Endoscopic Sciatic Nerve Decompression in the Prone Position—An Ischial-Based Approach

Timothy J. Jackson, M.D.

Abstract: Deep gluteal syndrome is described as sciatic nerve entrapment in the region deep to the gluteus maximus muscle. The entrapment can occur from the piriformis muscle, fibrous bands, blood vessels, and hamstrings. Good clinical outcomes have been shown in patients treated by open and endoscopic means. Sciatic nerve decompression with or without piriformis release provides a surgical solution to a difficult diagnostic and therapeutic problem. Previous techniques have used open methods that can now performed endoscopically. The technique of an endoscopic approach to sciatic nerve decompression in the prone position is described as well as its advantages and common findings. Through this ischial-based approach, a familiar anatomy is seen and areas of sciatic nerve entrapment can be readily identified and safely decompressed.

Deep gluteal syndrome (DGS) is an overlooked cause for chronic buttock and lower extremity pain. DGS, as opposed to piriformis syndrome, is a recommended terminology that encompasses any source of sciatic nerve entrapment as it courses under the gluteus maximus. Nerve entrapment can occur from the piriformis, gluteus, or hamstring muscles or fibrous bands surrounding the sciatic nerve.[1] Post-traumatic scarring in the deep gluteal space can cause sciatic nerve entrapment as well.[2]

Martin et al.[3] reported on the results of 35 patients treated with an endoscopic approach to sciatic nerve decompression. This approach gained access to the deep gluteal space through the peritrochanteric space. The advantage of this approach is ease of the supine position and the ability to address any intra-articular or peritrochanteric pain that may coexist.

It is our experience in dealing with endoscopic hamstring disorders that the sciatic nerve can readily be visualized and decompression can be accomplished, if needed, from the prone position. This allows one to address the sciatic nerve at the same time as hamstring disorders, which can coexist.[4] Hamstring disorders are treated with the patient in the prone position and endoscopic access achieved centered around the ischium.[5] In the prone position, the anatomic features of the deep gluteal space, including the ischium and overlying combined hamstring tendon origin, the deep external rotators, and the sciatic nerve, can be easily visualized with an ease of orientation. In this manner, the surgeon looks down at the posterior hip, making orientation in a complex anatomic space simpler. In this position, hamstring disorders can be addressed as well.

For patients who do not have intra-articular or peritrochanteric pain and may or may not have hamstring pathology, we prefer an ischial-based, prone approach to sciatic nerve decompression in the deep gluteal space. This compromises the most patients we treat for DGS. The purpose of this technical note is to describe an endoscopic approach to sciatic nerve entrapment in the deep gluteal space in the prone position; this is an ischial-based approach.

Technique

Positioning

The patient is placed under general endotracheal anesthesia before positioning. The patient is then positioned prone on a radiolucent table that allows fluoroscopy to image the pelvis. It is our preference to use a Jackson table. All bony prominences are well padded, and the pelvis and lower extremities are positioned with the hip flexed approximately 30° (Fig 1, Table 1).

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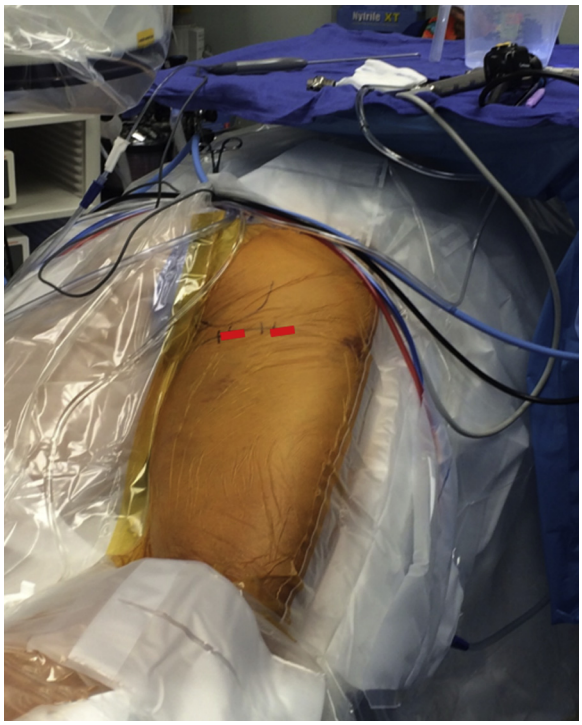

Fig 1. Portal placement and positioning. The patient is placed prone on a radiolucent table. The hips are slightly flexed to allow for maneuverability of instruments. The gluteal crease is marked before prepping and marks the location for the portals. A more lateral portal is created first, 2 to 4 cm lateral to the lateral border of the ischium. Portals are marked with a red line.

Portal Placement and Access

Before prepping, the gluteal crease is marked to guide the placement of the incision for portal placement. Fluoroscopy is used to assure the angle and location of insertion of the trocar and sheath. The 2 primary portals are a posterolateral (PL) portal and a posteromedial (PM) portal (Fig 1). The PM portal is located just distal and slightly medial to the lateral border of the ischium and the PL portal 3 to 4 cm lateral to the PM portal. The exact location of the PL portal can be confirmed by fluoroscopy, judging the angle at which the trocar will strike the ischium (Fig 2A). The PL portal is created first, with insertion of the trocar aimed at the ischium. The trocar is inserted through the gluteus maximus muscle, at the inferior border of the muscle, before striking the ischium. Tactile feedback and fluoroscopic imaging confirm placement (Table 1, Fig 2A). A 70° arthroscope is inserted and the fluid insufflated to 40 to 50 mm Hg (DualWave, Arthrex, Naples, FL). It is important to be patient and not begin using a shaver immediately, as fluid insufflation progresses to open the space under the gluteus maximus (Table 1). Alternatively, a spinal needle and over-the-guidewire technique can be used before insertion of the trocar. The PM portal is then made by a similar method but with direct visualization of the trocar entering into the DGS.

Ischial Bursectomy

For visualization and elimination of any bursal component to pain, an ischial bursectomy is performed. The arthroscope and working instruments can be placed in whichever portal is ergonomically optimal. With the camera facing the ischium, the white background of the common hamstring origin can be seen and the overlying bursal tissue removed with a shaver (Incisor plus Elite, 4.5 mm, curved, Smith and Nephew, Andover, MA) (Figs 2B and 3A, Video 1). It is important to keep pump pressures constant such that activation of suction on the shaver does not decompress the space and draw in muscle tissue. Electrocautery can be used to coagulate any bleeding that is encountered. Once the hamstring tendon is completely visualized, attention is turned to the sciatic nerve (Video 1).

Sciatic Nerve Decompression

Once adequate visualization of the ischium and overlying tendons is performed, the 70° arthroscope is turned to face upward at the overlying gluteus maximus muscle. With this view, for orientation sake, keep the ischium to the side of the screen while looking proximal and posterior (Video 1). Another helpful view is obtained by dropping your hand and putting the tip of the arthroscope more posterior and pointing the 70° camera anteriorly. This provides a view from posterior to anterior, keeping the ischium at the bottom of the

Table 1. Pearls and Pitfalls

	Pearl	Pitfall
Prone positioning	Hip slightly flexed to allow the arthroscope to advance from distal to proximal without interference from the posterior thigh	Unable to manipulate lower extremity to assess excursion of nerve
Access	Initial access from lateral portal, aimed medial, hitting ischium	From medial to lateral, insertion too deep by "plunging" will hit the sciatic nerve
Visualization	Wait until adequate distension of deep gluteal space before using a shaver and/or cautery	Without adequate distension, damage to nerves and arteries can occur
Dissection	Using the 70° arthroscope, alternating views to achieve "orthogonal" views of gluteal space	Keep a broad view of surroundings; too narrow of focus can lead dissection in the wrong direction
Radiofrequency (RF)	Short bursts of the RF device after isolation of fibrous tissue	Aggressive RF usage can damage arteriovenous structures

screen. It is through this view that most dissection occurs (Fig 3B, Video 1). Begin by bluntly dissecting remaining loose connective tissue with a 50° curved radiofrequency (RF) device superficially (posteriorly) and laterally, away from the ischium. We now prefer use of a RF device that functions at lower temperatures to lessen risk of damage to neural structures (Multivac 50° XL, Smith and Nephew). Generally, with just light

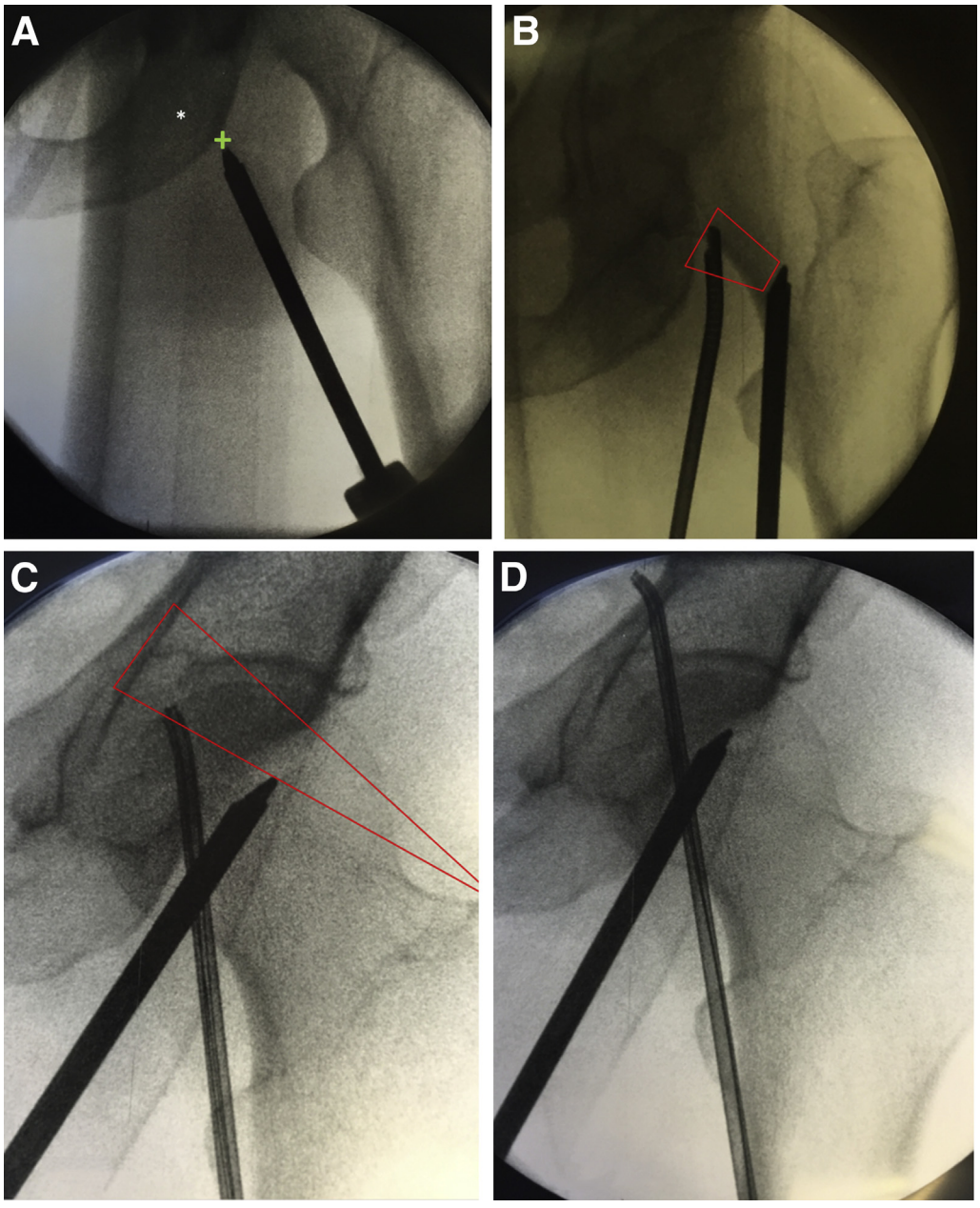

Fig 2. Anteroposterior fluoroscopic images of the operative hip in the prone position. Several steps can be aided with use of fluoroscopy. (A) The lateral portal is used for initial access. Image showing the trocar aimed at the ischium (asterisk), striking the ischium (green plus), and not plunging deep into the neurovascular structures. Tactile feedback and fluoroscopic imaging confirm the location of the trocar. (B) Fluoroscopic image taken during ischial bursectomy to confirm the location of instrumentation. Note that the 70° arthroscope is in the lateral portal and is pointed at the ischium as a reference point. The red represents the cone of visualization of the arthroscope. The shaver is placed in the medial portal. The tendon is a "lighthouse" reference point throughout the procedure. The origin of the common hamstring on the lateral border of the ischium is the starting point for dissection, beginning with a shaver to remove bursal tissue laying over the tendon. (C) The arthroscope is in the medial portal and the radiofrequency device is in the lateral portal. The level of release of piriformis tendon bands seen on fluoroscopy. The red triangle simulates the approximate location of the piriformis muscle in relation to the hip image. (D) Fluoroscopic view showing the proximal extent of sciatic nerve decompression reaching the sciatic notch, after starting in the distal aspect of the ischium.

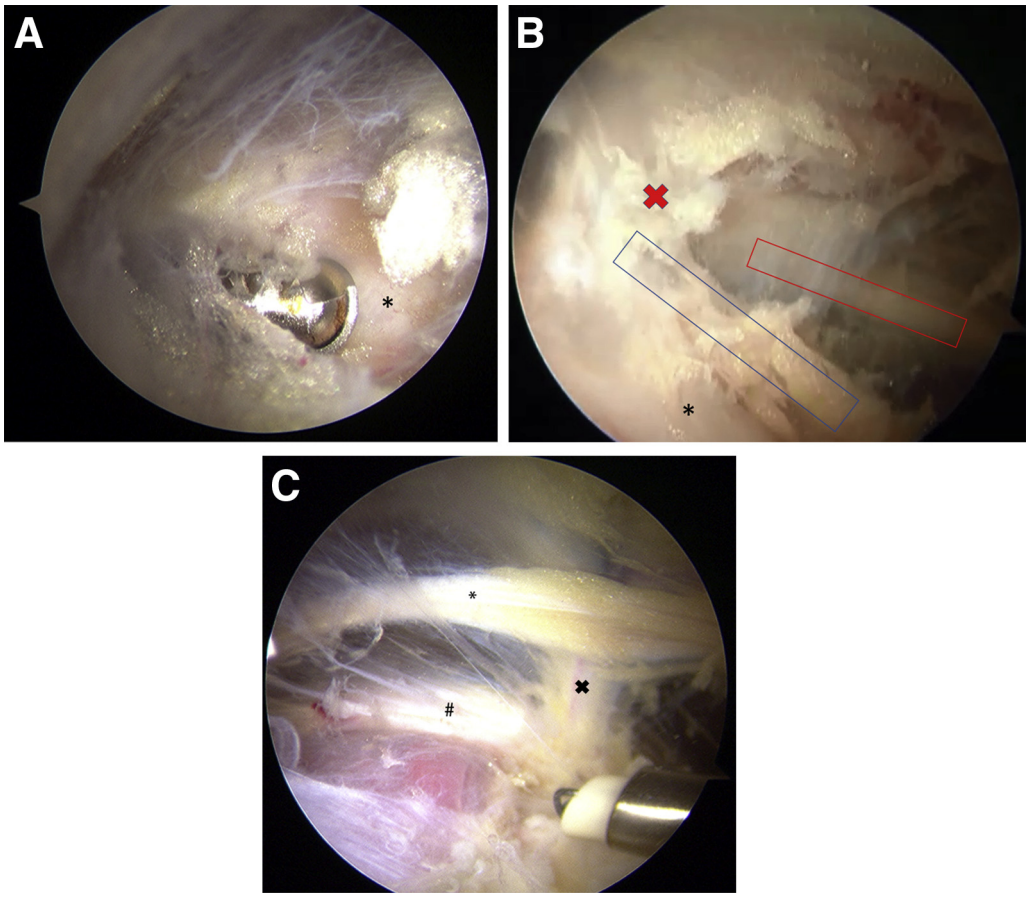

Fig 3. (A) Endoscopic view at the time of initial bursectomy with the hamstring tendon in the background (asterisk). The camera is in the lateral portal and the shaver in the medial portal. (B) Endoscopic view of the fibrous bands (red X), ischium (asterisk), and neural structures before decompression. The posterior femoral cutaneous nerve can be seen under some thin connective tissue (red rectangle). The blue box highlights the region where the sciatic nerve is located. At this early point in the dissection, the nerve is not visible. (C) Photo in the same view as in B. After release of the fibrous bands, the sciatic nerve (#) and the posterior femoral cutaneous nerve (*) can be seen in their entirety. A leash of vessels is visible traversing the deep gluteal space (x).

dissection, the posterior femoral cutaneous nerve can be visualized in this superficial tissue. Often this can be isolated with blunt dissection only. Should there be fibrous bands, short bursts of RF can further release these to completely visualize the cutaneous nerve (Video 1). This nerve should not be confused for the sciatic nerve as it is quite thick in appearance through the magnification of the arthroscope. This can be followed distally to see that it exits superficially and does not track deep along the hamstring.

After the superficial nerve is free, sweep the tissue deeper to it, in line with the course of the sciatic nerve. The sciatic nerve lies deep (anterior) and immediately adjacent to the ischium.[6] Because the entrapment is often at the proximal extent of the hamstring origin or proximal to that, it is helpful to find the nerve more distal along the ischium (Table 2). From here, crossing fibrous bands overlying the sciatic nerve are released with short, careful activation of RF (Fig 3B). With a curved device, the electrocautery can be placed under

Table 2. Advantages and Limitations

Advantage	Limitation
Able to treat concomitant hamstring pathology	Unable to treat concomitant peritrochanteric pathology
Ease of orientation to anatomy	Prone positioning risks
Endoscopic approach improves visualization and with less damage to muscle than the open approach	Familiarity with endoscopic techniques is critical to success
By starting distally in native tissue, can begin from normal to abnormal, even in cases of previous surgery	Technically demanding in cases of previous surgery
Portal incisions in gluteal crease is accepted cosmetically	Initial postoperative sitting pain from sitting on the portals and area of surgery

the fibrous band and elevated away from the nerve before release (Video 1, Table 1). This proceeds from distal to proximal. Before release, ensure that the tissue that is to be released is not an arteriovenous structure. Invariably, a leash of vessels is encountered in this region. It is our preference to avoid damaging or purposely tying these off unless the nerve is entangled in the vessels (Video 1, Fig 3C). To aid in visualization and orientation, alternate the view of the arthroscope from the 2 previously described to achieve orthogonal views of the nerve (Table 1). After final release of all crossing fibrous bands, the space will open tremendously and allow for visualization of the sciatic nerve (Video 1). These crossing fibrous bands run from the ischium to the gluteus maximus muscle, and after releasing them, the overlying gluteus maximus muscle lifts to open the DGS even further. At this point, further blunt dissection proximally will allow you to visualize the nerve coursing proximally toward the sciatic notch. A tendinous band of the piriformis muscle can be seen crossing posterior to the nerve. If this seems to be an impinging structure, a release of the tendinous portion can be done (Fig 2C). Often, there is a large amount of separation between the piriformis muscle and the nerve. Fluoroscopy can be used to ensure that you are proximal enough with the release (Fig 2D, Video 1). Complete decompression can be visualized from the hamstring to the sciatic notch with easy mobilization of the sciatic nerve with a blunt instrument (Fig 3C, Video 1).

Discussion

We have described a surgical technique to decompress the sciatic nerve through its course in the deep gluteal space. We believe this ischial-based technique to be highly reproducible and very safe to surrounding structures. This technique is optimal for patients who have concomitant hamstring pathology and patients who do not have concomitant peritrochanteric or intra-articular pathology.

The advantages of this technique are seen mainly in the endoscopic versus an open approach. Improved visualization and less soft tissue and muscle damage are possible with the arthroscope. This has the potential to help in the recovery and amount of postoperative pain. Improved visualization can help surgeons appreciate subtle anatomic anomalies that can create sciatic nerve compression such as vascular and fibrous structures. The prone position allows surgeons to orient to the fairly complex anatomy in this region. This helps prevent damage to important arteriovenous and neural structures. The ability to treat hamstring pathology and ischial bursitis is another important advantage in those with hamstring pathology. Hamstring tendon tearing can lead to surround scar tissue, causing sciatic nerve entrapment.[4] Without treating the hamstring pathology as well, residual pain from the hamstring could compromise clinical outcomes.[7] The ischial-based approach allows the surgeon to begin in normal anatomy and move to areas of entrapment or abnormal anatomy. This allows the surgeon to find the nerve and trace it proximally, simplifying the dissection (Table 2).

The limitations of this technique are the inability to address peritrochanteric pathology that may occur concomitantly. It has been our experience that these do not often occur together so the limitation is not seen as major. Another limitation is a short length of increased sitting pain postoperatively from the location of the portals. The portal placement is in the gluteal crease and allows for less damage to the gluteus maximus with less risk of inferior gluteal nerve injury. This distal location allows for easy advancement from distal normal to proximal abnormal anatomy, but portal placement is in a location of sitting. Often patients have pain with sitting before the surgery, and simply telling patients that this pain may get worse for a few weeks before it gets better is enough to minimize this issue. Complications from positioning in the prone position is a risk; however, this risk is small with operative times of less than 1 hour.[8]

Exclusion of discogenic pain or radicular etiology is critical before performing a sciatic nerve decompression.[9] Nondiscogenic sciatic pain is a highly studied topic but remains controversial, and there is no gold standard for diagnosis. Many tools are available to make the diagnosis but it is often a diagnosis of exclusion. Pelvis magnetic resonance imaging, specific magnetic resonance neurography, electromyography/nerve conduction velocity, specialized physical exam tests, and diagnostic injections are tools for diagnosis.[10-12] The most critical component to success in this technique is assuring that the location of the sciatic nerve entrapment is within the deep gluteal space.

The fibrous bands discussed here and seen in Video 1 are present in a large number of the sciatic nerve decompressions performed by the author (T.J.J.). The exact etiology of these is unclear. They are presumed to be from scarring either from direct trauma or from repetitive trauma and create a compression of the nerve in the deep gluteal space. This “gluteal tunnel syndrome” has been previously described but deserves more recognition for causing sciatic nerve entrapment.[3]

The prone, ischial-based endoscopic approach to sciatic nerve decompression is a safe, reliable technique for addressing the multiple causes of sciatic nerve entrapment and allows for concomitant treatment of associated hamstring pathology.

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