Technical Note

Endoscopic Treatment of Deep Gluteal Syndrome: 3-Portal Technique

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Abstract: We describe all-endoscopic deep gluteal syndrome treatment and sciatic nerve decompression at the infrapiriformis space. Surgery is performed with the patient in the prone position with the usual arthroscopic instruments and pump. The first step includes performing placement of 2 initial portals (medial and median) without fluoroscopy in the area of the ischial tuberosity and conjoint tendon, as well as release in this area with a subsequent shift in the lateral direction. The second step includes performing placement of an additional lateral portal for instruments, switching the camera into the median portal, and visualizing the sciatic nerve and its decompression at the infrapiriformis space and upper part of the thigh area. The postoperative period includes early activation, immediate passive and active motion after surgery, and full weight bearing the day after surgery.

Deep gluteal pain syndrome is a widespread pathology and is estimated to account for 0.3% to 6% of lower-back and upper or posterior thigh pain; among 40 million patients with back or sciatic pain, there are approximately 2.4 million new cases of deep gluteal syndrome annually.[1] It unites such syndromes as "sciatic neuropathy," "infrapiriformis space syndrome," "piriformis muscle syndrome," "obturator internus/gemellus syndrome," and "quadratus femoris/ischiofemoral pathology."[2]

In case of conservative treatment failure, surgical intervention is performed with sciatic nerve decompression. Endoscopic decompression is much less traumatic than open techniques and is gaining more and more popularity. Jackson[3] described an ischial-based approach to the sciatic nerve with the patient in the prone position using fluoroscopic control for portal placement, which lengthens the procedure and makes it more expensive and complicated. In other studies, Ilizaliturri et al.,[4] Aguilera-Bohorquez et al.,[5] and Knudsen et al.[6] also considered the use of fluoroscopy for performing portal placement. Some authors, such as Yoon et al.,[7] have used a traction table and distraction to perform surgery with the patient in the supine position. Among the most recent publications about the effectiveness and safety of endoscopic sciatic nerve decompression are the works of Metikala and Sharma[8] (2022) and Parodi et al.[9] (2023). Metikala and Sharma performed a systematic review that included a total of 4 studies with 144 patients with a mean age of 46 years and average follow-up period of 26.3 months (range, 12-32 months). They observed that the available

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studies reported a high degree of clinical success with a low rate of complications. Parodi et al. published their results of an endoscopic operation for sciatic nerve entrapment in 57 patients with a mean age of 43.6 years (range, 24-88 years). At a mean follow-up of 22.7 months, the median modified Harris Hip Score improved from 59 to 85 points, the median visual analog scale score decreased from 7 to 2, and postoperative complications occurred in 12% of patients.

Our technique was developed to allow an endoscopic approach to the sciatic nerve without fluoroscopic control and traction and to perform decompression with a standard arthroscopic set of instruments with the patient in the prone position. It can be easily performed by both orthopaedic surgeons and neurosurgeons in their clinical practices.

Surgical Technique

The operation is performed with the patient under general anesthesia in the prone position. Moderate abduction of both legs of the patient is performed, and the surgeon is located between the legs. The surgical procedure starts with marking of the anatomic landmarks and projection of the sciatic nerve. This skill requires a good orientation in the topographic anatomy of the deep gluteal space, which is shown in Figure 1. We usually draw the anatomic landmarks, projection of the sciatic nerve, and endoscopic portals with a permanent marker before draping; however, it can also be performed with a sterile marker after draping (Fig 2). The medial portal is located 2 to 3 cm distal to the tip of the ischial tuberosity and slightly lateral from it (1-2 cm). The median portal is located at the same level but 3 to 4 cm lateral from the medial portal. Finally, the lateral portal is located 3 to 4 cm lateral from the median portal, again at the same level. We then perform medial and median portal placement with a special "atraumatic" technique.

We make only a skin incision (0.5-1 cm) with a blade in the projection of portals; then, with a straight mosquito clamp, we bluntly make a channel in the direction to the tip of the ischial tuberosity. This is palpated with the tip of the mosquito clamp. From a position slightly proximal and above the ischial tuberosity, the surgeon performs a horizontal movement from the medial to lateral direction with a mosquito clamp above the ischial tuberosity to create the "primary space." Next, the surgeon repeats all the same steps for the median portal, bearing in mind that the mosquito clamp should always be directed to the tip of the ischial tuberosity because this is a safe direction without the risk of damaging the inferior gluteal artery and sciatic nerve. We started performing our technique using vertical skin incisions, but we now perform horizontal incisions because they are more cosmetic.

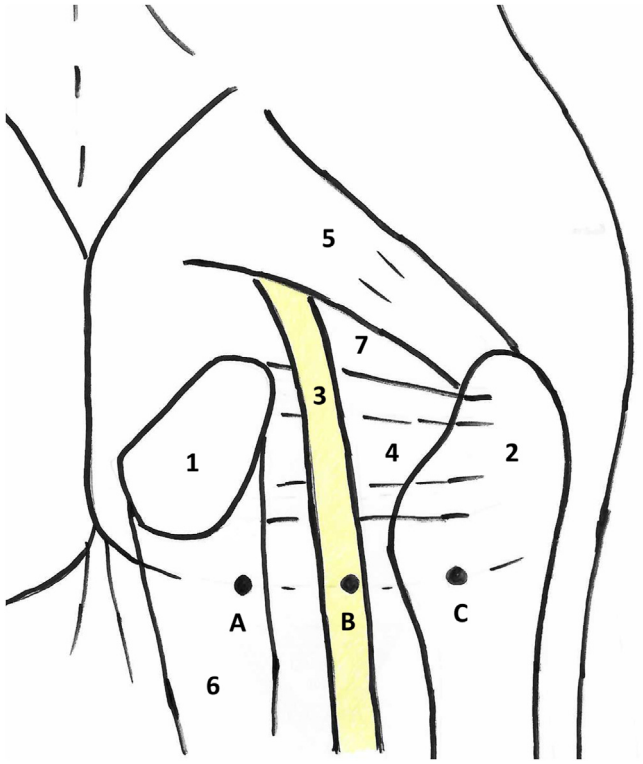

Fig 1. Topographic anatomy of right buttock area with patient in prone position: ischial tuberosity (1), greater trochanter of femur (2), sciatic nerve (3), hip rotator cuff (obturator internus and gemellus superior and inferior muscles) (4), piriformis muscle (5), conjoint tendon (6), and infrapiriformis space (7). The portals consist of the medial portal (viewing portal) (A), median portal (viewing and working portal) (B), and lateral portal (working portal) (C).

We now introduce a scope (4K 30° Scope; Karl Storz) into the medial portal and instruments into the median portal and visualize the ischial tuberosity. Sometimes, the surgeon will feel the contact of the instruments with his or her fingers even before looking at the screen; sometimes, the surgeon will have to perform a small debridement of this area with an ablator (Quantum 2; Smith & Nephew) or shaver (Advantage Turbo/Console; ConMed Linvatec) before visualizing his or her instruments. We use a standard arthroscopic pump (24K Pump; ConMed Linvatec) and saline solution for the procedure.

Next, we perform a release at the area of the ischial tuberosity and conjoint tendon (3-4 cm distally); thereafter, we continue the release into the lateral direction toward the sciatic nerve. We should be careful at this step because the inferior gluteal artery is located between the sciatic nerve and ischial tuberosity (it also extends from the pelvis to the gluteal area through the infrapiriformis space), and in some cases, this artery can be encountered (Fig 3). Laterally to it, after release and debridement, the sciatic nerve is visualized. We perform

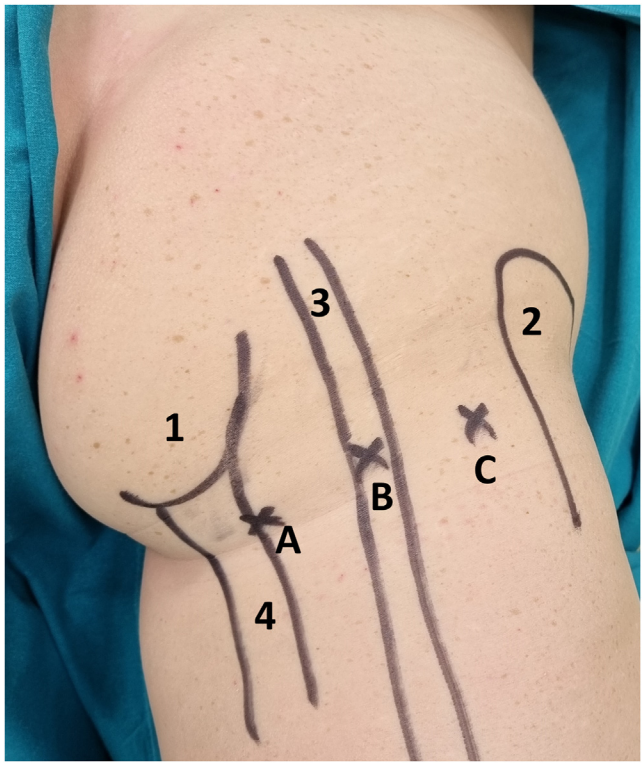

Fig 2. Marking of anatomic landmarks of right buttock area before surgery with patient in prone position: ischial tuberosity (1), greater trochanter of femur (2), sciatic nerve (3), conjoint tendon (4), and infrapiriformis space (7). The portals consist of the medial portal (viewing portal) (A), median portal (viewing and working portal) (B), and lateral portal (working portal) (C).

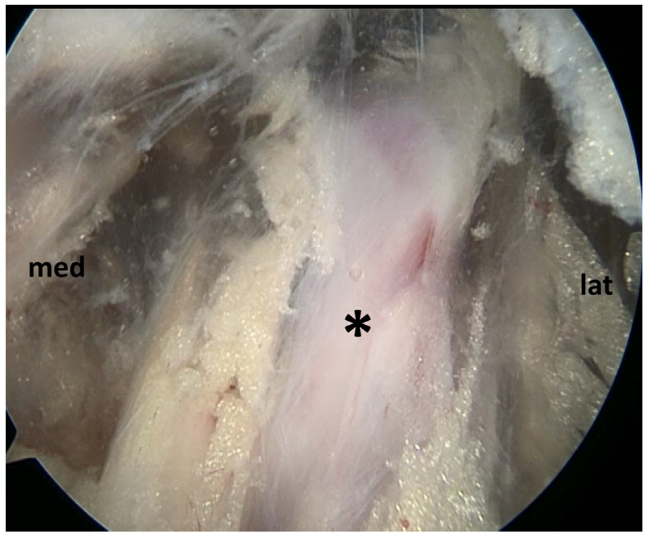

Fig 3. Endoscopic picture of deep gluteal space and right inferior gluteal artery (asterisk) during approach to sciatic nerve. The camera is located in the median portal, and the instruments are introduced in the lateral portal. The patient is in the prone position, and the right side is the operative side. Lat, lateral direction; med, medial direction.

neurolysis of the sciatic nerve and follow it in a proximal direction until reaching the infrapiriformis space. Then, we cut all fibrous tissues and adhesions around the sciatic nerve, visualizing the piriformis muscle, as well as the gemelli and obturator internus muscle. Fibrous bands are easily cut with an ablator, and "soft" scars and adhesions can be removed by a shaver. The surgeon can also dissect the sciatic nerve from adhesions with a blunt obturator. We usually complement our decompression with a slight myotomy of the piriformis and obturator internus muscles. A final view of the sciatic nerve after decompression is presented in Figure 4. During the surgical procedure, the anesthetist usually uses controlled hypotension to decrease bleeding and improve visualization.

The final step of surgery is closure of the portal wounds. Moderate swelling of the buttock area occurs after surgery, but this does not create any problems; edema decreases the day after surgery with no consequences. A postoperative view of the buttock area and portals is presented in Figure 5. A surgical demonstration of endoscopic decompression of the sciatic nerve is presented in Video 1.

Regarding the postoperative period, the patient starts passive and active motion of the hip joints and full weight bearing the day after surgery. The patient also immediately starts performing rehabilitation exercises. At 10 to 12 days after surgery and wound healing, a

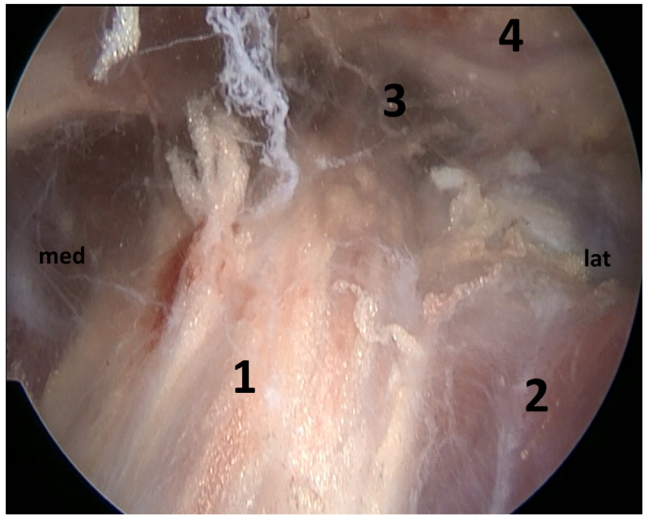

Fig 4. Endoscopic picture of right infrapiriformis space after sciatic nerve decompression: sciatic nerve (1), hip rotator cuff (obturator internus and gemellus superior and inferior muscles) (2), infrapiriformis space (3), and piriformis muscle (4). The camera is located in the median portal, and the instruments are introduced in the lateral portal. The patient is in the prone position. Lat, lateral direction; med, medial direction.

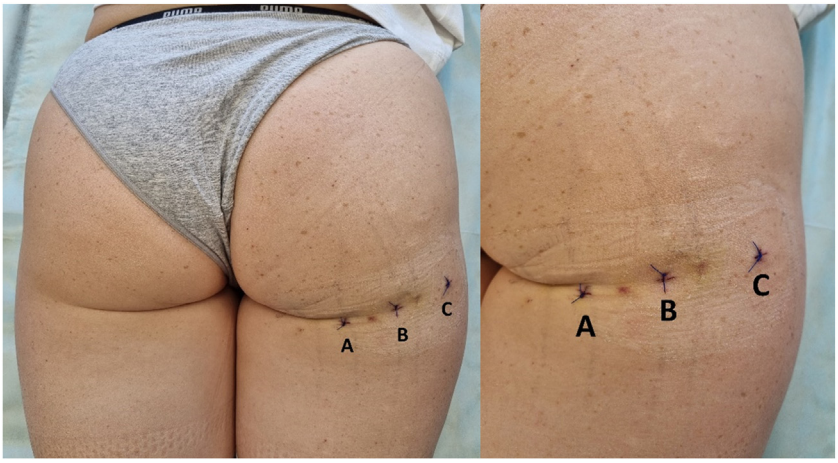

Fig 5. External view of right buttock area after endoscopic deep gluteal syndrome treatment, in which A is the medial portal (viewing portal), B is the median portal (viewing and working portal), and C is the lateral portal (working portal).

Table 1. Pearls and Pitfalls of Surgical Technique

Pearls
Avoidance of use of fluoroscopy (less radiation, with no need to wear heavy protective robes for brigade)
Possibility of performing surgery by both orthopaedic surgeons and neurosurgeons
Perfect cosmetic effect
Early and painless rehabilitation
Simultaneous conjoint (hamstring) pathology treatment if needed
Pitfalls
Risk of damaging parietal peritoneum in case of penetration from infrapiriformis space too deeply
Limitation of surgical time, which should not exceed 2 hours (risk of severe soft-tissue edema because of pump)
Possible technical problems in highly obese patients
Presence of at-risk artery—inferior gluteal artery—in area of intervention (extreme care should be taken)
Possible problems in marking portals and performing portal placement in patients with healed pelvic fractures with severe impairment of anatomy

Table 2. Advantages and Disadvantages of Surgical Technique

Advantages
Use of only 3 endoscopic portals for complete deep gluteal space revision and sciatic nerve decompression
Use of standard arthroscopic set of instruments
No need to use traction or arthroscopic table (as for arthroscopy in supine position)
No need to use side stops (as for lateral decubitus positioning)
Disadvantages
Necessity of use of controlled hypotension to decrease bleeding
Requirement for perfect orientation of surgeon in topographic anatomy of deep gluteal space to prevent damage to nerves and vessels
Difficulty in turning over heavy patients (requiring help of assistants)
Pressure in pump should be kept as low as possible

rehabilitation protocol with physiotherapy and swimming-pool exercises can be initiated.

Discussion

The advantages of endoscopic decompression of the sciatic nerve compared with the open approach in deep gluteal pain syndrome are now self-evident and unambiguous. However, the answer to the main question remains unclear: Which surgical technique of decompression is better? Three main methods of performing surgery currently exist, consisting of supine positioning, lateral decubitus positioning, and prone positioning of the patient.

Surgical techniques in the supine position have been well described by Tipton et al.,[10] Ham et al.,[11] and Aguilera-Bohorquez et al.[5] In addition, Zhang et al.[12] recently described a technique of simultaneous lesser trochanter osteoplasty, quadratus femoris debridement, and sciatic nerve decompression for ischiofemoral impingement in the supine position in 4 patients with good results. In our opinion, the main disadvantages and limitations of this technique are the necessity of using a traction or arthroscopic table, applying fluoroscopic control to perform portal placement, and using a 70° scope for full visualization. As such, the procedure is more expensive and complicated.

Sciatic nerve decompression in the lateral decubitus position has been well described by Ilizaliturri et al.,[4] Knudsen et al.,[6] and Pierce et al.[13] The main disadvantages of this technique, in our opinion, are the use of fluoroscopic control for portal placement, the use of side stops for patient positioning, and possible conflict of the scope and instruments with femoral bone during the approach to the sciatic nerve and when performing neurolysis.

Finally, prone positioning in an ischial-based technique for sciatic nerve decompression has been nicely described by Jackson.[3] This position gives the surgeon excellent visualization of the deep gluteal space, in addition to the conjoint (hamstring) tendon, which can be addressed as well in case of pathology. However, the main disadvantage of the described technique is again

the necessity of fluoroscopic control for portal placement. Another disadvantage is placement of the scope in the medial portal, which in some cases does not supply satisfactory visualization of the sciatic nerve and infrapiriformis space.

Our surgical technique is safe and reproducible in the hands of a surgeon who knows the topographic anatomy of the buttock region well. The main advantage of this technique is the avoidance of the use of fluoroscopy and a traction or arthroscopic table. The surgical procedure uses 3 endoscopic portals and can be performed by both orthopaedic surgeons and neurosurgeons. During surgery, a standard arthroscopic set of instruments is used, consisting of a standard 30° scope, ablator, shaver, switching stick, and obturator. The prone position is easily reproduced and allows the surgeon to work comfortably; difficulties can be met in a patient who is obese and heavy, in which case an assistant is required to turn over the patient. Our technique also has some risks and pitfalls: There is always a risk of damaging the parietal peritoneum if penetration and release from the infrapiriformis space are performed too deeply. The surgeon should be extremely careful during dissection not to damage the inferior gluteal artery, which is located between the ischial tuberosity and sciatic nerve. It is better to use controlled hypotension to decrease bleeding. The surgeon should be perfectly orientated in the topographic anatomy of the deep gluteal space. The main limitation of our technique is the use of a saline solution environment and arthroscopic pump, which limit the surgical time. We recommend that the surgical time should not exceed 2 hours; otherwise, it can lead to compression and hyperperfusion syndromes. It is better to keep the pressure in the pump as low as possible to decrease swelling. Pearls and pitfalls of the described surgical technique are summarized in Table 1, and advantages and disadvantages are summarized in Table 2.

In conclusion, the described technique allows one to perform endoscopic decompression of the sciatic nerve at the infrapiriformis space without fluoroscopic assistance with the patient in the prone position. This technique is safe and can be easily performed by both orthopaedic surgeons and neurosurgeons.

Disclosures

All authors (E.A.B., F.L.L., A.A.S., D.L.P., A.P.P., M.F.L., R.K.S., N.V.Z.) declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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