

## 24. CONTINUOUS PERIPHERAL NERVE BLOCK

### INTRODUCTION

The continuous peripheral nerve block (CPNB) catheter allows the benefits of regional anesthesia to be extended beyond the 8 to 20 hours achieved with single-injection, long-acting local anesthetics. A CPNB is typically used to provide the following:

- anesthesia for surgery and prolonged analgesia postoperatively (eg, shoulder, hip, or knee arthroplasty);
- prolonged analgesia and anesthesia for patients with significant trauma who require multiple surgeries;
- diagnostic or therapeutic treatment for chronic pain syndromes; or
- pain control for patients during aggressive post-operative physical therapy and rehabilitation (eg, with use of a continuous passive motion device).

Figure 24-1. Contents of Contiplex Tuohy package (B Braun Melsungen AG, Melsungen, Germany; used with permission).



Only those with previous experience and competence in single-injection blocks should consider performing CPNB. Please see the chapters on single-injection blocks for the appropriate approaches and indications. Follow these chapters for anatomy, patient positioning, landmarks, needle advancement, and stimulation. *Note: The medical materials are displayed in this chapter for illustration purposes only and should not be considered an endorsement of any product.*

### PROCEDURE

#### Equipment

- 18-gauge continuous block needle system (eg, the Contiplex Tuohy needle system, Figure 24-1 [B Braun Melsungen AG, Melsungen, Germany]) needles in 5-cm, 10-cm, and 15-cm lengths (Figure 24-2). This is an insulated Tuohy design with an uninsulated tip; the system includes the needle and an integrated stimulating wire and extension tubing with a diaphragm allowing for catheter insertion.
- Multiorifice catheter (comes with the Contiplex Tuohy)
- Nerve stimulator
- Chlorhexidine preparation
- Surgical marking pen
- Sterile drape
- Local anesthetic for tunneling
- 3-mL syringe and 25-gauge needle for local anesthetic infiltration
- No. 11 scalpel blade
- Skin adhesive (eg, Dermabond [Ethicon Inc, Somerville, NJ])
- Surgical skin adhesive strips (eg, Steri-Strips [3M, Saint Paul, Minn])
- Adhesive spray (eg, Hollister Medical Adhesive [Hollister Inc, Libertyville, Ill])



Figure 24-2. Contiplex needles, left to right: 5 cm, 10 cm, and 15 cm (B Braun Melsungen AG, Melsungen, Germany; used with permission)

- Transparent dressing (eg, Tegaderm [3M])
- AmbIT (Sorenson Medical Inc, West Jordan, Utah) CPNB infusion pump and tubing (Figure 24-3)
- 16-gauge Angiocath (BD Medical, Sandy, Utah) needle



Figure 24-3. AmbIT (Sorenson Medical Inc, West Jordan, Utah; used with permission) pump and tubing.

## Infection Control

Regional blocks are placed under sterile conditions. Medical personnel should wear a mask, hat, and sterile gloves. A surgical gown can also be considered. Finally, an antimicrobial dressing (eg, BioPatch [Johnson & Johnson Wound Management, Ethicon Inc]) should be placed around the catheter site, if available.

## Steps for Catheter Placement

- Position the patient as for a single-injection block, ensuring that the patient is on standard monitors and has intravenous access for medications.
- Landmarks for catheter placement are identical to those used for single-injection nerve blocks.
- After identifying skin landmarks, use a chlorhexidine sponge for skin disinfection (povidone-iodine solution is an alternative, although less effective, skin disinfectant) and repeat the preparation before draping the patient.
- Connect the venous valve side port to the Contiplex Tuohy needle. Flush the needle with local anesthetic solution, and attach the stimulating wire to the nerve stimulator.
- Remove the CPNB catheter from its package and place the catheter in a sterile and easily accessible position.
- Inject a local anesthetic skin wheal at the needle insertion site.
- Orient the block needle so that the bevel is parallel with the nerve or plexus to be blocked (Table 24-1). Note that the white wire coming from the needle hub is oriented in the same direction as the needle bevel. Thus, the wire provides a visual guide to bevel orientation at all

**TABLE 24-1**

**NEEDLE AND CATHETER SPECIFICATIONS FOR VARIOUS NERVE BLOCKS**

Block	Needle Length	Bevel Orientation	Distance to Thread Catheter
Interscalene	3.8 cm	Anterior and toward axilla	3 cm
Supraclavicular	5 cm	Anterior and toward axilla	3 cm
Infraclavicular	10 cm	Anterior and toward axilla	3 cm
Lumbar plexus	10 cm or (rarely) 15 cm	45° angle lateral and caudal	5 cm
Femoral	5 cm	Anterior and cephalad	5 cm
Sciatic posterior	10 cm or (rarely) 15 cm	Cephalad (toward sciatic notch)	5 cm
Sciatic lateral	10 cm	Cephalad	5 cm
Paravertebral	See Chapter 12, Paravertebral Nerve Block		

times. Proper orientation can facilitate catheter threading.

- Advance the needle using the same techniques as in a single-injection block, maintaining appropriate bevel orientation.
- When successful stimulation is achieved, inject local anesthetic using the same procedure as single-injection blocks. Care should be taken not to inject the anesthetic too fast.

## Threading the Catheter

- Stabilize the Tuohy needle with one hand (it may be helpful to hold the needle with part of the hand braced against the patient).
- Hold the catheter at the distal tip and advance it through the center of the diaphragm. Continue to thread the catheter until it reaches the end of the needle (Table 24-2).

- Advance the catheter in small increments until it reaches the desired distance (see Table 24-1).

**TABLE 24-2**

**CONTIPLEX TUOHY CATHETER PLACEMENT FOR EACH NEEDLE LENGTH**

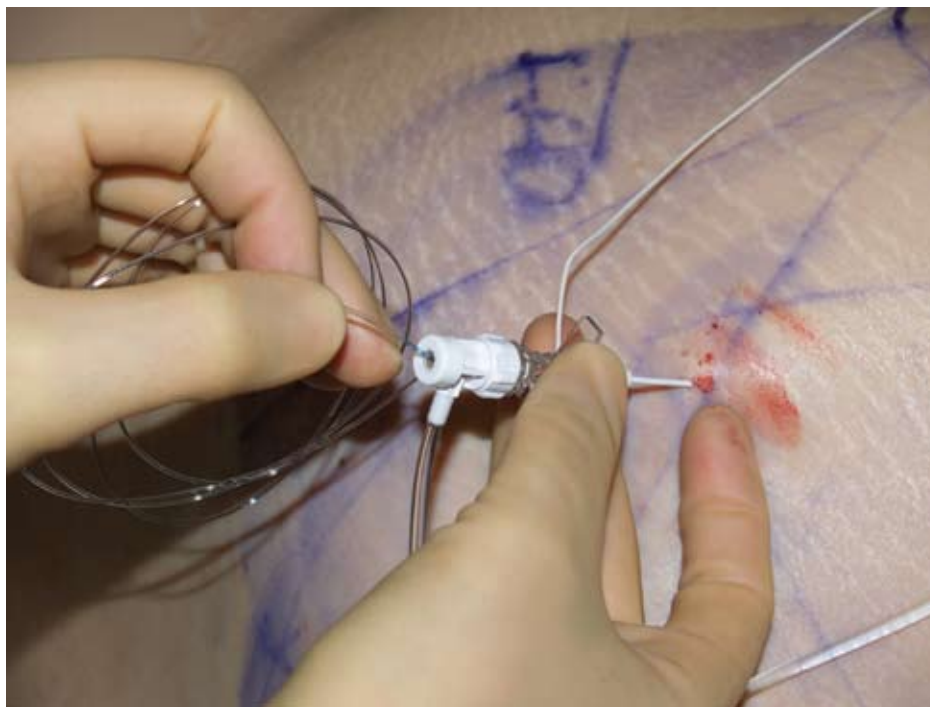
Needle Length	Distance for Catheter to Exit Needle, Extension Tubing, and Diaphragm
5 cm	10 cm
10 cm	15 cm
15 cm	20 cm (catheter markings end at 20 cm)

## Ultrasound

Placing CPNBs under ultrasound is similar to single-injection block using ultrasound described in the individual block chapters. In addition, it may be more difficult to thread the catheter because the CPNB needle may be perpendicular rather than parallel to the nerve.

### Teaching Points

- Use the nondominant hand to hold the needle. The hand is braced against the patient with the needle held at the most proximal end (Figure 24-4).
- Use the dominant hand to thread the catheter.
- Increased resistance to catheter threading at the needle tip is common, and increased force is often needed to pass the catheter beyond the needle tip.
- If the catheter will not advance, confirm that the bevel and needle opening are oriented parallel to the nerve or plexus.
- If the catheter still will not advance, try the following techniques:
  - Relax the hand on the needle, allowing it to assume a natural position, and then grip the needle and attempt to thread the catheter again.
  - Rotate the needle 45° and retry.
  - Put a slight backward tension on the needle and retry.
  - Finally, attempt to thread the catheter while simultaneously infusing a small amount of local anesthetic or normal saline through the needle extension tubing.



**Figure 24-4.** Stabilize the Tuohy needle with one hand. It is helpful to have one part of the hand braced against the patient and the other holding the proximal end of the needle near the diaphragm. Hold the catheter at the distal tip and push it through the center of the diaphragm.

### Securing the Catheter

- If the catheter is not to be tunneled, hold the catheter steady while removing the needle (similar to an epidural catheter placement).
- Place the syringe connector on the end of the catheter, aspirate, and test dose the catheter with 5 mL of either 1.5% mepivacaine or 0.5% ropivacaine with 1:400,000 epinephrine.
- After a negative test dose (no increase in heart rate or aspiration of blood), ensure that the site is clean and dry. Use skin adhesive (Dermabond) to seal the area where the catheter exits the skin. Allow the adhesive to dry.
- Spray a light coating of spray adhesive around the catheter. Ensure that the area sprayed is

larger than the area of the transparent dressing (Tegaderm) that will be used to cover the site. Allow time for the spray adhesive to become sticky.

- Loop the catheter on the skin and apply three skin adhesive strips (Steri-Strips) to hold the catheter in place.
- Apply the transparent dressing over the catheter and skin strips, ensuring that all the edges of the dressing are completely adherent to the skin. **Do not place tape over or around the transparent dressing; this would result in tape burns from skin traction and loss of dressing adherence because of trapped moisture.**
- Label the catheter with side and type of CPNB infusion (eg, right femoral block) and date placed.

## Tunneling the Catheter

CPNB catheters expected to remain in place for more than 3 days should be tunneled. Tunneling makes the catheter less likely to fall out and may decrease the risk of infection.

- After successfully threading the catheter, maintain a neutral catheter position and withdraw the needle 0.5 to 1 cm.
- Anesthetize the skin with local anesthetic along a track 2 to 4 cm lateral to the needle insertion site (Figure 24-5).



Figure 24-5. Create a local anesthetic skin wheal, starting 2 to 4 cm lateral to the needle position and moving in a straight line toward the needle insertion site.



Figure 24-6. Make a skin nick with the no. 11 scalpel blade at the needle insertion site.

- Make a small skin nick with the no. 11 scalpel blade at the needle insertion site (Figure 24-6).
- Insert a 16-gauge Angiocath needle starting at the lateral aspect of the localized skin. The tip of the Angiocath should exit the skin incision made by the scalpel blade immediately adjacent to the Tuohy needle. Try to avoid leaving a skin bridge between the Angiocath and the Tuohy needle. Note that the CPNB needle is protecting the catheter during this procedure (Figure 24-7).

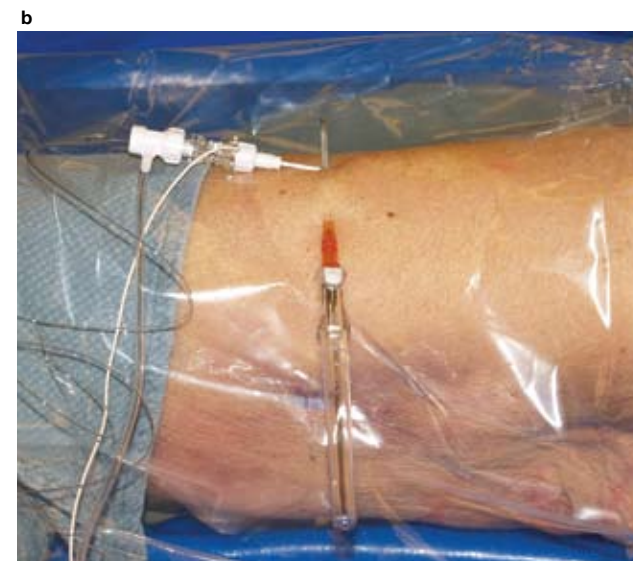


Figure 24-7. (a) Insert a 16-gauge Angiocath (BD Medical, Sandy, Utah; used with permission) needle starting at the lateral aspect of the localized skin wheal. (b) The tip of the Angiocath should exit the skin incision made by the scalpel blade immediately adjacent to the Tuohy needle.

- Remove the Angiocath needle and leave the Angiocath in place.
- Remove the Tuohy needle and leave the catheter in place.
- Thread the CPNB catheter through the tip of the Angiocath and pull the CPNB catheter through (Figure 24-8).



Figure 24-8. Thread the distal end of the CPNB catheter through the Angiocath, and pull the CPNB catheter through.

- Pull the regional anesthesia catheter until it seats within the skin nick. Do not allow the catheter to kink at this point (Figure 24-9a).
- Carefully remove the Angiocath without displacing the CPNB catheter (Figure 24-9b).
- Test dose the catheter.
- Clean and dry the CPNB catheter site. Glue both sites closed with skin adhesive glue (Figure 24-10).



Figure 24-9. (a) Pull the regional anesthesia catheter until it seats within the skin nick, and (b) remove the Angiocath.



Figure 24-10. Clean and dry the CPNB catheter site. (a) Glue both sites closed with skin adhesive glue, and (b) spray a light coating of adhesive spray around the catheter.

- Secure the catheter as previously described (Figures 24-10b through 24-13).

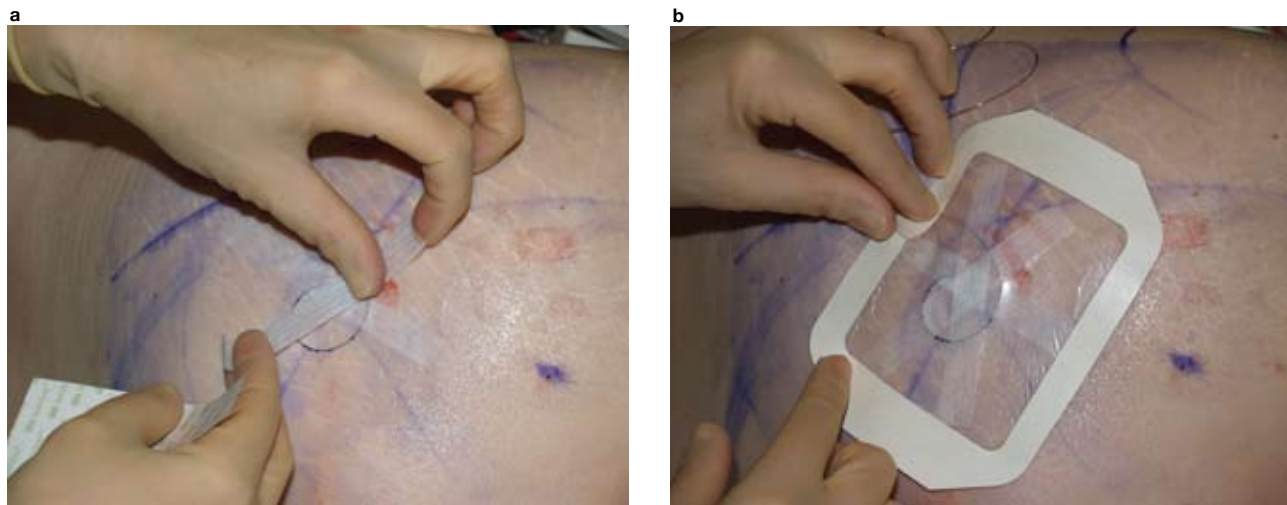


Figure 24-11. (a) Loop the catheter on the skin and apply three skin adhesive strips to hold the catheter in place. (b) Apply a transparent skin dressing over the area. Ensure that all edges of the skin dressing are completely adherent to the skin. The catheter dressing should not prevent visual inspection of the catheter site.

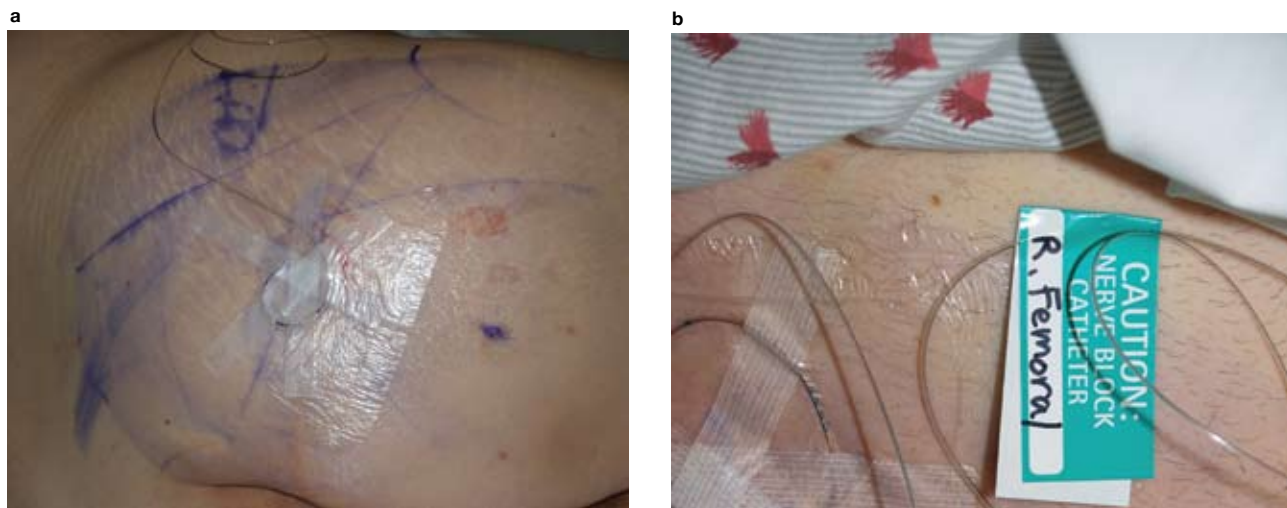


Figure 24-12. (a) Do not place tape around the clear skin dressing. (b) Label the CPNB catheter.



Figure 24-13. Start the local anesthetic infusion.

## Continuous Paravertebral Catheters

Different equipment and techniques are required to place thoracic paravertebral catheters; for instance, a single orifice (open-tip) epidural catheter is used rather than a multiorifice catheter. The single orifice catheter is used because the paravertebral space is small and allows only 2 cm of catheter to be threaded into the space. If a multiorifice catheter were used for this block, at least one hole of the multiorifice catheter would be outside the paravertebral space and the local anesthetic infusion would leak out and track retrograde along the catheter path.

### Equipment for Paravertebral Catheters

- 18-gauge Tuohy epidural needle (this has centimeter markings on the needle)
- Side port and diaphragm from the 18-gauge Contiplex Tuohy needle
- Single-orifice, open-tip, epidural catheter (Figure 24-14)
- 22-gauge Tuohy needle used for single injection paravertebral blocks

**Landmarks for Paravertebral Catheters.** Same as for a single-injection paravertebral block.



Figure 24-14. Single-orifice catheter.



Figure 24-15. 22-gauge Tuohy needle used as a finder of the transverse process.

### Procedure for Paravertebral Catheters

- Attach the side port of the Contiplex Tuohy needle to the 18-gauge epidural Tuohy needle.
- Use the 22-gauge single-injection Tuohy needle as a finder needle to locate the transverse process at the level where the catheter will be placed (Figure 24-15).
- Replace the finder needle with the 18-gauge epidural Tuohy needle.
- Enter the paravertebral space with the 18-gauge Tuohy needle in the same manner as for single injection paravertebral block (Figure 24-16).
- Slowly bolus 10 to 15 mL of an appropriate local anesthetic solution containing epinephrine through the 18-gauge Tuohy needle.
- Attempt to thread the single-orifice epidural catheter through the diaphragm and needle 2 cm



Figure 24-16. (a) 18-gauge epidural Tuohy needle with the side port of the Contiplex Tuohy needle attached. (b) Push the needle tip caudad to facilitate catheter threading.

## DAILY MANAGEMENT

past the end of the Tuohy needle into the paravertebral space. *Note: The paravertebral space is small, and these catheters are frequently difficult to thread. A catheter that is very easy to thread may be in the intrapleural space.*

- If you are unable to thread the catheter, rotate the needle 90° laterally or angle the needle tip either cephalad or caudad. All three maneuvers are often required.
- After threading the catheter, remove the Tuohy needle, taking care not to withdraw the catheter as well.
- Attach the syringe connector to the catheter. Test dose the catheter with 5 mL of local anesthetic containing 1:400,000 epinephrine. If you cannot inject anesthetic through the catheter, the open tip of the catheter is likely pushed up against the rib. Pull the catheter back 0.25 cm and reattempt to inject.
- Secure the catheter in the same manner as a non-tunneled CPNB catheter. Pay particular attention to sealing the catheter exit site with skin adhesive glue. A watertight seal is necessary to prevent leakage of local anesthetic solution around the catheter.

## INFUSIONS

The maximum number of catheters is usually two (on rare occasions three). Total infusion amounts (continuous plus bolus) greater than 20 mL/h are usually avoided. However, based on patient condition and the judgment of the provider, certain patients may receive more than 20 mL/h of 0.2% ropivacaine. See Chapter 3, Local Anesthetics, Table 3-3.

All patients with CPNB catheters must be evaluated at least once daily. A tracking system should be used to ensure that all such patients are clinically monitored by providers experienced with CPNB. The hospital or unit acute pain service is usually responsible for this activity. Routine management of CPNB catheters includes the following measures:

- Evaluate vital signs (including fever) for the last 24 hours.
- Assess any changes in the patient's medications that could affect the CPNB infusion, such as anti-coagulants and adjunct pain medication.
- Evaluate sleep, pain score, and satisfaction with pain control.
- Inspect and palpate the catheter site for evidence of dislodgement or infection.
- Confirm that the correct local anesthetic medication is infusing in the correct patient.
- Confirm the desired infusion rate, bolus amount, lockout time, and local anesthetic bag volume.
- Appraise the patient for signs or symptoms of local anesthetic toxicity (see Chapter 3, Local Anesthetics).
- Initiate heel precautions for patients with sciatic catheters, who may be at increased risk for pressure ulcers of the heel. Ideally the heel should be elevated and off the bed at all times.
- Determine if the patient needs additional pain medications.
- Determine if the patient should be weaned from the catheter, or if the catheter should be removed.
- Generate a daily clinical note on each patient documenting management of the CPNB catheter.

## ENOXAPARIN

Prophylactic enoxaparin (Lovenox, Sanofi-Aventis, Bridgewater, NJ) is defined as either 30 mg twice a day or 40 mg daily. In patients receiving prophylactic enoxaparin, delay placement or removal of CPNB catheters until 10 to 12 hours after the last enoxaparin dose. After removing a catheter, wait 2 hours before dosing with enoxaparin.

Therapeutic enoxaparin is defined here as anything greater than 30 mg twice a day. Usually therapeutic enoxaparin is either 1 mg/kg twice a day or 1.5 mg/kg daily. Delay the placement or removal of CPNB catheters until 24 hours after the last enoxaparin dose in patients receiving therapeutic enoxaparin. Do not place continuous lumbar plexus catheters in these patients. If a continuous lumbar plexus catheter is in place and the patient is subsequently started on therapeutic enoxaparin, removal of that catheter is recommended. Other CPNB catheters may be placed or continued in patients receiving therapeutic enoxaparin at the discretion of the provider, after thorough discussion with the patient and primary care team on the risks and benefits of CPNB placement or continued CPNB use.

If a CPNB catheter appears infected, use clinical judgment to determine whether to wait the recommended amount of time after the last enoxaparin dose before removing the catheter or to remove it immediately.

Patients may be taking a variety of anticoagulation medications. To date, no clear guidance exists on the use of CPNB catheters in patients taking anticoagulants (other than heparins). In patients with an international normalized ratio greater than 1.5, decisions must be balanced between the benefits of CPNB catheters for pain relief versus the risk of bleeding into the region of the body where the block is placed.