it impractical in most clinical settings. In addition, it is difficult to apply and maintain in place when used on a digit. Refrigerants achieve analgesia in a much shorter time and may be administered as topical sprays such as Ethyl Chloride® and Fluro-Ethyl®,[1] or by direct contact of ice with the skin. Ice has the advantage of less intense cooling with minimal risk of tissue freezing; a potential complication of spray refrigerants. A general review of the physiological effects of cold and ice used to reduce pain has previously been published by Sauls [3].

Previous studies have demonstrated that a significant degree of anaesthesia is achieved when ice is applied to the calf, forearm and face [4–6]. However, no studies have evaluated the effect of ice on the pain associated with a digital

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nerve block of the hallux. The aim of this study was to investigate whether application of ice prior to injection reduced the pain of needle-stick and infiltration of a local anaesthetic. In addition, patient preference was evaluated.

2. Methods

Approval for this study was obtained from the relevant Institutional Ethics Review Committee (University of Western Sydney, NSW, Australia). Participants were all volunteer undergraduate podiatry students. Prior to enrolment, informed consent was obtained from all recruits. A standard pre-anaesthetic check was performed and recruits were excluded if they were at risk of complications associated with a local anaesthetic injection using lignocaine.

Injections were given by 4th year podiatry students as part of a review session prior to nail surgery clinics. All students had given a minimum of five digital nerve blocks prior to their participation in the study. All injectors were taught the same technique and all gave equal numbers of injections with or without ice to each participant, minimizing the effect of any variation in technique.

Each participant received 2× 1 ml injections of 2% lignocaine into the hallux (one each on the medial and lateral side) as a digital nerve block. After swabbing with an alcohol swab for disinfection of the skin, the needle was inserted into the superior aspect of the base of the digit and a small bleb of anaesthetic deposited just beneath the skin. Following this the needle was advanced slightly and 0.3 ml injected in the dorsal region of the digit. The needle was then advanced and a further 0.3 ml deposited in the plantar region. Finally, the remaining 0.3 ml was deposited continuously as the needle was withdrawn.

A randomized, cross-over design was used [7]. Prior to each injection, participants were randomized to either receive no-ice or a six-minute application of ice over the injection site. Therefore, for each digit injected, ice was used prior to one of the injections and no-ice for the other. A six-minute application time was chosen after reviewing the literature on this topic and through trialling the icing technique prior to the main study. Less than six-minute gave sub-optimal anaesthesia, while greater than six-minute was excessively long. The allocation sequence for ice application was randomly assigned according to a computer generated random number sequence. All injectors were requested to perform the first injection on the medial aspect of the hallux, however no specification was made as to whether the left or right toe should be injected first. The ice used was in the form of a typical ice cube used for cooling beverages. The surfaces of the cube that did not come into contact with participants' skin were wrapped in paper towel for convenience and to minimize melting.

After each injection the participant was asked to indicate the level of pain associated with the penetration of the needle through the skin ('needle-stick' pain) and also the infiltration of the lignocaine into the digit ('infiltration' pain). The pain associated with each injection was recorded on a 100 mm visual analogue pain scale. This procedure was then repeated on the opposite foot. After the four injections were completed, each participant was then asked to give an overall preference by indicating if they preferred no-ice, ice or had no preference for either protocol.

There has been considered discussion surrounding the problems of doubling sample size by considering the side rather than the individual as the unit of measurement [8]. We therefore chose to average the pain data for each participant (i.e. the two injections with ice were averaged and the two without ice averaged), so each participant rather than each toe was considered. The distributions of all data were checked for normalcy. As some of the data associated with the injections were not normally distributed, and because of the small sample size, the data were analysed using non-parametric statistical testing. Data are explored graphically using box plots and differences between groups were analysed using the Wilcoxon Signed-Rank test. Statistical significance was set at the conventional level of $P < 0.05$.

3. Results

Twenty-one participants were recruited into the trial. Blood was aspirated during one injection, requiring the needle to be removed without injection of anaesthetic and this participant was withdrawn from the study. Of the 20 participants to complete the trial there were 7 (35%) females and 13 (65%) males. The age of participants ranged from 21 to 38 years (mean 25.9 years, S.D. ± 4.9). Their mean height was 176.6 cm (S.D. ± 11.2) and mean weight 74.0 kg (S.D. ± 16.8).

The mean pain score associated with the penetration of the needle in the skin (i.e. 'needle-stick' pain) was reported to be 53.5 mm (S.D. ± 21.0) when using the no-ice protocol and 23.3 mm (S.D. ± 18.0) when ice was applied prior to injection. This represents a 56% reduction in needle-stick pain when ice is used prior to injection. The difference in needle-stick pain with and without application of ice was statistically significant ($P < 0.001$; $Z = -3.921$). Group needle-stick pain and infiltration pain scores are presented in Table 1

Table 1
Needle-stick and infiltration pain data ($N = 20$)

	No-ice	Ice
Needle-stick pain		
Mean ± S.D.	53.5 ± 21.0	23.3 ± 18.0
Median (inter-quartile range)	57.3 (40.8–67.6)	15.8 (6.7–40.8)
Infiltration pain		
Mean ± S.D.	47.4 ± 23.5	42.6 ± 22.8
Median (inter-quartile range)	49.0 (28.4–69.1)	47.3 (24.1–58.9)

NB: median (inter-quartile ranges) are provided as non-parametric statistical tests (Wilcoxon Signed-Rank test) were used to compare no-ice to ice.