Chapter 8

# Axillary Blocks

- Single-Injection Axillary Block
- Continuous Axillary Block

## SINGLE-INJECTION AXILLARY BLOCK

### Introduction

The axillary block is done on the branch level of the brachial plexus (1). Because there are seven branches, of which two are sensory nerves, this block is sometimes difficult to master, and it is often impossible to obtain complete block with a single injection.

### Specific Anatomic Considerations

The brachial and antebrachial cutaneous nerves (see Fig. 1-1, [19] and [20]) originate from the medial cord (see Fig. 1-1, [14]). These two nerves and the musculocutaneous nerve in the forearm (see Fig. 1-1, [22]) are sensory nerves. The details of the sheath surrounding the plexus at this level has been described and debated by Thompson and Rorie (2), Winnie and colleagues (3), Partridge and colleagues (4), and Klaastad and associates (5).

Figure 7-1 illustrates the neurotomes of the area that will be blocked if the radial nerve is blocked. This area will likewise be spared if the radial nerve is missed with this block.

Figure 7-3 illustrates the sensory innervation of the median nerve, whereas Figure 7-5 illustrates the area innervated by the ulnar nerve. Figure 7-7 illustrates the area innervated by the musculocutaneous nerve.

The areas supplied by the brachial and antebrachial cutaneous nerves are indicated in Figure 5-7.

### Technique

The patient is positioned in the supine position with the shoulder abducted and the elbow flexed. The axillary artery is identified and marked (Fig. 8-1).

The skin and subcutaneous tissue are anesthetized after disinfection of the skin. Care must be taken not to penetrate the nerve sheathes with the needle at this stage.

The stimulating needle, attached to a nerve stimulator set at a current output of 1 to 2 mA, a frequency of 2 Hz, and a pulse width of 100 to 300 μsec, enters the skin angled slightly cephalad next to the artery, and a distinct "pop" can be felt as the brachial plexus sheath is entered (Fig. 8-2).

The needle can now be adjusted to place it close to the most appropriate nerve or nerves for the planned surgery.

The nerve stimulator is turned down to 0.3 to 0.5 mA when the needle is placed on the most appropriate nerve.

While keeping the needle steady and observing the motor response, local anesthetic agent is injected. The motor response stops immediately on injection. This constitutes a positive Raj test, and is an additional indication that the block to this specific nerve will be successful. The other nerves can now be identified and separately blocked. Ultrasound is also very handy for this block (Figure 8.3).

### Local Anesthetic Agent Choice

Most local anesthetic agents have been used for this block. Typically, 15 to 40 mL of ropivacaine

**FIGURE 8-1** The axillary artery is palpated and marked.

**FIGURE 8-2** After a small skin wheal is raised, the needle entry is perpendicular to the axillary artery.

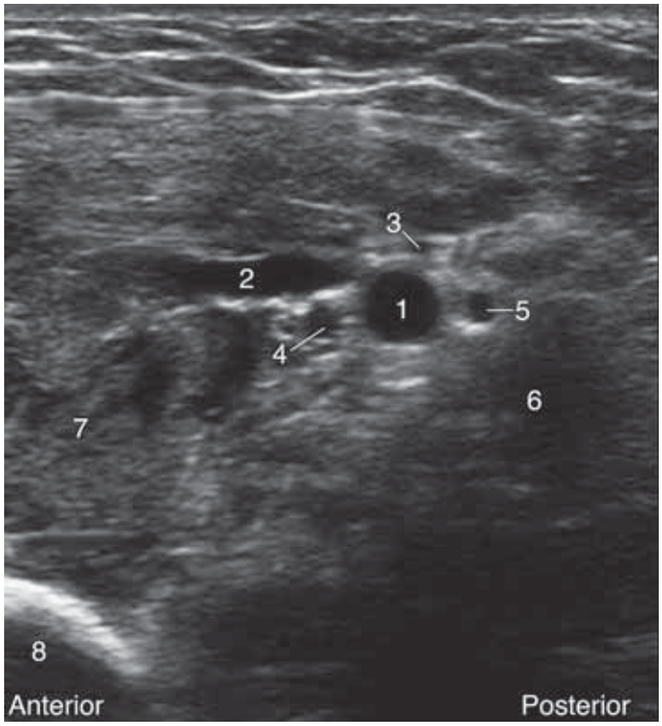


**FIGURE 8-3** Ultrasound image of axillary area. 1 = Axillary artery; 2 = Axillary vein; 3 = Ulnar nerve; 4 = Median nerve; 5 = Radial nerve; 6 = Triceps brachii muscle; 7 = Coracobrachialis muscle; 8 = Humerus.

0.5% to 0.75% is used, of which 10 to 25 mL is injected onto the most appropriate nerve and the remainder into at least one of the other nerves. Adding buprenorphine 0.3 mg or dexamethasone 40 mg to the mixture may lengthen the duration of action of the block, but if a long-acting block is required, it is best to place a continuous nerve block.

(See single-injection axillary block movie on DVD.)

## CONTINUOUS AXILLARY BLOCK

### Introduction

As in the continuous infraclavicular block, the catheter is situated on a specific peripheral nerve for the continuous axillary block (6). This nerve is likely to be the only nerve that will be blocked with the relatively small volumes of local anesthetic agent infused days after surgery,

A

B

**FIGURE 8-4** **A,** A small skin wheal is raised. **B,** The area of intended catheter tunneling is also anesthetized.

and this has proved disappointing in clinical practice. All the peripheral nerves to the arm and forearm need to be blocked for elbow and wrist surgery.

## Technique

The patient is positioned supine with the shoulder joint abducted and the elbow flexed.The skin and subcutaneous tissue (Fig. 8-4A) and intended path of the tunneling of the catheter (Fig. 8-4B) are anesthetized after the skin has been prepared and the area covered with a sterile, fenestrated, transparent dressing.

An insulated 17- or 18-gauge Tuohy needle, attached to a nerve stimulator set to a current output of 1 to 2 mA, a frequency of 2 Hz, and a pulse width of 100 to 300 μsec, enters the skin next to the axillary artery and is directed medially (Fig. 8-5). The needle is held steady and the stylet removed after the most appropriate nerve has been identified and the nerve stimulator output has been turned down to approximately 0.3 to 0.5 mA. This guarantees accurate needle placement, but not accurate catheter placement.

It is important not to inject any conductive fluids such as local anesthetic agent or normal saline through the needle at this point because this will render stimulating catheter placement impossible. If the anesthesiologist subscribes to the notion of "opening of the space," 5% dextrose and water can be used, which will not abolish the electrical stimulus.

The nerve stimulator is now set to 0.5 to 1 mA and attached to the proximal end of the catheter (Fig. 8-6). Note the special mark on the catheter, which indicates that the catheter tip is now situated at the tip of the needle. The catheter is advanced beyond the needle tip; if the motor response disappears, it means that the catheter tip is moving away from the nerve.

**FIGURE 8-5** An insulated Tuohy needle is placed on the appropriate branch of the brachial plexus.

**FIGURE 8-6** The nerve stimulator is attached to the proximal end of the stimulating catheter, which is advanced through the needle.

**FIGURE 8-7** If the motor response is lost, the needle is rotated counterclockwise after the catheter is withdrawn inside the needle shaft.

Withdraw the catheter tip carefully to inside the needle shaft, make a small adjustment to the needle, such as turning it clockwise or counterclockwise or advancing or withdrawing it slightly (Fig. 8-7). Repeat this maneuver as often as necessary until the motor response remains constant during catheter advancement. Advance the catheter 3 to 5 cm beyond the needle tip, but not more than 5 cm.

The needle is removed without disturbing the catheter position.

A special tunneling device can be used to tunnel the catheter subcutaneously. The Tuohy needle and its stylet can also be used. Tunneling

is essential to prevent catheter dislodgement (see Chapter 12). A skin bridge may be important for short- to medium-term catheter use because it facilitates catheter removal. Catheter leakage, however, is common if a skin bridge is used.

The catheter connecting device is attached to the catheter and the nerve stimulator, set to an output of 0 mA, is attached to the fixation device. The nerve stimulator output is slowly turned up until a muscle twitch can just be seen. Local anesthetic agent or any conducting fluids, such as normal saline, can now be injected and the muscle twitches will immediately stop after the injection starts. This constitutes a positive Raj test, which gives further assurance that the secondary block to the particular peripheral nerve will be successful. It does not guarantee complete block to all the nerves, especially not for long-term blocks if low volume infusions are used.

## Local Anesthetic Drug and Infusion Choice

All local anesthetic agents have been used for this block. Typically, 15 to 40 mL of ropivacaine 0.5% to 0.75% is used as the initial bolus, followed by a 5- to 10-mL/hour infusion of ropivacaine 0.2%. It is essential to allow for relatively large patient-controlled boluses of 10 to 15 mL every 60 minutes to recapture unblocked peripheral nerves in the postoperative period, should this become necessary.

## Catheter Removal

The catheter is removed after the patient no longer requires continuous block and full sensation has returned to the limb (see Chapter 12). Any radiating pain during catheter removal may indicate that the catheter has coiled around a nerve, and this situation should be managed with utmost care. Remove the catheter by stabilizing the proximal part and first removing the distal part of the catheter from the skin bridge. Once this is done, keep the distal part sterile and remove the rest of the catheter.

(See continuous axillary block movie on DVD.)

## REFERENCES

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