

Ultrasound-Guided Ulnar, Median, and Radial Nerve Blocks

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The ultrasound-guided peripheral nerve block is an easy technique to learn, and can enhance the clinician's ability to provide adequate analgesia and anesthesia.

Emergency physicians (EPs) have traditionally used the landmark technique to block the radial, ulnar, and median nerves at the wrist (**Figure 1**). Many times, however, there is a need to perform the block more proximally. Performing these blocks with real-time ultrasound guidance allows the clinician to visually target the nerve, requires less anesthetic agent, and helps to avoid vascular structures. As with any procedure, employing the appropriate technique, along with practice, increases the success of the block.

Patient Selection

Before performing a nerve block, the EP must first determine if the patient is an appropriate candidate. The EP should be cautious in performing a nerve block on any patient who has paresthesias, tingling, or weakness, as the block will complicate further examinations. Likewise, a nerve block may be contraindicated in a patient in whom compartment syndrome is a concern, since the analgesic effect will inhibit the patient's ability to sense increasing pain or worsening paresthesias.

Equipment and Preprocedure Care

An ultrasound-guided nerve block is performed using the linear high-frequency probe. Prior to the procedure, standard infection-control measures should be taken—ie, thoroughly cleaning the preinjection site and using

a transducer-probe cover. Regarding the choice of anesthetic, either bupivacaine or lidocaine is appropriate; however, bupivacaine will provide a longer duration of analgesia. To administer the anesthetic, we typically use a regular cutting needle or a spinal needle. A review of the literature typically suggests either noncutting needle tips or tips with short bevels. There is a paucity of data on needle tip selection. The use of noncutting needle tips or tips with short bevels may be a better

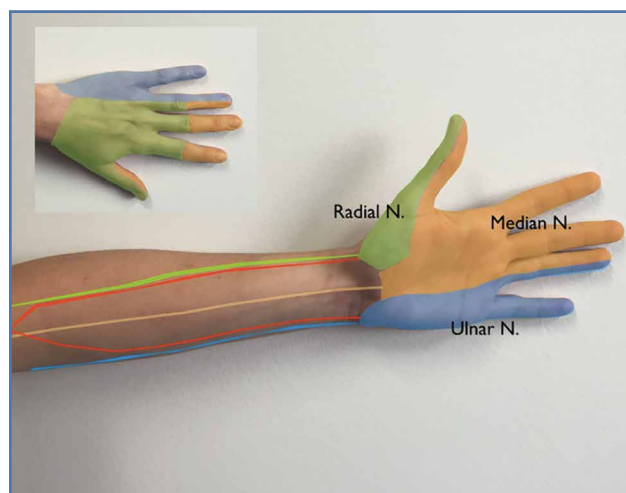


Figure 1. Photo illustrating the locations of the median, ulnar, and radial nerves in the hand, wrist, and forearm.

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choice than a regular cutting needle or a spinal needle because they may decrease the chance of intraneural injection and consequent nerve injury.

Single- Versus Two-Person Technique

Peripheral nerve blocks can be performed using either a single- or two-person technique. In the one-person technique, the operator manipulates both the probe and the syringe. The two-person technique, however, requires the addition of tubing between the needle and the syringe. This can be done with the addition of a small section of intravenous (IV) tubing or by connecting two pieces of tubing together (the type tradi-

tionally placed on IV catheters). The operator holds the needle and the probe while the syringe and injection are controlled by the second person. Then, with the ultrasound machine set at the nerve or soft-tissue presetting, the scan begins by placing the probe in a transverse orientation.

Nerve Location and Identification

As previously noted, the ulnar, median, and radial nerves have traditionally been identified through use of the landmark technique just proximal to the wrist. The nerves can be located initially at these sites and then traced proximally.

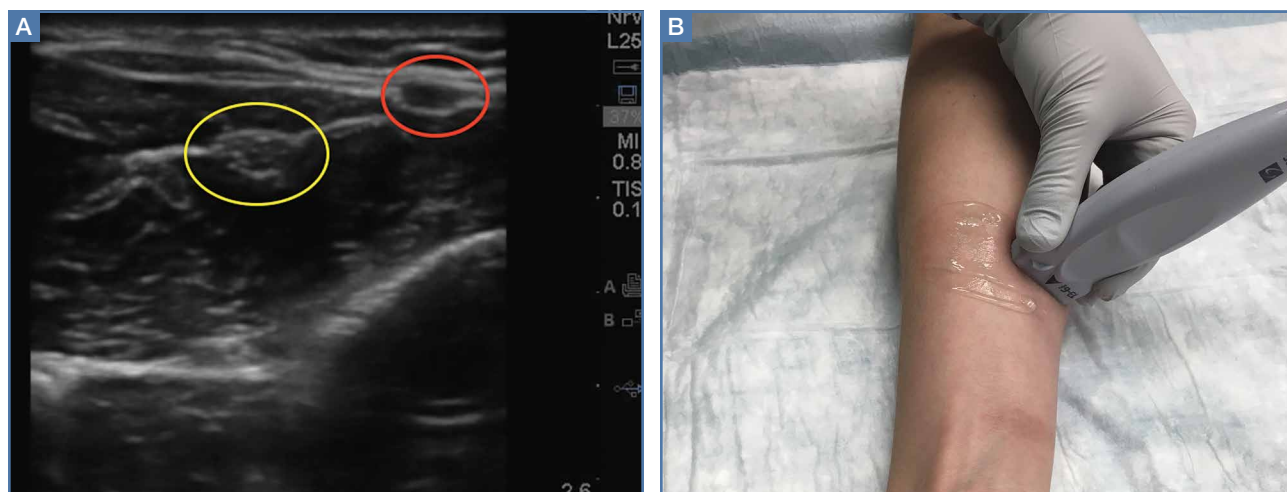


Figure 2. (A) Ultrasound image visualizing the ulnar nerve (yellow circle) and ulnar artery (red circle). (B) Photo demonstrating the correct probe position for visualizing the ulnar nerve.

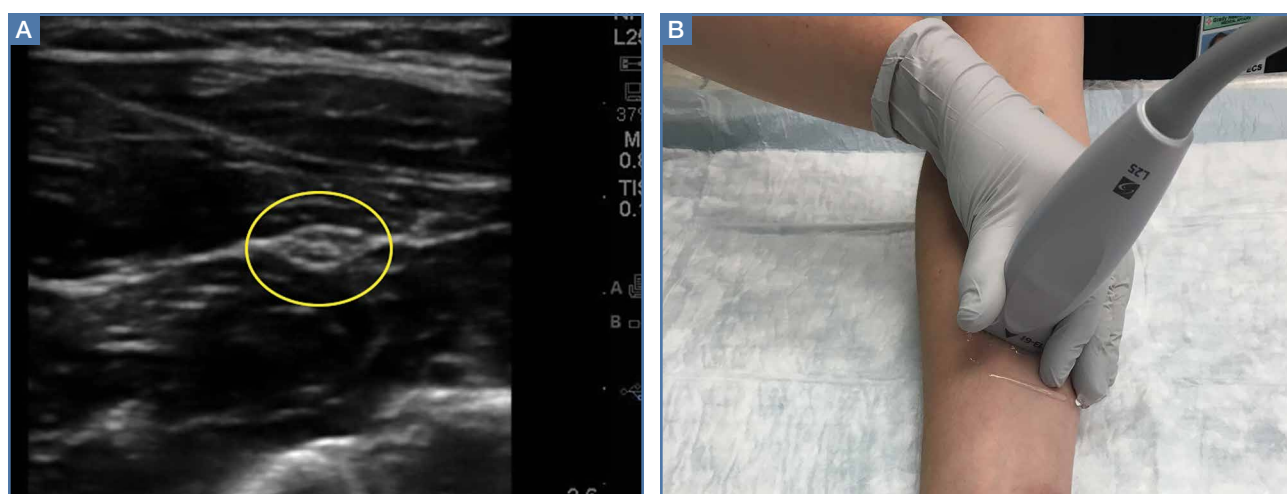


Figure 3. (A) Ultrasound image visualizing the median nerve (yellow circle); there is no surrounding artery and vein. (B) Photo demonstrating the correct probe position for visualizing the median nerve.

Ulnar Nerve

The ulnar nerve is located on the ulnar side of the forearm, just proximal to the wrist. (Figure 2a and 2b). The clinician should begin by fanning the probe at the wrist to find the ulnar artery and locate the nerve bundle. The ulnar nerve is also located on the ulnar side of the ulnar artery. The nerve will diverge from the path of the ar-

tery as it is traced proximally. To decrease the chance of an arterial injection/injury, the clinician should administer a nerve block after separating these two structures.

Median Nerve

The clinician can employ the landmark approach to help find the nerve; then the scan should begin at the carpal

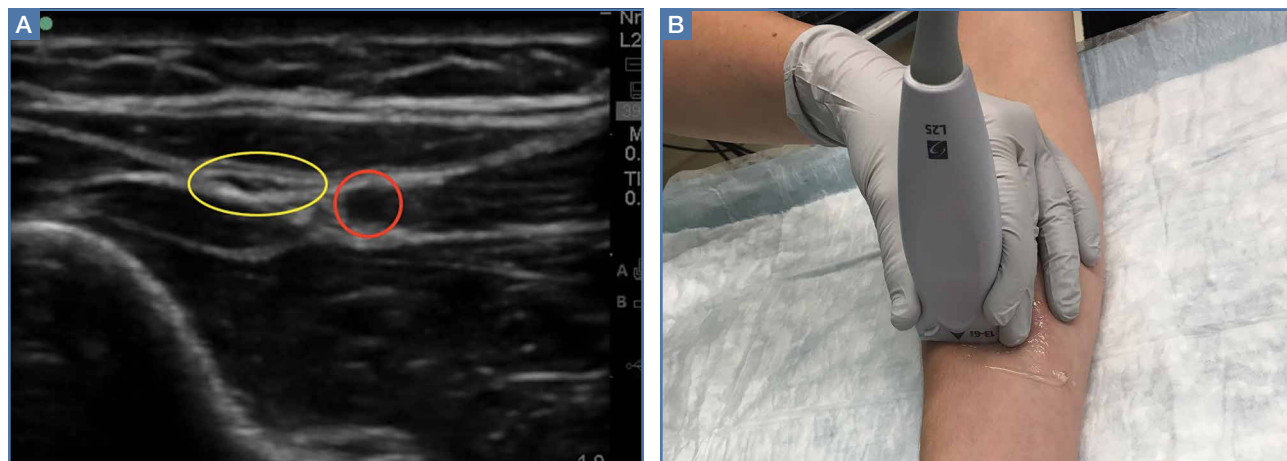


Figure 4. (A) Ultrasound image visualizing the radial nerve at the wrist (yellow circle) and the radial artery (red circle); the radial nerve is smaller at this location and more difficult to identify. (B) Photo demonstrating the correct probe position for visualizing the radial nerve at the wrist.

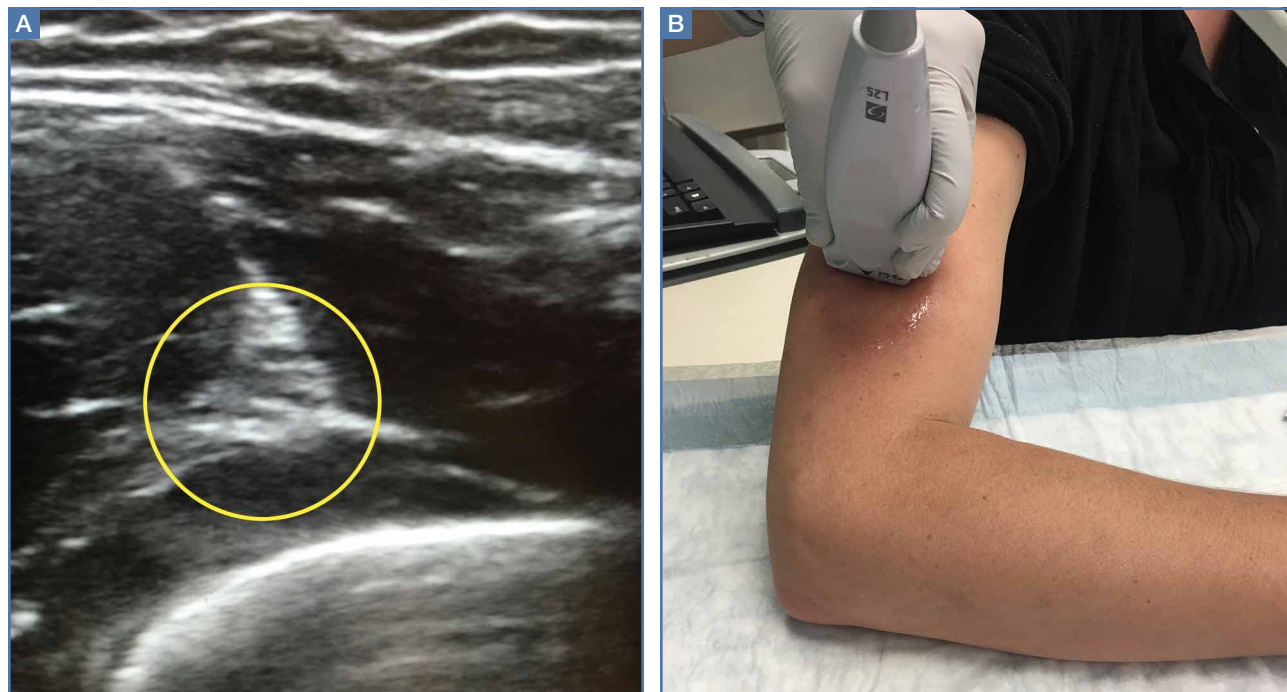


Figure 5. (A) Ultrasound image visualizing the radial nerve at the elbow (yellow circle); the radial nerve proximal to the elbow appears much larger than at the wrist and is therefore a more preferable target site. (B) Photo demonstrating the correct probe position for visualizing the radial nerve at the elbow.

tunnel. On ultrasound, the tendons in the carpal tunnel will appear similar to nerves (ie, round and hyperechoic) compared to surrounding muscle. As one continues to slide the probe up the forearm, the tendons will become muscles and a single hyperechoic structure will remain—the median nerve running in between the flexor digitorum superficialis and the flexor digitorum profundus (**Figure 3a and 3b**). Since there is no artery alongside the median nerve, it can be traced proximally; therefore, the procedure can be performed in any convenient location.

Radial Nerve

Of the three nerves, the radial nerve is the most challenging to visualize on ultrasound. There are two approaches to performing a radial nerve block. In the first approach, the radial nerve can be found just proximal to the wrist crease on the radial side of the radial artery (**Figure 4a and 4b**). This nerve is typically much smaller and harder to visualize at this level; it can be traced proximally and the block performed at this location. In the second approach, the radial nerve can be located 3 to 4 cm proximal to the elbow with the probe located anterolaterally (**Figure 5a and 5b**). In this location, the radial nerve lies between the brachialis and the brachioradialis muscles. In this approach, the nerve is much larger and easier to visualize.

Performing the Block

Prior to performing an anesthetic block at the ulnar, median, or radial nerve at the wrist, the clinician should first place the patient in a sitting or supine position with

the appropriate elbow extended. When performing the block at the radial nerve above the elbow, the hand is typically placed in a resting position on the patient's abdomen. When localizing the nerve, the angle of the transducer can vary the appearance of the nerve dramatically. To ensure the best possible view, the clinician should slowly "rock" the probe back and forth 10° to 20° in plane with the long axis of the arm, making sure the probe is placed as perpendicular as possible to the nerve. Once the nerve is identified, the clinician can follow it up and down the forearm with the probe to identify the best site to perform the block. In the optimal location, there should be a clear path that is as superficial as possible and avoids any vascular structures. We prefer using an in-plane technique to perform the nerve block to visualize the entire needle as it approaches the nerve. Once the site has been determined, the clinician should slowly inject 4 to 5 cc of anesthetic around the nerve, with the objective to partially surround the nerve. There is no need to completely surround the nerve, as doing so is not necessary to achieve a successful block. The clinician should stop immediately if the patient reports pain or if there is increased resistance, because this could indicate an intraneural injection.

Summary

Ultrasound-guided peripheral nerve blocks are an excellent option for providing regional anesthesia to lacerations and wounds that are too large for a local anesthetic. This technique can provide better analgesic relief, enhancing patient care.