Comparison of Transthecal Digit Block and Single Injection Volar Subcutaneous Digit Block

Lin Huang, MD

Abstract: Background. A study was designed to compare the efficacy of anesthesia between transthecal digit block (TDB) and single injection volar subcutaneous block. Methods. A 36-patient, randomized, controlled, prospective investigation was undertaken. The parameters included the onset of time to achieve anesthesia, visual analog scale pain score during the infiltration, and anesthesia duration. Results. The mean time of the onset of anesthesia was 120 ± 8.9 seconds for transthecal blocks compared with 140 ± 7.8 seconds for the single injection volar subcutaneous digit blocks, and the mean time to loss of anesthesia was 3 ± 0.12 hours versus 4.3 ± 0.21 hours, respectively. The pain score was 3.1 ± 0.12 versus 2.4 ± 0.17. The difference among the three parameters between the two groups was statistically significant (P < 0.05). Conclusion. These results confirm the efficacy of the transthecal block and the single injection volar subcutaneous digit block for achieving anesthesia of the finger, but the author prefers single injection volar digit block since it causes less pain during injection and the anesthesia lasts longer.

Single injection transthecal digital block (TDB) involves the infusion of an anesthetic into the flexion tendon sheath as a means of providing anesthesia to the digit. Transthecal digital block was first described by Chiu in 1990, and was advocated by other surgeons for its advantages over traditional digital nerve block. Keramidas et al made a comparison between TDB and traditional digit block, and confirmed the efficacy of TDB for achieving anesthesia of the finger, but there was also more discomfort when introducing the agent into the tendon sheath; therefore, several modifications to TDB were proposed. In 1991, Harbinson described volar block variation with the midline subcutaneous injection according to finger innervation. Brutus et al found the subcutaneous block to be safe, efficient, and easy to perform. Low et al performed a randomized, controlled comparison between the two digit blocks among volunteers and suggested that subcutaneous block could work well, while causing less discomfort than TDB. After a finger sustains injury, the results of the digit blocks may vary in...
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Methods

Patients. Between September of 2007 and April of 2009, 36 patients (21 men and 15 women) who had sustained a laceration or nail bed injury were enrolled in the study on an outpatient basis. Exclusion criteria were pregnancy, vascular or hematologic disease, and lidocaine allergy. Subjects ranged from 18- to 70-years-old with a mean (SD) age of 28 ± 2.3 years. All patients suffered injury of two fingers (distal to the proximal digital crease) on the same or opposite hand (Table 1).

Study design. This study was designed as a prospective, randomized, controlled, double blind study. The investigation began with a consecutive sample. A randomized, computer-generated chart was used to select which technique and which finger was injected first. The same surgeon performed all digit block procedures.

Study protocol. The Anzhen Hospital's ethical committee approved the study protocol, including the consent form and the patient information sheet.

Table 1. Characteristics of the transthecal digit block and single injection volar subcutaneous digit block groups.

<table>
<thead>
<tr>
<th>Trauma location Thumb/index/middle/ring/little finger</th>
<th>Transthecal digital block</th>
<th>Single injection volar subcutaneous digit block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trauma length (cm) &lt;0.5/&lt;1/&lt;1.5/&lt;2/&gt;2</td>
<td>4/10/8/12/2</td>
<td>5/12/11/6/2</td>
</tr>
</tbody>
</table>
Measurement. A 5-mL syringe and a 27-gauge needle were used for each technique. In the transthecal technique, 2 mL of 1% lidocaine was injected at the site of the proximal digital crease of the finger into the flexion tendon sheath. In the subcutaneous digit block, the injection of 2 mL of 1% lidocaine was injected into the subcutaneous space at the level of the proximal digital flexion crease of the midline midway between the neurovascular bundles (Figure 1). Only one puncture was made for each technique. The agents were masked preoperatively so that the operator could not differentiate between the two.

Another independent blinded investigator performed pain assessment for both techniques. First, the time to loss of pinprick sensation following both injection techniques was evaluated using an 18-gauge needle. Next, any pain associated with each technique was assessed immediately after the injection using a visual analogue scale. The scale consisted of a 10-cm line that represented “no pain” at one end (0) and “worst pain” at the other end (10). All patients were asked to indicate the point on the scale that corresponded to the level of pain they were experiencing. The pain score was estimated by measuring the distance in centimeters from the 0 point to the spot that the patient had indicated.

After the procedure, all patients were evaluated with regard to injection site pain, and it was recorded when patients began to feel pain again in the fingertips.

Patients were followed up 2 weeks later and were asked which finger they felt at most ease with during the procedure.

Data analysis. Mean times to loss of pinprick sensation, mean time to regain sensation, and mean pain scores were analyzed with SPSS 11.0 software. Comparisons among continuous variables were performed using Student’s t test. Alpha was preset at < 0.05 for statistical significance.

### Results

All digital block procedures were successful and none of the patients required supplementary anesthetic to achieve an adequate block. The mean (SD) time to loss of pinprick sensation, after the injection was complete, was 120 ± 8.9 seconds for the transthecal blocks compared to 140 ± 7.8 seconds for the subcutaneous digit blocks—a difference of 20 seconds (P < 0.05). Mean (SD) pain scores for transthecal blocks were 3.1 ± 0.12 compared to 2.4 ± 0.17 for the subcutaneous digit block (P < 0.05). The mean time to loss of anesthesia was recorded as follows: 3.0 ± 0.12 hours (transthecal) versus 4.3 ± 0.21 hours (volar subcutaneous; P < 0.05; Table 2). All but four of the patients preferred the subcutaneous digit block technique indicating that the subcutaneous block accounted for less pain during the injection.

**Limitations.** The study’s sample size was small and the efficacies seen in the study still need to be investigated further. One surgeon performed all digital blocks, so the present findings might not be reproducible in other settings where multiple operators might be involved.

### Discussion

Chiu1 first described TDB in a report from 1990. Sarhadi and Shaw-Dunn² conducted an interesting investigation of the anatomical basis for transthecal digital nerve block. After an injection of methylene blue, the

### Table 2. Duration of anesthesia and pain scores.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Transthecal digital block (mean value)</th>
<th>Single injection volar subcutaneous digital block (mean value)</th>
<th>P (paired t test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset of anesthesia (seconds)</td>
<td>120 ± 8.9</td>
<td>140 ± 7.8</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Duration of anesthesia (hours)</td>
<td>3 ± 0.12</td>
<td>4.3 ± 0.21</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Visual analog scale pain score (0–10 cm)</td>
<td>3.1 ± 0.12</td>
<td>2.4 ± 0.17</td>
<td>&lt; 0.05</td>
</tr>
</tbody>
</table>

**Key Points**

- The present study found that TDB worked more quickly than the single injection volar subcutaneous block (~20 seconds different), but it was of minimal clinical significance; however, the patients overwhelmingly preferred the single injection volar subcutaneous block.
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up visit. It should be noted that TDB is better than single injection volar block over TDB at the 2-week follow-up, which would explain why the patients preferred the single injection volar subcutaneous block alongside the digital nerves, vessels, and their branches. Based on that finding, it is believed that the block works via the infusion of the flexor tendon sheath.

The advantages of the original transthecal technique are as follows: single injection; use of a small volume of anesthetic solution; limited risk of damaging the neurovascular bundle either directly or indirectly because of the compartment pressure increase in the digit; and rapid onset of anesthesia. Although no reports were found in the literature regarding damage to the flexor tendon, the potential for injury and more discomfort to the flexor tendon exists. Many modifications to the procedure were proposed subsequent to the innovation of the transthecal injection, including the single subcutaneous injection at the level of A1 or A2 pulley.

The present study compared the effectiveness between the transthecal and single injection volar subcutaneous block. Each patient served as his or her own control with one finger being injected using TDB and the other volar subcutaneous block.

The present study found that TDB worked more quickly than the single injection volar subcutaneous block (~20 seconds different), but it was of minimal clinical significance. The study results implied that TDB anesthesia did not last as long as the volar subcutaneous anesthesia, which might be attributed to the rapid diffusion of the lidocaine through the tendon sheath after TDB. To some extent, the longer block duration might make the patient feel more comfortable and further ease pain.

Transthecal digit block must be injected deeply into the tendon sheath, while the single injection volar block is injected into the subcutaneous tissue. The pain experienced during subcutaneous digit block may be less, which would explain why the patients preferred the single injection volar block over TDB at the 2-week follow-up visit. It should be noted that TDB is better than single injection volar subcutaneous block in providing anesthesia to the “dorsal and radial proximal zones” of the fingers. For some defects close to the dorsal or radial proximal zones, the author prefers TDB or using single injection volar subcutaneous block combined with additional subcutaneous injection.

Conclusion

The presented results confirm the efficacy of both transthecal and single injection volar subcutaneous digital block for achieving anesthesia of the finger. While the former worked slightly faster, patients preferred the latter, which was less painful and afforded a longer duration of anesthesia.

References


Key Points

- 32 of 36 patients preferred the subcutaneous digit block technique, indicating that the subcutaneous block accounted for less pain during the injection.
- The mean (SD) time to loss of pinprick sensation, after the injection was complete, was 120 ± 8.9 seconds for the transthecal blocks compared to 140 ± 7.8 seconds for the subcutaneous digit blocks—a difference of 20 seconds.