Lateral Femoral Cutaneous Nerve Impairment After Direct Anterior Approach for Total Hip Arthroplasty

TARUN BHARGAVA, MD; ROBIN N. Goytia, MD; LYNNE C. Jones, PHD; MARC W. Hungerford, MD

Abstract

The anterior supine approach for total hip arthroplasty (THA) offers the advantage of operating through a true intravascular and intraneuronal plane, but it places the lateral femoral cutaneous nerve at risk. The purpose of this study was to identify the incidence of and impairment relating to injury of the lateral femoral cutaneous nerve.

We performed a retrospective chart review of 81 hips undergoing anterior supine THA from November 2005 through May 2007 to determine operative time, estimated blood loss, fluoroscopic time, type of anesthesia used, intraoperative complications, and postoperative systemic and wound complications. Postoperative radiographs were evaluated for leg-length discrepancy, acetabular inclination and anteverision, and femoral stem position. Patients were reassessed at 6 weeks, 3 months, 6 months, 1 year, and 2 years. At each visit, patients were questioned about numbness or paresthesias in the distribution of the lateral femoral cutaneous nerve; if present, the patient outlined the area with a marking pen. This area was photographed, and data were collected. No hip had frank numbness; 12 hips (14.8%) had paresthesias. For those 12, symptoms resolved in 4 by 6 months, in 6 by 1 year, and in 10 (83.3%) by 2 years; 2 remained unresolved. No significant difference was found between patients with and without paresthesias or between patients with resolved or unresolved paresthesias. Impaired sensation did not appear to affect functional outcome or Harris Hip Score. Incision position, dissection plane, retractor placement, tension and soft tissue handling, and surgeon experience may affect incidence of injury to the lateral femoral cutaneous nerve.
Total hip arthroplasty (THA) has traditionally been performed through a posterolateral or lateral approach, each of which has advantages and disadvantages. The posterolateral approach requires division of the external rotators and can be complicated by a high dislocation rate. The lateral approach has a lower dislocation rate but can be complicated by abductor weakness that causes a postoperative limp. The anterior approach provides several advantages: a true intraneural and intramuscular plane that obviates the dissection of muscle or tendon from bone, in-tact gluteus medius and minimus tendons, a nondisrupted posterior capsule, and a resulting low dislocation rate. However, as described in detail by Matta et al., the technique requires a specialized operating table and intraoperative fluoroscopy.

The senior author (M.W.H.) has recently transitioned to a minimally invasive direct anterior approach when performing primary THA. This approach offers the advantages outlined above but places the lateral femoral cutaneous nerve at risk. The purpose of this study was to identify the incidence of and impairment relating to injury of the lateral femoral cutaneous nerve. Based on the experience of Matta et al., we hypothesized that there would be a clinically insignificant incidence of injury and that most cases would resolve by final follow-up.

**MATERIALS AND METHODS**

**Patient Population**

With approval from our Institutional Review Board, we reviewed our institution’s patient database to identify patients who underwent primary THA by the senior author from November 2005 through May 2007 via a minimally invasive direct anterior approach (as described by Matta et al) or a traditional lateral approach. Inclusion criteria for use of the minimally invasive anterior supine approach included primary THA in patients with an underlying diagnosis of osteoarthritis, rheumatoid arthritis, or osteonecrosis, and radiographs depicting Dorr type B bone. Exclusion criteria were defined as preexisting meralgia paresthetica; radiographs showing Dorr A or Dorr C bone; patients with hip dysplasia, posttraumatic arthritis, or need for hardware removal; and patients requiring revision THA. Finally, although no specific body mass index (BMI) was used as a criterion, patients with a body habitus showing that an abdominal pannus would contact the wound when seated were excluded.

The minimally invasive anterior approach was used in 81 of 154 hips (53%; 73 patients). Mean age of the 35 men (41 hips) and 38 women (40 hips) was 57.8 years (range, 27-83 years). Average BMI was 27.5 (range, 16.4-42.8). The original diagnoses were osteoarthritis in 64 hips and osteonecrosis in 17.

We retrospectively reviewed those patients who underwent primary THA by the senior author from November 2005 through May 2007. The femur is broached progressively for an M/L taper stem (Zimmer) using an offset broach handle until the broach is axially and rotationally stable. Intraoperative fluoroscopy is used to confirm the level of the neck cut, the position and hip center of acetabular reaming, the fit and fill of the femoral component, and the leg length at trial reduction. Leg length is measured on a single low anteroposterior fluoroscopic image of the pelvis that includes both lesser trochanters. This image is printed on a transparency, and a line is drawn across both ischial tuberosities through the lesser trochanters.

After implantation of the final components and hip reduction, closure is completed with a heavy absorbable suture to the capsule, followed by a running absorbable suture to the fascia. Subcutaneous absorb-
able suture and skin staples are then placed. A one-eighth-inch Hemovac drain (Zimmer) is placed below the fascia, exiting distal and lateral to the wound.

**Postoperative Procedures**

Patients were mobilized on the first postoperative day and allowed to bear weight as tolerated with bilateral support. The drain was removed on postoperative day 2. Hip precautions, including no adduction past midline, no flexion past 90°, and no internal rotation past neutral, were maintained for 6 weeks. For deep venous thrombosis prophylaxis, all patients wore graduated compression stockings for 6 weeks. Additionally, patients used sequential compression devices while in bed during their hospital stay. All patients received chemoprophylaxis for deep vein thrombosis with warfarin titrated to an international normalized ratio of 2 to 2.2 for 2 weeks and then aspirin (350 mg twice daily) for an additional 4 weeks.

All patients were seen in clinic 2 weeks postoperatively. Any patient who had cutaneous redness extending >1 cm from the wound edge was treated prophylactically (cephalexin 500 mg twice daily for 7 days) for superficial infection. Patients treated with oral antibiotics were seen again the following week to monitor wound healing.

Patients were reassessed postoperatively at 6 weeks, 3 months, 6 months, 1 year, and 2 years. Conventional radiography and physical examination were part of every postoperative visit. At each follow-up visit, each patient was questioned regarding the presence of numbness or paresthesias in the distribution of the lateral femoral cutaneous nerve. If numbness or paresthesia was present, the patient was asked to outline the area with a marking pen. This area was digitally photographed with a ruler in place (Figure 1). Image J software (National Institutes of Health, Bethesda, Maryland) was used to measure the affected area. This protocol was repeated at all subsequent postoperative visits. All data regarding lateral femoral cutaneous nerve paresthesia were collected prospectively. Patients with permanent injury were questioned regarding impairment (numbness, partial numbness, burning, pain) and level of concern (constant, often, occasional, never).

**Statistical Methods**

Differences in frequencies were evaluated using chi-square analysis with Yates’ correction. Parametric data were analyzed with Student t test. We used the JMP statistical package (SAS, Cary, North Carolina), and significance was accepted at the \( P < 0.05 \) level.

**RESULTS**

We found no statistically significant difference in demographics, laterality, BMI, diagnosis, or operative parameters between patients with and without paresthesias (Table 1) or between patients with resolved or unresolved paresthesias (Table 2).

Of the 81 hips studied, spinal anesthesia was used in 25 hips and general anesthesia was used in 56. Estimated blood loss averaged 561 mL, operative time averaged 114 minutes, and fluoroscopy time averaged

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<th>Table 1</th>
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<tr>
<td><strong>Comparison of Patients With and Without Paresthesia</strong></td>
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<td>Mean blood loss, mL</td>
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<td>Mean fluoroscopy time, sec</td>
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Abbreviation: BMI, body mass index.
21 seconds. No intraoperative complications occurred. Postoperative systemic complications included 2 arrhythmias, 2 pneumonias, 1 deep vein thrombosis, and 1 nonfatal pulmonary embolism. Wound complications included 5 presumed superficial infections, 1 hematoma (treated nonoperatively), and 1 stitch abscess. None of the 5 patients treated for presumed superficial infection had any purulence, and none of the patients were febrile. The presumed superficial infections resolved with oral antibiotics, and the stitch abscess resolved with oral antibiotics and removal of the stitch remnant.

Postoperative radiographic analysis showed an average leg-length discrepancy of 2 mm. The acetabular cup averaged $49^\circ$ of inclination and $13^\circ$ of anteversion. There was no statistically significant difference between groups. Femoral stem position was within $5^\circ$ of neutral in all patients.

There was no functional difference noted between patients with and without lateral femoral cutaneous nerve impairment. Average Harris Hip Score increased from 61.5 (range, 57-66) to 97.5 (range, 95-100) in patients with lateral femoral cutaneous nerve impairment, compared with an increase from 61.5 (range, 59-64) to 95.1 (range, 94-96) in those without impairment.

Regarding the lateral femoral cutaneous nerve, no hip had frank numbness, and 12 hips (14.8%) had paresthesias: 4 of 41 (10%) male hips and 8 of 40 (20%) female hips (not a significant difference). Of those 12 hips with paresthesias, full resolution of symptoms occurred by 6 months in 4 hips. By 1-year follow-up, 6 of 12 had resolved (Table 3). At final 2-year follow-up, 10 of 12 (83.3%) had full resolution of symptoms, and 2 remained unresolved and were deemed permanent injury.

The average size of the affected area was 93.21 cm$^2$ (range, 28-398 cm$^2$) at initial follow-up. Of the 2 patients with permanent paresthesia, 1 showed a sizable decrease (initial follow-up, 77.70 cm$^2$; final follow-up, 25.66 cm$^2$), and the other showed no substantial change (initial follow-up, 109.89 cm$^2$; final follow-up, 108.54 cm$^2$). The size of the initial area affected did not correlate with time to resolution. The 2 patients with permanent injury were questioned regarding impairment. Both described the impairment as partial numbness without symptoms of meralgia, such as burning or pain. Both patients reported the paresthesia was of no concern and only noticeable during clinical examination.
DISCUSSION

To the best of our knowledge, our study is the first to identify the incidence of and impairment caused by injury to the lateral femoral cutaneous nerve during THA through the minimally invasive anterior supine approach. Reports in the literature offer concerns regarding lateral femoral cutaneous nerve injury but do not define the incidence or degree of impairment.4,7-9

The lateral femoral cutaneous nerve supplies sensation to the anterior and lateral thigh. It is usually described as exiting the lateral border of the psoas muscle, crossing under the inguinal ligament, and coursing over the body of the tensor fascia lata between 1.5 and 5 cm distal to the anterior superior iliac spine.10 However, Aszmann et al11 identified 5 anatomic variants that showed significant variability in the anatomic location of the nerve in relation to the tensor muscle and the inguinal ligament. Of the specimens examined, 7% had the main trunk of the nerve or a major branch cross over the iliac crest posterior to the anterior superior iliac spine.11 Because the surgical interval for the minimally invasive anterior supine approach is between the tensor fascia lata and sartorius muscles, the lateral femoral cutaneous nerve will always be in the vicinity of the surgical field.

In the original description of this technique, Matta et al4 reviewed 494 hips, reported accurate leg-length equality and a dislocation rate of 0.61% (3 of 494), and observed that some patients had lateral femoral cutaneous nerve injury in the early part of the series. After adjusting the incision “more lateral” in an attempt to avoid this problem, they found no additional further lateral femoral cutaneous nerve paresthesias. They did not report the number of patients with lateral femoral cutaneous nerve paresthesias.

Kennon et al7,8 retrospectively reviewed results of primary and revision THAs through a minimally invasive anterior approach. Of 2132 consecutive primary THAs, the lateral femoral cutaneous nerve was injured in only 5 (<0.01%).9 However, the approach used was different from the single incision used by the senior author in our study. The former incision was described as a curved transverse or short straight incision with or without a small proximal incision or stab wounds. Furthermore, the tensor fascia lata muscle was split. Kennon et al7 reported no lateral femoral cutaneous nerve injuries in 468 revision THAs through a minimally invasive anterior approach.

Rauchbauer9 reported on 100 THAs via a minimally invasive anterior approach. These procedures, done without fluoroscopy or the use of a specialized table, included both cemented and cementless implants. The incision length averaged 7 cm. Results showed no dislocations, no subsidence >2 mm, and no sciatic or femoral nerve palsy. Complications included 1 calcac crack, 1 trochanteric tip fracture, 3 cases of delayed wound healing, 3 cases of leg-length discrepancy (1-2 cm), and 6 injuries (6 hips) to the lateral femoral cutaneous nerve. Of those 6, 4 patients had meralgia (2 were treated with neurolysis; 2 resolved within 1 year) and 2 involved numbness only, which resolved at 1 year.

The minimally invasive anterior approach provides a muscle-sparing approach with accurate restoration of leg length and a low dislocation rate.4,8,12 In our study, injury to the lateral femoral cutaneous nerve occurred in 12 of 81 hips (14.8%). Incision position, subcutaneous dissection plane, retractor placement, and tension and soft tissue handling may be factors influencing injury to the lateral femoral cutaneous nerve. Decreasing operative time and traction on the nerve may decrease the incidence. Specially curved and angled instruments for reaming of the acetabulum, placement of the acetabular component, and broaching of the femur are critical in minimizing soft tissue stress with this approach. Suitable instruments and implant systems are available from a number of manufacturers.

Although impairment to the lateral femoral cutaneous nerve was documented, no patient reported frank numbness. In addition, no patient in this study developed meralgia paresthetica or required surgical decompression. The presence of impaired sensation did not appear to affect the patients’ functional outcomes or Harris Hip Scores.

The surgeon’s (M.W.H.) learning curve correlated positively with impairment (paresthestia) of the lateral femoral cutaneous nerve: the incidence was 25% for the first 20 cases and only 5% for the final 20 cases (Figure 2). Of the 12 cases of lateral femoral cutaneous paresthesia, 11 (92%) occurred in the first 47 cases (23% incidence) and...
only 1 occurred in the last 34 cases (3% incidence).

Lateral femoral cutaneous nerve impairment occurs in approximately 15% of patients undergoing THA through the minimally invasive anterior supine approach. In our study, permanent impairment occurred in <3% of patients. Surgeons using the minimally invasive anterior approach may consider informing patients of this potential impairment. However, even with persistent lateral femoral cutaneous nerve paresthesia, impairment is minimal.

REFERENCES


