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Nerve Block, Median

Authors

John M. Pester¹; Matthew Varacallo².

Affiliations

¹ St. Luke's University Health Network

² Department of Orthopaedic Surgery, University of Kentucky School of Medicine

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Introduction

A median nerve block is a simple, safe, and effective method of obtaining anesthesia to the palmar aspect of the thumb, index finger, middle finger, radial portion of the palm and ring finger. Landmark-based techniques have been utilized for decades with success. However, since the introduction and widespread use of ultrasound, clinicians can obtain more consistent anesthesia with smaller volumes and fewer complications. Peripheral nerve blockade of the hand has been used primarily in the peri-operative and post-operative settings by anesthesiologists and hand surgeons, although emergency physicians and traumatologists have become more familiar with these blocks in the setting of acute pain and trauma.

Anatomy

The median nerve is a terminal branch of the brachial plexus, formed by the medial (C5, C6) and lateral cords (C8, T1). It branches from the brachial plexus at the axilla and courses through the upper arm along with the brachial artery, between brachialis and biceps brachii distally. Proximal to the elbow, the median nerve is located lateral to the brachial artery, and at the level of the elbow, the nerve is located medial to the artery.

Coursing distally, the median nerve enters the forearm between the biceps and pronator teres. In the proximal forearm, the nerve gives off the anterior interosseous nerve (AIN) branch, the terminal motor branch of the median nerve. AIN and the median nerve continuation both course deep to flexor digitorum superficialis and superficial to flexor digitorum profundus. The median nerve emerges in the distal forearm between FPL and FDS before transitioning to the wrist and hand via the carpal tunnel.

The median nerve travels in the carpal tunnel along with the FDS, FDP, and FPL tendons. The boundaries of the carpal tunnel include the transverse carpal ligament (the roof), the scaphoid tubercle and trapezium (radial border), the hook of hamate and pisiform (ulnar border), and the proximal row of carpal bones (the floor). In the tunnel, the median nerve is medial/ulnar to the tendons of FDS and FD. The nerve can be blocked at any point in the arm or forearm. However, its location in the forearm is quite superficial, and it is no longer adjacent to the brachial artery which makes inadvertent vascular puncture or injection less likely.

Carpal tunnel blocks are often performed, but studies have noted the wide range of anatomic variations and heterogenous outcomes and success of blockade in the carpal tunnel. A 2015 study proposed a novel technique utilizing wrist width to aid in injection accuracy at the wrist. The technique involves placement of the volar injection at the level of the carpal tunnel either on the relative radial (volar/radial) or relative ulnar (volar/ulnar) in a patient-specific approach to minimize complications and injury to surrounding tendons and neurovascular structures. Using the most radial side of the wrist at the "zero" position in terms total wrist width, the radial (30% position along the total width) and ulnar (60% position along the total width) were reliable injection techniques. The volar/radial position was safer than the ulnar position as well.

Indications

Blockade of the median nerve provides anesthesia to the palmar aspect of the thumb, index finger, middle finger, the radial aspect of the ring finger, or radial half of the palm including skin and underlying metacarpals and phalanges. This block may be used as the sole anesthetic, or as an adjunct for reduction or surgical repair of fractures and dislocations, repair of complex lacerations or performing incision and drainage of cysts and abscesses. The use of peripheral nerve blocks for postoperative analgesia have demonstrated shorter recovery times and decreased opioid use. A median nerve block is also an excellent opioid-sparing analgesic option for burns involving tissue in the median nerve distribution. A terminal median nerve block is a valuable rescue technique for incomplete brachial plexus blocks. Although compartment syndrome is frequently a concern with high energy injuries, there are reports of using forearm median, ulnar, and radial nerve blocks in blast injuries and other high energy injuries without serious sequelae. One should always assess the patient and mechanism of injury along with the treating physician before block placement.

Contraindications

Contraindications to a nerve block include:

- Patient refusal
- Cellulitis or abscess over the site of injection
- Anaphylactic reaction to local anesthetics
- Maybe relatively contraindicated in high-energy injuries at increased risk for compartment syndrome, discuss with consultants first.

Equipment

Equipment for the procedure includes the following:

- Local anesthetic - type and quantity varies depending on the intended duration of the block. 5mL of lidocaine 2% for a short-medium duration block (1-2 hours), 5mL of bupivacaine 0.5% or ropivacaine 0.5% (2-4 hours)
- Block needle - short bevel 6cm or longer
- Chlorhexidine 2% or povidone-iodine
- High frequency (8MHz or greater) linear ultrasound probe
- Sterile ultrasound gel
- Sterile probe cover
- Access to intralipid 20% (1.5mL/kg bolus, 0.25mg/kg/hr drip) in the case of cardiac arrest due to LAST

Personnel

A practitioner trained in peripheral nerve blocks. Nurse able to administer resuscitation medications if needed.

Preparation

Preparatory steps include the following:

- Obtain consent for nerve block including risks, benefits, and alternative treatments
- Verify the patient's identity and site to be blocked
- Perform and document a detailed neurovascular exam of the affected extremity

- Position the affected arm on a stand, with the arm extended at the elbow and supinated distally
- Clean the arm from the elbow crease to about the mid-forearm with chlorhexidine 2% or povidone-iodine and allow the solution to dry
- Place ultrasound machine within line of sight
- Apply a sterile covering and sterile gel to a high-frequency linear ultrasound probe
- Draw local anesthetic solution into a sterile syringe.

Technique

A nerve block should be performed in the following steps:

1. Place the probe in the elbow crease over the proximal radius.
2. Identify the radius, with pronator teres lying medially.
3. Identify the flexor digitorum superficialis (FDS) and flexor digitorum profundus (FDP) medial to pronator teres.
4. The median nerve should be easily identifiable as a hyperechoic structure with a honeycomb appearance between FDS and FDP.
5. Insert a block needle in-plane and parallel to the probe surface. Ensure that the needle tip is visible at all times.
6. Aim the needle tip at the fascial plane between FDS and FDP.
7. Aspirate to confirm the needle tip is not within a blood vessel.
8. Inject a small amount of local anesthetic to confirm needle tip placement.
9. The needle tip may need to be advanced, or withdrawn slightly for optimal placement in the fascial plane, so that spread of local anesthetic around the nerve is achieved.
10. Once injectate is confirmed to be within the fascial plane containing the median nerve, continue aspiration followed by incremental injection of 1 mL to 2 mL of a local anesthetic until the satisfactory spread has occurred.

Complications

Complications can include:

- Bleeding from puncture site
- Intramuscular hematoma
- Infection at site of injection
- Allergic reaction to local anesthetic
- Vascular puncture
- Intravascular injection
- Local anesthetic systemic toxicity (LAST)
- Nerve damage including neuropraxia or neurolysis
- Unsuccessful block

Clinical Significance

Blockade of this nerve will result in anesthesia to the palmar aspect of the thumb, index finger, middle finger, half of the ring finger, and the area of the palm proximal to those digits. The sensation from the metacarpals and phalanges of the corresponding digits will also be affected. Motor paralysis of the lumbricals (1 and 2), opponens pollicis, abductor pollicis brevis, and flexor pollicis brevis is likely to occur with a dense block. A more proximal block will also result in paralysis of the flexors of the forearm except for flexor carpi ulnaris which is innervated by the ulnar nerve. This block is useful for injuries to the palm, thumb, index finger, middle finger and radial aspect of the ring finger. If additional analgesia is required for injuries to the ring finger, an ulnar nerve block should be added.

This block can also be performed using anatomic landmarks by injecting between flexor carpi radialis tendon and palmaris longus at the wrist crease. However, the use of ultrasound may result in a greater rate of a successful block, as well as a more dense blockade.

Questions

To access free multiple choice questions on this topic, [click here](#).

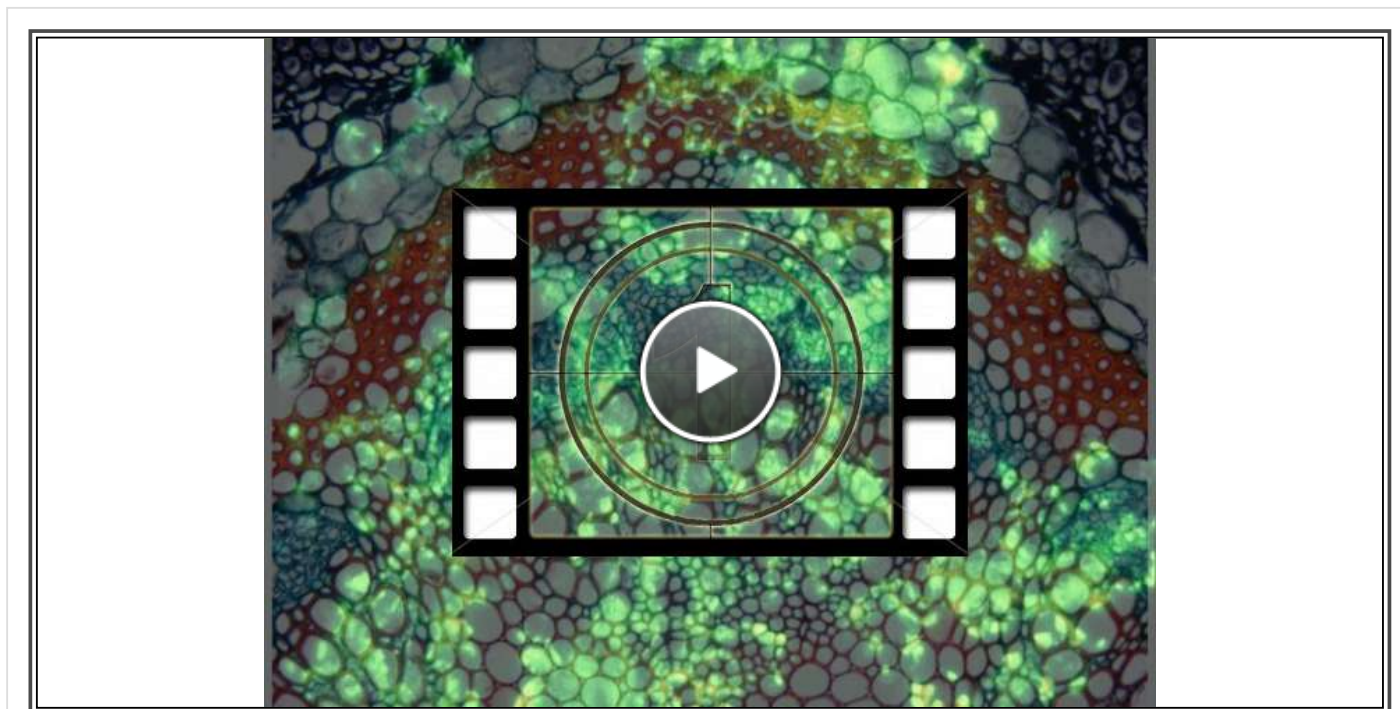
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Figures



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Live ultrasound guided in plane median nerve block, flexor digitorum superficialis, flexor digitorum profundus.
Contributed by John Pester, DO

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