Procedures in Family Practice

Wrist and Digital Nerve Blocks

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Wrist and digital nerve blocks are useful for the management of many common problems of the hands and fingers, including fractures, lacerations, and infections requiring drainage. The principal nerves in the wrist (radial, median, and ulnar), and the digital nerves in the hand or fingers are anatomically superficial. They can be easily located and are accessible for percutaneous injection of anesthetic agents such as lidocaine (Xylocaine), bupivacaine (Marcaine), and mepivacaine (Carbocaine). Careful selection of the anesthetic agent and type of nerve block can provide safe and effective anesthesia for many surgical procedures of the hands and fingers.

Wrist and digital nerve blocks are safe, effective, and very useful. These procedures can be readily learned and used to manage many problems of the hands and digits.

Sensory Nerve Distribution

The median nerve supplies the radial side of the palm of the hand and the palmar surface of the first (thumb), second, and third digits. The median nerve also supplies the dorsal surface of the distal two phalanges of the second and third digits as well as the radial aspect of the distal two phalanges of the fourth digit.

The ulnar nerve supplies the ulnar aspect of the hand (dorsal and palmar), the ulnar aspect of the fourth digit, and the entire surface of the fifth digit. The ulnar nerve also supplies portions of the dorsal surface of the proximal portions of the third and fourth digits.

The radial nerve innervates the radial aspects of the dorsum of the hand and portions of the dorsal aspects of the first, second, and third digits. It also supplies a portion of the palmar aspects of the first digit.

There is occasional anatomical variation and crossover of the sensory distribution of the hand and fingers. The exceptions to this are the distal portion of the second digit, which is always innervated by the median nerve, and the fifth digit, which is always innervated by the ulnar nerve.

Anesthetic Agents

Several anesthetic solutions are employed in peripheral nerve conduction blockade. A sum-

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Table 1. Commonly Used Anesthetic Agents for Peripheral Nerve Block

Agent	Procaine	Tetracaine	Lidocaine	Mepivicaine	Bupivicaine	Chloroprocaine
Trade Names	Novocain	Pontocaine Amethocaine	Xylocaine Lignocaine	Carbocaine	Marcaine	Nesacaine
Group	PABA-ester	ester	amide	amide	amide	ester
Onset (minutes)	5-10	5-15	5-10	5-10	15-25	5
Block established	----------All 15 to 40 minutes----------					
Expected duration (plain solution)	45-90 min	2-5 hr	1 hr	1 hr	5-7 hr	30 min
Concentration (percent)	1.5	0.15	1.0	1.0	0.25	1.5
Maximum dose mg/kg	14	2	7	7	4	20
Notes		Lower incidence of minor reactions per standard dose	Very stable	Very stable; some local vaso-constriction		Rapid onset; low toxicity

mary of the clinically pertinent characteristics of some of the more common ones is presented in Table 1.

The time of onset of action and the duration of action will vary with the anesthetic agent selected. It is recommended that the physician become familiar with a few commonly used agents. The duration of action of most anesthetic agents, particularly bupivacaine, will suffice for most procedures. If a particularly long procedure is anticipated, epinephrine may be added to the anesthetic agent. Agents containing epinephrine should not be used for digital blocks.

True allergic responses are uncommon with these agents, although they can occur. The ester groups are more prone to cause allergic reactions than are the amides, which are almost never associated with allergy.[1] If there has been allergy to an ester agent, an amide agent can be used. If one agent causes sensitivity of a nonallergic nature, any of the other agents could be offered as an alternative. All of the anesthetics in Table 1 can be autoclaved, although the amides prove more stable over repeated autoclaving than do the esters.

Systemic reactions (nonallergic) to the local anesthetic groups are, for the most part, uniform and include anxiety, dysarthria, disorientation, somnolence, tinnitus, convulsion, bradycardia, respiratory depression, and hypotension.[2] When side effects do occur, it should be recalled that esters are rapidly hydrolized by the blood and liver enzymes while amides are metabolized exclusively by the liver; hence, amides tend to remain in the body longer. All metabolites of both groups are excreted through the kidneys.[3]

Epinephrine is often premixed with anesthetic agents in order to provide a vasoconstrictive capacity to the agent and thereby lengthen its duration of action. To stabilize this solution, the pH is lowered, often in the range of pH 4.0. Such a mixture is considerably more painful when injected. To overcome this, one can mix 1:1,000 epinephrine at the time of the procedure to create a

1:200,000 dilution with the anesthetic volume added (eg, 0.25 ml of 1:1,000 epinephrine to 50 ml lidocaine). Anesthetic agents containing epinephrine may be used for wrist blocks. Because of the potential for vascular necrosis, mixtures containing epinephrine should not be used in digital nerve blocks.

Indications and Contraindications

The following indications apply to the use of the wrist and digital block: (1) multiple or complex lacerations, (2) skin grafting, (3) incision and drainage of infection, (4) reduction of fractures of the metacarpals, particularly "boxer's" fractures, and (5) removal of foreign body in the palm of the hand.

Wrist and digital block are contraindicated when the following circumstances exist:

1. True sensitivity to "caine-type" anesthetic agents most often occurring with the ester groups
2. Multiple injuries or extensive procedures requiring blockade of all three nerves (median, ulnar, and radial). (In these situations a large volume of anesthetic agent would be needed, which makes toxic reaction more likely and may interfere with venous return. A regional intravenous [Bier] block is a better choice.)
3. Soft tissue injury at the wrist
4. Patient's aversion to "nerve block"

It is worth noting that, because of pH changes, infected tissue interferes with the transfer of the local agent into the active form; hence, the ideal use of a nerve block is at a remote site.

Materials

The following materials are needed for wrist and digital nerve blocks:

1. Prep solution: Povidone-iodine, 10 percent or equivalent
2. Anesthetic agent: lidocaine (Xylocaine) .50 percent or 1.0 percent, bupivacaine (Marcaine) .25 percent or .50 percent, or mepivacaine (Carbocaine) .50 percent (Note: With or without vasoconstrictor—epinephrine—for block at the wrist; without vasoconstrictor for digital block)
3. Syringe: 10 ml

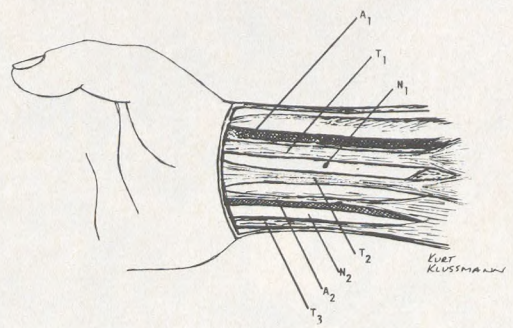

Figure 1. The anatomic relationships between nerves, arteries, and tendons at the level of the wrist. A_1—radial artery, T_1—flexor carpi radialis tendon, N_1—radial nerve, T_2—palmaris longus tendon, A_2—ulnar artery, N_2—ulnar nerve (palmar branch), T_3—flexor carpi ulnaris tendon

4. Hypodermic needle: Small gauge, No. 25, 26, 27, or 30 ($^3/_4$ to $1^1/_4$ in); large gauge to draw up solution, No. 18 ($1^1/_2$ in)
5. Sterile drape
6. Standard resuscitation equipment (oxygen, ventilation bag, medications)

Technique

General Considerations

Allow approximately 20 to 25 minutes after injection for the block to become fully effective. Do not inject the nerve itself, as this can result in nerve damage and resultant disability from hyperesthesia, dysesthesia, and/or motor weakness. Always aspirate prior to injection to avoid an accidental intravascular injection.

The patient is placed in a comfortable position and the wrist is exposed. The skin is prepped with povidone-iodine (10 percent) as it is for a surgical procedure. The field is then draped.

Median Nerve Block

The median nerve is quite superficial in the flexor aspect of the wrist (Figure 1) at the level of the proximal skin crease (Figure 2). In this region, the median nerve travels between the superficial

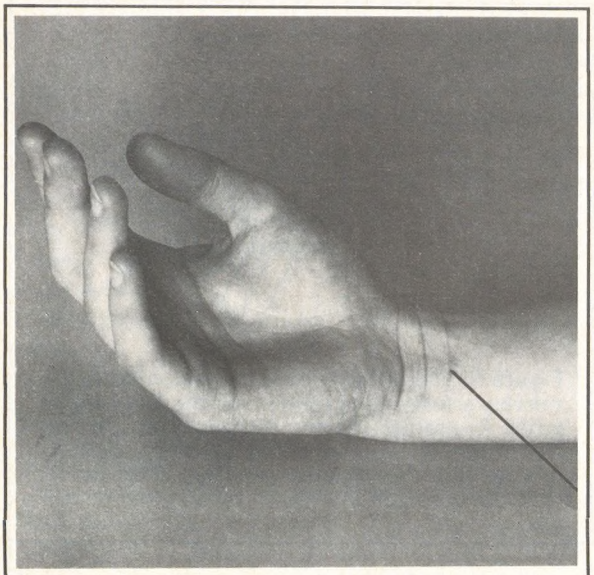

Figure 2. The proximal skin crease is easily identified at the wrist

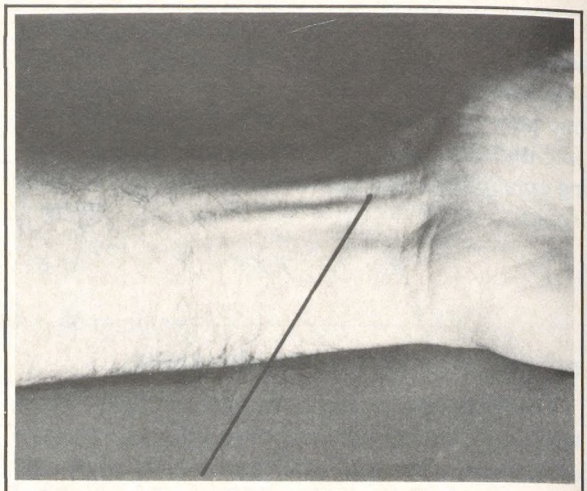

Figure 3. The Palmaris longus and flexor carpi radialis tendons are identified by their appearance at the wrist with the wrist in neutral position

and deep flexor muscles and their tendons. With the hand and wrist in neutral position, two tendons are commonly visible just under the skin—the palmaris longus and the flexor carpi radialis. The median nerve lies just radial to the palmaris longus tendon and ulnar to the flexor carpi radialis tendon, that is, between the two tendons (Figure 3). The palmaris longus tendon is the most superficial flexor tendon and can be easily identified by slight forced flexion of the wrist while actively opposing the thumb to the fifth digit. The palmaris longus tendon will then tent up the skin just medial to the flexor carpi radialis tendon (ie, on the ulnar side of the tendon) (Figure 4). The injection point is between these two tendons at the level of the proximal wrist (flexor) crease. The palmaris longus tendon is absent in 5 to 10 percent of the population.[4] In its absence, the injection is made on the ulnar side of the flexor carpi radialis tendon, which is identified by slight forced flexion of the wrist and is located just radial to the midline.[5] After identification of the injection site, the wrist is placed in neutral position. Injection is made using a one-inch (2.5 cm) narrow needle (25 gauge or smaller), instilling one of the anesthetic agents mentioned earlier. The authors use lidocaine (Xylocaine) 1 percent or bupivacaine (Mar-

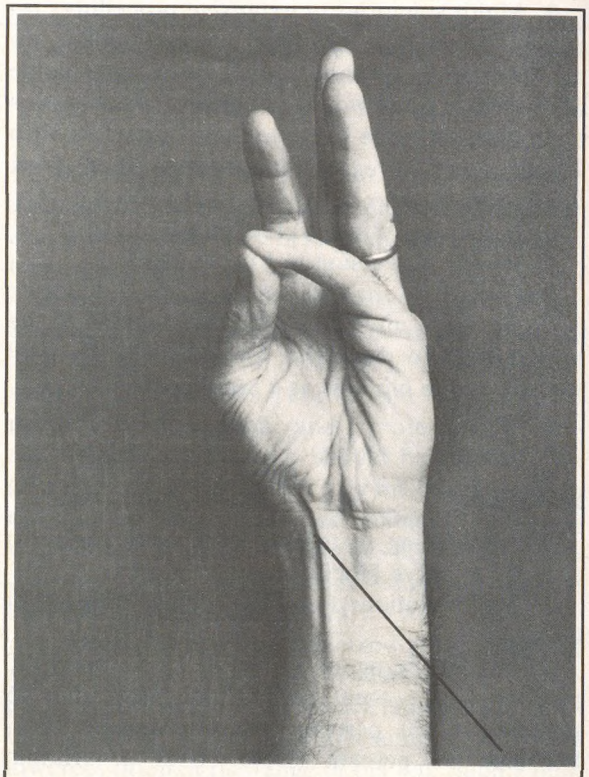

Figure 4. The palmaris longus tendon identified by slight forced flexion of the wrist while opposing the thumb to the fifth digit

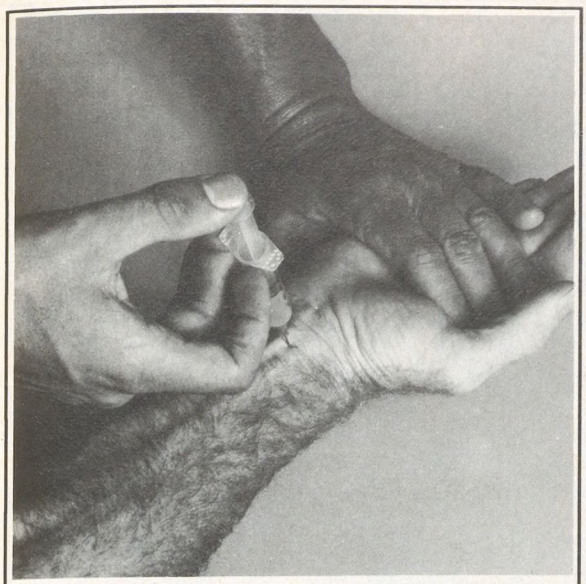

Figure 5. The needle is inserted at the proximal flexor crease between the tendons of the flexor carpi radialis and the palmaris longus, directed slightly distalward (medial nerve block)

caine) .25 percent with or without epinephrine. The needle is inserted as described at the proximal flexor crease between the two tendons and is directed at a slight angle distally (Figure 5). It is inserted approximately 1.5 cm or until one feels it "pop" through the dense tissue of the flexor retinaculum. At that point, 3 to 5 ml of the solution is injected. If a paresthesia is elicited, the needle is withdrawn 2 or 3 mm and the injection accomplished, avoiding the consequences of injection directly into the nerve.

Ulnar Nerve Block

The ulnar nerve travels down the ulnar aspect of the forearm beneath the flexor carpi ulnaris muscle. About 5 cm proximal to the wrist, the ulnar nerve branches into a dorsal and palmar branch. The dorsal branch passes beneath the flexor carpi ulnaris and then proceeds subcutaneously around the ulnar aspect of both the wrist and the dorsum of the hand. The palmar branch carries sensory as well as motor function as it parallels the radial border of the flexor carpi ulnaris tendon (Figure 1). It then divides at the pisiform bone into a superficial sensory branch and deep motor branches.[4,5]

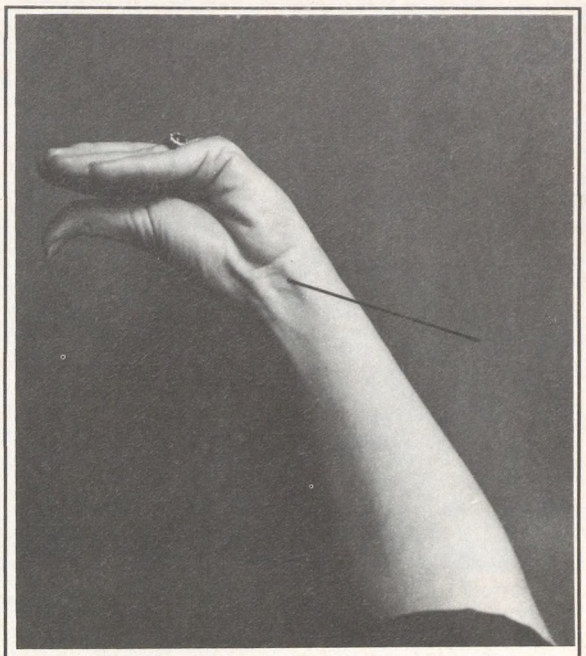

Figure 6. The tendon of the flexor carpi ulnaris is identified by palpating its radial border during moderate wrist flexion while the fingers are pressed together

Block of the Palmar Branch

On the flexor surface of the wrist at the proximal palmar crease (approximately the level of the ulnar styloid), the palmar branch of the ulnar nerve lies radial to the tendon of the flexor carpi ulnaris and medial to the ulnar artery.

The flexor carpi ulnaris tendon lies on the extreme ulnar side of the flexor surface of the wrist. It is most easily identified by flexing the wrist with moderate force and pressing the fingers together. As a result of this maneuver, the tendon is under tension and the radial border is easily palpated (Figure 6). The ulnar artery can often be felt a few millimeters radial to the tendon. The nerve courses between these structures.[5] A small-bore needle is inserted vertically 1.5 to 2 cm (Figure 7), and 3 to 5 ml of anesthetic solution with or without epinephrine is injected. If paresthesias are felt prior to or during the injection, the needle is withdrawn 2 to 3 mm and the injection carried out.

Block of the Dorsal Branch

The dorsal branch of the ulnar nerve is blocked by a subcutaneous injection just distal to the prox-

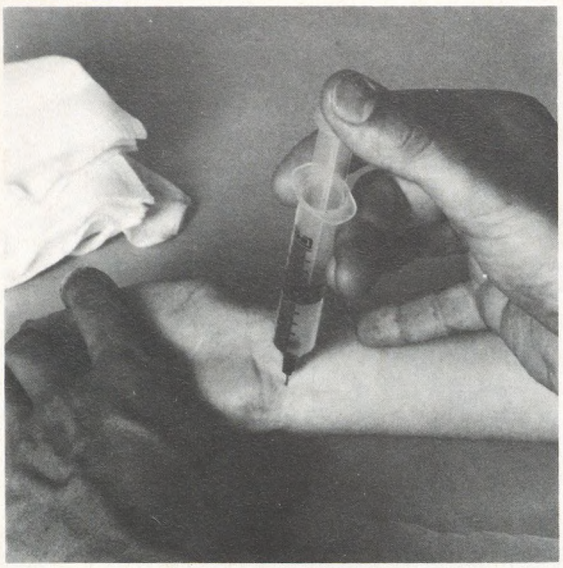

Figure 7. Blockade of the palmar branch of the ulnar nerve entails inserting the needle vertically between the flexor carpi ulnaris tendon and the ulnar artery

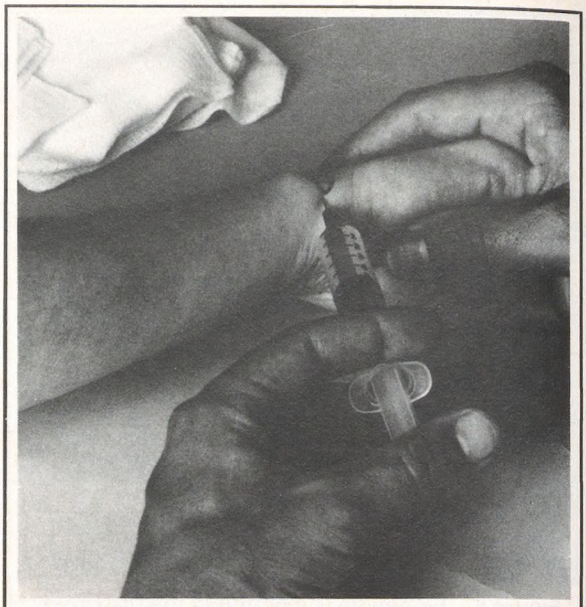

Figure 8. Blockade of the dorsal branch of the ulnar nerve involves a subcutaneous injection starting at the flexor carpi ulnaris tendon and extending around to the dorsum of the wrist at the level just distal to the proximal wrist flexor crease

imal wrist flexor crease starting at the ulnar side of the flexor carpi ulnaris tendon and proceeding subcutaneously 2 to 3 cm around to the ulnar side of the dorsum of the wrist (Figure 8).[5] Approximately 5 ml of anesthetic solution without epinephrine solution should be used.

Radial Nerve Block

The sensory branches of the radial nerve in the midforearm run deep to the brachioradialis and at a point approximately 7 cm proximal to the wrist emerge from beneath this muscle to lie in the subcutaneous space in the radial aspect of the dorsum of the wrist.[4,5] Blockade of these radial branches entails the use of a fine-gauge long needle (No. 27, $1^1/_4$ in), with the injection initiated at the radial aspect of the wrist at the level of the proximal flexor crease.[3] It is continued subcutaneously approximately one half of the way across the dorsal surface (Figure 9). Approximately 5 ml of anesthetic without epinephrine is instilled. Care must be taken to avoid the veins along this route.

Digital Block

The common digital nerves bifurcate proximally to the web of skin between the fingers and form part of the neurovascular bundle along the sides of the adjacent fingers. In the web space the nerves are volar to the lumbrical tendons. In this area the digital nerve is surrounded by relatively loose fibrous areolar tissue, and injection of anesthetic agent does not cause much tissue pressure or possible interference with venous outflow from the digit. On the radial side of the second digit and the ulnar side of the fifth digit, the digital nerve lies volar to the metacarpal heads.[4] Blockade of the digital nerve is accomplished by directing a fine gauge needle into the dorsal surface of the webbing between two fingers in the plane of the palm to a depth of approximately 1.5 cm (Figure 10), and 2 to 3 ml of anesthetic solution without epinephrine is injected. Blocking the radial side of the first digit and the ulnar side of the fifth digit requires that the injection infiltrate the fatty tissue at the respective metacarpal heads.

Conclusion

Through the appropriate selection of one or more of the discussed blocks and by careful selection of anesthetic agent, the family physician can

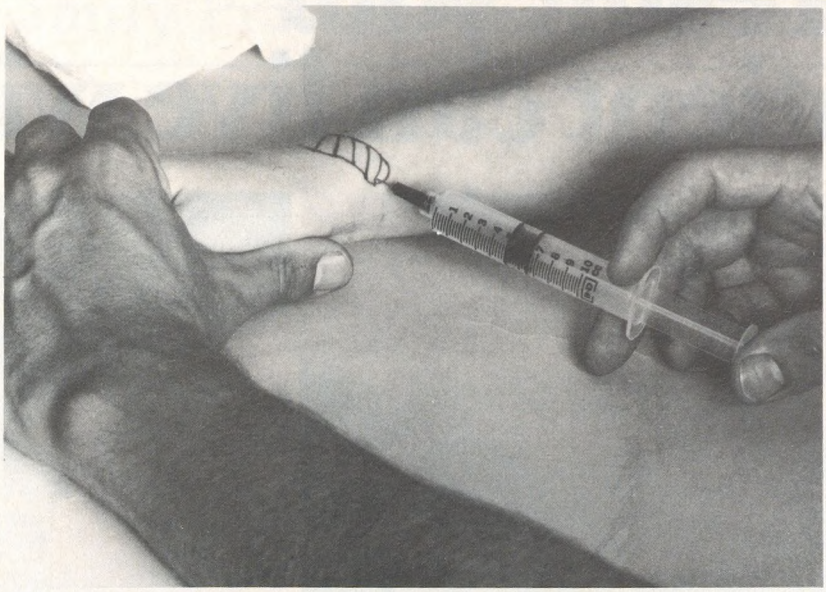

Figure 9. Blockade of the radial nerve branches requires injection at the radial aspect of the wrist, subcutaneously starting at the level of the proximal flexor crease and extending halfway across the dorsal surface

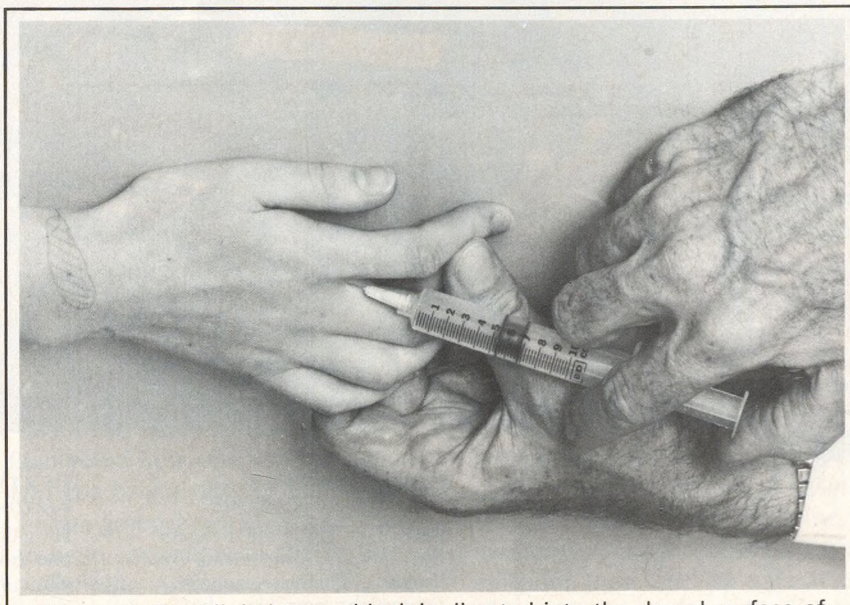

Figure 10. The digital nerve block is directed into the dorsal surface of webbing in the plane of the palm

accomplish hand and digit anesthesia as an effective tool in the management of a variety of common problems.

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