The Anatomic Relationship of the Sciatic Nerve to the Lesser Trochanter: Implications for Anterior Sciatic Nerve Block

Marty L. Ericksen, MD, Jeffrey D. Swenson, MD, and Nathan L. Pace, MD, Mstat

Department of Anesthesiology, University of Utah, Salt Lake City

Classic descriptions of the anterior sciatic nerve block suggest needle placement at the level of the lesser trochanter of the femur. Recently, investigators have reported that the sciatic nerve is not accessible at this level. To define more accurately the anatomic relationship of the sciatic nerve to the lesser trochanter, we analyzed magnetic resonance scans performed on 20 patients in the supine position. After IRB approval, magnetic resonance scans of the hip and proximal femur were reviewed in 20 supine patients in the neutral position. Images from five axial levels were studied, specifically, at the level of the lesser trochanter and at 1-cm intervals inferior to the lesser trochanter for 4 cm. In each axial image, the medial or lateral distance was measured from the sciatic nerve to a sagittal plane at the medial border of the femur. If the sciatic nerve was lateral to this sagittal plane (inaccessible), the distance was assigned a negative value, and if the sciatic nerve was medial to the sagittal plane (accessible), the distance was assigned a positive value. The distance between the coronal plane at the anterior border of the femur and the coronal plane through the sciatic nerve was also recorded for each level. At the level of the lesser trochanter, the sciatic nerve was lateral to the femoral border (inaccessible) in 13 of 20 patients with a mean distance of -4.0 ± 7.7 mm. At 4 cm below the lesser trochanter, the sciatic nerve was medial to the femoral border (accessible) in 19 of 20 patients with a mean distance 7.8 ± 5.8 mm. The distance from the anterior border of the femur to the sciatic nerve was 42.9 ± 5.8 mm at the level of the lesser trochanter and 45.7 ± 9.5 mm at 4 cm below the lesser trochanter. The classic description of the anterior approach to the sciatic nerve suggests that the needle be walked off medially at the level of the lesser trochanter. Our data are consistent with recent reports suggesting that in the majority of subjects, the position of the sciatic nerve relative to lesser trochanter made it inaccessible from an anterior approach at this level. In contrast, at 4 cm below the lesser trochanter, the sciatic nerve was medial to the femur in 19 of 20 subjects. We conclude that needle insertion medial to the proximal femur, 4 cm below the lesser trochanter, is a more direct anatomical approach to the anterior sciatic nerve block. (Anesth Analg 2002;95:1071–4)

The sciatic nerve block may be used to provide anesthesia and analgesia of the lower extremity. Although several approaches to the sciatic nerve block have been described (1–4), the anterior approach is unique in that it can be performed in the supine position without limb flexion or patient positioning.

In his original description of the anterior sciatic nerve block, Beck (4) reports using surface anatomy to direct needle insertion at the level of the lesser trochanter of the femur. However, it is important to note that this technique was performed without eliciting either paresthesia or nerve stimulation. Instead, the point of injection was determined by a loss of resistance to injection. This loss of resistance correctly identified the fascial compartment containing the sciatic nerve. Like many regional anesthesia techniques, the anterior approach to the sciatic nerve was originally described before the advent of modern imaging techniques. Since that time, Chelly and Delaunay (5) have described modified techniques for the anterior sciatic nerve block, which also involve needle insertion at the level of the lesser trochanter.

Recently, accessibility of the sciatic nerve using an anterior approach at the level of the lesser trochanter has been questioned. Vloka et al. (6) reported that the sciatic nerve is often obstructed by the lesser trochanter and not accessible using a direct anterior approach at that level. In fixed cadaver models, the needle could not be fully advanced to the level of the sciatic nerve because of obstruction by the lesser trochanter.

The purpose of this study is to more accurately define the anatomic relationship of the sciatic nerve to the lesser trochanter in living subjects who are positioned supine. To accomplish this, we examined the

Accepted for publication May 31, 2002.

Address correspondence and reprint requests Jeffrey D. Swenson, MD, Department of Anesthesiology, University of Utah Medical Center, 50 North Medical Dr., Salt Lake City, UT 84132. Address e-mail to vicky.larsen@hsc.utah.edu.

DOI: 10.1213/01.ANE.0000026366.76537.A7

0003-2999/02

magnetic resonance images of 20 patients in the supine position with the lower extremity in the neutral position.

Methods

This study was approved by the IRB of the University of Utah Medical Center, Salt Lake City. Initial screening of 107 archived magnetic resonance images scans was performed to identify 20 scans suitable for inclusion in this review. Criteria for inclusion were adequate image quality, absence of pathology in proximity to the sciatic nerve or proximal femur, and neutral position of the femur with respect to external or internal rotation. Neutral position of femur was identified by three radiological criteria. First, in axial images at the level of the proximal femur, the neutral position was verified when the posterior boarder of the cortex between the lesser trochanter and the lateral femur formed a horizontal plane. Second, in anterior-posterior scout films, external rotation was identified if there was foreshortening of the femoral neck and superimposition of the femoral head on the greater trochanter. Third, in anterior-posterior scout films, internal rotation was identified if there was superimposition of the proximal femoral shaft on the lesser trochanter.

The position of the sciatic nerve relative to the femur was studied in five axial planes. The first axial image was at the midlevel of the lesser trochanter, followed by 1-cm intervals inferior to the lesser trochanter for 4 cm (Fig. 1). Two measurements were taken in each axial plane (Fig. 2). The first measurement was the distance from the center of the sciatic nerve to a parasagittal plane at the medial border of the lesser trochanter or shaft of the femur. If the sciatic nerve was lateral to this parasagittal plane (inaccessible from an anterior approach), the distance was assigned a negative value. If the sciatic nerve was medial to this parasagittal plane (accessible from an anterior approach), the distance was assigned a positive value. The second measurement was the distance from the coronal plane at the anterior border of the femur to the coronal plane through the sciatic nerve. The data were expressed in millimeters as mean ± SD. A McNemar's test was performed to assess the equality of binary responses from paired data on these subjects using StatXact version 4 (CYTEL Software Corporation, Cambridge, MA). An α value of 0.05 was chosen.

Results

Subjects included for analysis had an average age of 45 ± 21 yr, with a mean height and weight of 170 ± 8 cm and 76 ± 18 kg, respectively. There were 14 women and 6 men included in the study. Equal numbers of left and right lower extremities were analyzed.

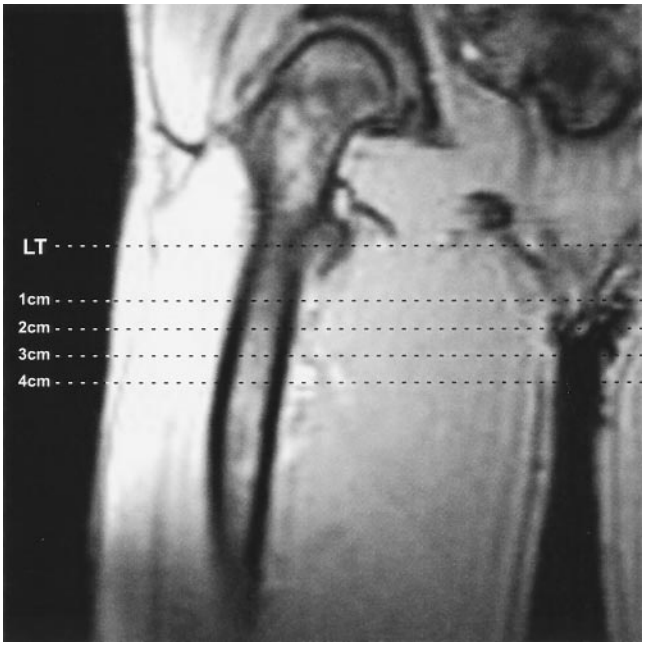

Figure 1. Measurements were made of the sciatic nerve relative to the femur in five axial planes. The first image is at the midlevel of the lesser trochanter (LT) followed by 1-cm intervals inferior to the lesser trochanter for 4 cm.

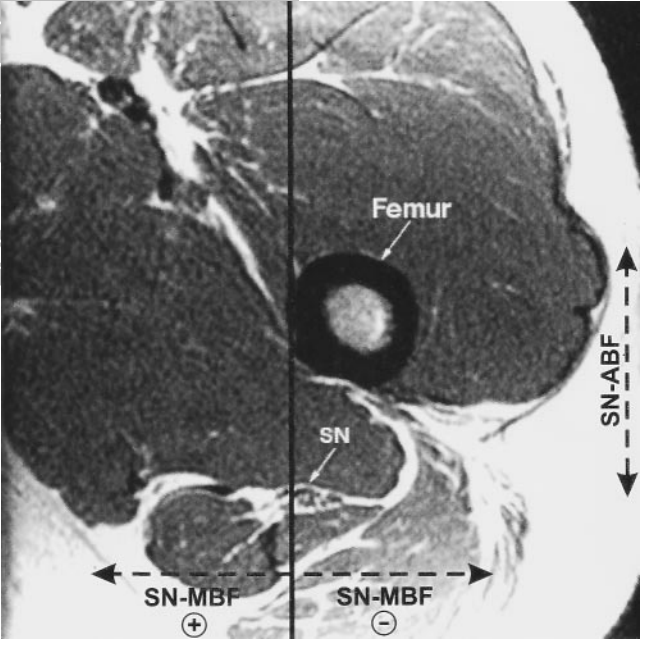

Figure 2. The horizontal line represents the position of the sciatic nerve relative to the medial border of the femur (SN-MBF). If the SN was lateral to this plane (inaccessible), the distance was assigned a negative value (-). If the SN was medial to this plane (accessible), the distance was assigned a positive value (+). The second measurement (vertical line) was the distance from the coronal plane through the SN to the coronal plane at the anterior border of the femur (SN-ABF).

At the level of the lesser trochanter, the distance from the sciatic nerve to the medial border of the femur was −4.0 ± 7.7 mm. At this level, the sciatic

Table 1. Position of the Sciatic Nerve Relative to the Femur

	Millimeters lateral (−) or medial (+) to the femoral boarder	Patients inaccessible using the anterior approach (n = 20)
Lesser trochanter	−4.0 ± 7.7	13
Inferior to lesser trochanter		
1 cm	6.1 ± 7.3	3
2 cm	6.6 ± 6.8	3
3 cm	7.4 ± 6.3	2
4 cm	7.8 ± 5.8	1

Data are expressed as mean ± SD.

Table 2. Comparison of Nerve Accessibility at the Level of the Lesser Trochanter and 4 cm Below the Lesser Trochanter

		Measurements at 4 cm below the lesser trochanter		
	Accessibility	Yes	No	Total
Measurements at the lesser trochanter	Yes	7	0	7
	No	12*	1	13
Total		19	1	20

Note that in 12 of 20 patients, the sciatic nerve was inaccessible at the level of the lesser trochanter and accessible 4 cm below the lesser trochanter. In contrast, of 20 patients, there were no patients with the sciatic nerve accessible at the level of the lesser trochanter and not accessible at 4 cm below the lesser trochanter.
* P = 0.005; McNemar's test.

nerve in 13 of 20 subjects was obstructed from the anterior approach by the medial border of the femur (Table 1). Measurements made at 1-cm intervals below the lesser trochanter are also displayed in Table 1. At 4 cm below the lesser trochanter, the mean distance from the sciatic nerve to the medial border of the femur was 7.8 ± 5.8 mm. In only 1 of 20 patients at this level was the sciatic nerve obstructed from an anterior approach by the medial border of the femur. A two-sided McNemar's test comparing the accessibility of the sciatic nerve at the level of the lesser trochanter versus an approach 4 cm below the lesser trochanter demonstrated a P value of 0.005 (Table 2). The distance from the anterior border of the femur to the sciatic nerve was 42.9 ± 5.8 mm at the level of the lesser trochanter. In the proximal femoral shaft, the distances were 41.4 ± 6.6 mm at 1 cm, 41.6 ± 7.1 mm at 2 cm, 43.7 ± 8.0 mm at 3 cm, and 45.7 ± 9.5 mm at 4 cm, respectively.

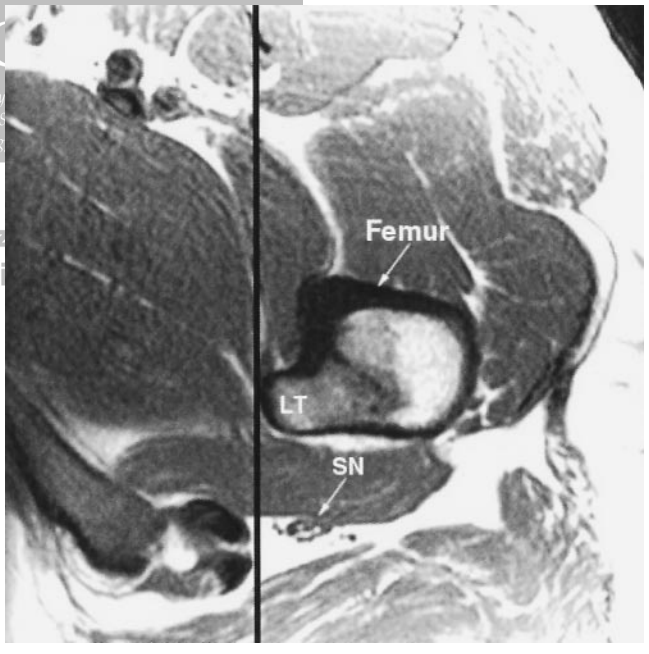

Figure 3. The solid vertical line represents the needle path in an anterior approach to the sciatic nerve (SN) at the level of the lesser trochanter (LT). This view demonstrates the position of the SN, which is lateral to the femoral border, making it inaccessible from an anterior approach.

Discussion

Despite being a procedure that provides excellent anesthesia and postoperative analgesia, the sciatic nerve block is relatively underused when compared with other anesthetic techniques. Although data comparing the success rates of various techniques for sciatic nerve block are lacking, the small frequency with which all sciatic nerve blocks are performed in residency programs (median of zero for graduating CA3 residents) (7) suggests that there is not widespread confidence on the part of clinicians attempting existing techniques.

In Beck's (4) original description of the anterior sciatic nerve block, he did not report either paresthesia

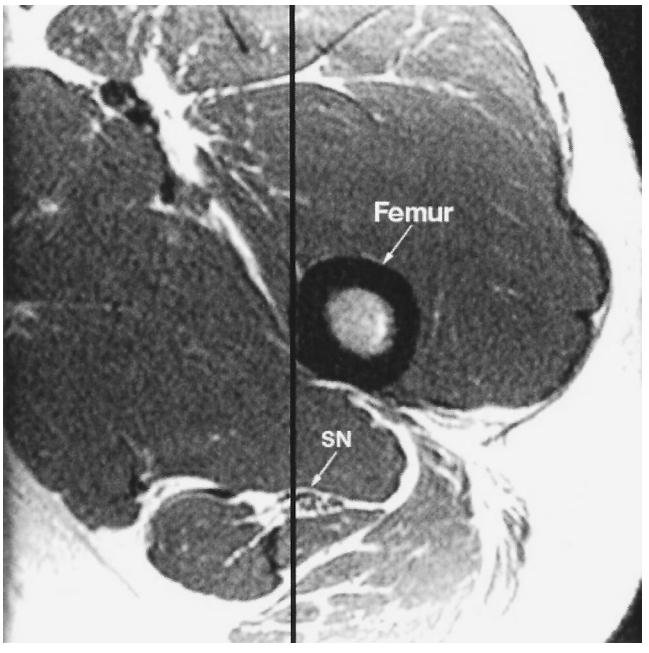

Figure 4. The solid vertical line represents the needle path in an anterior approach to the sciatic nerve (SN) at 4 cm below the lesser trochanter. This view demonstrates the position of the SN, which is medial to the femoral border, making it accessible from an anterior approach.

or nerve stimulation. Correct needle position was determined by a loss of resistance to injection as the needle entered the fascial plane between the quadratus femoris and gluteal muscles. Although this fascial plane containing the nerve is readily accessible at the level of the lesser trochanter, the nerve itself is not (Fig. 3). Therefore, attempting to elicit a paresthesia or nerve stimulation at this level may be difficult. Vloka et al.(6) confirm that other investigators have also noted this anatomic relationship. Using cadavers fixed in phenol and glycerin, the authors reported that in 80% of cases, a needle could not be successfully passed anteriorly to the sciatic nerve at the level of the lesser trochanter. Likewise, at 2 cm below the lesser trochanter, the nerve was inaccessible in 40% of cases.

To confirm the results of Vloka et al. (6) in normal tissue, we chose to record the position of the sciatic nerve relative to the femur in patients who were imaged in the supine position. We anticipated that the soft tissues of pelvis and proximal thigh might be displaced medially with the patient in a supine position. The trends demonstrated in our study are similar to those reported by Vloka et al. (6). At the level of the lesser trochanter, the sciatic nerve was inaccessible in 13 of 20 patients (65%). Figure 3 shows the sciatic nerve lateral to the needle path at the level of the lesser trochanter and therefore not accessible from an anterior approach. However, at the level of the proximal femur, the sciatic nerve was accessible in 17 of 20 patients (85%) at 1 and 2 cm below the lesser trochanter. At 3 cm below the lesser trochanter, the sciatic nerve was accessible in 18 of 20 patients (90%) and in 19 of 20 patients (95%) at 4 cm below the lesser trochanter. Figure 4 shows the sciatic nerve medial to the needle path at 4 cm below the lesser trochanter and therefore accessible from an anterior approach.

When performing the anterior approach using a loss of resistance technique, the descriptions by Beck (4) and Chelly and Delaunay (5) correctly identify the position for needle insertion at the level of the lesser trochanter. If using a paresthesia or nerve stimulator technique, a more distal approach (4 cm below the lesser trochanter) provides an unobstructed path to the sciatic nerve. Moreover, this distal approach decreases the likelihood of passing the needle through the groin and into capsule of the hip joint, which extends onto the lesser trochanter of the femur.

References

1. Labat G. Regional anesthesia: its technique and clinical applications. 2nd ed. Philadelphia, PA: WB Saunders, 1924:45–55.
2. Ichiyanagi K. Sciatic nerve block: lateral approach with patient supine. Anesthesiology 1959;20:601–4.
3. Raj PP, Parks RI, Watson TD, et al. A new single-position supine approach to sciatic-femoral nerve block. Anesth Analg 1975;54: 489–93.
4. Beck GP. Anterior approach to sciatic nerve block. Anesthesiology 1963;24:222–4.
5. Chelly JE, Delaunay L. A new anterior approach to the sciatic nerve block. Anesthesiology 1999;91:1655–60.
6. Vloka JD, Hadzic A, April E, et al. Anterior approach to the sciatic nerve block: the effects of leg rotation. Anesth Analg 2001;92:460–2.
7. Smith MP, Sprung J, Zura A, et al. A survey of exposure to regional anesthesia techniques in America anesthesia residency training programs. Reg Anesth Pain Med 1999;24:11–6.