

Digital anaesthesia: one injection or two?

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ABSTRACT

Background Digital nerve blocks (DNB) are performed frequently in the Emergency Department (ED). The aim of this study was to establish whether single injection subcutaneous digital nerve block (SDNB) is as effective as the traditional (two injection) digital nerve block (TDNB) for digital anaesthesia.

Method Single blinded, prospective, randomised-controlled multicentre trial within Hampshire EDs. Patients ≥ 16 years attending the ED with fingertip injuries/infections (distal to the distal-interphalangeal joint) requiring a DNB were randomised to SDNB/TDNB groups. Outcome measures were: primary - successful anaesthesia; secondary - patient distress, clinician satisfaction (CS), complications.

Results 76 patients were randomised. (37 received SDNB). At 5 min, more patients in the SDNB group (28/37, 76%) were adequately anaesthetised than in the TDNB group, (22/34, 65%). At 10 min, 33/37 (89%) of the SDNB group compared to 28/34 (82%) of the TDNB group were adequately anaesthetised. The mean (SD) of self-reported distress scores for the SDNB group were lower than those reported for the TDNB group, whereas the mean (SD) of CS scores for SDNB were higher than those reported for TDNB. Neither group reported complications from anaesthesia.

Conclusions SDNB is as effective as TDNB. Outcome measures favoured SDNB, but only CS scores achieved statistical significance. Trial recruitment is much slower than anticipated. However, clinical practice has demonstrated that SDNB works and practice is already changing within the Hampshire region, with some departments adopting SDNB as standard practice. Therefore, the results are being presented now to allow clinicians to make an informed choice. Our results may also contribute to future metanalyses.

BACKGROUND

Digit injuries and infections are common Emergency Department (ED) presentations. Digital nerve blocks (DNB) are performed frequently in the ED, enabling analgesia and appropriate treatment (exploration, suturing and debridement of wounds, incision and drainage of abscesses and nail removal with nail bed repair).

The traditional (two injection) digital nerve block (TDNB) is the method most commonly used.¹ The technique requires two separate injections of local anaesthetic (LA) around the four digital nerves at the base of the finger, resulting in rapid onset of anaesthesia. Two other techniques for DNB are described in the literature (transthecal and subcutaneous), each requiring only one LA injection at the finger base. The transthecal method² involves

LA injection into the flexor tendon sheath on the palmar aspect of the hand at the level of the skin crease at the base of the finger. The subcutaneous (SDNB) method involves a single subcutaneous injection to the volar aspect of the base of the digit.³

The transthecal method is technically more difficult to teach medical staff,⁴ causes trauma to the flexor tendon sheath and is more painful to administer than the other methods.^{5 6} Randomised controlled trials have shown SDNB to be as effective as the transthecal DNB in terms of effectiveness, distribution, onset and duration of anaesthesia.^{5 7}

In randomised controlled trials (RCTs) with healthy volunteers the SDNB, TDNB and the transthecal methods have similar pain scores, but patients preferred SDNB. Time to onset of anaesthesia with SDNBs was similar to time to onset using the transthecal method, but shorter than using the TDNB.^{6 8} A recent small paediatric case series of SDNB at the A1 pulley proved to be effective.⁹

SDNB remains to be compared with TDNB in a RCT in injured patients. This is the first RCT looking specifically at the equivalence of the two methods to achieve anaesthesia of an injured digit and potentially has a wide impact on the current practice of emergency physicians.

METHOD

A multicentred, prospective, randomised controlled trial within the EDs of Queen Alexandra (large district general hospital, DGH), Southampton General (large teaching hospital) and Haslar (nurse-led walk-in centre) Hospitals, Hampshire, UK, commenced in November 2007 following ethics committee approval. Patients aged 16 or over were eligible for recruitment when presenting with fingertip injuries/infections (at or distal to the distal-interphalangeal joint, DIPJ) requiring digit LA. Exclusion criteria were as follows: signs of digital nerve injury proximal to DIPJ, presence of another painful distracting injury, multiple finger injuries requiring blocks, psychotic mental illness, under the influence of drugs/alcohol, unable to consent, peripheral neuropathy, vasculopathy, English not primary language, injuries to dorsum of digit proximal to proximal-interphalangeal joint (PIPJ). (SDNB misses dorsal branches of the digital nerve, so, in order to ensure consistent comparison, this study looked only at distal injuries.) Eligible patients were approached, informed of the study, provided with a written information sheet and invited to participate.

Following recruitment date of attendance, sex, age, hospital number, nature of presenting finger injury and trial number were recorded on a data

capture sheet. Patients were randomly allocated to intervention groups using a computer-generated randomisation list in permuted blocks and stratified by centre. Block randomisation occurred for all sites to ensure equal proportions of the two techniques. Opaque envelopes containing treatment allocations (TDNB or SDNB) were numbered sequentially and sealed.

Two clinicians, working independently, completed the care of a trial patient. A primary clinician confirmed the patient's eligibility for the trial and obtained written consent. An independent second clinician, without the primary clinician's knowledge, opened the randomisation envelope and performed the designated DNB with 2–3 millilitres of warmed 0.5% bupivacaine (used as an alternative to lignocaine given current evidence),¹⁰ and covered all potential injection site(s) with gauze. The primary clinician returned at 5 min (unaware of the type of DNB performed) and assessed whether a pinprick at the fingertip with a 25 g needle was painful. If the patient reported no pain, the clinician commenced treatment. If the patient reported pain, it was reassessed again after a further 5 min. If pinprick was still painful at 10 min, the patient was classified as having an 'unsuccessful block' and alternative interventions were undertaken at the discretion of the clinician and recorded. Patient observational distress scores (1–10, with 1 = low distress score) and clinician satisfaction (CS) with technique scores (1–10 with 1 = low satisfaction with the technique performed) were also recorded.^{11 12} The data collection sheet included the clinician's names so that technical problems could be identified and explained.

Double blinding was unattainable. It is impossible to blind patients to their injection(s). It was emphasised to the patient in their written information sheet, and again following injection not to disclose the nature of their DNB. During training the importance of covering the injection sites with gauze with no visible blood spot(s) was emphasised. The TDNB group acted as control patients, as this is current standard practice.

ED consultants, middle grades, nurse practitioners and Senior, Senior House Officers were involved in patient recruitment and performing the allocated DNBs. All had received training in the

study protocol, the SDNB and TDNB techniques and their DNB techniques were witnessed and signed-off as competent by an author. The training package consisted of a Powerpoint (Microsoft) presentation followed by direct observation in the performance of techniques in up to three cases for each technique prior to sign-off. Figure 1 illustrates the SDNB technique.

On discharge, patients were encouraged to telephone, re-present or return their freepost 'problem card' should they have concerns. Each patient's GP was informed via letter of his/her enrolment and asked to encourage the patient to complete the problem card or contact the ED should he/she consult with a problem.

Sample size calculation

Previous studies have shown the TDNB to be successful in 95% cases. Assuming a reduction in the success rate of, at most, 5% would be accepted by most clinicians as indicating non-inferiority, then approximately 250 patients in each group are required to achieve a power of 80% (assuming a 5% one tailed significance level).

The success of anaesthesia (absence of painful sensation to a pinprick at the fingertip) at 5 and 10 min was the primary outcome measure, with secondary outcomes of self-reported patient distress score during the injection(s) and operator satisfaction with the technique.

RESULTS

This analysis was undertaken after the recruitment of only 76 patients rather than the intended 500 for the following reasons:

1. Although a pilot study suggested achievable recruitment of 10 patients per week, recruitment rates were slow. This was despite maximum effort and means that full recruitment was projected to take 5 years. Sustainability of the trial over this period and justification of future medical staff resources would be difficult.
2. Anecdotal feedback from clinicians that the SDNB was effective had led many to adopt this technique as their normal practice, adding to recruitment difficulties.

Figure 1 Single injection subcutaneous digital nerve block technique. (A) Landmark. Identify the proximal skin crease on the volar aspect of the injured finger. (B) After cleaning the skin, use one hand to gently pinch the soft tissues of the finger just distal to the skin crease. (C) Insert the needle (25G) just beneath the skin at the midpoint of the skin crease. Inject 2–3 millilitres of warmed 0.5% bupivacaine into the soft tissues. (D) Massage the anaesthetic into the soft tissues.

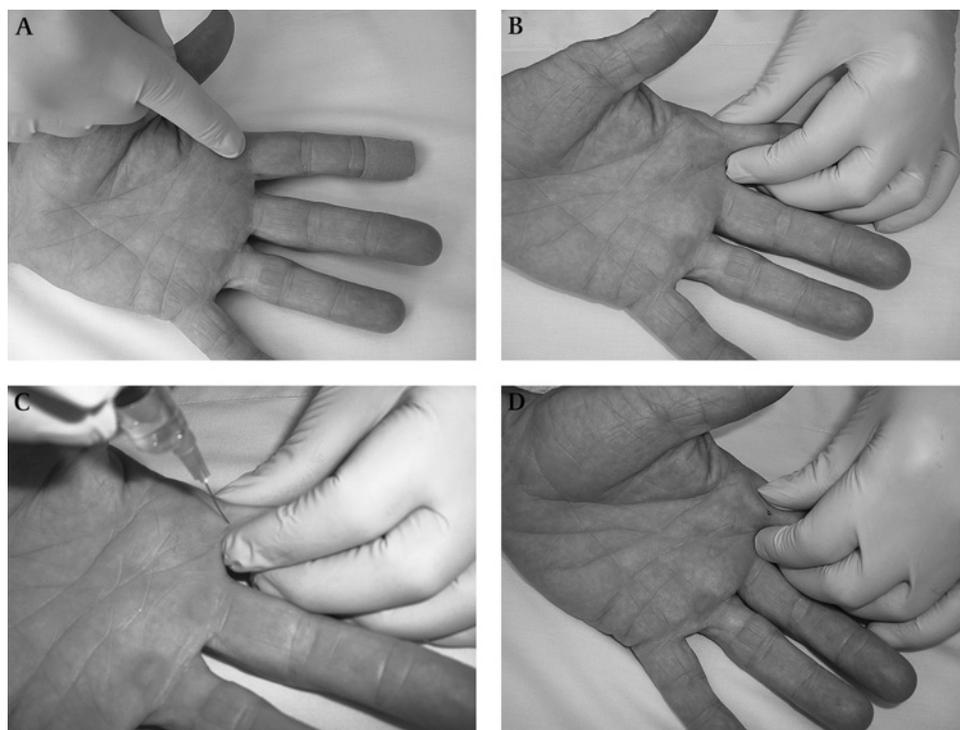
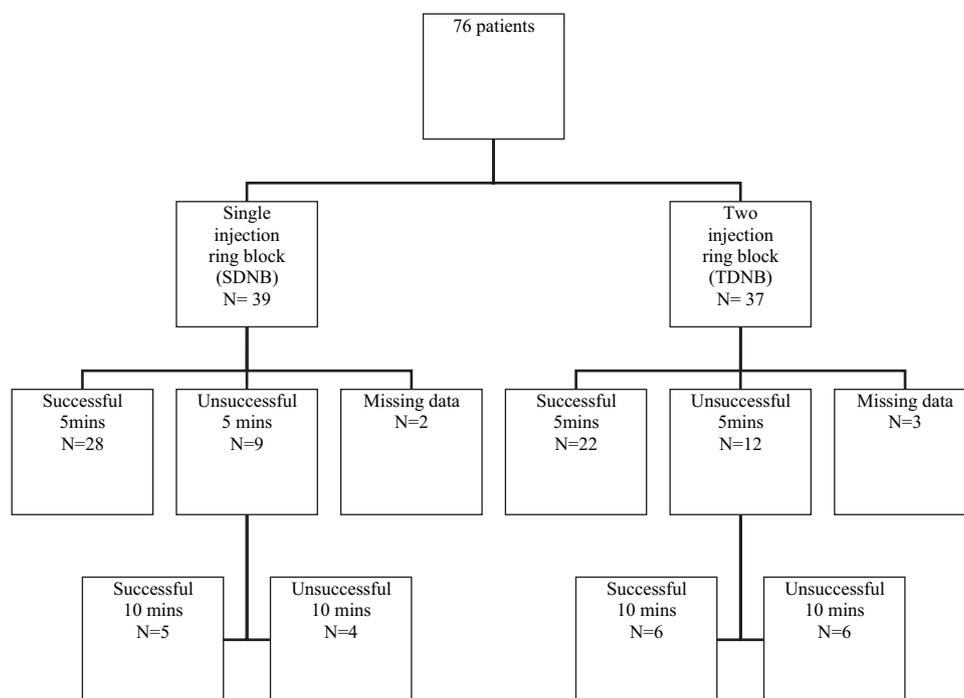


Figure 2 Consort diagram.

3. There is a risk of the trial not being completed or reported, despite all of the effort within the trial design and at recruitment. Not analysing, and not sharing results and experience of the trial would neglect some important results that could also contribute to future meta-analyses. The results so far have the potential to change practice in a common area in our speciality.

The 76 patients recruited to date were randomised to receive the SDNB (single injection subcutaneous digital nerve block) or the TDNB (traditional, two injection, digital nerve block). Five data capture sheets were missing at the time of analysis (Figure 2). A larger proportion of the population were men, but this was similar for both arms of the study (26 SDNB, 20 TDNB). Groups were well matched for age (median (range)); TDNB 36 (19–89), SDNB 44 (20–73) years). Mechanisms of injury are shown in table 1. Neither group reported adverse events on follow-up.

Thirty-seven patients received SDNB. At 5 min, more patients in the SDNB group 28/37 (76%; 95% CI 59 to 88) were adequately anaesthetised compared to 22/34 (65%; 46 to 80) of patients in the TDNB group although the difference (11%; –10 to 32) did not reach statistical significance ($p=0.436$).

At 10 min, 33/37 (89%; 75 to 97) of patients in the SDNB group compared to 28/34 (82%; 65 to 93) of patients in the TDNB group were adequately anaesthetised. Again the difference in success rates (7%; –9 to +23) did not reach statistical significance ($p=0.410$).

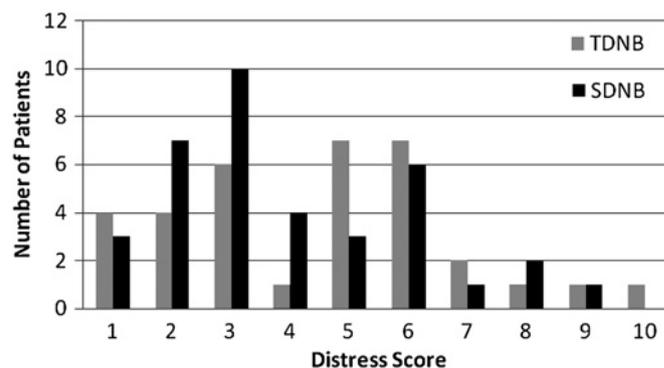
The mean (SD) of self-reported distress scores for the SDNB group, 3.95 (2.09) were lower than those reported for the TDNB group, 4.47 (2.34). However, the difference, 0.52 (–0.52 to +1.57), failed to reach statistical significance ($p=0.332$). The mean (SD) of CS scores for the SDNB group, 8.1 (2.2) were higher than those reported for the TDNB group, 6.8 (2.5), the difference, 1.3 (0.2 to 2.4), reaching statistical significance ($p=0.020$), (Figures 3 and 4).

DISCUSSION

An equivalence of the two techniques has been demonstrated with a statistically significant difference in operator satisfaction scores. The authors recommend that emergency clinicians adopt the single subcutaneous digital nerve block (SDNB) over the traditional two injection method (TDNB). The SDNB is easy to teach and the patients only receive one injection. All the results consistently read in favour of SDNB and those that did not

Table 1 Mechanisms of injury

INJURY	SDNB (N=37)	TDNB (N=34)
Volar surface wound	9	5
Crush injury	9	14
Paronychia	1	4
Avulsed nail	2	3
Dorsal wound	2	0
Fracture manipulation	0	2
Dog bite	0	1
Partial amputation	6	1
Dislocation	4	0
Foreign body	2	2
Other	2	2

**Figure 3** Patient Distress Score.

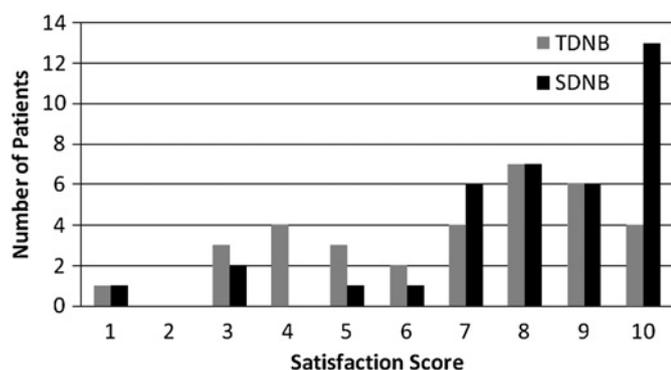


Figure 4 Clinician Satisfaction Scores.

achieve statistical significance were undoubtedly because of the small sample size so far.

Normal practice had been to use lignocaine for DNB in some centres prior to the trial. RCTs have recommended bupivacaine for DNB;¹⁰ 0.5% bupivacaine was easily available and stored in warmers. Nurse practitioners used patient group directives or bupivacaine was prescribed for use by a doctor.

Recruitment rates were significantly lower than anticipated. Possible explanations include: injuries specifically to the DIPJ and beyond were not so frequent, government target time pressures within the EDs may have prevented staff from enrolling patients, the inner cities contain several populations who had to be excluded due to language barriers (as they could not provide informed consent) and patients may have presented to other local walk-in centres not participating in the trial. The strict eligibility and training of clinicians who could participate in the trial will have lessened bias but potentially may have led to eligible patients not being recruited if those clinicians were unavailable. Half of the department staff was trained to recruit patients.

The rate of successful DNB observed in the present trial (86%) was lower than reported previously (95%). Clinical skills should not have influenced this, as only experienced and fully trained clinicians were eligible to perform the DNB.

Patients self-selected to participate in the study. Although well matched trial arms, it is possible that this group may not be comparable when extrapolating results to the general population. However, experience of local EDs who have adopted the SDNB as their preferred DNB technique suggests that this is unlikely to be the case.

A larger proportion of the present patient population were men. A large Norwegian study of 7459 occupational injuries found that fingers were the injured body part with the highest

difference in injury rates between men and women. This may be due to more risk-taking behaviour in men and also men are generally employed in the more risky jobs.¹³ Although children were excluded from this study, the SDNB has the benefit of a single injection. Extrapolating the present results to the paediatric population would support the conclusion of a recent small paediatric case series that this is a useful technique in the younger age groups.⁹

CONCLUSIONS

This study demonstrates that SDNB is as effective as TDNB. All outcome measures favoured SDNB, but only CS scores achieved statistical significance. Due to the small number of patients no comments can be made on safety, but no adverse events were reported. A decision has been made to report results now as recruitment has stalled, and the authors want to share the results, which could contribute to future meta-analyses.

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Competing interests None.

Patient consent Obtained.

Ethics approval This study was conducted with the approval of the Research Ethics Committee ref no: 07/Q1704/10 Southampton & South West Hampshire REC (B).

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