# CONTINUOUS SCIATIC NERVE BLOCK

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## INDICATIONS

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 1. "Single shot" 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 author 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.

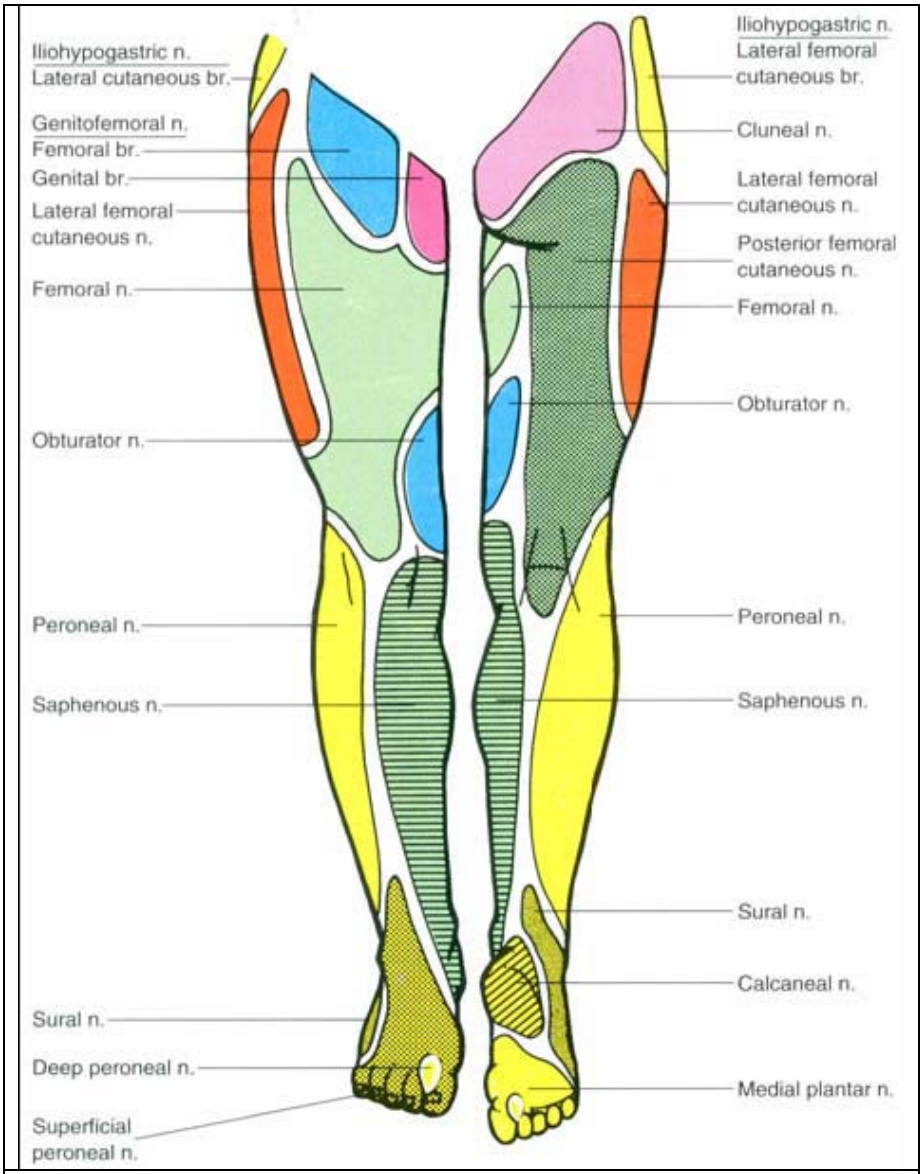


Figure 1a. *Somatic neurotomal distribution of the lower extremity. (Reprinted from Brown DL. Atlas of Regional Anesthesia [1]).*

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

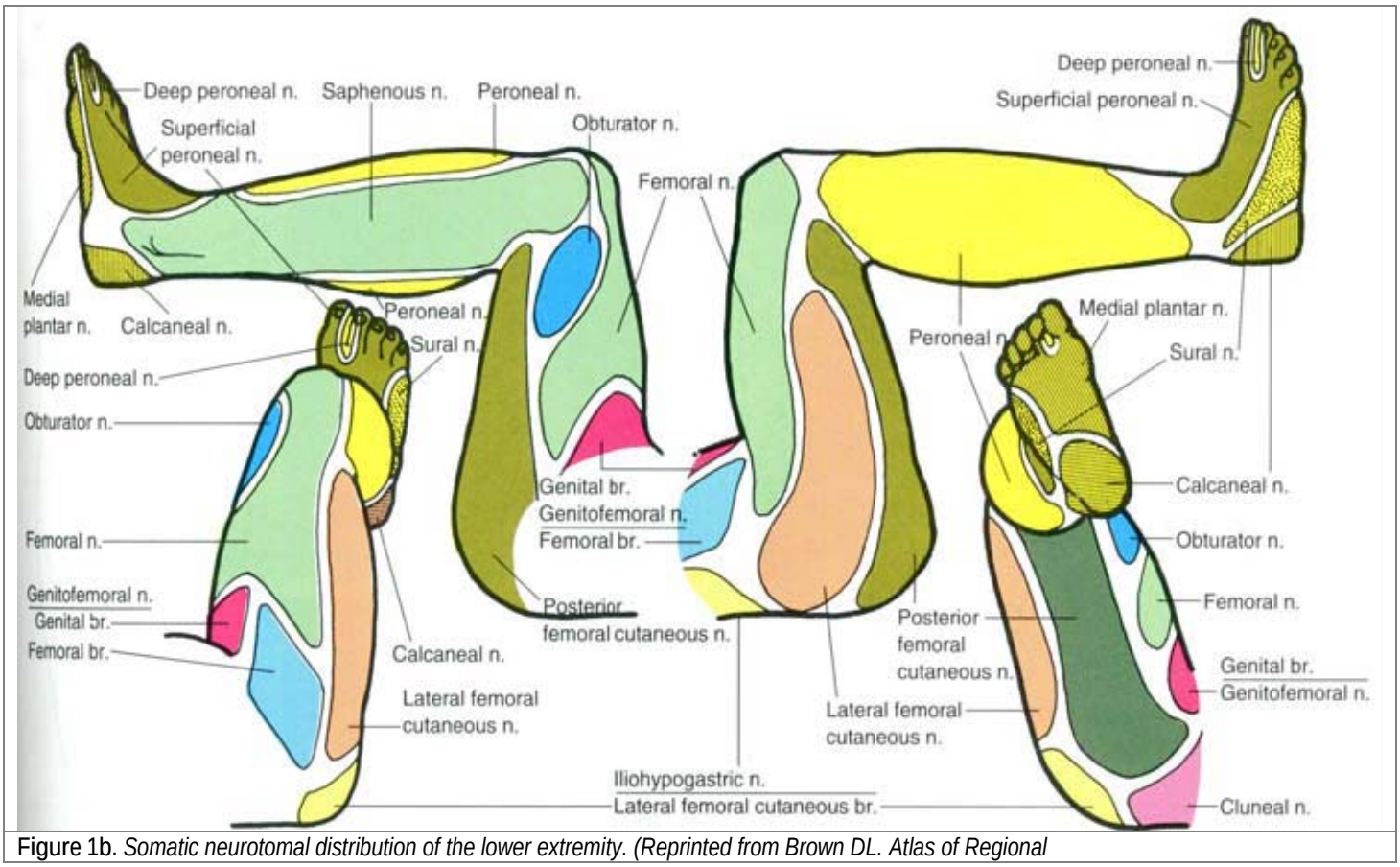


Figure 1b. *Somatic neurotomal distribution of the lower extremity. (Reprinted from Brown DL. Atlas of Regional*

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 shot" block a Stimuplex needle (BBraun, Melsungen, Germany) 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 - 300μs. Muscle twitches that will be met with the most frequent successes of the block are flexion of the toes.

Most continuous catheter techniques that developed after the initial attempts of Ansbro in 1946 [2] were hampered by inaccurate catheter placement or catheter dislodgement. 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 (StimuCath, Arrow International, Reading, PA, USA) (Figure 2a) and a catheter with an inner steel spring capable of conducting electrical impulses to its distal uncovered "bullet-tip" end – a "stimulating catheter" (Figures 2b) – are used for the methods described here (Arrow StimuCath™, Arrow International, Reading, PA, USA).

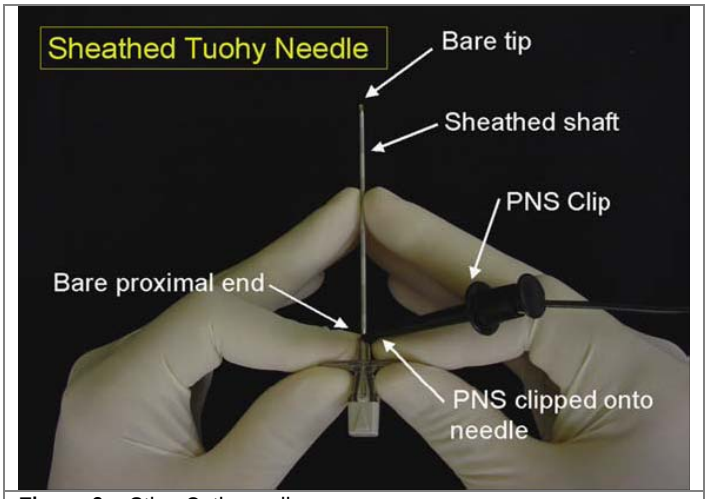


Figure 2a: StimuCath needle
*The StimuCath needle is an insulated Tuohy needle with a bare tip and a bare proximal area.*
*PNS = Peripheral Nerve Stimulator.*
*The StimuCath catheter has an inner spring reinforcement, which is electrically conductive and continues from its proximal to its distal bare end of the catheter.*

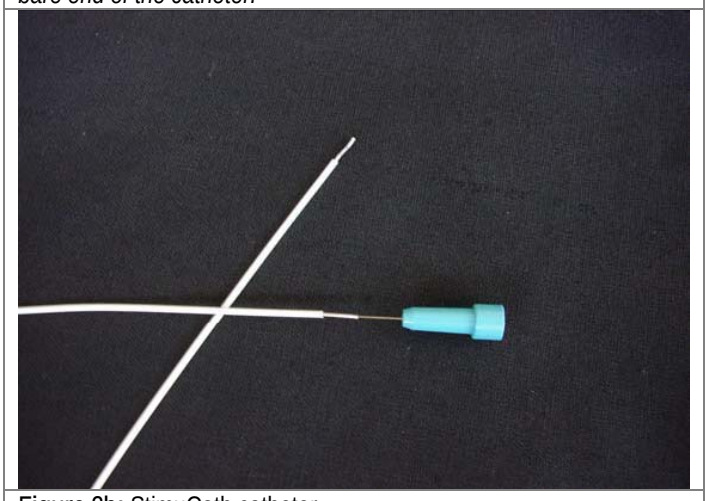

Figure 2b: StimuCath catheter
*The StimuCath needle is an insulated Tuohy needle with a bare tip and a bare proximal area.*
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*The StimuCath catheter has an inner spring reinforcement, which is electrically conductive and continues from its proximal to its distal bare end of the catheter.*

## ANATOMY

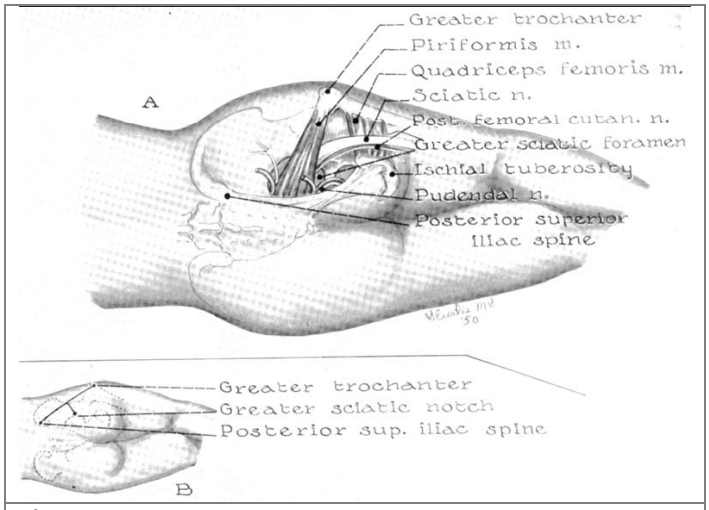


Figure 3a. Anatomy
*A. Anatomy. Reprinted from Moore DC. Regional Block [4].*
*B. Classical Labat approach.*

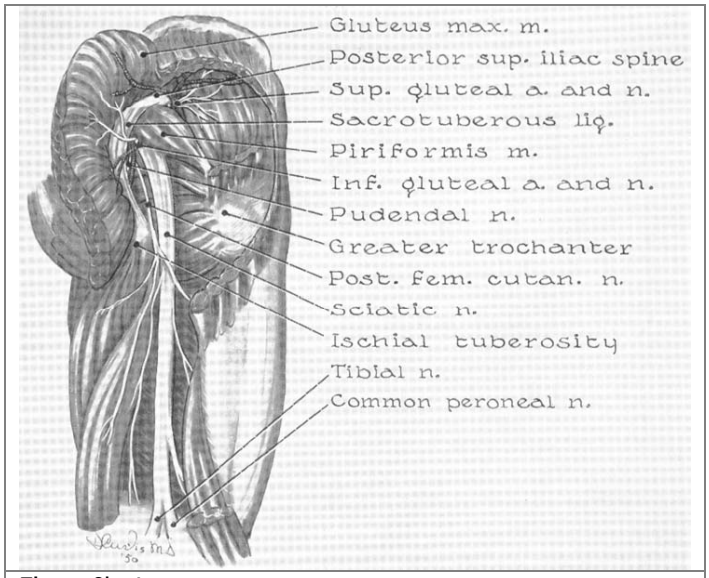


Figure 3b: Anatomy
*Reprinted from Moore DC. Regional Block [4]*

### ANATOMIC LANDMARKS

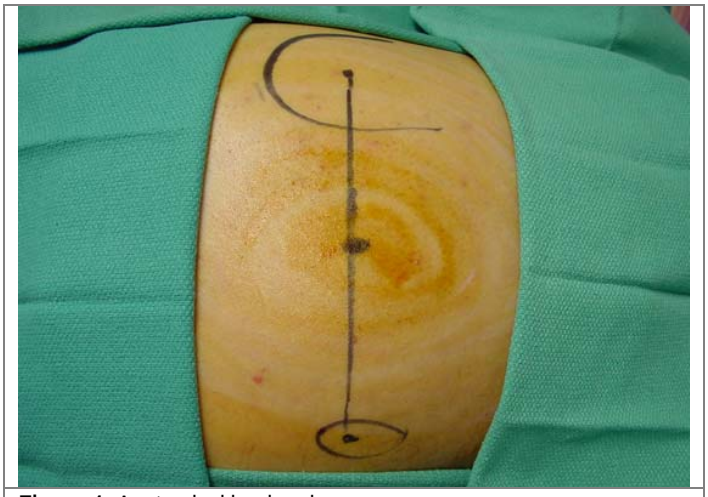

Figure 4: Anatomical landmarks
*A = Greater trochanter of the femur*
*B = Midpoint of the greater trochanter*
*C = Midpoint of ischial tuberosity*
*D = Line connecting B and C*
*E = Midpoint of line D. (Point of needle entry)*

## TECHNIQUE

### PATIENT POSITION

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

### NEEDLE PLACEMENT

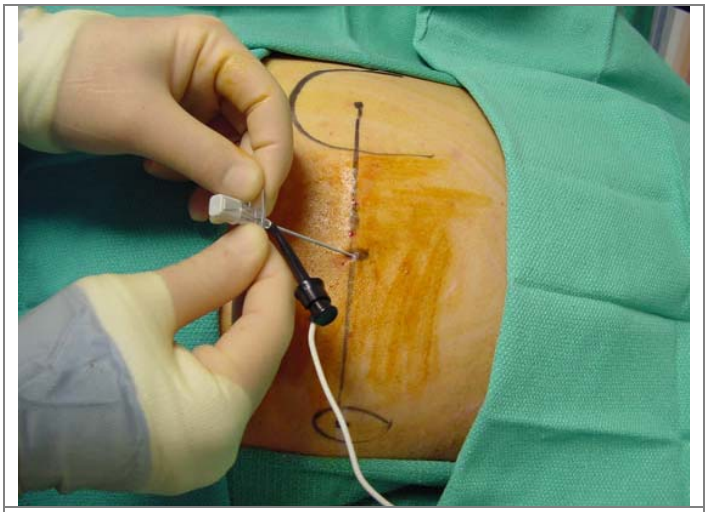

Figure 5. Needle Entry. *The needle enters the skin midway on a line connecting the midpoint of the greater trochanter of the femur and the midpoint of the ischial tuberosity. Advance the needle until the sciatic nerve is encountered. Flexion/extension of the toes is the best indicator that the needle is close to the nerve.*

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 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 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.

### CATHETER PLACEMENT

The nerve stimulator clip is now removed from the needle and attached to the proximal end of the stimulating catheter (Figure 6).

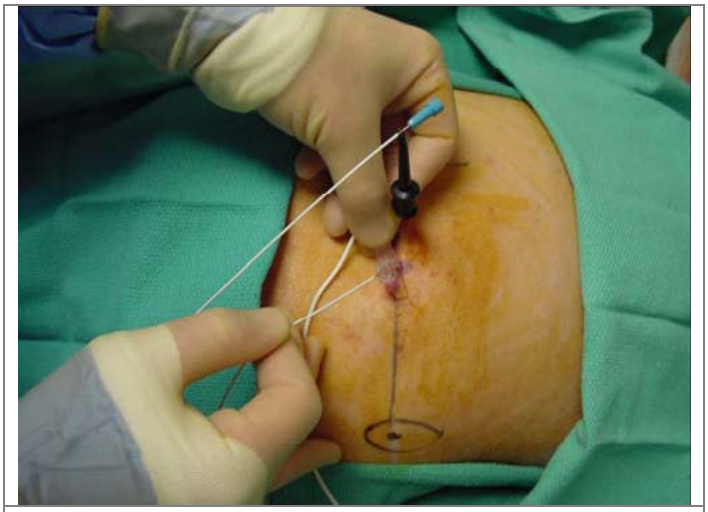

Figure 6. Catheter placement. *The needle is held steady; the nerve stimulator is now clipped to the proximal end of the catheter and the catheter in advanced through the needle. There should be no change in the quality of the muscle twitches. Be sure that the same muscles are twitching at the same intensity.*

*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 to 5 centimeters. 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*

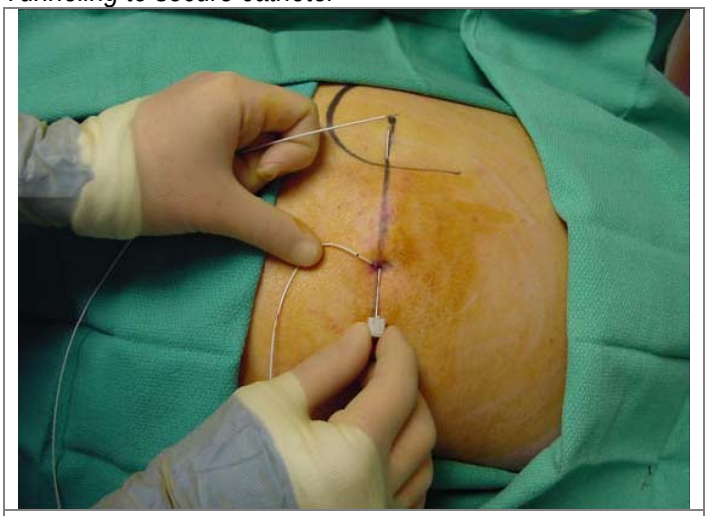

Figure 7. Tunneling. *Insert the inner stylet of the needle 2 – 3 mm from the catheter exit wound and advance subcutaneously to exit the skin 6 – 10 cm laterally. Be sure that this skin has been infiltrated with local anesthetic agent previously.*

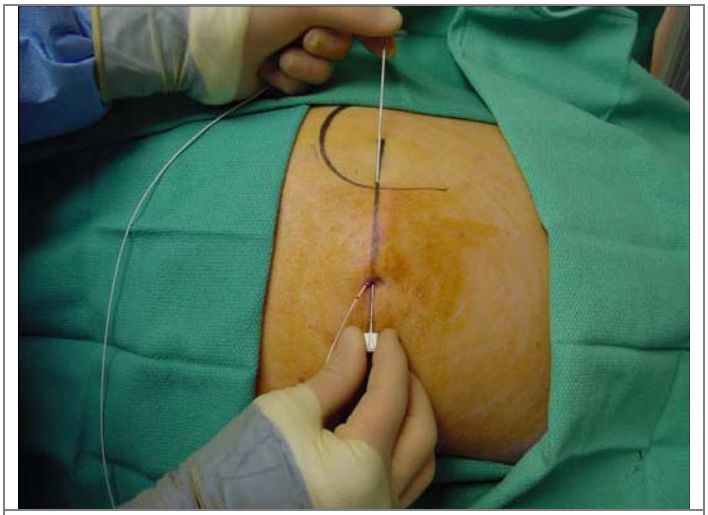

Figure 8. Tunneling. "Railroad" the needle back over the stylet.

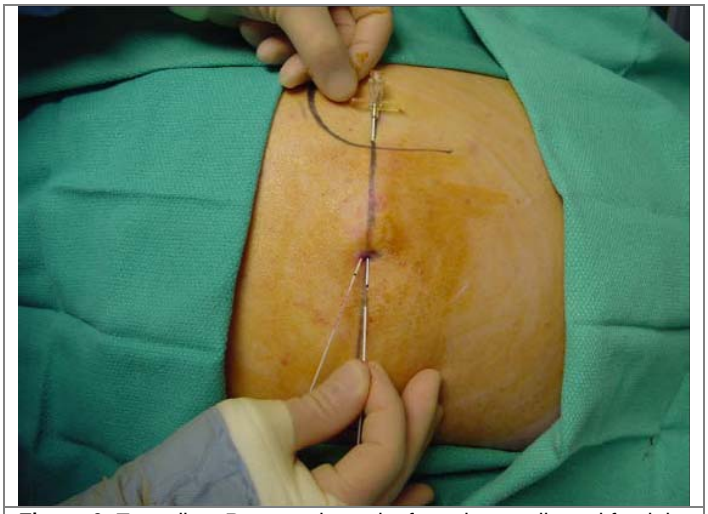

Figure 9. Tunneling. Remove the stylet from the needle and feed the proximal end of the catheter through the needle.

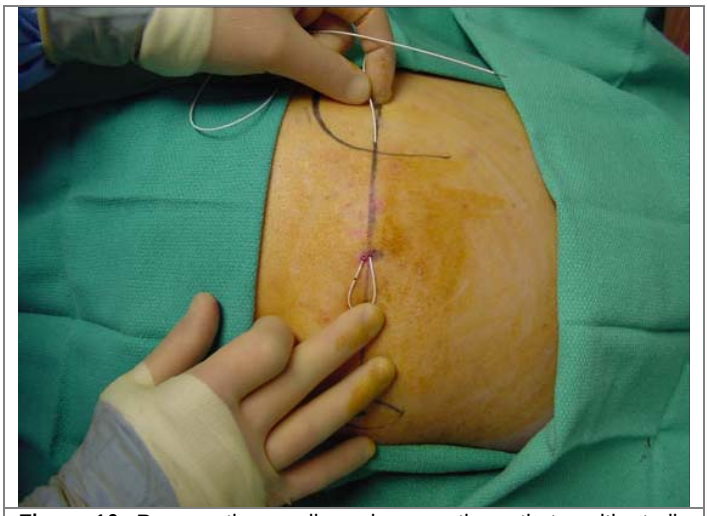

Figure 10. Remove the needle and secure the catheter with sterile dressings. Observe skin bridge. If the skin bridge is undesirable, allow the needle to exit through the same whole in the skin as the catheter. Be careful not to damage the catheter with the needle

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 11). The muscle twitches disappear immediately after local anesthetic agent injection has commenced.

[The twitches do not disappear because the nerve is pushed away from the catheter tip. Raj originally thought this to be the mechanism, since the twitches also

disappear when saline is injected. Raj was mistaken, since when water for injection is injection, the muscle twitches do NOT disappear. The mechanism is simply that saline, being a conductor of electricity, disperses the current density and more current would be required to again make the nerve "fire" again. Water does not conduct electricity and therefore the twitches do not disappear. This is the same reason why Urologists cannot use saline when they perform TURP operations. Local anesthetic agents simply block the sodium channels and block the nerve.]

# DRUGS

### INITIAL BOLUS INJECTION

The authors use 0.25ml/kg ropivacaine (0.25 - 0.5%) or bupivacaine (0.25 - 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), 0.5ml/kg is usually required.

### CONTINUOUS INFUSION

Breakthrough pain is rare and patient satisfaction high in patients when an infusion of 0.1 ml/kg/hr in children or 5ml/hr in adults of 0.25% ropivacaine or 0.25% bupivacaine is used. . Patient-controlled injection can probably also be used with satisfactory results [5], but it is the experience of this author that the worse the catheter placement (or the more inaccurate the catheter placement) the more boluses and "multimodal" analgesia is required.

### 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 (10 micrograms/kg) 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 sub-perineural needle or catheter placement if brisk muscle twitches are present with nerve stimulator settings less than 0.2mA (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.
- NEVER cut a catheter that has a spring wire inside, such as the StimuCath. This will most certainly result in the catheter "falling apart", since there is a wire inside the catheter that anchors the distal end of the catheter to the proximal end. This situation is bound to attract medico-legal attention, since parts of the catheter may break off and may be left behind.

## REFERENCES

1. Brown DL. Psoas compartment block. In: Brown DL, ed. Atlas of Regional Anesthesia. 2nd ed. Philadelphia, PA: W.B. Saunders Company; 1999: 88 - 91.
2. Ansbro P. A method of continuous brachial plexus block. American Journal of Surgery 1946; 121: 716 – 722
3. Boezaart AP, de Beer JF, du Toit C, van Rooyen K. A new technique of continuous interscalene nerve block. Canadian Journal of Anesthesia 1999; 46(3): 275 – 281.
4. Moore DC. Regional Block. Fourth Edition. Springfield IL, Charles C Thomas Publishers; 1967: 276 – 277.
5. Borgeat A, Schäppi B, Biasca N, Gerber C. Patient-controlled analgesia after major shoulder surgery: Patient-controlled interscalene analgesia versus patient-controlled analgesia. Anesthesiology 1997; 87: 1343 – 1347.
6. Boezaart AP, Berry AR, Nell ML, van Dyk AL. A comparison of propofol and remifentanil for sedation and limitation of movement during peri-retrobulbar block. Journal of Clinical Anesthesia 2001; 13: 422 – 426.