

ORIGINAL ARTICLE

COMPARISON OF THE EFFICACY OF SINGLE VOLAR SUBCUTANEOUS DIGITAL BLOCK AND THE DORSAL TWO INJECTIONS BLOCK

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**Background:** Digital nerve blocks are commonly used as effective techniques of anaesthesia to allow a variety of surgical procedures performed on digits. This study was conducted to compare the efficacy of volar subcutaneous single injection block and the traditional dorsal two injections digital block. **Methods:** This randomized controlled trial was conducted at Plastic and Reconstructive Surgery Department, Hayatabad Medical Complex Peshawar from December. 2009–10. A total of 126 patients with pathology distal to the first palmer digital crease divided into two equal groups. Group A received volar subcutaneous digital block while group B dorsal two injections block. Efficacy of digital block was measured in terms of time of onset of anaesthesia, which was the total time duration after administering local anaesthetic to loss of pinprick sensation and total duration of anaesthesia, which was defined as the time period from onset of block (loss of pinprick sensation) till the appearance of pain which required additional local anaesthetic or postoperative analgesia. **Results:** A total of 126 patients were studied, 63 in each group. Of the total patients, 102 (81%) were male and 24 (19%) female with a mean age of  $27\pm 4.2$  years (range 17–60 years). The mean time of onset of anaesthesia from injection till the loss of pin prick sensation was  $3.32\pm 0.42$  minutes for volar single injection group and  $4.53\text{ minutes}\pm 0.57$  minutes for dorsal two injections group ( $p=0.049$ ). Similarly the mean total duration of anaesthesia for the volar subcutaneous group was  $271.9\pm 29.34$  minutes while for the dorsal two injections group, it was  $229.52\pm 28.82$  minutes ( $p=0.415$ ). **Conclusion:** Single injection volar subcutaneous digital block provides faster onset of anaesthesia, produces predictable, consistent dense anaesthesia of all of the fingers with the help of single injection prick.

**Keywords:** Volar digital block, dorsal digital block, local anaesthesia

J Ayub Med Coll Abbottabad 2014;26(1):88–91

INTRODUCTION

Digital Nerve blocks are commonly used as effective techniques of anaesthesia to allow a variety of surgical procedures performed on digits.<sup>1</sup> Digital blocks can be broadly classified into dorsal and palmer blocks. Dorsal blocks comprise the traditional digital block involving two dorsal punctures at the level of web space and the metacarpal block via two dorsal punctures, 1 cm proximal to metacarpo-phalangeal joint for each digit.<sup>2</sup> Volar blocks consist of intrathecal block using single injection into flexor tendon sheath<sup>3</sup> and the more recently described subcutaneous volar block with single injection into the base of the finger subcutaneously.<sup>4</sup>

An ideal block should have quick onset, safe, easy to perform, painless, and produce complete anaesthesia on volar and dorsal aspects of digit.<sup>4</sup> Though there is no difference in injection pain in the two techniques,<sup>2,4,5</sup> the volar block is easier to perform and safe<sup>6–8</sup> but lacks the property of anesthetizing the dorsum of proximal phalanx of digits.<sup>5</sup> The traditional block though anesthetizes the dorsum, has the danger of damaging the neurovascular bundles.<sup>3</sup> However,

there are inconsistent findings with respect to anaesthesia distribution of various digital blocks.<sup>9</sup>

This study compares the volar single subcutaneous digital block with the traditional dorsal two injections block in terms of time of onset and total duration of anaesthesia. The result of the study will help us selecting the block for surgery on digits in a pain free atmosphere for longer duration and thus minimizing patient discomfort by avoiding repetitive administration of local anaesthetic.

MATERIAL AND METHODS

After approval of the study by ethical committee, this randomized controlled trial was conducted at Plastic and Reconstructive Surgery Department, Hayatabad Medical Complex Peshawar from December 2009–10. A total of 126 patients divided into two equal groups based on purposive non probability sampling technique were included in the study. All the patients were enrolled from Out Patients' department or referrals from other units. After explaining the study protocol, informed consent was taken from all patients. All the patients above 16 years of age of either gender

with pathology distal to first palmer digital crease like trauma, tumour/lump, contracture, phalangeal fracture etc., were included. Patients with history of peripheral neurovascular diseases like diabetes mellitus, Raynaud's disease or previous nerve injury were excluded from the study because these could lead to faulty interpretation of sensation due to presence of numbness and paresthesias. Prior intake of any analgesic was also taken in exclusion criteria because it could obscure the proper assessment of sensation. Cases with involvement of two adjacent fingers were also excluded because of the risk of diffusion of anaesthetic agent into the digital nerves of adjacent finger and thus could deliver increased amount.

First patient was recruited by lottery method and the remaining patients were allocated groups on alternate basis. Patients in group A received the volar subcutaneous and those of group B, the traditional digital block. Neither the patient nor the investigator knew about the type of block given in the two groups such as during each block, the patient was instructed not to watch, to blind him. After the block, the proximal part of the finger was covered to blind the investigator.

In order to control biases, same volume of 3 ml lidocaine with adrenaline having same concentration of 2%, in a 5 ml syringe of 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) to control inter-observer bias. Patients were instructed about how to identify sharp touch and to rate the severity of pain using Visual Analogue Scale (VAS).<sup>6</sup>

Volar block was performed by placing the patient's hand in supine position on flat surface and metacarpophalangeal joint flexed to 45 degree to relax palmer skin. The needle was introduced at the centre of proximal palmer digital crease and 3 ml of 2% lidocaine injected subcutaneously, 2–3 mm deep to skin. In the traditional digital block, the patient hand was used to be placed in a pronated position on a flat surface. The needle was inserted through the dorsum of one side at the base of proximal phalanx and directed around the bone towards the palmer skin. One ml of 2% lidocaine was injected to block the digital nerve. Then the needle was slowly withdrawn and an additional 0.5 ml injected to block the nerve branches on the dorsum of the digit. An identical injection was made into other side of the injured finger. A total of 3 ml solution was injected to each finger.

After injection, patients were assessed for sensory blockade using pinprick with an 18 gauge needle over the radial, ulnar, palmer and dorsal aspects of the involved digit. The end of injection was considered as time 0 and stopwatch started at the same

time. The investigator entered the room immediately and carried out sensory evaluation at 15 seconds interval until distal sensations were abolished. If there was no loss of sensation after 15 minutes, the block was considered failed.

Time to anaesthesia (complete sensory blockade) was defined as the time between injection and the complete development of anaesthesia (no sensation reported to pinprick). Duration of block was noted as the time taken between the onset of block and the appearance of pain requiring additional local anaesthetic intra-operatively or analgesia postoperatively. Pain was assessed using visual analogue scale [VAS] where 0 represents no pain and 10 meant the worst possible pain. Injection Tramadol 1mg/kg IV used to be given as rescue analgesic when the pain score exceeded 4.

SPSS-14 was used to analyse the data. T-test was used to compare the time of onset and duration of anaesthesia for both the procedures. *p*-value  $\leq 0.05$  was considered to be statistically significant.

## RESULTS

A total of 126 patients were studied, 63 in each group. Of the total patients, 102 (81%) were male and 24 (19%) female with a mean age of 27±4.2 years (range 17–60). Index finger was the most commonly involved finger as seen in 43 (34%) patients. (Table-1).

The most frequently involved site of surgery was volar 60 (47.6%) followed by dorsum 47 (37.3%) with circumferential area in 19 (15%) cases. Soft tissue laceration was the most commonly encountered injury in 50 (39.7%) cases. Tendon and bone was involved in 38 (30%) cases each.

The mean time of onset of anaesthesia from injection till the loss of pin prick sensation was 3.32±0.42 minutes for volar single injection group and 4.53±0.57 minutes for dorsal two injections group (*p*=0.049). Similarly the mean total duration of anaesthesia for the volar subcutaneous group was 271.9±29.34 minutes while for the dorsal two injections group, it was 229.52±28.82 minutes (0.415).

**Table-1: Involved digit and injured phalanx**

Involved Digit	Injured Phalanx (n)			Total
	Proximal phalanx	Middle Phalanx	Distal Phalanx	
Thumb	1	0	4	5 (4%)
Index	3	16	24	43 (34.1%)
Middle	3	15	17	35 (27.8%)
Ring	2	11	16	29 (23%)
Small	0	4	10	14 (11.1%)
<b>Total</b>	<b>9</b>	<b>46</b>	<b>71</b>	<b>126 (100%)</b>

## DISCUSSION

An ideal digital block technique should have quick onset, safe, easy to perform, relatively painless and produce complete reversible anaesthesia on volar and

dorsal aspects of digit.<sup>10</sup> This enables the surgeons to perform a variety of different surgical procedures on fingers in a pain free atmosphere and without any complications.

The two injections dorsal digital block technique has been considered as the technique of choice among the health care providers.<sup>11</sup> This attitude is due to the persistence of claim that palmer skin of hand and fingers is more glabrous and so more painful to injection than the dorsal pliable and soft skin.<sup>12</sup>

However several studies showed that there is no difference in pain due to injections on palmer and dorsal skin,<sup>5,7,13</sup> which has led us to the consideration of different volar single injection digital blocks to anesthetize the fingers. One of the techniques is the volar single injection subcutaneous digital block, as described by the Harbison<sup>14</sup> in 1991.

In this study, the volar subcutaneous block has comparatively quick onset of anaesthesia in contrast to the traditional block. This is consistent with the results of study carried out by Knoop *et al.*<sup>15</sup> In this study subcutaneous block was compared with the dorsal block, by performing the two techniques on the opposite sides of the same injured digit in 30 patients. Though there was no difference in the injection pain of the two techniques, the traditional block took significantly longer time to achieve abolition of sensation (6.35 minutes as compared to 2.82 minutes) and failed to achieve complete anaesthesia in 23% of patients as compared with a 3% failure rate for the subcutaneous block. However, as different doses of lidocaine were used for each method and that each method was applied to half of the same injured finger; confounding variables had not been controlled in their study.

In another study by Hung *et al.*, the efficacy in terms of onset of anaesthesia was studied among subcutaneous, dorsal and transthecal digital blocks (besides injection pain) on 50 healthy volunteers.<sup>8</sup> Each volunteer received all the three block techniques on the alternating fingers, with the same dose and same concentration of anaesthetic agent (2ml of 2% lidocaine). The average time for a digit to become anesthetized for all test end points for the dorsal block was 265 (11) seconds (mean (SEM)), as compared with 187 (10) seconds for the subcutaneous block and 176 (10) seconds for the transthecal block. This study showed that time to abolition of sensation was significantly greater with the traditional block with a *p*-value 0.0003.

The faster onset of anaesthesia for the volar block in this present study might be due to the fact that volar subcutaneous block is easier to execute as one has to follow more readily identifiable landmarks (subcutaneous injection in the midline of the phalanx at the level of first palmer digital crease). This

observation has been noticed by various other authors that technical failures are more common with the traditional dorsal two injections block.<sup>7,9</sup>

Similarly, though both these techniques involve the administration of anaesthetic solution into the subcutaneous plane, but due the proximity of the adjacent digital nerves of the uninvolved fingers, there is equal chance of diffusion of the anaesthetic solution to those areas. This renders less amount of anaesthetic solution for involved digit, thus might account for the comparatively delayed onset of anaesthesia for the traditional digital block. In fact this observation has been supported by the finding that in many cases, the uninvolved fingers were also found anesthetized and numb.

In the current study comparatively increased mean duration of anaesthesia for the volar subcutaneous but the difference was statistically not significant. This finding is in contrast to the study carried out by Bashir *et al.*<sup>9</sup> In their study, they compared the same two techniques of digital block with respect to total duration of anaesthesia besides many other variables like effectiveness of block, pain score and number of adjacent numb fingers in 30 injured patients. They showed that mean total duration of anaesthesia for the volar subcutaneous group was comparatively higher with a *p*-value <0.05. In our study, the relatively decreased duration of anaesthesia in the dorsal two injections block can be attributed once again to the assumption that there is maximum chance of diffusion of local anaesthetic solution in to the adjacent web spaces, thereby leaving less amount of anaesthetic solution around the digital nerves of the involved fingers. This explanation has also been supported in the study by Bashir *et al.*<sup>9</sup>

In this present study, we did not face any case of failure of injection or incomplete block requiring further injections in both the groups. The dorsum of proximal phalanx, in particular was well anesthetized even in the volar subcutaneous group.

Disadvantages and limitations of the dorsal traditional block includes the need for two injections, the inconsistent anaesthesia achievement, the increased technical demand and the risk of damaging the nerve and artery as the needle is inserted much closer to the neurovascular bundles.<sup>7</sup> However, we did not find any case of nerve or artery injury in our patients.

The limitation of this study is that it is a single centre limited series.

## CONCLUSION

Single injection volar subcutaneous digital block has got the properties of an ideal digital block as it provides faster onset of anaesthesia, produces predictable, consistent dense anaesthesia of all of the fingers with the help of single injection prick. This

technique is easy to teach and has a good learning curve. Moreover there is little risk of damaging the neurovascular bundles as the injection is executed in the midline. However, though there was comparatively increased duration of anaesthesia for the volar single injection but it was not found to be statistically significant. Further multi-centred randomized controlled trials are required to improve the findings.

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