Chapter 3

Cervical Paravertebral Block

- **Single-Injection and Continuous Cervical Paravertebral Blocks**




SINGLE-INJECTION AND CONTINUOUS CERVICAL PARAVERTEBRAL BLOCKS

Introduction

The cervical paravertebral block (CPVB) is indicated for painful conditions of the entire upper limb (1-4). It is specifically indicated for major shoulder, major elbow, and major wrist surgery, provides a more sensory than motor block, and has a wider distribution than the interscalene block because it is performed at the root level of the brachial plexus. It should not be done for minor surgery and relatively painless conditions. It is possible to place the cervical paravertebral after surgery using the loss-of-resistance-to-air or ultrasound technique without nerve stimulation. The techniques and equipment for single-injection CPVB and continuous CPVB are identical except for the placement of the catheter in the latter (4).

Specific Anatomic Considerations

The anatomic considerations for this block are discussed in Chapter 1.

The osteotomes included with this block are illustrated in Figure 3-1, while the dermatomes are illustrated in Figure 3-2, and the neurotomes in Figure 3-3 (see also Chapter 1).

Technique

The patient is positioned in the lateral decubitus or sitting position for this block (1-4). A line is drawn from the dorsal spine of C6 to the suprasternal notch (Fig. 3-4).

Needle entry is in the apex of the "V" formed by the trapezius and levator scapulae muscles and on the line drawn from the C6 dorsal spine to the suprasternal notch. First, identify the wide groove between the levator scapulae and trapezius muscles at the base of the skull (Fig. 3-5A). The circled number "7" on Figure 3-5A indicates the position of the dorsal spine of C7, and the "6" the dorsal spine of C6.

Then, while keeping the fingers in the groove, move downward (caudad; Fig. 3-5B) until the line connecting the dorsal spine and the suprasternal notch is reached (Fig. 3-5C). The solid line runs from the dorsal spine of C6 to the suprasternal notch, and the groove between the levator scapulae and trapezius muscles can be palpated. Make sure that this groove is not the groove anterior to the levator scapulae muscle, between the latter and the posterior scalene muscle. The correct groove is usually not more that 5 cm from the midline, but usually approximately 4 cm. If it were more than 5 cm, it would be wise to reassess the landmarks. The Pippa approach (5) is for single-injection CPVB and does not seek to avoid penetration of the extensor muscles of the neck. In the Pippa approach, needle entry is 3 cm from the midline, but this approach cannot be used for catheter placement for continuous nerve block. The needle entry point used by Sandefo and colleagues (5) and the use by Rettig and coworkers (6) of thin, sharp needles for paravertebral blocks have been criticized (7,8). For catheter placement, needle entry should be in the groove on the line between the front and middle finger on Figure 3-5C, as shown in Figure 3-5D. This is to avoid penetration of the often-tender extensor muscles of the neck. Penetration of these muscles for single-injection CPVB does not seem to cause pain and seems to be acceptable (5,6).

After skin preparation, the area is covered with a sterile, fenestrated, clear plastic drape (Fig. 3-6). The fingers of the nonoperative hand separate the muscles and a 25-gauge needle is used to anesthetize the skin and subcutaneous tissue. This needle remains on the plane of the line drawn between the C6 spinal process and the suprasternal notch.

The subcutaneous tissue is anesthetized liberally, but after direct subcutaneous injection, as a safety measure, no local anesthetic agent is injected until contact with the bony pars intervertebralis, articular column, or short transverse process of C6 is made. Only after contact with the bone should local anesthetic agent be injected, and only on withdrawal of the needle. This is done to prevent the theoretical possibility of intramedullary or subdural injection if the bony structures are missed and the needle is accidentally aimed too medially, or numbing of the plexus if the bony structures are missed laterally.

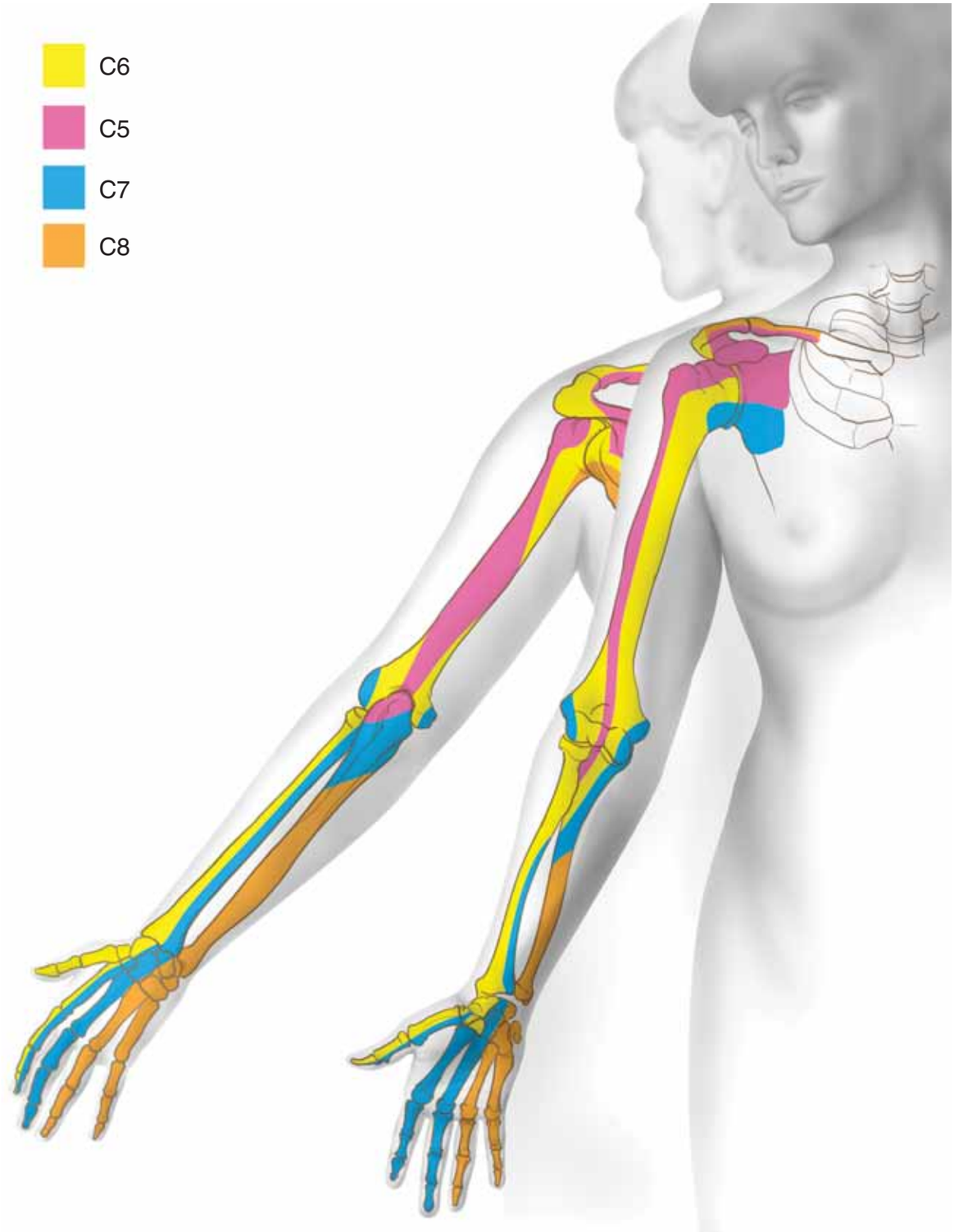


FIGURE 3-1 The osteotomes included in the brachial plexus root block.

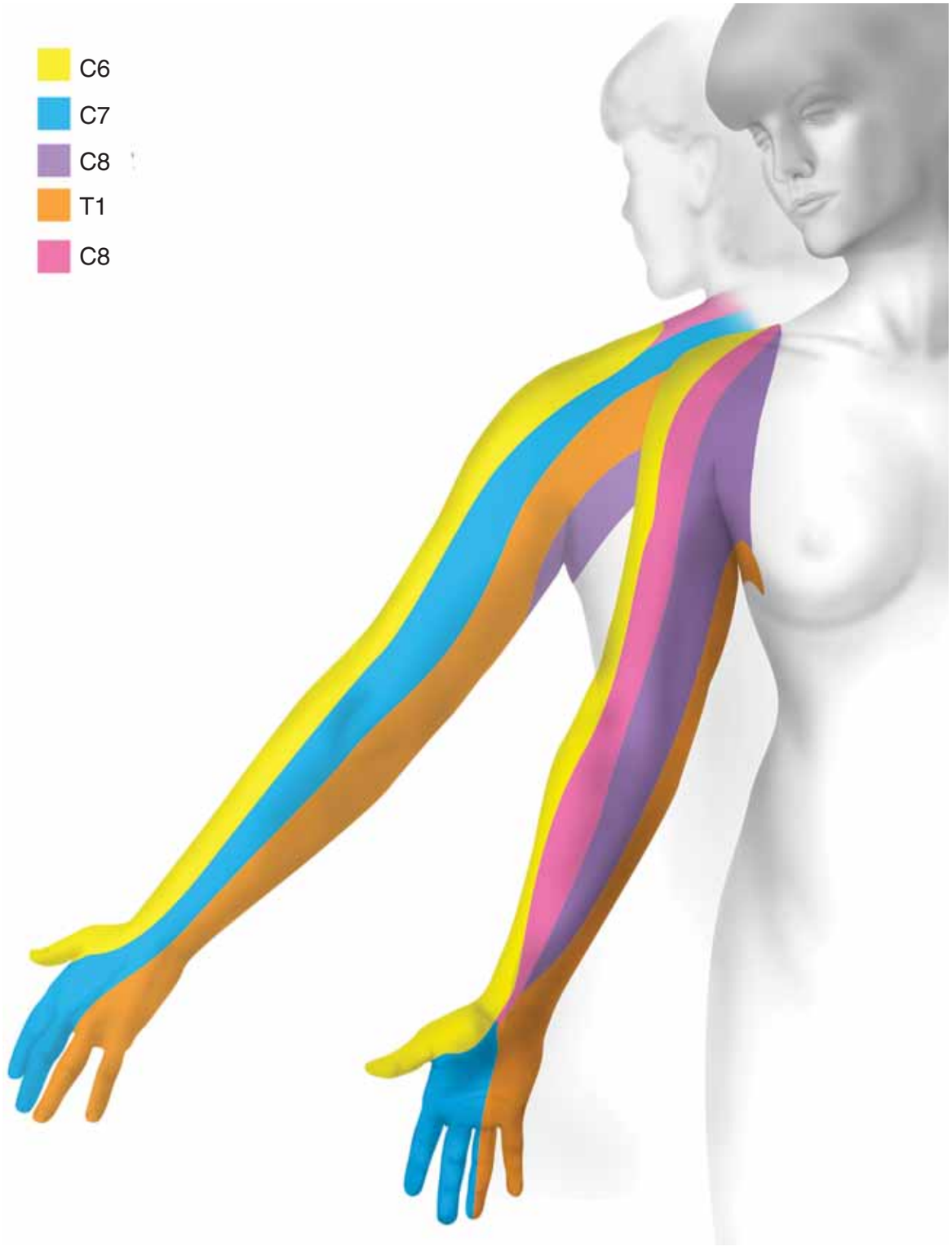


FIGURE 3-2 The dermatomes included in the brachial plexus root block.

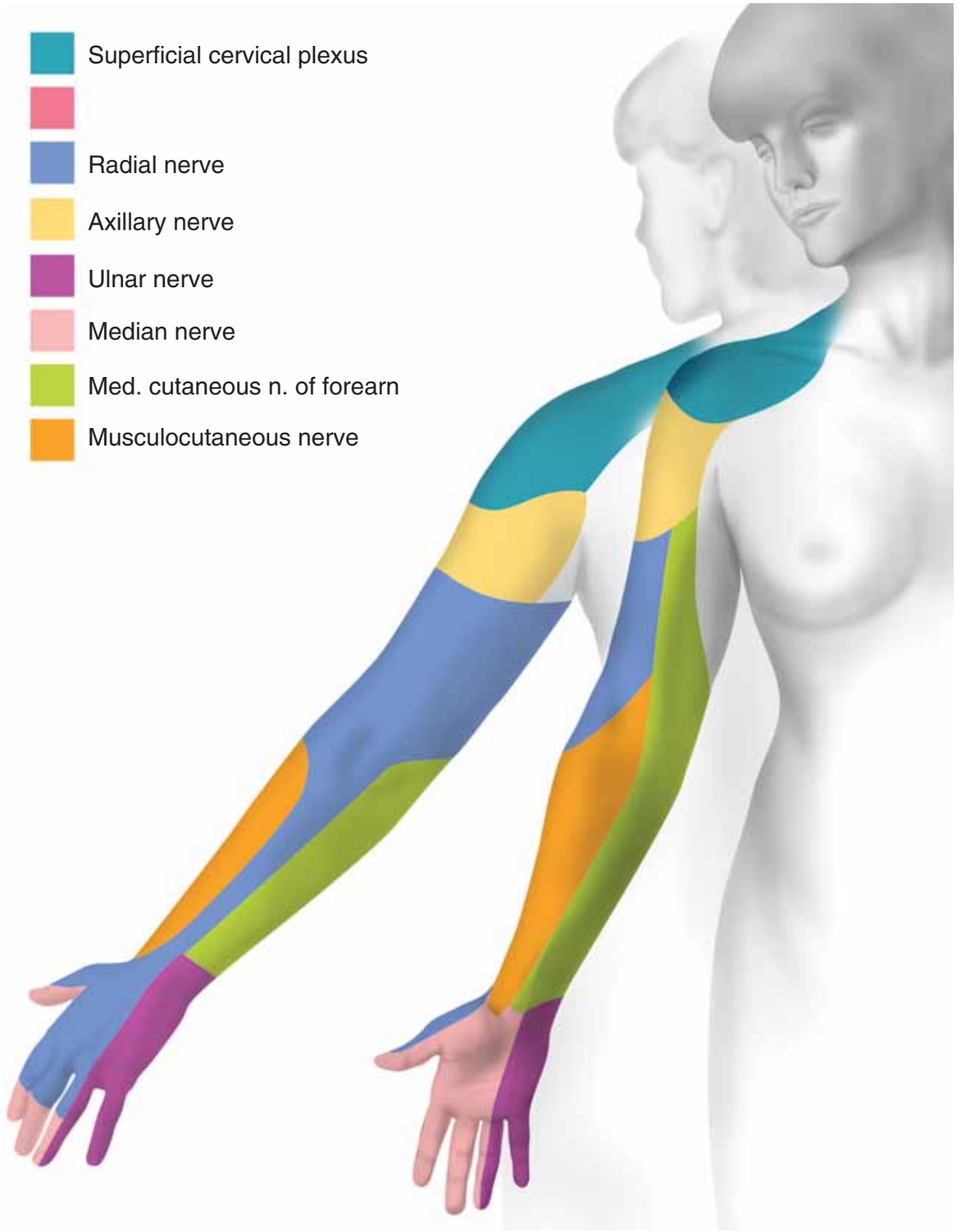


FIGURE 3-3 The neurotomes included in the brachial plexus root block.

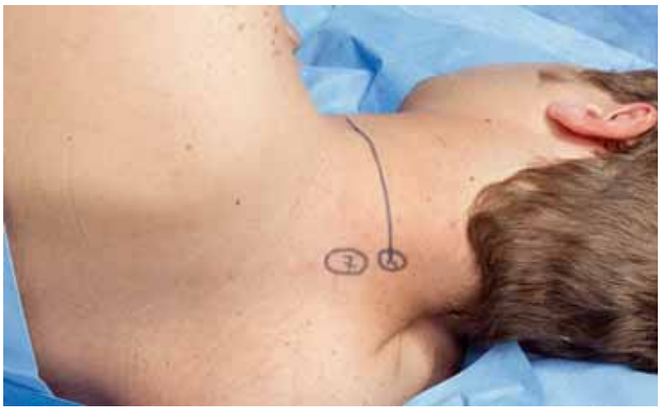
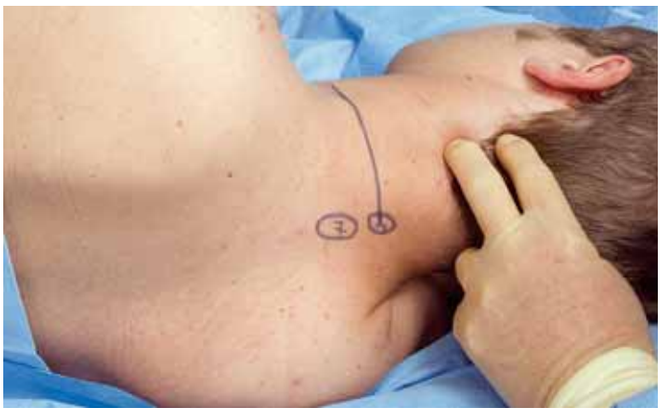
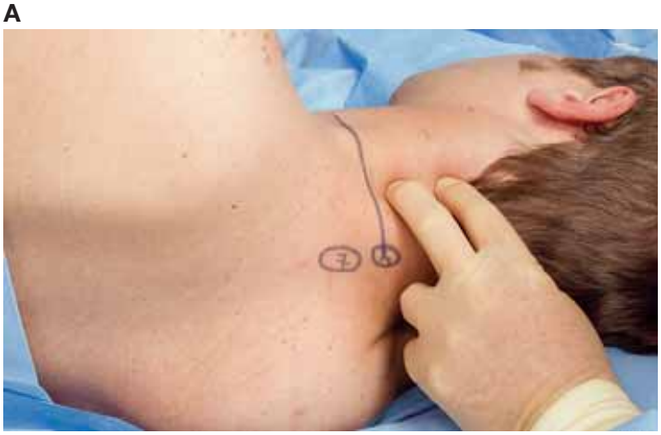


FIGURE 3-4 In this instance, the patient is placed in the lateral position. The "7" indicates the dorsal spine of C7, and "6" the dorsal spine of C6. The *solid line* joins the dorsal spine of C6 with the suprasternal notch.



A

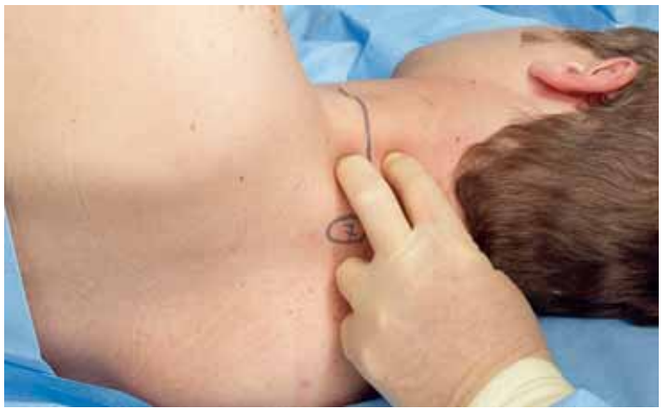


B

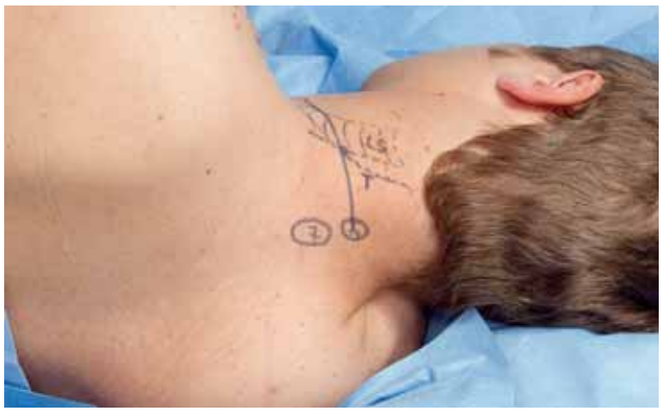
FIGURE 3-5 **A,** Feel for the groove between the trapezius and levator scapulae muscles in the occipital area, where this groove is widest and easiest to palpate. **B,** Move the palpating fingers caudad.

The subcutaneous path intended for tunneling of the catheter is also adequately anesthetized (Fig. 3-7).

The trapezius and levator scapulae muscles are again separated with the fingers of the nonoperative hand and a 17- or 18-gauge insulated Tuohy needle, which is attached to a nerve stimulator set to a current output of 1 to 3 mA, a frequency of 2 Hz, and a pulse width of 100 to 300 µsec, is advanced aiming toward the suprasternal notch until contact with the bony structures is made (Fig. 3-8). Notice that this needle always remains on the plane of the line drawn from the C6 dorsal spine to the suprasternal notch.



C



D

FIGURE 3-5 *cont'd* **C,** The palpating fingers are moved until the groove can be palpated at the level of C6. **D,** A *solid line* is drawn from the dorsal spine of C6 to the suprasternal notch. 6, Dorsal spine of C6; 7, dorsal spine of C7; LS, levator scapular muscle; T, trapezius muscle. The dot in the apex of the "V" between these two muscles indicates the point of needle entry.

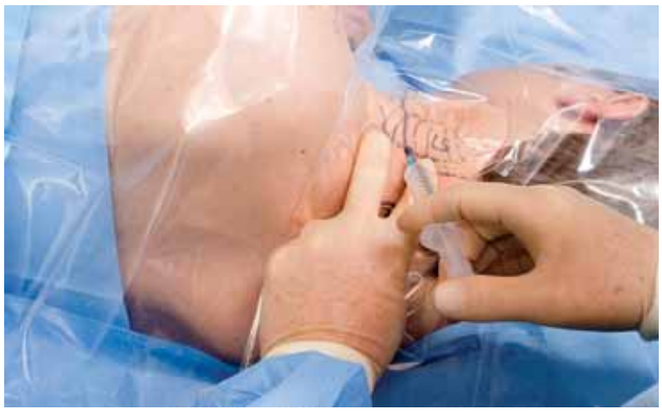


FIGURE 3-6 The levator scapulae and trapezius muscles are separated by the index and middle fingers of the nonoperative hand, and the skin and subcutaneous tissue are injected with a local anesthetic agent using a 25-gauge needle.

It is advisable to use a needle designed not to perforate the dura (i.e., a 17- or 18-gauge Tuohy needle) when any paravertebral block (cervical, thoracic, lumbar, or sacral) is performed (8). This is because the dural sleeve can follow well down the nerve roots to the area where the paravertebral block is done, essentially making all paravertebral block extradural, peridural, or epidural blocks. The same safety precautions required for epidural block should therefore be applied to paravertebral blocks (9,10) (Fig. 3-9).

After contact with the bone, the stylet of the needle is removed and a loss-of-resistance-to-air syringe is attached to the needle (Fig. 3-10). The

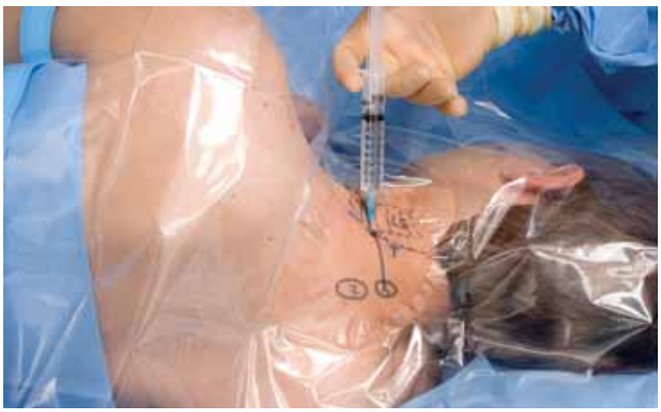


FIGURE 3-7 The intended path for tunneling of the catheter is also injected with local anesthetic agent.

FIGURE 3-8 An 18-gauge insulated Tuohy needle is attached to a nerve stimulator and enters the skin in the apex of the "V" between levator scapulae and trapezius muscles. It is advanced anteromedially, aiming for the suprasternal notch, until the pars intervertebralis or articular column is encountered.

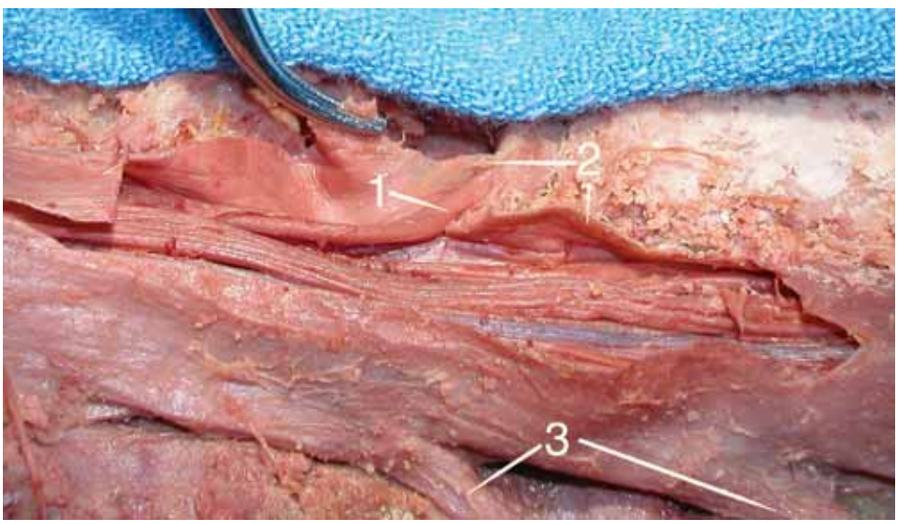


FIGURE 3-9 A dissection of the nerve root in the lumbar area shows the dura surrounding the nerve roots. This configuration is similar for the cervical, thoracic, lumbar, and sacral roots. 1, Nerve root; 2, dura; 3, nerve roots surrounded by dura. (Photograph courtesy of Carlos D. Franco, MD.)

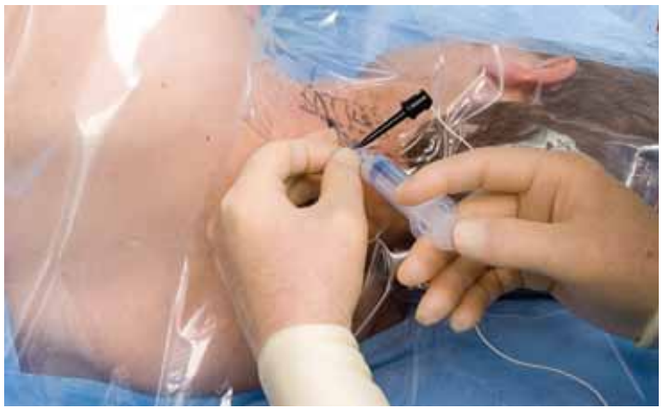
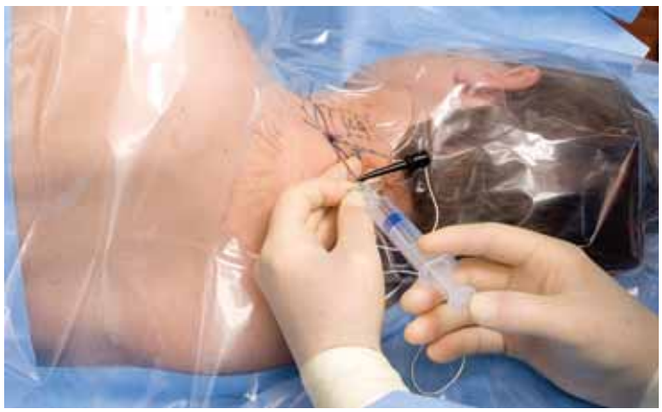


FIGURE 3-10 Once contact with the bony part is made, a loss–of–resistance-to-air syringe and nerve stimulator are attached to the insulated Tuohy needle.



A

B

FIGURE 3-11 **A,** The needle is advanced by walking it off the bony process in a lateral direction. Notice the middle finger is placed under the shaft of the needle. **B,** An alternative technique of holding the needle to ensure that the needle is walked laterally off the bony process.

needle tip is now carefully walked off the bony structures in a lateral direction, remaining on the plane of the line drawn from the dorsal spine of C6 to the suprasternal notch.

At this stage, the tip of the needle should be against the "wall of bone" formed by the pars intervertebralis, articular column, or short transverse process of C6.

After walking off these bony structures, the needle is advanced carefully in an anterior direction, remaining on the plane of the line between the dorsal spine of C6 and the suprasternal notch. Note the middle finger (Fig. 3-11A) or index finger (Fig. 3-11B) under the shaft in these two needle-advancing techniques. Loss of resistance to air occurs simultaneously with a

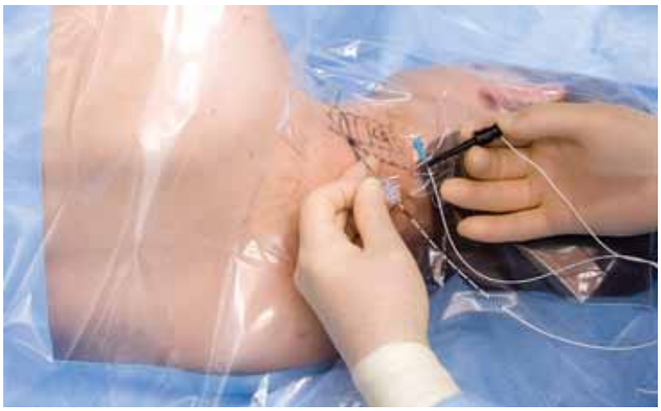


FIGURE 3-12 The nerve stimulator is attached to the proximal end of the catheter, and the distal end of the catheter placed inside the shaft of the needle.

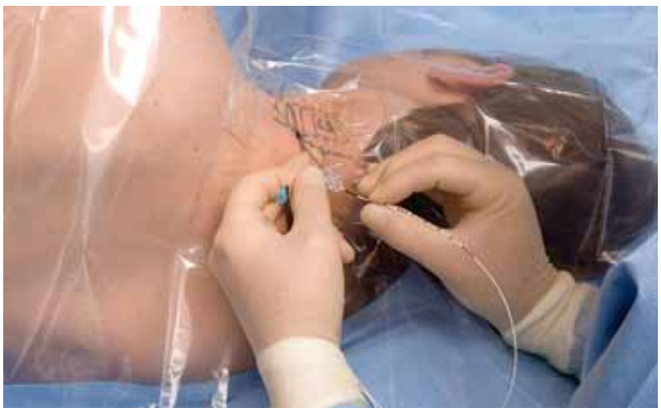


FIGURE 3-13 The catheter is advanced while an unchanged motor response is observed.

motor response. The muscles involved are usually the biceps, deltoid, or major pectoral muscles at the C5-C6 level. This is good if shoulder surgery is planned, but not for major wrist or elbow surgery. If major wrist or elbow surgery is planned, the needle should be withdrawn and slightly redirected caudad. This can be repeated until a triceps or hand motor response is seen, which indicates that the needle is now in the vicinity of the C7-C8 nerve roots—ideal for wrist and elbow surgery. Because the posterior aspect of the roots of the brachial plexus contains mainly sensory fibers, the patient may sometimes report a sensory pulsation just before the appearance of the motor response. This block is ideally suited to the use of ultrasound (Figure 3-17).

The recording on the associated DVD gives a posterior view of the loss of resistance to air and motor response appearing simultaneously. Observing the patient's mouth, it can be seen that the patient reports a sensory pulsation before the motor response appeared. This is more common in young patients. The tip of the needle is now situated between the anterior and middle scalene muscles and is in contact with the C6 root of the brachial plexus.

The nerve stimulator is removed from the needle and attached to the proximal end of the stimulating catheter, and the tip of the catheter is inserted into the needle shaft (Fig. 3-12).

Notice that the proximal part of the catheter and the nerve stimulator clip can be placed in the palm of the left hand, which also holds and manipulates the needle (Fig. 3-13). The right hand advances the catheter tip into the needle shaft and beyond. If ultrasound is used, an assistant holds the ultrasound probe (Figure 3-16).

The nerve stimulator is typically set at a current output of 1 mA or at an output that is comfortable for the patient. The motor response should be unchanged, and the broad black mark on the catheter indicates that the catheter tip is

FIGURE 3-14 The special mark on the catheter at the hub of the needle indicates that the tip of the catheter has not yet protruded beyond the needle tip.

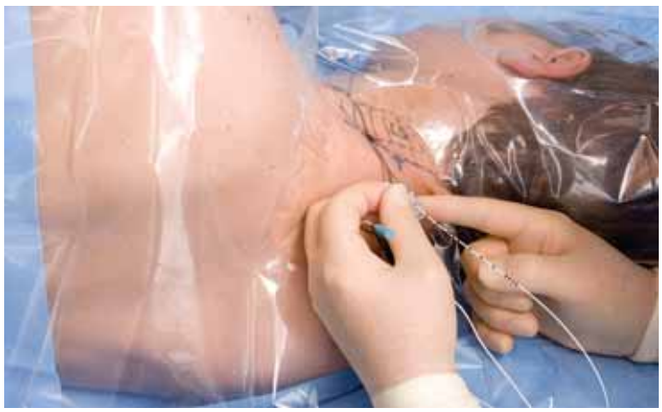


FIGURE 3-15 The needle should not be manipulated if the special mark on the catheter is not visible.

situated at the tip of the needle (Fig. 3-14). It is important not to manipulate the needle if the special mark is not completely visible.

Advance the catheter beyond the needle tip. If the motor response disappears, carefully withdraw the catheter tip to inside the needle shaft, make a small adjustment to the needle by rotating it clockwise or counterclockwise, advancing it slightly, or withdrawing it slightly. Repeat this maneuver until the muscle twitches remain unchanged during catheter advancement (Fig. 3-15). This indicates that the catheter tip is now situated on the nerve root. Advance the catheter approximately 3 to 5 cm beyond the needle tip, but never further than 5 cm.

It may be of considerable help to use ultrasonography to identify the pars intervertebralis and the nerve roots, as illustrated in Figure 3-16. The ultrasound probe is held anterior to the levator scapulae muscle and outside the sterile field. Figure 3-17 illustrates the pars intervertebralis (articular column), nerve roots, and subclavian artery.

Remove the needle without disturbing the catheter, and remove the inner stylet of the catheter (Fig. 3-18). The catheter position can now be reconfirmed by attaching the nerve stimulator to the catheter. The motor response should be unchanged.

The catheter will probably dislodge if it is not secured. The best method of securing the catheter is by subcutaneous tunneling, as illustrated in Chapter 12. This is done by first placing the inner stylet of the needle subcutaneously from a point approximately 1 to 2 mm from the catheter exit site, if a skin bridge is required, to where the tunneling is anticipated. If a skin bridge is not required, the needle stylet enters through the same site as the catheter, with care taken not to damage the catheter. This area has already been anesthetized.

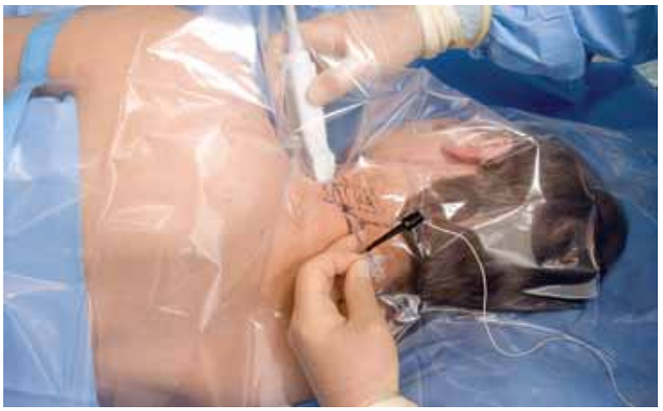


FIGURE 3-16 An ultrasound probe placed anterior to the levator scapulae muscle indicates the position of the needle relative to the bony pars intervertebralis and the nerves of the brachial plexus.

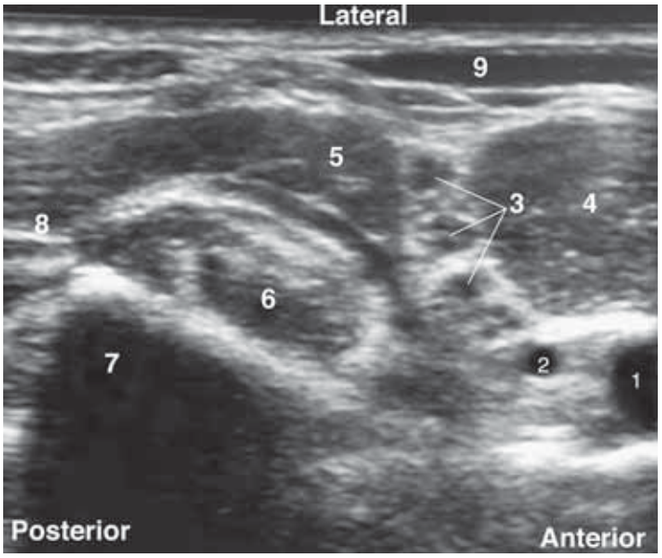


FIGURE 3-17 Ultrasonographic image of the lateral aspect of the neck: 1. Subclavian artery; 2. Vertebral artery; 3. Brachial plexus roots; 4. Anterior scalene muscle; 5. Middle scalene muscle; 6. Posterior scalene muscle; 7. Pars intervertebralis (articular column) of C6; 8. Needle entry from posterior.

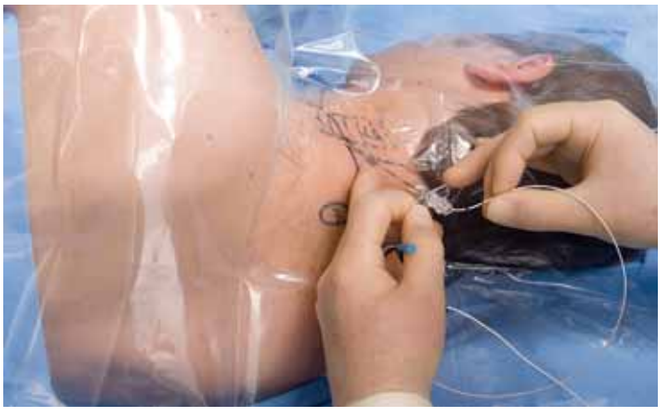


FIGURE 3-18 The needle is removed without disturbing the position of the catheter.

The needle is now "railroaded" back over the stylet and the stylet removed.

The proximal end of the catheter is fed through the needle and the needle is removed, leaving a loop of catheter.

The silicone tubing that protected the catheter tip during packaging is handy to use to protect the skin bridge. The proximal end of the catheter can also be looped through the skin bridge. The skin bridge makes removal of the catheter easier.

Attach the Luer lock connecting device to the catheter and attach the nerve stimulator to the connecting device.

The motor response should remain unchanged. Injection of local anesthetic agent or any other conductor of electricity (e.g., saline) that decreases and disperses the current density at the catheter tip will cause the motor response to stop immediately. This is a positive Raj test and gives final confirmation that the block will be successful.

The catheter is covered with a sterile transparent dressing and the connecting device is placed in the fixation device.

Local Anesthetic Agent and Infusion Choice

Fifteen to 40 mL of ropivacaine 0.5% to 0.75% is usually used for intraoperative analgesia, and an infusion of 0.2% at 3 to 10 mL/hour is used for postoperative pain management. Patient-controlled boluses of 5 to 10 mL with a lockout time of 30 to 120 minutes can be used if indicated.

The concentration of the infusion drug and the rate on infusion should be individualized depending on the clinical situation. If a motor and sensory block is required, such as for rotator cuff repair or total shoulder replacement the first few days after surgery, a relatively high concentration (0.2%) and a relatively high infusion rate (5 mL/hour) can be used. This, combined with patient-controlled boluses of 10 mL locked out at 120 minutes, should give good results. If, on the other hand, sensory block without motor block is required, a low concentration of the drug (e.g., 0.1%) can be used at a low infusion rate (3 to 5 mL/hour), and the patient-controlled boluses can be set at 10 mL and locked out at 60 minutes.

Another strategy is to use a drug concentration of 0.5%, infused at 5 mL/hour for the first 25 hours, which should provide a good motor and sensory block. If the reservoir is filled with 240 mL, an infusion of 5 mL/hour should leave 120 mL in the reservoir after 24 hours. If the reservoir is then filled with saline, the infusion concentration is halved to 0.25%, which should increase the motor function somewhat for the second day. After another 24 hours, there will again be 120 mL left in the reservoir, and it can again be filled with saline, which will now decrease the concentration of ropivacaine to 0.125%. This would allow the motor function to improve further. This process can be repeated until the block is no longer required. This infusion strategy allows for a solid motor block directly after surgery, followed by a gradual return to full motor function and sensation as the pain naturally decreases and requirements for motor function increase.

Catheter Removal

Catheter removal, when the patient no longer requires continuous nerve block and after full sensation has returned to the arm, is done by fixating the proximal end of the catheter and then removing the distal end before removing the entire catheter. The catheter removal technique is illustrated in Chapter 12.

(See continuous cervical paravertebral block movie on DVD.)

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