Appropriate Digital Nerve Block Technique: The Single-Injection Subcutaneous Volar Block Versus the Two-Injection Dorsal Digital Block

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Abstract

Background: Finger injuries are a common chief complaint in the emergency department (ED) and primary care setting. Repair of these injuries often require digital anesthesia through performing a digital nerve block (DNB). The two-injection subcutaneous volar block (SVB) and a two-injection dorsal digital block (DDB) are two of the most prevalently performed digital blocks in practice today. This systematic review examines which DNB technique is most appropriate and attempts to offer a recommendation for a standardized level of care.

Methods: An extensive literature search was performed using Medline-OVID, Medline-PubMed, CINAHL, and Google Scholar. The following keywords were searched individually and in combination: digital anesthesia, digital block, and finger block. Inclusion criteria consisted of trials comparing the SVB and the DDB from 2007 to present. All articles were assessed for quality using GRADE.

Results: The search resulted in 114 articles that were narrowed down to 32 by limiting articles to human studies written in English and published after 2007. The abstracts and titles were then hand searched for trials comparing the SVB and the DDB. Final articles meeting all inclusion criteria were three studies, two RCTs and one quasi-experimental. The primary outcome of successful anesthesia was measured and the quasi-experimental showed the SVB being more effective than the DDB and the two RCTs provided data with no significant difference between the two digital blocks. A secondary outcome of the patients' pain score of the injection was also measured by two of the studies and no statistical significance was found.

Conclusion: The SVB is equally effective in delivering anesthesia as the DDB but is only a single injection making it less invasive, easier to perform and teach, and avoids the risk of damaging the finger nerves. For these reasons a safe recommendation come be made for the use of the SVB when repairing a finger injury that is not located on the dorsal aspect of the proximal phalanx in which case is the only clinical scenario that the DDB should be utilized.

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Table of Contents

Abstract .......................................................................................................................... 2
Table of Contents ......................................................................................................... 3
List of Tables .............................................................................................................. 4
List of Abbreviations .................................................................................................. 4
Background .................................................................................................................. 5
Methods ...................................................................................................................... 6
Results ......................................................................................................................... 6
Discussion .................................................................................................................... 10
Conclusion ................................................................................................................... 12
References .................................................................................................................... 13
Table I ........................................................................................................................... 14
List of Tables

Table I: GRADE Quality of Assessment and Summary of Findings

List of Abbreviations

ED………………………………………………………………………………….Emergency Department
DDB………………………………………………….. Two-Injection Dorsal Digital Block
DIPJ……………………………………………Distal to the Distal-Interphalangeal Joint
DNB……………………………………………………..……………Digital Nerve Block
GRADE……..Grading of, Recommendations, Assessment, Development and Evaluations
SVB…………………………………………..Single-Injection Subcutaneous Volar Block
**Appropriate Digital Nerve Block Technique: The Single-Injection Subcutaneous Volar Block Versus the Two-Injection Dorsal Digital Block**

**BACKGROUND**

Finger injuries treated in the emergency department (ED) and primary care setting are a daily occurrence for medical providers. Local anesthesia through the use of a digital nerve block (DNB) is currently standard practice. There are several different ways to perform a DNB. They differ by the number of injections given and where the injections are placed on the finger. Due to the variety of DNB techniques a meta-analysis was conducted in 2006 on the current DNB trials. The results suggested that the two subcutaneous block techniques were less painful than the transthecal digital block.

These two subcutaneous blocks were first described as a single-injection subcutaneous volar block (SVB) and a two-injection dorsal digital block (DDB). The SVB is carried out by placing a single injection of local anesthetic midline on the volar surface at the base of the finger. The injection is inserted just past the skin. This block is very simple to reproduce and avoids possible complications of hitting one of the pairs of nerves running medially and laterally down the finger. The second subcutaneous block, the DDB, is a two-injection block placed on the dorsal aspect of the finger. One injection of local anesthetic is given on each side of the finger at the dorsal base of the digit. Knoop. The DDB is more invasive with an additional injection and runs the theoretical risk of damaging the bilateral pairs of nerves of the finger.

The use of multiple DNB techniques continues in current practice despite this research. Medical providers continue to question which method of DNB, the SVB or the
DDB, should be used in practice. This systematic review of the current literature will attempt to alleviate confusion on which DNB technique is most appropriate and offer a recommendation for a standardized DNB.

METHODS

An extensive literature search was performed using Medline-OVID, MEDLINE-PubMed, CINAHL, and Google Scholar through Pacific University’s Library. The following keywords were searched individually and in combination: digital anesthesia, digital block, and finger block. The search was then limited to human studies, English language, and articles published since 2007. All articles analyzed in this paper were reviewed for validity using a standard critical appraisal form. The articles were then assessed using the Grades of Recommendation, Assessment, Development and Evaluation (GRADE) system to analyze any methodology limitations, inconsistent results, indirectness of evidence, publication bias, or lack of precision. The GRADE criterion was then applied to rate the overall quality of the study as high, moderate, low, or very low.

RESULTS

The initial search resulted in 114 articles. After applying eligibility criteria, 32 articles remained. Through hand search of titles and abstracts, only trials specifically comparing SVBs and DDBs were selected. The final articles meeting all inclusion criteria were three studies, two randomized control trials and one quasi-experimental. See Table I.

Cannon et al
This was a single blinded, prospective, randomized-controlled multicenter trial within EDs in the United Kingdom. The primary outcome of successful anesthesia was measured and secondary outcomes of patient distress score and clinician satisfaction were measured. There were 76 Patients who were older than 16 with fingertip injuries/infections (distal to the distal-interphalangeal joint, (DIPJ)) requiring a DNB. They were randomized by computer generation into either a SVB group or a DDB group. Of the 39 patients assigned to the SVB group, 26 were men, 13 were women and there was a median age of 44. The DDB group consisted of 20 men, 17 women with a median age of 36. 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, individuals under the influence of drugs or alcohol, individuals unable to consent, peripheral neuropathy, vasculopathy, individuals where English was not their primary language, injuries to dorsum of digit proximal to proximal-interphalangeal joint.5

Two independent working clinicians performed the DNB and measurements. One clinician received an opaque envelope containing treatment allocation from the other clinician and then performed the DNB assigned. Each block was performed using 2-3 ml of warm 0.5% bupivacaine and then the injection site was covered with gauze. The clinician who was measuring outcomes then returned at two 5-minute intervals, (unaware of the type of DNB performed) and assessed whether a pinprick at the fingertip with a 25-gauge needle was painful. If no pain was felt then the treatment was started. Anesthesia was deemed successful if no pain was felt at 10 minutes after the DNB was performed. Patient observational distress scores (a range of 1-10, with 1 equating to low distress) and
clinician satisfaction with technique scores (a range of 1-10, with 1 equating low satisfaction) were also recorded. At 5 minutes 28/37 patients from the SVB group were adequately anesthetized and at 10 minutes 33/37 of the same group were successfully anesthetized. In the DDB group 22/33 of the patients were anesthetized at 5 minutes and 28/34 of patients were anesthetized by 10 minutes. There was no statistical significance between the two groups’ anesthesia success rate. The mean patient distress score of the SVB group, 3.95, was lower than 4.47 of the DDB group. However, this difference was not statistically significant. The difference in clinician satisfaction of procedure was statistically significant favoring the SVB technique. The mean clinician satisfaction scores for the SVB group was 8.1 and 6.8 for the DDB group. Authors attributed the lack of statistical significance of anesthesia success rate due to the small sample size.

Afridi et al

This was a randomized controlled trial conducted at the Plastic and Reconstructive Surgery Department, Hayatabad Medical Complex Peshawar from December 2009 to 2010 comparing the efficacy of SVB and the DDB. 126 patients were studied after meeting all criteria. Inclusion criteria included: 16 years of age or older of both sex and a pathology distal to the first palmer digital crease. Exclusion criteria were as follow: history of peripheral neurovascular diseases like diabetes mellitus, Raynaud’s disease, or previous nerve injury or prior intake of any analgesic. There were 63 patients in each of the DNB groups. There were 102 who were male and 24 who were female and there was a mean age of 27 years.
The first patient was recruited by lottery method and the remaining patients were allocated groups on alternate basis. Patients in group A received the SVB and group B received the DDB. Three milliliters of lidocaine with adrenaline 2%, in a 5 ml syringe with a 25-gauge needle was injected by the same qualified plastic surgeon for both techniques while the outcome variables were checked by another investigator (senior resident). After the DNB patients were assessed for sensory blockade using a 18-gauge needle over the radial, ulnar, palmer, and dorsal aspects of the involved digit. Anesthesia was considered unsuccessful if sensation was not lost after 15 minutes. Time to anesthesia was measured by stopwatch.

In this study the authors placed more emphasis on the time it took for complete anesthesia. Their results showed quicker onset of anesthesia through the use of the SVB. The mean time of onset of anesthesia for the SVB group was 3.32 minutes and 4.53 minutes for the DDB group. Anesthesia success rate was 100% in both the SVB group and the DDB group. They also reported that the dorsum of the proximal phalanx, in particular was well anesthetized even in the SVB group.

**Bashir et al**

This trial is quasi-experimental and compared the effectiveness of anesthesia and pain of initial pinprick between the DDB and SVB. The experimental study was conducted at Albert Victor Hospital and Casualty Operation Theatres, Mayo Hospital, KEMU, Lahore, from January to June 2007. There were 30 patients with two finger injuries distal to the proximal phalanx crease that were included in the study and any patients with a history of allergy to the agents, previous vascular insufficiency like
Raynaud’s disease or phenomenon, severe peripheral vascular disease, or peripheral neuropathy, or previous digital replantation were excluded. Of the 30 patients, 22 were males and 8 were females with a mean age of 29 years.7

One finger of every patient received a DDB and the other finger a SVB. The order of blocks given alternated between patients. The same person gave all blocks with a 27-gauge needle using 2 ml of 2% lidocaine with 1:100 000 epinephrine.7

The DDB involved injecting 1 ml of anesthetic into web space on each side of the finger from the dorsal side. The SVB was executed by subcutaneously injecting 2 ml of anesthetic in the midline, just short of proximal flexion crease of the finger. Patients were instructed to look away during the performance of the block. Primary outcomes of initial pinprick pain and effective anesthesia were measured by having the patient write the severity of their pain on a visual analogue scale of 0 (no pain) to 10 (greatest pain imaginable) and if no pain was experienced 5 minutes after the block during surgery.7

The mean pain scale number was 4.27 for the SVB (range 3-6, SD 0.87). The mean pain scale number was 5.27 for the DDB (range 4-7, SD 1.05 a t-value 4.0238, p less than 0.001). The difference in pain score was statistically significant. 100% of the fingers from the SVB group received successful anesthesia compared to only 24 of 30 fingers, 80%, from the DDB group. They mention that the only drawback to the SVB technique is the inability to anesthetize the dorsal aspect of the proximal phalanx.7

**DISCUSSION**

The primary outcome of successful anesthesia was clearly measured by all the studies.5,6,7 In the first two studies5,6 there was no significant difference between the two techniques; however, there seemed to be a trending of improved efficacy favoring the
SVB. In the Bashir et al study\textsuperscript{7} the SVB was measure to be more effective than the DDB. However Bashir et al\textsuperscript{7} and Cannon et al\textsuperscript{5} show inconsistent anesthesia over the dorsal aspect of the proximal phalanx with the use of the SVB. These findings can help medical providers select the DDB technique when a patient has an injury on the dorsal aspect of the proximal phalanx, but this is the only time the DDB is necessary.

Although a lower pain score was reported in the SVB groups, the difference was not statistically significant.\textsuperscript{5,7} No complications of nerve damage using the DDB were reported in any of the studies but it remains anatomically theoretical and less likely to occur during the SVB. The single injection in the SVB compared to the two injections in the DDB make the SVB less invasive, easier to reproduce, and simple to teach. Cannon et al\textsuperscript{5} found that clinician satisfaction of technique was higher for the SVB. These aspects are very important to consider when standardizing care amongst providers.

When a patient comes in with a finger injury the clinician must first determine the site of injury and then select the most appropriate DNB technique to perform. The DNB that will be effective and the least invasive should be considered. A safe recommendation can be made to use the SVB to deliver digital anesthesia unless the injury is located on the dorsal aspect of the proximal phalanx in which case the DDB can be used.

Although the results of the studies\textsuperscript{5,6,7} are promising, there were several limitations. Blinding the patient from the DNB technique performed was not possible during the trials due to the fact that it was one injection versus two. Sample sizes were small and could be a limitation to the results. Additional large randomized controlled trials should be done in order to strengthen the results. In the Bashir et al\textsuperscript{7} study there was no randomization of patients. Patients were assigned beforehand to the DNB they would
receive first in order to evenly distribute which block was given first. This study also performed both injections on each patient. This could greatly affect the pain score of the second DNB. Despite some of these limitations all trials were considered of sufficient quality for the purpose of this paper. See Table I

CONCLUSION

A safe recommendation can be made to medical providers to select the SVB technique as the standard of care when repairing finger injuries. Clinical practice and current research suggests the SVB is less invasive, easier to perform and teach, and at least equally as effective as the DDB. The use of the DDB will still likely be necessary only when pathology is located on the dorsal aspect of the proximal phalanx.
References


### Table I. GRADE Characteristics of Reviewed Studies

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<tr>
<th>Study</th>
<th>Design</th>
<th>Limitations</th>
<th>Indirectness</th>
<th>Imprecision</th>
<th>Inconsistency</th>
<th>Publication bias likely</th>
<th>Number of Patients Treated</th>
<th>Successful Anesthesia</th>
<th>Quality</th>
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<td>Serious⁵</td>
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<td>No bias likely</td>
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- **Effective Anesthesia**
  - Moderate
  - Critical

- **Pain Score of Injection**
  - Mean Pain Score 1-10
  - Overall Low
  - Important

- Small sample size
- Single blinding and risk of carryover effect