Sciatic Nerve Catheter Placement: Success with Using the Raj Approach

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BACKGROUND: Continuous regional analgesia has increased in popularity and is becoming standard of care for many painful surgical procedures. Various approaches of sciatic catheter insertion have been proposed, each with attributes and disadvantages. We investigated whether the Raj approach that uses a simple midpoint landmark between the ischial tuberosity and greater trochanter will facilitate sciatic catheter placement.

METHODS: After informed consent, 20 patients were recruited to receive sciatic catheter placement using the Raj approach. An insulated Tuohy needle was inserted perpendicular to skin at the midpoint of a line between the ischial tuberosity and greater trochanter. After sciatic nerve stimulation, a catheter was inserted 2–4 cm past the end of the needle and secured. The catheters were then incrementally injected with 30 mL of 1.5% mepivacaine. Twenty minutes after local anesthetic injection, sensory block was assessed using cold and pinprick tests, whereas motor block was assessed using a modified Bromage score. Complications and side effects were recorded.

RESULTS: In all instances, blocks were easy to perform and were successful. No major side effects or complications were noted.

CONCLUSION: Use of a simple landmark between easily identifiable bony structures enhances the simplicity and placement of a sciatic nerve catheter and is recommended for use in clinical practice.

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Postoperative pain associated with total joint replacements, particularly total knee arthroplasty, is often severe and refractory to IV opioids. Advances in needle and catheter systems have enabled continuous regional analgesia to become increasingly popular with the primary advantage of providing analgesia well into the postoperative period. Single injection sciatic nerve block and catheter techniques have been performed utilizing different approaches at many levels after the nerve exits the sciatic notch in the pelvis.[1–5] One of the most commonly used techniques of sciatic nerve blockade is the Labat approach during which the patient is placed in the Sim's position. Because the "Euclidian Geometry" required to identify a surface landmark for needle insertion using this technique can be difficult, particularly in an obese patient population, alternative approaches have been suggested.[6,7] Although these alternative approaches may appear promising, the soft tissue landmarks identified using these techniques can still be misleading.

In 1975, Raj described a technique of blocking the sciatic nerve at the point where it lies between the greater trochanter of the femur and ischial tuberosity.[8] The accuracy and simplicity of this technique relies on the fact that these bones are easily palpable and consistent landmarks requiring solely their identification and the midpoint between them before needle insertion. In addition to the simplicity of needle insertion site identification, this technique is desirable because moving the patient into a Sim's position is not required and the sciatic nerve is more superficial at this level compared with transgluteal approaches. Although there is some evidence demonstrating success with sciatic nerve catheters using another subgluteal approach,[2,9] there are no studies in which a Raj approach was used for catheter placement. This study was designed to determine whether the simplicity of the single injection technique could be reproduced using a catheter placement technique. This pilot study was performed to determine the reliability, feasibility, and success rate of sciatic catheters placed via the Raj approach.

METHODS

After institutional review board approval, 20 patients, who met inclusion criteria (patients undergoing primary unilateral knee arthroplasty or ankle surgery, >18 yr-of-age, ASA physical status of I, II, or III, competent and able to provide informed consent), were recruited for the study. Exclusion criteria included patients <18 yr of age, pregnant or lactating patients, patients who are unwilling or unable to provide written informed consent, patients who refuse

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Figure 1. Proper leg positioning for sciatic nerve block using Raj approach.

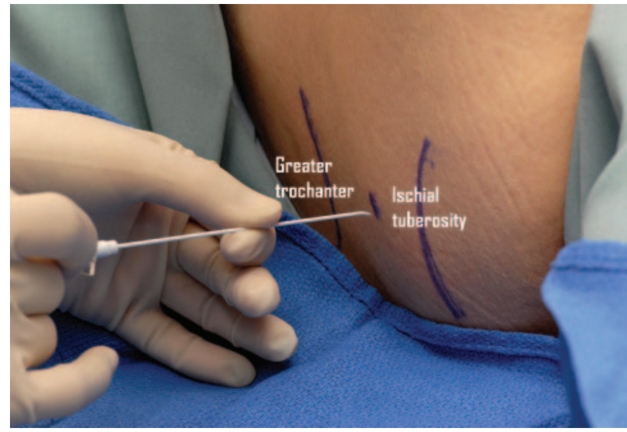

Figure 2. Surface landmarks and needle insertion site for sciatic nerve block using Raj approach.

regional anesthesia, patients who have a contraindication to regional anesthesia (i.e., coagulopathy, bleeding diathesis), and patients who have a known allergy to amide local anesthetics. After informed consent, standard monitors (noninvasive blood pressure cuff, ECG, pulse oximetry) were placed on each patient. Supplemental oxygen was administered via nasal canula at 2–3 L/min. Intravenous midazolam was administered in increments of 1 mg for anxiolysis and fentanyl was administered in increments of 50 μg for pain associated with the procedure. The patient was positioned supine with the operative extremity flexed at the hip and flexed 90° at the knee (Fig. 1).

The greater trochanter and ischial tuberosity were identified and marked (Fig. 2). The needle insertion site was at the midpoint of a line joining the greater trochanter and ischial tuberosity at the level of the gluteal crease. After sterile prep and drape, and subcutaneous local anesthetic injection, an 18-G, 4-in. (100 mm) insulated Tuohy needle (B. Braun, Bethlehem, PA) attached to a nerve stimulator (Stimuplex Dig RC, B. Braun) with an initial setting of 1.5 mA, 2 Hz was inserted perpendicular to the skin with the bevel directed cephalad (toward the gurney). On successful sciatic nerve stimulation (plantar flexion/dorsiflexion) at a current of <0.5 mA, a 20-G multiport, closed tip polyamide nylon catheter (B. Braun) was advanced through the needle to lie approximately 2–4 cm past the tip. If difficulty was encountered with catheter advancement (inability to easily advance catheter on first attempt), 10 mL of sterile saline were injected through the needle injection side port, and an attempt to advance the catheter was repeated. An anesthesiologist present during the block procedure documented the number of needle passes and the time taken to perform the block procedure. After negative aspiration and negative test dose injection (3 mL 1.5% lidocaine with 1:200,000 epinephrine), 30 mL of preservative free mepivacaine 1.5% was injected through the sciatic catheter in 5 mL increments. The catheters were fixed to the skin with Steri-Strips (3M, St. Paul, MN) and a Tegaderm (3M). Sensory and motor blockade were assessed 20 min after the completion of injection by another anesthesiologist who was blinded to the regional block technique performed. Sensory blockade was assessed in the plantar and dorsal surfaces of the foot using a blunt tip needle. Motor block of the tibial and common peroneal branches of the sciatic nerve were assessed using a modified Bromage score (Appendix). Successful block was defined as the presence of sensory block and motor block (Bromage scale ≥2) in either the common peroneal or tibial nerve distribution, 20 min after local anesthetic injection through the catheter.

Data Collection

The following information was collected from 20 patients in this observational study: age, sex, height, weight, time from needle insertion to completion of catheter insertion, total number of skin punctures made during block, total number of redirections made during block, lowest current achieved during block, difficulty during catheter insertion, need for saline dilation, distance from skin to sciatic nerve, depth of catheter, presence of blood in catheter, fentanyl dose, midazolam dose, Bromage score in the tibial nerve distribution, Bromage score in the peroneal nerve distribution, and

Table 1. Patient Characteristics

Variable	Summary (N = 20)
Age	69 (9)
Sex (male)	10 (50%)
BMI	31 (4)

Numerical data are summarized with the sample mean (SD).
BMI = body mass index.

sensory block assessment at the bottom of the foot, heel, anterior and lateral aspect of the foot.

Statistical Analysis

Numerical data was summarized with the sample median and range. Categorical data was summarized with number and percent of patients. An exact binomial 95% confidence interval was used to estimate the proportion of successful blocks.

RESULTS

Twenty patients were recruited for the study. All 20 patients completed the study. All patients tolerated positioning and catheter insertion well using moderate sedation. Patient characteristics are presented in Table 1. All 20 patients (100%) had a successful block. Most patients (75%) required one needle puncture site, only one required more than two puncture sites. Average time for catheter placement was 2.8 min with 1.2 needle redirections. Difficult catheter advancement was encountered in two patients (10%) but was easily managed with saline injection through the needle before catheter readvancement. Two other patients had saline injection through the needle before catheter advancement because of the anesthesiologist's preference. Average distance of the sciatic nerve from skin was 5.9 cm. Tibial nerve stimulation was observed in 16 patients and peroneal nerve stimulation in four patients (Table 2). Success rate of the Raj sciatic catheter is summarized in Table 3. All patients had sensory anesthesia in the distribution of both the tibial and peroneal nerves. At the 20 min time point, 16 patients had significant weakness in both terminal nerve distributions, whereas four patients had significant weakness in the peroneal distribution only. None of the patients demonstrated any signs of local anesthetic toxicity during the procedure.

DISCUSSION

Continuous sciatic nerve blockade using a subgluteal approach has been described in the past with excellent results.[9–12] However, we know of no reports of sciatic nerve catheter placement using a Raj approach. The benefits of using this approach over other approaches are that patient repositioning to a Sim's position is not required and that dependence on difficult to identify landmarks is eliminated. Easy to identify landmarks are particularly important in an obese patient population where block failure is more likely to occur.[13] All patients in our study population (100%) had a successful block as defined by sensory

Table 2. Surgery/Block Characteristics

Variable	Summary (N = 20)
Side of surgery (right)	9 (45%)
Time taken to place needle and catheter (min)	2.8 (1.6)
Number of skin punctures made during block	
1	15 (75%)
2	4 (20%)
3	1 (5%)
Number of redirections made during block	1 (0–4)
Lowest current achieved during block (mA)	0.46 (0.09)
Nerve distribution with motor response[a]	
Tibial nerve	15 (79%)
Peroneal nerve	4 (21%)
Difficulty during catheter insertion	2 (10%)
Saline dilation	4 (20%)
Distance from skin to sciatic nerve (cm)	5.9 (2.0)
Depth of catheter (cm)	6.5 (2.1)
Fentanyl dose (μg)	128 (62)
Midazolam dose (mg)	2.9 (1.1)

Numerical data are summarized with the sample mean (SD) and the number of redirections given as a median with range.
[a] Not available for one patient.

Table 3. Patient Outcomes

Variable	Summary (N = 20)
Sensory block	
Plantar aspect of the foot	20 (100%)
Dorsum of the foot	20 (100%)
Motor block	
Plantar flexion weakness (Bromage T ≥2)	16 (80%)
Dorsi flexion weakness (Bromage P ≥2)	20 (100%)
Successful block	20 (100%)

loss to pinprick on the dorsum or plantar surface of the foot at 20 min (in actuality both plantar and dorsum sensory blockade was present in all patients). All blocks were quickly performed (average, 2.8 min) with minimal needle redirections (average, 1 redirect). Most catheters (90%) were easily advanced on the first attempt. The remaining two catheters (10%) were easily advanced after the injection of 10 mL of saline. Although data were not compiled regarding analgesia in the postoperative period, because the local anesthetic was administered through the peripheral nerve catheter, a functional catheter is assumed. Pain associated with total knee arthroplasty is variable, particularly in the posterior knee. In fact some patients, although it is the minority, do not require the use of continuous sciatic nerve blockade.[14] This has led some practitioners to perform single injection sciatic nerve blockade or forego sciatic nerve blockade altogether in favor of IV patient-controlled analgesia. However, because the majority of patients do in fact have at least some degree of posterior knee pain following total knee arthroplasty,[14] an easy to perform, reliable approach to sciatic nerve catheter placement is particularly attractive for patients in whom narcotic analgesia is best avoided (allergy, history of opioid associated nausea/vomiting, obstructive sleep apnea, cognitive dysfunction)[15,16] or is likely to be inadequate (chronic opioid dependence).[17] With the increasing prevalence of obesity, an approach to sciatic nerve blockade that is both easily performed and reliable is ideal. By flexing the leg at the hip in the supine position, the Raj approach to sciatic nerve blockade accentuates the two bony landmarks necessary for identification and simplifies nerve blockade. Furthermore, it requires little cooperation on the part of the patient by allowing them to remain in a supine position. It should be noted that a subgluteal approach for sciatic nerve blockade may not provide adequate posterior thigh anesthesia or analgesia because of a proximal branching of the posterior cutaneous nerve of the thigh.[6]

There are clearly some limitations to this pilot study. First of all, although all patients in our study population were considered overweight, few of them were obese, and there were no patients considered morbidly obese by body mass index criteria. Because the aim of our study was to demonstrate the feasibility of sciatic nerve catheter placement and subsequent blockade with through the catheter injection of local anesthetic using the Raj approach, patients with a normal or slightly elevated body mass index were not excluded. A follow-up study to test the utility of this approach over the classic Labat approach in an obese patient population should recruit morbidly obese patients and compare the two approaches directly. Secondly, because sensory and motor testing data in the postoperative period were not included, we are unable to ascertain the functionality of these catheters in terms of postoperative analgesia. However, the catheters were used for the initial dosing, and 100% of patients had a sensory deficit and 80% of patients had a motor deficit in both tibial and common peroneal distributions before the surgical procedure, making some degree of functionality implicit. Furthermore, the employed method of dosing sciatic catheters in the postoperative period at our institution (due in part to surgeon concern for foot drop and desire for participation in rehabilitation) is one of the intermittent boluses (4–6 mL every 4–6 h). This is identical except in terms of volume to the initial (and 100% successful) block.

Because all patients studied underwent total knee arthroplasty and received either spinal anesthesia or general anesthesia we cannot determine whether or not the blocks ever attained true surgical anesthesia. Again, comprehensive sensory and motor testing indicated that all blocks were successful.

In summary, our data suggest that a functional peripheral nerve catheter can be easily placed using the Raj approach to sciatic nerve blockade with a high degree of success. Although further randomized controlled studies are necessary to draw extensive conclusions from this data, the implication is that this approach is an easy alternative to other previously described approaches to sciatic nerve catheter placement and blockade.

APPENDIX

Description of the Bromage score adapted to the tibial nerve: grade criteria	
I	Full capacity for plantar flexion of the foot
II	Just able to plantar flex the foot
III	Unable to plantar flex the foot but with free movement of the toes
IV	Unable to move the foot
Description of the Bromage score adapted to the peroneal nerve: grade criteria	
I	Full capacity for dorsiflexion of the foot
II	Just able to dorsiflex the foot
III	Unable to dorsiflex the foot but with free movement of the toes
IV	Unable to move the foot

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