chapter VI

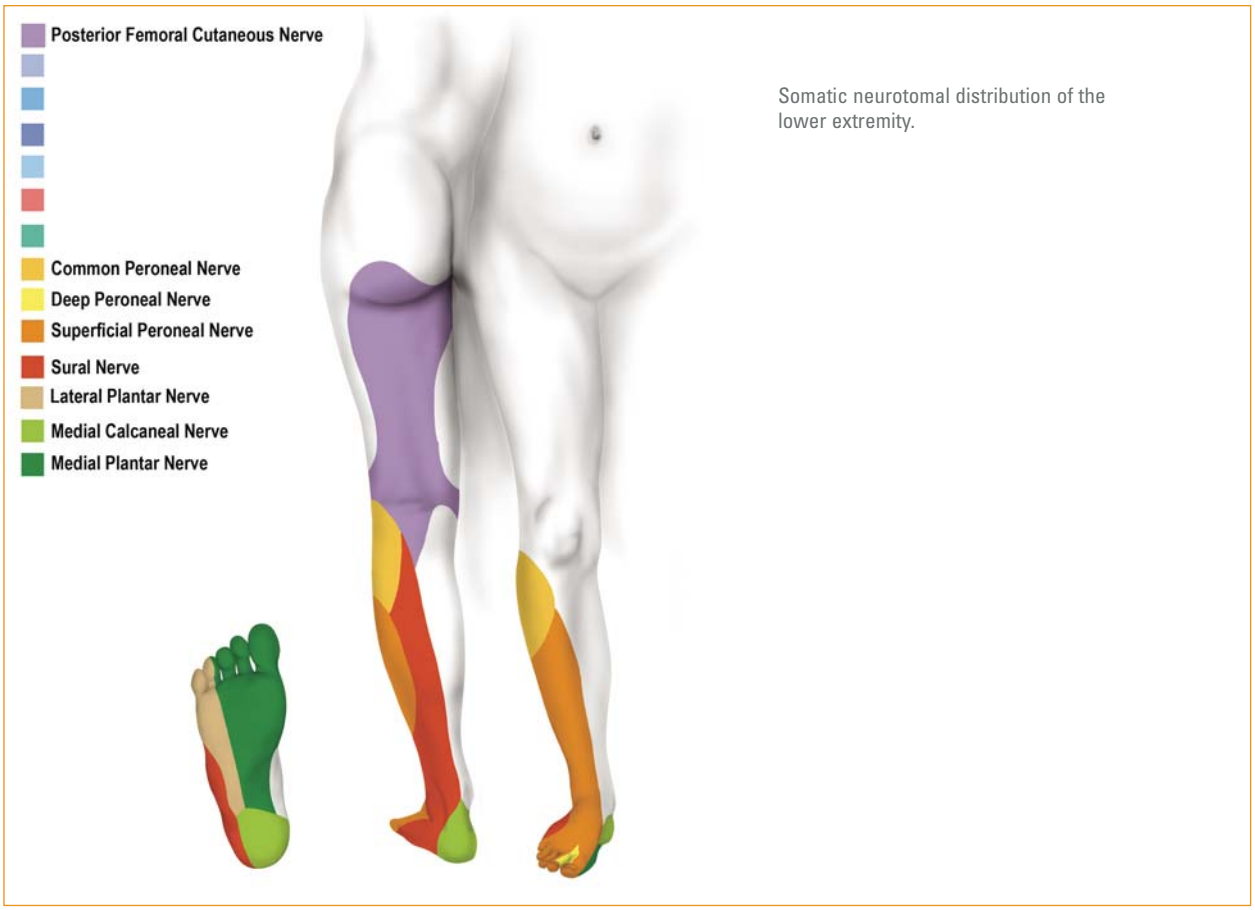
Continuous Sciatic Nerve Block

Introduction

Due to the intricacy of the nerve supply of the joints of the lower extremity, sciatic nerve block on its own is almost never adequate as sole anesthetic for lower limb joint surgery. It is almost always necessary to block of the other peripheral nerves to the lower extremity as well. Sciatic nerve block is therefore usually performed in conjunction with femoral nerve block, or at least saphenous branch of the femoral nerve block at the level of the knee or ankle.

The sensory distribution of the sciatic nerve supply is outlined in Figure 6.1. "Single injection" sciatic nerve blocks are numerous because the sciatic nerve has a long course in the upper leg. Numerous "sciatic nerve blocks" have been described and most carry the name of some or other author. This communication will describe the subgluteal approach to the sciatic nerve, since it is the belief of the current authors that this is the most appropriate approach for continuous sciatic nerve block. Other approaches have been described and are being used successfully, but we feel that the catheter for continuous sciatic blocks, as for all continuous nerve blocks, should be where surgical tourniquets are usually not placed and tourniquets for lower leg surgery is usually applied in the mid-femoral area. Continuous nerve block catheters should therefore probably not be inserted in this area. The presence of a continuous catheter under the pressure of a tourniquet may well cause pressure damage to the nerves, although this notion has not yet been tested by formal research. The reader is referred to standard textbooks for all the different approaches to the sciatic nerve and one favorite approach should be chosen for "single shot" blocks. Because of the presence of all the blood vessels in the vicinity of the sciatic notch and the possibility of nerve impingement under the piriform muscle, the present authors do not advise the standard Labat approach. It is our contention that the

subgluteal, mid-femoral, popliteal, anterior or lateral approaches to the sciatic nerve are probably safer and easier to perform. For "single injection" block a Stimuplex needle (BBraun, Melsungen, Germany) or Arrow Quick Flash® Catheter needle is typically used and the local anesthetic agent is injected after location of the nerve with the nerve stimulator set at 0.4–0.6 mA and 200–300 μs. Muscle twitches that will be met with the most frequent successes of the block are flexion of the toes.



Somatic neurotomal distribution of the lower extremity.

Figure 6.1

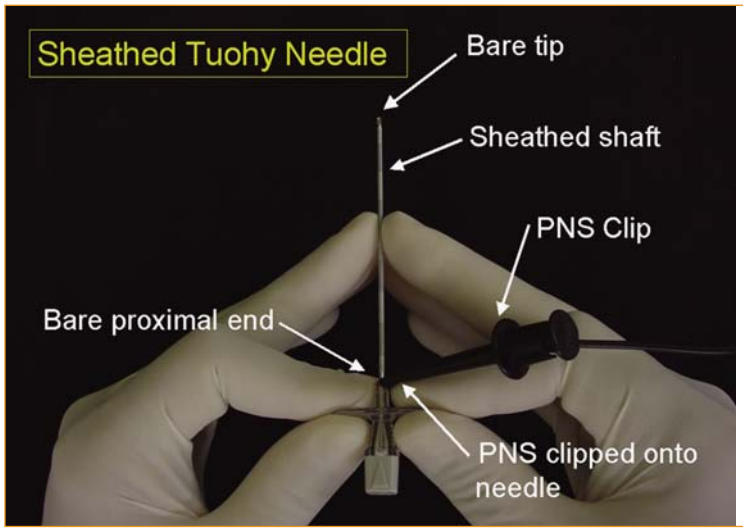
Most continuous catheter techniques that developed after the initial attempts of Ansbro in 1946[2] were hampered by inaccurate catheter placement or catheter dislodgment. In order to provide reliable analgesia for lower extremity surgery and prevent readmission due to failed catheter placement, it was necessary to develop a method to ensure real-time catheter positioning (i.e., during placement). This can now be done immediately, rather than hours later when the initial block has worn off, for all continuous peripheral nerve blocks, by stimulating the nerves *via* both the needle through which the catheter is placed and *via* the catheter itself.[3] This accuracy of catheter placement is combined with a method to secure the catheter so that it does not become dislodged. Although it is probably not always strictly necessary to place the needle and catheter for continuous psoas compartment block with the aid of a nerve stimulator, and loss of resistance to air may also be used successfully, it may give more reliable results if a nerve stimulator and loss of resistance to air are used. This author strongly prefers the use of a nerve stimulator for most "single shot" and continuous peripheral nerve blocks.

Indications

Sciatic nerve block is mainly indicated for the management of pain associated with unilateral ankle, foot and lower leg surgery. It is important to note that the saphenous nerve supplies the medial aspect of the lower leg and ankle and even foot, which is a branch of the femoral nerve. "Single shot" sciatic nerve blocks usually last a relatively long time—up to 36 hours—and continuous nerve block is therefore indicated for special cases. Ankle arthroplasty surgery is a good example of an indication for sciatic nerve block. Ankle block is probably more appropriate for foot surgery *per se*.

Equipment:

A sheathed insulated 17-gauge Tuohy needle (Arrow International, Reading, PA, USA) (Figure 6.2a) and a catheter with an inner steel spring capable of conducting electrical impulses to its distal uncovered "bullet-tip" end—a "stimulating catheter" (Figure 6.2b)—are used for the methods described here (Arrow StimuCath®, Arrow International, Reading, PA, USA)



The StimuCath needle is an insulated Tuohy needle with a bare tip and a bare proximal area.

PNS = Peripheral Nerve Stimulator.

The StimuCath catheter has an inner spring reinforcement, which is electrically conductive and continues from its proximal to its distal bare end of the catheter.

Figure 6.2a—StimuCath needle

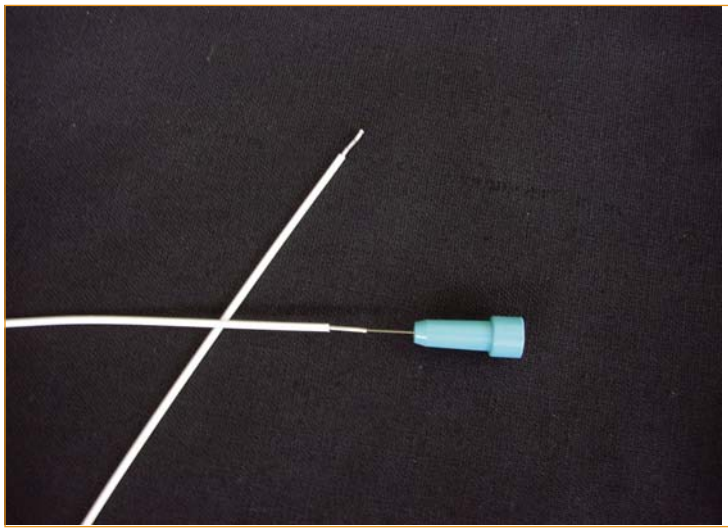


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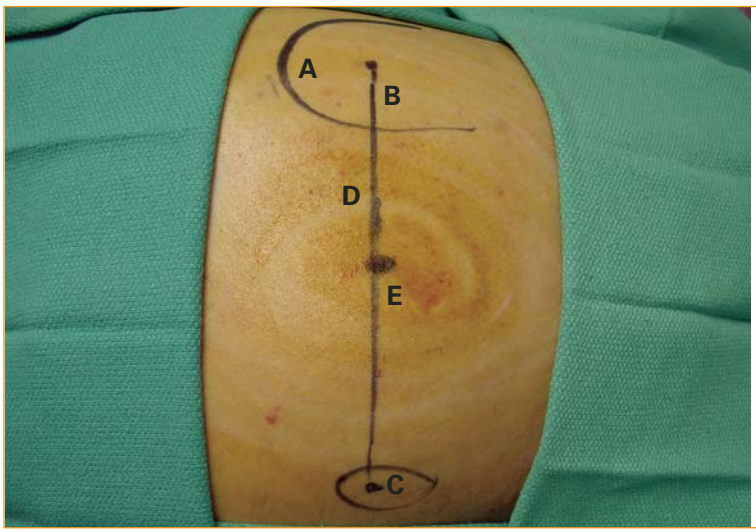
Figure 6.2b—StimuCath catheter

Anatomy

Figure 6.3—Anatomy

Anatomic landmarks



(A) Greater trochanter of the femur
(B) Midpoint of the greater trochanter
(C) Midpoint of ischial tuberosity
(D) Line connecting B and C
(E) Midpoint of line D. (Point of needle entry)

Figure 6.4—Anatomical landmarks

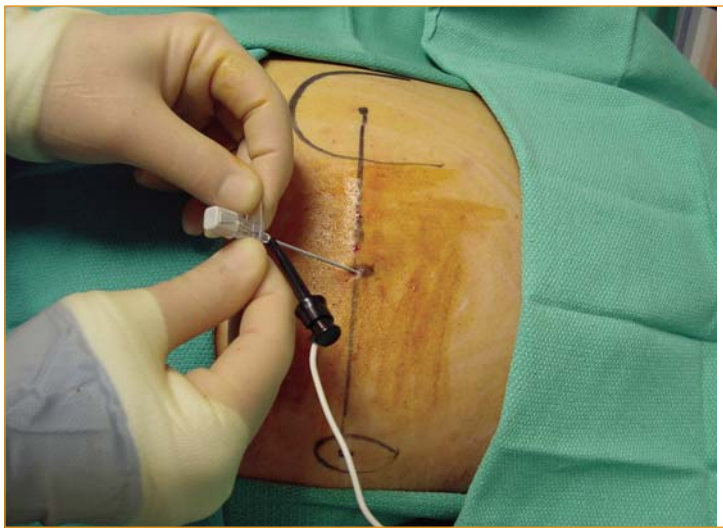
Technique

Patient position

The patient is positioned in the Sims's position with the operative side uppermost and the upper ankle positioned on the lower knee.

Needle Placement

After liberal skin and subcutaneous tissue infiltration of local anesthetic agent (beware not to block the sciatic nerve with this!), the needle enters the skin aiming approximately 45 degrees caudad from a point midway on a line joining the midpoint of the greater trochanter of the femur and the midpoint of the ischial tuberosity (Figure 6.4). The nerve stimulator is clipped to the proximal bare area of the needle. Aim the bevel of the needle in the direction in which the catheter is intended to go—caudad in this instance (Figure 6.5). Twitches of the muscles moving the foot (preferably flexion of the toes) should be sought with the nerve stimulator set approximately at 0.5 mA (0.3–0.6 mA) and a pulse width at 200–300 μs.

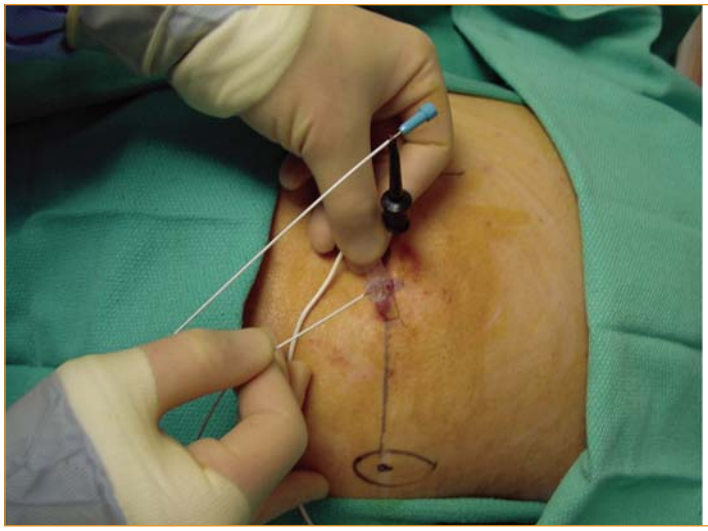


The needle enters the skin midway on a line connecting the midpoint of the greater trochanter of the femur and the midpoint of the ischial tuberosity. Advance the needle until the sciatic nerve is encountered. Flexion/extension of the toes is the best indicator that the needle is close to the nerve.

Figure 6.5—Needle entry

Catheter placement

The nerve stimulator clip is now removed from the needle and attached to the proximal end of the stimulating catheter (Figure 6.6).



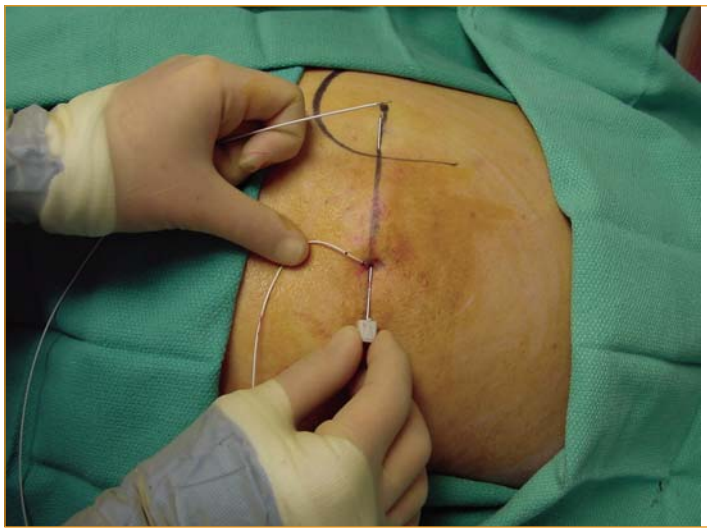
The needle is held steady; the nerve stimulator is now clipped to the proximal end of the catheter and the catheter in advanced through the needle. There should be no change in the quality of the muscle twitches. Be sure that the same muscles are twitching at the same intensity.

Figure 6.6—Catheter placement

- Introduce the stimulating catheter into the needle.
- The muscle twitches should begin again and should be unchanged. The catheter is then gradually advanced beyond the tip of the needle for a distance of approximately 3–5 cm. The muscle twitches should continue unchanged over the entire distance of the catheter advancement.
- If stimulation ceases during catheter advancement, the catheter should be carefully withdrawn to inside the shaft of the needle, the needle position changed in rotation, angulation or depth until the catheter can be easily advanced with unchanged muscle twitches throughout the procedure.
- The catheter is now correctly placed near the femoral but will most likely dislodge over time unless secured.

Tunneling to secure catheter

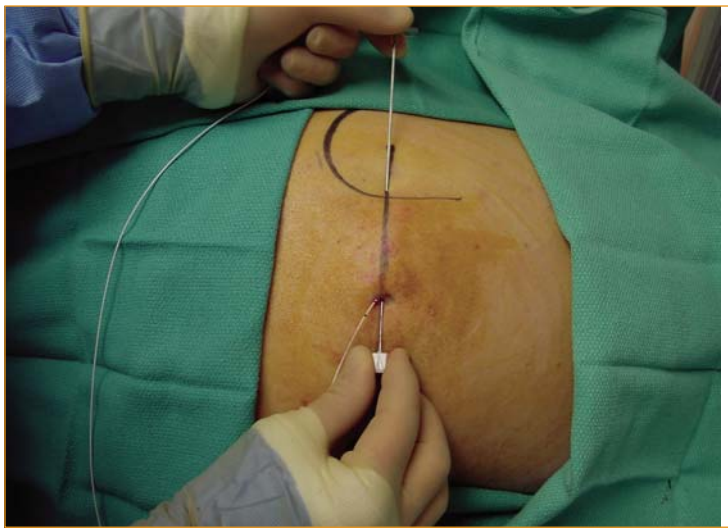
> Penetrate the skin with the inner steel stylet of the needle 1–3 mm from the catheter entry site and advance the stylet subcutaneously in a lateral direction to exit the skin 8–10 cm laterally (Figure 6.7).



Insert the inner stylet of the needle 2–3 mm from the catheter exit wound and advance subcutaneously to exit the skin 6–10 cm laterally. Be sure that this skin has been infiltrated with local anesthetic agent previously.

Figure 6.7—Tunneling

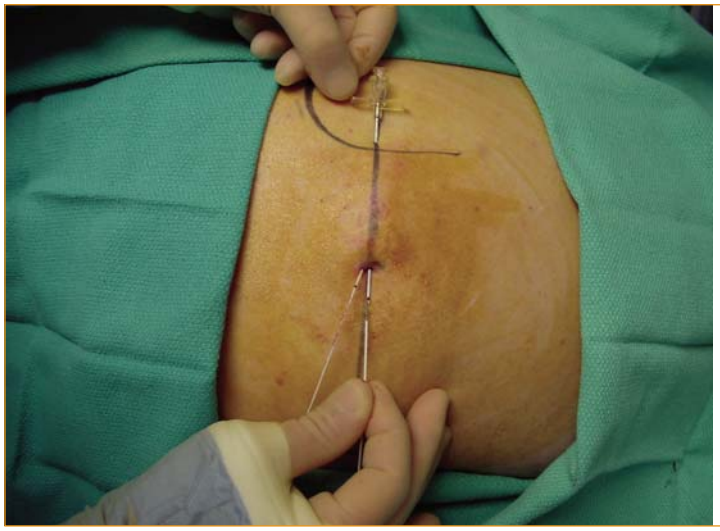
> "Rail-road" the needle over the stylet (Figure 6.8).



"Rail-road" the needle back over the stylet.

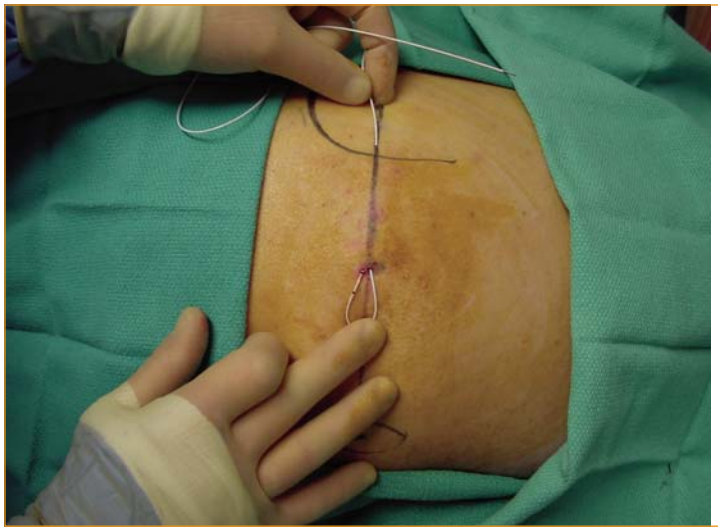
Figure 6.8—Tunneling

> Remove the stylet and feed the catheter retrogradely through the needle. After passage of the catheter, remove the needle and observe the skin bridge (Figure 6.10).



Remove the stylet from the needle and feed the proximal end of the catheter through the needle.

Figure 6.9—Tunneling



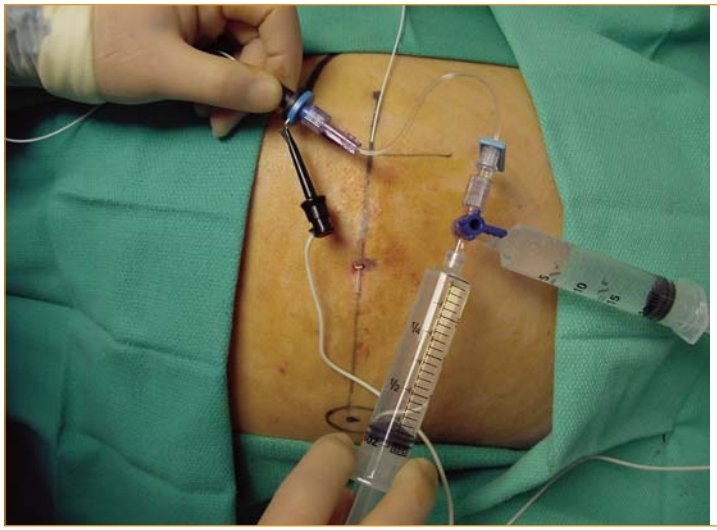
Remove the needle and secure the catheter with sterile dressings. Observe skin bridge. If the skin bridge is undesirable, allow the needle to exit through the same whole in the skin as the catheter. Be careful not to damage the catheter with the needle.

Figure 6.10—Tunneling

Final stimulation test

> Apply the SnapLock™ (Arrow International, Reading, PA, USA) device onto the proximal end of the catheter.

> Apply the nerve stimulator to the SnapLock and perform a final stimulation test—sometimes referred to as the "Raj test" (Figure 6.11). The muscle twitches disappear immediately after local anesthetic agent injection has commenced.



Inject local anesthetic agent while stimulating the nerve via the SnapLock (Arrow Intl, Reading PA, USA) now attached to the catheter. Set the nerve stimulator to the lowest output that will still cause brisk muscle twitches and note that the twitches stop immediately once the injection is started. This provides additional confirmation that the block will be successful and is sometimes referred to as the "Raj test." Inject the rest of the bolus dose in 5 ml increments.

Figure 6.11—Final stimulation test ("Raj test")

Drugs

Initial bolus injection

The authors use 0.5 ml/kg ropivacaine (0.5–0.75%) or bupivacaine (0.5%) as a bolus injection for intra- and postoperative analgesia if the block is combined with general anesthesia. If it is used as sole anesthetic (usually in combination with a sciatic nerve block), 40 ml is usually required.

Continuous Infusion

Breakthrough pain is rare and patient satisfaction high in patients when an infusion of 5 ml/hr of 0.2% ropivacaine or 0.25% bupivacaine is used. Patient-controlled injection of 5–10 ml at a lockout time of 30–60 minutes can be used with satisfactory results.[5]

Sedation for placing block

Very little or no sedation is typically required for this block. Based on a study of sedation for retrobulbar block,[6] this author uses midazolam 10–50 µg/kg combined with remifentanil 0.3–0.5 µg/kg given as an intravenous bolus 1 minute before the placement of the block. The remifentanil injection can be repeated when necessary if painful conditions such as fractures are present. Alfentanil or fentanyl is also appropriate in this situation.

Blocks are usually performed in non-anesthetized patients, but under certain circumstances they may be performed in anesthetized patients. These circumstances include situations such as if the patient is a child, when very painful conditions, for example, fractures, are present or when the patient is very anxious. The skin and subcutaneous tissue should always be properly anesthetized for blocks as well as for the intended tunneling path of the catheter.

Special precautions:

- The catheter should always be withdrawn entirely into the needle before the needle is repositioned. Catheter withdrawal should be done carefully to prevent damage to the catheter.
- The presence of significant paresthesia during catheter advancement should be carefully evaluated before advancement of the catheter.
- Be suspicious of intraneural needle or catheter placement if brisk muscle twitches are present with nerve stimulator settings less than 0.2 mA (except in children).
- Since an indwelling catheter is left in situ for some time, formal sterile procedures are necessary. The entry site of the catheter should be inspected daily for early signs of infection.

> Sensation should be allowed to return to the limb before the catheter is removed. Catheters should never be cut while being removed. If the surgical pain is still intolerable, a bolus of the local anesthetic agent should be injected and the infusion initiated again. If surgical pain is tolerable or manageable with simple analgesics, the catheter may be removed by gently pulling on it in the direction of the tunneling or by removing the part distal to the skin bridge first. Radiating pain experienced during removal may indicate that the catheter has curled around a nerve root. Surgical removal of catheters has never been reported to be necessary but should probably be considered if radiating pain persists during attempted removal. The skin bridge makes removal easier.

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