Endoscopic Sciatic Neurolysis

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Abstract: Despite remaining a controversial diagnosis, piriformis syndrome continues to affect patients' quality of life with pain, sitting discomfort, and exercise intolerance. Open sciatic neurolysis has been noted by the senior author to often only bring temporary relief of the symptoms, with the recurrence presumably due to postoperative scar tissue. Minimally invasive techniques used to decompress the nerve have met with mixed results. This article describes a step-by-step surgical technique designed to maximize patient safety, as well as surgeon orientation, and achieve a thorough neurolysis. Preoperative findings suggestive of piriformis syndrome are described and include retro-trochanteric pain, sciatica-like leg pain, and paresthesias, as well as a positive response to computed tomography–guided injection of dilute ropivacaine hydrochloride and 40 mg of triamcinolone. The operation is performed with the patient in the lateral decubitus position through 2 portals 6 to 8 cm apart, allowing for good triangulation. Dissection is undertaken with a combination of radiofrequency and a laparoscopic peanut, with the assistance of a vascular sling to control the sciatic nerve. Encouraging results have been achieved, and with increasing interest in this procedure, a step-by-step technical description with an accompanying video may prove useful for other experienced hip arthroscopists. Pearls and pitfalls are discussed.

Entrapment or tethering of the sciatic nerve as it traverses the piriformis muscle in the buttock has been well described. However, because of a lack of definitive diagnostic clinical features or specific investigations, the diagnosis of piriformis syndrome or deep gluteal syndrome remains controversial.[1-8]

Open sciatic neurolysis with or without piriformis tenotomy has been the most accepted surgical treatment for this condition. More recently, endoscopic techniques and results have been published. Dezawa et al.[4] described the arthroscopic release of the piriformis muscle for sciatic nerve entrapment with the patient under local anesthesia in 2003.[8] In another article Martin et al.[5] described an endoscopic treatment for piriformis syndrome, reporting positive results.[8]

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We describe a step-by-step endoscopic technique designed to assist orientation and maximize surgical safety during endoscopic sciatic neurolysis. The illustrations and Video 1 show a patient undergoing a reoperation for a recurrence of symptoms 2 years after open sciatic neurolysis performed at another institution, presumably due to re-formation of scar tissue and loss of sciatic nerve excursion.

Technique

The senior author (M.J.B.) uses the surgical criteria described in Table 1 to select patients to undergo endoscopic sciatic neurolysis. The patient is placed in the lateral decubitus position. General anesthesia without paralysis is administered. The traction bolster of the McCarthy hip traction device (Innomed, Savannah, GA) is used. If hip arthroscopy is indicated, this is undertaken before sciatic neurolysis. The leg is taken out of traction and placed on a custom U-shaped bolster allowing free flexion and extension of the hip. The traction boot is also removed to allow visualization of any foot movement as a result of sciatic nerve stimulation.

The femur is marked; the posterosuperior portal is positioned 1 cm superior to the tip of the greater trochanter and 1 to 2 cm posterior to the posterior edge of the greater trochanter (Fig 1). The posteroinferior portal is positioned 6 to 7 cm distally, allowing easy

Table 1. Surgical Criteria Used to Identify Patients in Whom Endoscopic Sciatic Neurolysis Will Most Likely Prove Most Beneficial

Retro-trochanteric pain, sciatica-like leg pain, numbness, and paresthesia
Sitting intolerance
Buttock pain on resisted external rotation of hip at 90° of flexion and full internal rotation
Normal lumbar spine MRI findings
Positive response to CT-guided injection of dilute ropivacaine hydrochloride and 40 mg of triamcinolone (either immediately with the local anesthetic or delayed with cortisone)
Symptoms and failure of conservative measures for >6 mo

CT, computed tomography; MRI, magnetic resonance imaging.

triangulation between the arthroscope and instruments (Fig 1). To ensure easy access to the retro-trochanteric space, spinal needles inserted through the marked portals should strike the femur at a 30° to 40° angle to the vertical plane. A lesser angle results in an awkward vertical position of the scope and instruments (Video 1). Standard adhesive drapes are used with a large pocket for collecting arthroscopic fluid. The image intensifier C-arm is a helpful tool given the lack of simple anatomic landmarks. Two straight artery forceps are used for blunt dissection through the gluteus maximus into the retro-trochanteric space (Fig 2). The image intensifier combined with surgical "feel" or "jousting" can confirm triangulation posterior and medial to the greater trochanter (Fig 2). A 30° scope with a blunt trocar is introduced into the distal portal, aiming for the back of the greater trochanter. A fluid pump (Arthrex, Naples, FL) set at 40 mm Hg is used. The retro-trochanteric space is characterized by loose areolar tissue and fat (Fig 3, Video 1). If muscle is encountered, the instruments are too posterior or lateral and the gluteus maximus has not been fully traversed (Fig 4). Positioning further anterior and medial, along with a few degrees of internal rotation of the femur, is required.

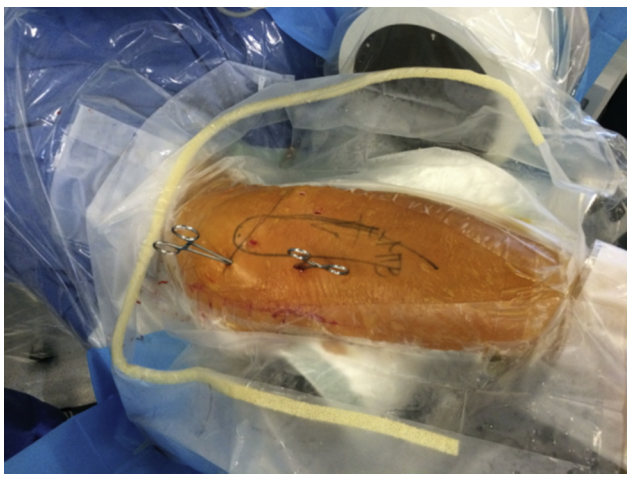

Fig 1. The femur is marked; the posterosuperior portal (portal on the left) is positioned 1 cm superior to the tip of the greater trochanter and 1 to 2 cm posterior to the posterior edge of the greater trochanter. The posteroinferior portal (portal on the right) is positioned 6 to 7 cm distally, allowing easy triangulation.

Fig 2. Two straight artery forceps are used for blunt dissection through the gluteus maximus into the retro-trochanteric space. The image intensifier C-arm is a helpful tool given the lack of simple anatomic landmarks. In this image the positioning of the 2 portals can be seen, with the posterosuperior portal positioned 1 cm superior to the tip of the greater trochanter and 1 to 2 cm posterior to the posterior edge of the greater trochanter and with the posteroinferior portal positioned 6 to 7 cm distally. The ideal position allows the artery forceps to "bump" the back of the trochanter and "touch tips."

The ArthroCare 50° radiofrequency wand (ArthroCare, Austin, TX) has proved an ideal starting instrument because it minimizes bleeding. The characteristic white color of the posterior edge of the trochanter is important to identify to confirm orientation (Fig 3). Dissection medially combined with further internal rotation of the limb by an assistant will lead to the piriformis tendon. Once found, it can be released using the radiofrequency wand, resulting in 10 mm of retraction (Fig 5).

The 50° wand is useful to follow the obturator internus muscle medially until the outline of the sciatic nerve is seen. This wand will result in muscle activation and foot twitches within 20 mm of the nerve (Fig 6). Once twitches are seen, the wand is exchanged for the Saber electrode (ArthroCare). Radiographs should confirm that the wand is directly posterior to the middle of the femoral head. The Saber allows safe dissection because scar tissue over the nerve can be hooked, pulled away from the nerve, and then cut. It is

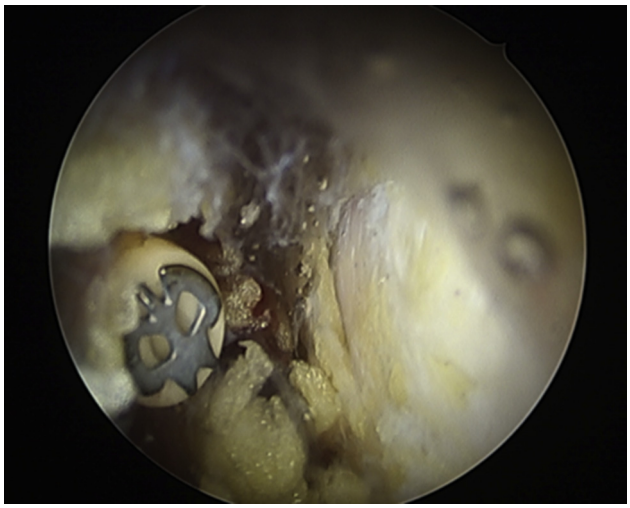

Fig 3. Starting view. The white of the trochanter is seen on the right, with a clear view of the wand. The surgeon can now find the piriformis tendon with radiographic guidance and gentle internal rotation of the hip. The retro-trochanteric space is characterized by loose areolar tissue and fat; if muscle is all the surgeon can see, they are still within the gluteal bulk. The scope should be removed, and blunt dissection further anteriorly with artery forceps is required.

important to note that the nerve to the obturator internus and the posterior cutaneous nerve of the thigh are immediately medial to the sciatic nerve (Fig 7). To release tissue on the medial side of the sciatic nerve (inferior in the lateral position), a laparoscopic peanut is useful (Fig 8). A "candy floss" technique is safe. The surgeon should twist the areolar tissue around the laparoscopic peanut by spinning the instrument and then gently pull, teasing the tissue away (Fig 8, Video 1). A shaver (facing away from the nerve) should

Fig 4. Outside view of Figure 3, highlighting the desired position of the instruments when working, that is, at a 30° to 40° angle to the vertical plane. A lesser angle results in an awkward vertical position of the scope and instruments.

Fig 5. The ArthroCare 50° radiofrequency wand has proved an ideal starting instrument because it minimizes bleeding. The fibers of the piriformis are divided by the wand, resulting in 10 mm of retraction.

only be used for loose fronds of areolar tissue because, otherwise, bleeding can be difficult to deal with close to the nerve. The laparoscopic peanut is also a safe instrument for working in and around the greater sciatic notch.

Once 3 to 4 cm of the nerve is free as it exits the greater sciatic notch, a blue vascular sling is passed around the nerve (Fig 9). Placed in the tip of a blunt grasper, the sling is pushed anterior and medial to the nerve and retrieved posterior and medial (below) the

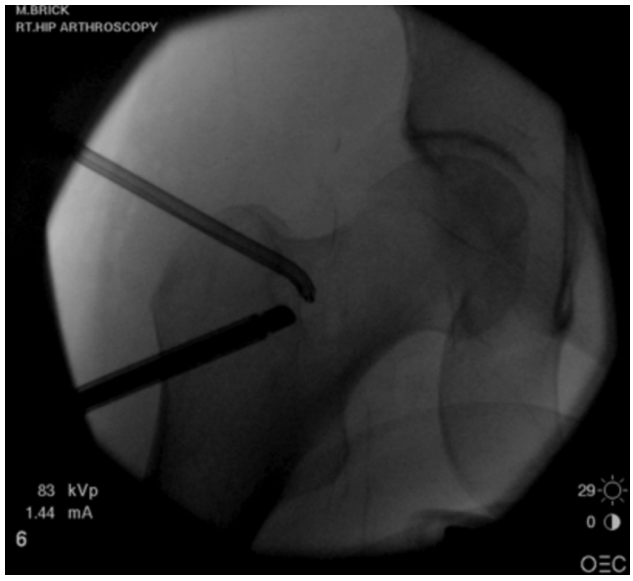

Fig 6. Dissection is taken further medially. Early sciatic nerve twitches are an indication of being within 20 mm of the nerve. This is a good time to switch to the ArthroCare Saber electrode. Other clues are that the nerve can be seen and the wand is near the center of the femoral head on radiographs.

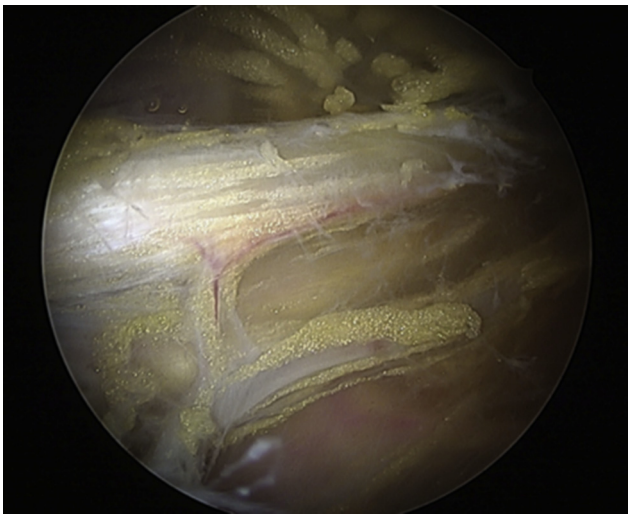

Fig 7. The posterior cutaneous nerve of the thigh is seen posterior to the sciatic nerve.

nerve (Fig 10). This allows gentle lateral traction and simplifies medial dissection (Video 1). The nerve is followed into the greater sciatic notch. The surgeon must be aware that the inferior gluteal nerve hooks around the inferior border of the piriformis here (Fig 11). It is safer to dissect in the notch with the laparoscopic peanut (Video 1). Branches of the inferior gluteal artery are often encountered. Should these restrict sciatic nerve movement, they can be clipped with a 5-mm laparoscopic vascular staple. Once the proximal part of the release is completed, the portals are switched to continue distally. The ischial tuberosity is easily palpated with instruments medially (Fig 12). The sciatic

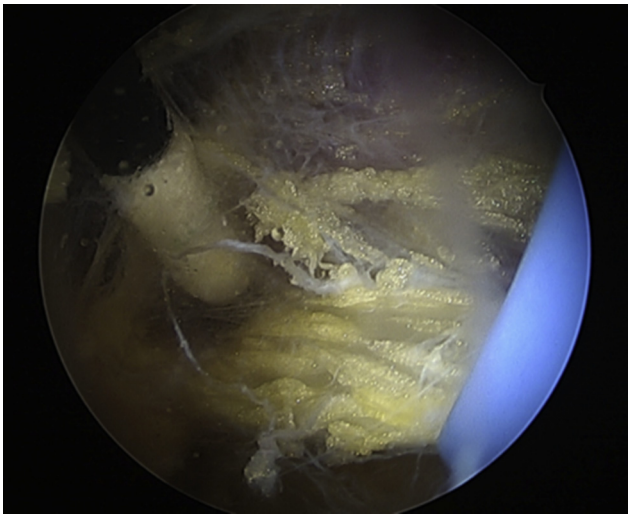

Fig 8. The laparoscopic peanut is used to dissect tight fibrous bands at the greater sciatic notch. A safe method is the candy floss (cotton candy) technique of gently winding up the areolar tissue with a twisting movement, followed by a gentle pull.

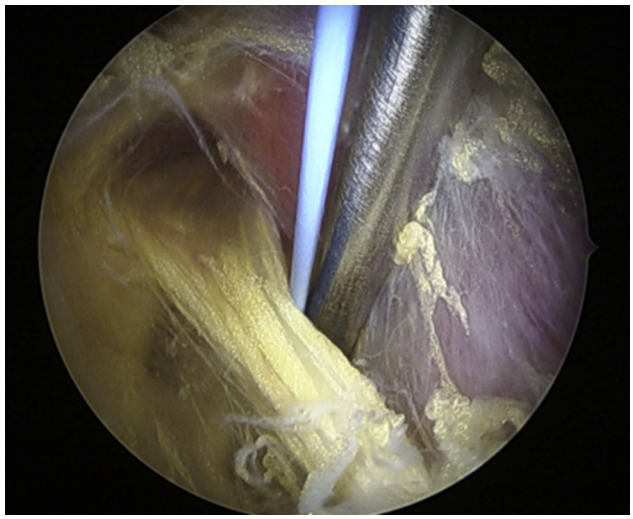

Fig 9. The blue vascular sling is passed anterior to the nerve with the Arthrex suture "loops." These are useful because they have a 15° to 20° bend near the tip. The sling is retrieved on the posterior side.

nerve is often tethered medially to the ischial tuberosity and can be safely freed with the Saber electrode. Often, the electrode does not require activation and can be used here as a simple mechanical hook. Further distally, the hamstring tendons are visualized. Radiographs confirm that dissection has been taken at least as far as the distal edge of the lesser trochanter (Video 1). The goal is to slide the vascular sling up and down the nerve all the way from the greater sciatic notch to the lesser tuberosity (Fig 13, Video 1). Blood vessels supplying the nerve, which do not restrict movement, are left intact. The final step is to place a spinal needle at a safe distance from the nerve; remove the arthroscopic fluid with a vacuum, thus collapsing the view; and inject 40 mg of triamcinolone (Video 1).

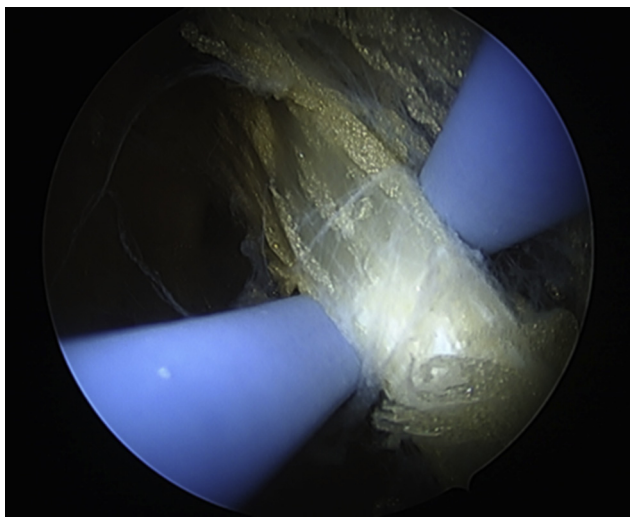

Fig 10. The nerve is now controlled.

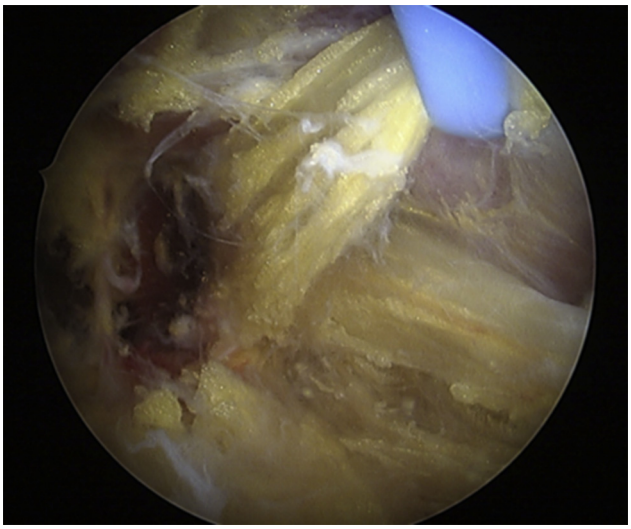

Fig 11. High division of peroneal and tibial nerves at sciatic notch.

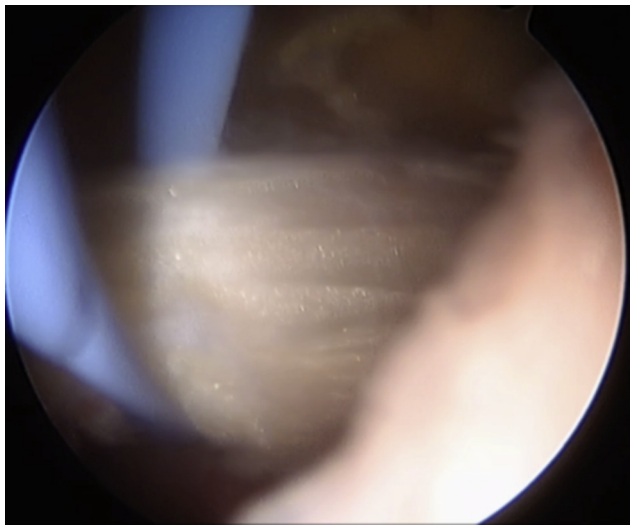

Fig 13. Once dissection is completed, the goal is to slide the vascular sling up and down the nerve all the way from the greater sciatic notch to the lesser tuberosity.

Discussion

In the past several years, clinicians have developed a deeper understanding of piriformis syndrome. The classic mechanism of injury is a heavy fall on the buttocks, but it is also seen with repetitive activities such as competitive sports.[6] The senior author has encountered patients with intra-articular hip pathology (femoroacetabular impingement, traumatic chondrolabral injury) who manifest burning nerve-like pain down the leg as far as the sole of the foot with or without altered sensation, marked sitting intolerance, and retrotrochanteric tenderness. In these patients treating the hip pathology alone has not resolved the buttock or neurogenic pain (or both). Endoscopic sciatic neurolysis allows both areas to be addressed with minimal extra morbidity and 1 extra portal. Published results for endoscopic surgery have been encouraging.[5] Procedures similar to our technique have been described,[4] with mixed results. In the presented case, the patient underwent a revision neurolysis after an open procedure performed at another institution. The amount of scar tissue seen is typical of revision surgery and considerably more than that from a primary procedure. The senior author has noted, in his practice, an estimated 30% rate of recurrence of symptoms after open surgery, which was a significant driver to refine a safe endoscopic technique. To accommodate hip movement, sciatic nerve excursion of up to 28 mm has been measured.[6,7] Any anatomic variant, a vascular or

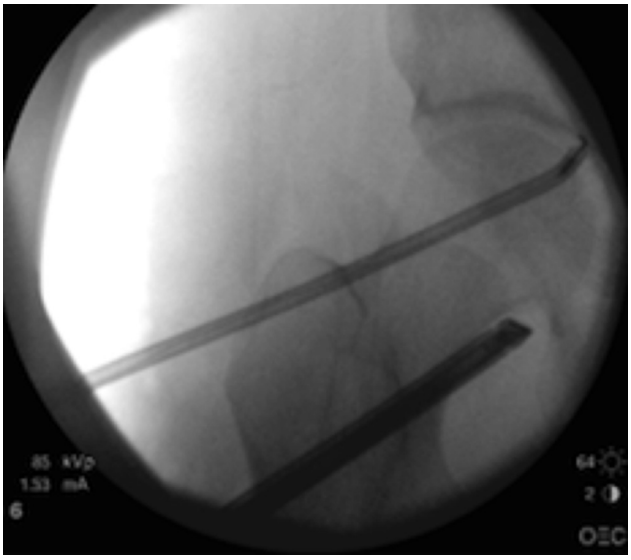

Fig 12. The proximal (and distal) extent of the dissection is easily checked with the radiograph.

Table 2. Crucial Points to Ensure Success of Operation and Pitfalls Encountered

Tips
The procedure is suitable for an experienced arthroscopist.
Cadaveric laboratory experience is valuable.
The posterior aspect of the greater trochanter is an excellent initial landmark.
The anesthetic should not use a paralyzing agent.
If proximal hamstring tethering is encountered, a third more distal portal can be used to extend the surgical range.
Pitfalls
Large branches of the inferior gluteal artery can bleed after cautery. A laparoscopic vascular clip can be used if the surgeon is concerned.
Bleeding is difficult to overcome with fluid pressure. Care is required.
The inferior gluteal nerve, posterior cutaneous nerve of the thigh, and nerve to the obturator internus are small, fragile, and nearby. Knowledge of anatomy is important, and radiofrequency is best avoided immediately medial to the sciatic nerve and within the greater sciatic notch.

Table 3. Advantages and Disadvantages of Endoscopic Approach

Advantages
Surgical morbidity is reduced.
The endoscopic approach can easily be performed at the same time as hip arthroscopy.
Bleeding, scarring, and the potential for recurrence are reduced.
Excellent visualization of the anatomy is possible.
Visualization from within the greater sciatic notch all the way to well below the hamstring origin is possible.
Disadvantages
A high level of arthroscopic proficiency is required.
Bleeding is more difficult to control in a large potential space.
Landmarks are more challenging to identify than with intra-articular surgery.
Any postoperative bleeding occurs in a confined space and can create a pressure effect on the sciatic nerve.

NOTE. The surgeon should focus on the ability to gain better visualization of the anatomy and of the working space while reducing potential complications and morbidity. Being able to perform the procedure at the same time as hip arthroscopy is very helpful. Disadvantages include the need to be experienced in not only hip arthroscopy but also the described technique itself. The enclosed space with the gluteus maximus intact makes it more important to control bleeding; the surgeon should use vascular clips for larger vessels and consider using a drain.

connective tissue leash, or post-traumatic scarring has the potential to limit the required excursion and trigger "sciatica-like" pain, sitting intolerance, and retrotrochanteric tenderness. A risk of open surgery is damage to the sciatic nerve or its branches. Arthroscopic sciatic neurolysis allows excellent visualization and the ability to protect local nerves. Use of the radiofrequency wand minimizes bleeding and thus the potential for recurrent scarring and tethering of the nerve. Structures at risk include the sciatic nerve itself and, more importantly, the smaller nerves nearby (inferior gluteal nerve, posterior cutaneous nerve, nerve to obturator internus). Larger branches of the inferior gluteal artery are more safely clipped with a laparoscopic vascular staple because bleeding can continue even with extensive cautery.

With increasing interest in the described procedure, a step-by-step technical description with tips may prove useful for other hip arthroscopists (Table 2). Orientation is more difficult than with intra-articular arthroscopy. The procedure is suitable for an experienced arthroscopist with the recommendation of prior cadaveric work or observation of a surgeon currently performing the technique (Table 3). Table 4 details some of the important points of the operation.

Table 4. Pearls

Ensure that the patient is not paralyzed.
Perform intra-articular arthroscopic work before sciatic neurolysis, if necessary.
Triangulate the instruments with the help of the image intensifier.
Switch from the ArthroCare wand to the Saber when approaching the nerve.
Bear in mind that a laparoscopic peanut is useful for dissection of areolar tissue from the nerve.
Use a vascular sling to help control the nerve after preliminary dissection.
Dissect until the nerve is free from the sciatic notch to the lesser trochanter.
Inject triamcinolone at the end of the case after placement of the needle under direct vision.

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