7 Endoscopic Deep Gluteal Syndrome Techniques: Ischiofemoral Impingement Decompression

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7.1 Introduction

Ischiofemoral impingement syndrome (IFI) is an underrecognized form of atypical, extra-articular hip impingement defined by hip pain related to narrowing of the space between the ischial tuberosity and the femur. Narrowing of the ischiofemoral space leads to muscular, tendon, and neural changes [1, 2]. Since the first description of an impingement syndrome between the femoral lesser trochanter (LT) and the ischium by Johnson in 1977 [3], ischiofemoral impingement has been increasingly recognized as an overlooked cause of hip pain. A rubbing mechanism between the ischium and the lesser trochanter could lead to the development of quadratus femoris (QF) edema. The syndrome may occur acutely because of inflammation/edema or chronically because of fibrous tissue formation that traps the sciatic nerve (SN).

7.2 Etiology and Predisposing Factors

The ischiofemoral space should be understood as a gait-related dynamic area with several contributing and predisposing factors. A recent study about the effect of angular deformities of the proximal femur on impingement-free hip range of motion found that when increasing neck–shaft angles (≥135°) and femoral torsion (≥25°), ischiofemoral impingement occurred [4]. In native hips, IFI has been discussed as a result of marked coxa valga deformities [5]. Other authors have suggested excessive femoral antetorsion and other changes in pelvic anatomy in patients with IFI [6]. Gómez-Hoyos et al. [7] assessed the femoral neck version (FNV) and the lesser trochanter version (LTV) in 11 patients with confirmed diagnosis of IFI. No difference was found in mean LTV between groups; however, the mean

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Table 7.1 Potential etiologies and predisposing factors of ischiofemoral impingement (IFI) according to the pathophysiological mechanisms [8]

1.	Primary or congenital (orthopedic disorders)
1.1	Coxa valga
1.2	Prominence of the lesser trochanter
1.3	Congenital posteromedial position of the femur
1.4	Larger cross section of the femur
1.5	Abnormal femoral antetorsion
1.6	Coxa breva
1.7	Variations of the pelvic bony anatomy
2.	Secondary or acquired
2.1	Functional disorders
(a)	Hip instability
(b)	Pelvic and spinal instability
(c)	Abductor/adductor imbalance
2.2	Ischial tuberosity enthesopathies
2.3	Traumatic, overuse, and extreme hip motion
2.4	Iatrogenic causes
2.5	Tumors
2.6	Other etiologies (genu valgum, leg discrepancy, pronated foot)

FNV (21.7° vs. 14.1°) was higher in symptomatic than in asymptomatic patients, with statistical significance. Isolated dynamic entrapment of the sciatic nerve by the quadratus femoris muscle (QFM), spasm, or anatomical variants has not been reported. A list of potential etiologies and predisposing factors of ischiofemoral impingement is presented in Table 7.1 [8].

7.3 Clinical Examination and Symptoms

- The clinical assessment of patients with IFI is difficult because the symptoms are imprecise and may be confused with other lumbar and intra- or extra-articular hip diseases, including deep gluteal syndrome [9].
- Patients typically present with mild to moderate nonspecific chronic and sometimes gradually increased pain in the deep gluteal region. This pain can be also located lateral to the ischium, in the groin and/or in the center of the buttock.
- Limited sitting time and limitation of physical activities including long-stride walking are frequent. Duration of these symptoms vary between months and several years and usually there is no precipitating injury (except trauma-related cases) [1, 10–12]. The specific physical examination test included the long-stride walking test and IFI test [8, 10, 13]. The injection test of the ischiofemoral space (IFS) has both a diagnostic and therapeutic function.

7.4 Medical Imaging

Although IFI is increasingly being discussed in the medical literature, it remains a poorly recognized condition because symptoms are often nonspecific. Hence, imaging plays an important role in its diagnosis and treatment. Patients presenting with unexplained buttock pain must be initially screened with lumbar and pelvic imaging to rule out spinal pathology and/or unusual pelvic masses.

- **Radiographs**: There are no specific radiographic findings for IFI. The IFS narrowing on radiographs is uncommon and has not been related to clinical findings or other imaging tests. Although chronic osseous changes of the lesser trochanter and ischial tuberosity may be present, it is uncertain whether chronic contact between them represents the cause. However, hip and pelvic radiographs are useful to diagnose osseous abnormalities that may cause acquired IFI or to depict other causes of pain [8].
- **Magnetic resonance imaging (MRI)**: Characteristic findings are a decreased ischiofemoral space compared to healthy controls (the ischiofemoral space measures 23 ± 8 mm and femoral space 12 ± 4 mm) and altered signals from the quadratus femoris muscle, which results in edema, muscular rupture, or atrophy [13, 14] (Figs. 7.1 and 7.2). However, soft tissue magnetic resonance imaging (MRI) signal abnormalities are present within the IFS in 9.1% of asymptomatic patients (edema in 1.4% and fatty infiltration in 7.7%) [15]. Unfortunately, the resting position of the limb that is required for routine MRI does not reproduce the conditions leading to instability in daily life. Moreover, there is ≥10% width difference between the right and left IF spaces

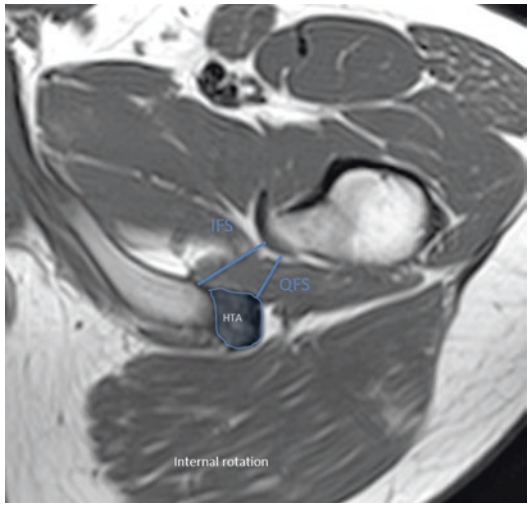

Fig. 7.1 Axial T1-weighted magnetic resonance (MR) image at the tip of the lesser trochanter (LT) in internal rotation shows normal left ischiofemoral space (IFS), quadratus femoris space (QFS), and hamstring tendon area (HTA). IFS is defined as the gap between the ischium tuberosity and the iliopsoas tendon, and the LT and QFS as the smallest gap between the superolateral surface of the hamstring tendons and the posteromedial surface of the iliopsoas tendon or the LT

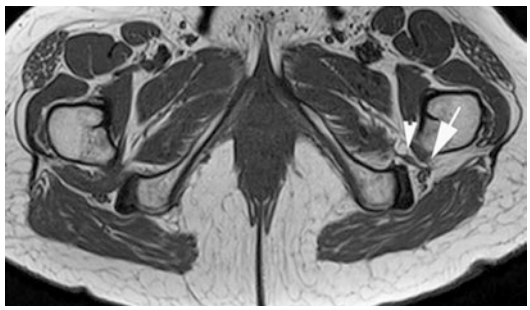

Fig. 7.2 Left deep gluteal syndrome secondary to chronic ischiofemoral impingement (IFI) in a 53-year-old woman. Axial proton density (PD)-weighted magnetic resonance (MR) image shows bilateral narrowing of the ischiofemoral space (IFS). On the left side, quadratus femoris muscle atrophy and a residual fibrous type-2 band (arrowhead) anchored to the sciatic nerve (arrow) are seen

in approximately half of asymptomatic individuals [15]. These measurements depend on the degree of hip rotation, adduction, and extension during MRI; therefore, the validity of these values remains unclear [16, 17]. Nevertheless, these studies are not invalid. Using a cutoff of ≤15 mm, a sensitivity of 76.9%, specificity of 81.0%, and overall accuracy of 78.3% have been reported. For quadratus femoris space (QFS), a cutoff of ≤10.0 mm resulted in 78.7% sensitivity, 74.1% specificity, and 77.1% overall accuracy [13].

7.5 Conservative Treatment

- Several management strategies have been proposed for relieving symptoms, although no definitive treatment has been recommended. Initial management should be conservative [8]. Several reports describe patients successfully treated with a nonsurgical algorithm, which can normalize the range of motion in the hip joint. Stretching exercises and strengthening of the spine musculature and the hip muscles are essential.
- The exercise program must be targeted to the external rotators of the hip, specially the quadratus femoris muscle (QFM) and abductor musculature, to adequately reduce pain and increase range of motion in the hip joint and increase its stabilizing effect on the hip. This approach may be essential for solving cases secondary to atrophy or related to instability of the hip, pelvis, and spine. Nonsteroidal anti-inflammatory medications and an infiltration test may be beneficial as an adjunct to the exercise program.
- Although the injection test is not always a definitive treatment, it is a nonsurgical alternative in selected patients that provides the palliative relief of symptoms. Most patients recognize the pain location when the needle is advancing into the IFS, and as an indicator of a successful injection, they experience a significant immediate postinjection decrease in symptomatology, which can last from 1 day to 9 months [18].

7.6 Operative Treatment

As a general guideline, only patients who have failed conservative measures are considered for operative treatment. The type of surgical proce-

dure (open or endoscopic) depends on the clinical and imaging diagnosis. The response to targeted injections is helpful to predict the treatment success. Until recently, excision of the LT with an open approach had been recommended as a normal operative technique for IFI with a narrowed ischiofemoral distance [19]. Arthroscopic access to decompress the IFS, as an alternative to an open approach, has been recently described with high success rates because it managed to significantly improve clinical scores [10, 20–22].

7.6.1 Endoscopic Surgical Technique

7.6.1.1 Indications

- Entrapment injuries of the sciatic nerve at the level of the quadratus femoris
- Ischiofemoral impingement

7.6.1.2 Anatomy

- The quadratus femoris muscle (QFM) is a flat and quadrilateral muscle, situated within the subgluteal space of the hip [23]. The potential structures in danger are the medial and lateral femoral circumflex arteries, which course on the upper border of the QF muscle [24]. A cadaveric dissection study described that the medial circumflex artery was located on an average of 18 mm from the lesser trochanter (LT) [25].

7.6.1.3 Lesser Trochanter Approach

Due to the location of the LT, the arthroscopic procedure can be approached either anteriorly or posteriorly and with partial or complete resection of the LT. The goal of surgery is to reestablish a normal distance, which may not require a complete resection of the lesser trochanter. We agree with other authors that the posterolateral trans-quadratus approach seems to be the most appropriate route [10, 26, 27]. The anatomy of vascular structures suggests increased safety of posterior access to the lesser trochanter [28]. Another advantage of this approach is that it allows simultaneous assessment of the sciatic nerve and hamstring repair if needed. Ischioplasty when necessary can also be done with this approach. The aim of the osteoplasty of the posterior one-third of the lesser trochanter is to obtain an IFS of at least 17 mm, leaving non-impingement bone and the iliopsoas insertion intact. Partial resection without releasing all of the iliopsoas tendon insertions can potentially decrease the risk of stress fracture when compared with complete resection and this fact may be particularly important for high-performance athletes [10]. We will describe the posterior approach with partial resection. This approach in our hands have had favorable outcomes without any complications.

7.6.1.4 Patient's Position

- Supine or lateral position in a traction table, standard preparation for hip arthroscopy, no traction. May be performed concomitant to a hip arthroscopy of the central and/or peripheral compartments, if indicated.
- Leg is abducted to about 15–20° in order to open the interval between the trochanter and the iliotibial band (ITB) and the leg is internally rotated 20–40° or more to bring the lesser trochanter into the field of view (Fig. 7.3; Video 7.1).

7.6.1.5 Instruments/Equipment/Implants Required

- Arthroscopic shaver and burr.
- A 30–70° arthroscope, and in some cases or larger patients the use of an extra-longer arthroscope is required.
- Radiofrequency probe. The cannulas are opened to maintain the fluid flow, when utilizing the radiofrequency probe. Additionally, the temperature profile during activation of a monopolar radiofrequency device was found to be safe at a distance of 3–10 mm to the sciatic nerve during activation times of 3, 5 and 10 s [29]. The standard approach to vessel cauterization is a 3-s interval of radiofrequency activation, maintaining continuous irrigation.
- A blunt switching stick can be used to gently dissect and palpate the tissues to improve visualization.

Fig. 7.3 Patient's position: right hip. Supine position in a traction table, standard preparation for hip arthroscopy, no traction, and 20° of contralateral tilt. Leg is abducted to about 15–20° in order to open the interval between the trochanter and the iliotibial band and the leg is internally rotated 20–40°, for the same reason

- Fluoroscopy. Frequent use of intraoperative fluoroscopy will confirm the proper location of the endoscopic view.

7.6.1.6 Portals

The technique of endoscopic decompression of the sciatic nerve requires significant hip arthroscopy experience with familiarity with the gross and endoscopic anatomy of the subgluteal space [23]. The subgluteal space is the posterior extension of the peritrochanteric space, so entrance into this space is accomplished by portals traveling through the peritrochanteric space, which is between the greater trochanter and the iliotibial band. Different portals have been described to access the peritrochanteric space. Basically, we can divide these portals into two groups: (1) standard portals redirected to the peritrochanteric space (anterolateral, anterior, and posterolateral portals), and (2) portals described to access the peritrochanteric space [30] (proximal anterolateral accessory portal, distal anterolateral accessory portal, peritrochanteric space portal, and auxiliary posterolateral portal). Auxiliary distal portals at the level of the lesser trochanter (ischiofemoral impingement [IFI] portals) are crucial for performing this type of surgery [10] (Fig. 7.4).

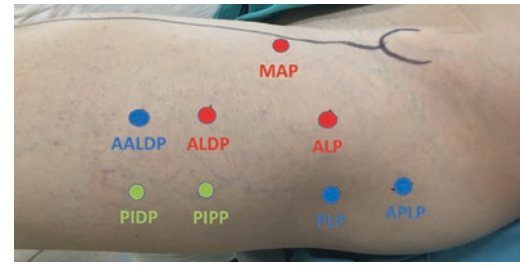

Fig. 7.4 Left gluteal region showing portal placement for subgluteal endoscopy. *MAP* midanterior portal, *AALDP* accessory anterolateral distal portal, *ALDP* anterolateral distal portal, *ALP* anterolateral portal, *PLP* posterolateral portal, *APLP* auxiliary posterolateral portal; for ischiofemoral impingement decompression, auxiliary distal portals at the level of the lesser trochanter (ischiofemoral impingement [IFI] portals) are crucial for performing this type of surgery, *PIDP* posterior ischiofemoral distal portal, *PIPP* posterior ischiofemoral proximal portal

7.6.1.7 Posterolateral Trans-Quadratus Approach Technique

Aim

- Osteoplasty of the posterior one-third of the lesser trochanter to obtain an IFS of at least 17 mm, leaving non-impingement bone and the iliopsoas insertion intact.

- Sciatic neurolysis. Chronic inflammatory changes and adhesions causing scar tissue between the muscle and the sciatic nerve result in entrapment during hip motion. In these cases, endoscopic neurolysis of the sciatic nerve is required.

Approach to Peritrochanteric Space

- First, the peritrochanteric space portal is established. A 5.0-mm metallic cannula is positioned between the ITB and the lateral aspect of the greater trochanter, and the tip of the cannula can be used to sweep proximal and distal to ensure placement in the proper location. Fluoroscopy can also be used to confirm that the cannula is located immediately adjacent to the greater trochanter at the vastus ridge.

Orientation

- The arthroscope is placed perpendicular to the patient and looks in a distal direction in order to identify the gluteus maximus tendon inserting into the linea aspera of the femur posteriorly (Fig. 7.5).

Procedure: Step-by-Step Description of the Technique

- The deep gluteal space is endoscopically accessed using three to four portals: anterolateral, posterolateral, and auxiliary distal at the level of the lesser trochanter (ischiofemoral impingement [IFI] portals). The anterolateral portal is used for access to obtain visualization. The posterolateral portal and auxiliary distal ischiofemoral portals are used for the introduction of a probe, arthroscopic burr, curved retractors, or the arthroscope (Fig. 7.6).
- The main surgical steps are: peritrochanteric inspection and bursectomy; identification of quadratus femoris muscle and sciatic nerve; and palpation of the lesser trochanter with a blunt probe under fluoroscopic control.
- Access to the lesser trochanter is achieved via a small window in the quadratus femoris muscle (Fig. 7.7).
- This window is located between the medial circumflex femoral artery (proximal) and first perforating femoral artery (distal) (Fig. 7.8). To protect the vessels, preservation of the proximal and distal muscle is recommended.
- Assessment of the sciatic nerve (SN) within the subgluteal fat must be done to perform neurolysis in the case of entrapment. Identifying and decompressing the SN, which is often concomitantly involved, is critical to achieving optimal results.

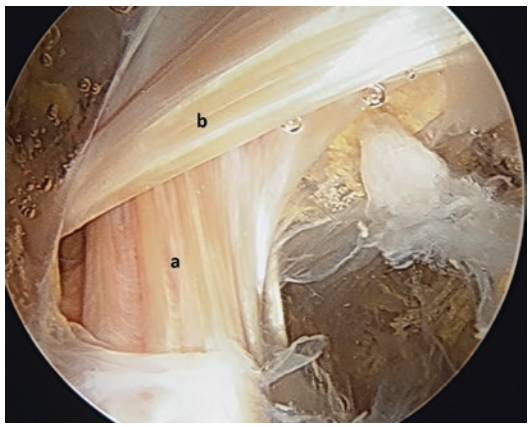

Fig. 7.5 Endoscopic view of left hip. Visualizing through the peritrochanteric portal, the examination begins at the gluteus maximus insertion at the linea aspera. (**a**) Gluteus maximus insertion; (**b**) Vastus lateralis

Fig. 7.6 Right gluteal region showing portal placement for ischiofemoral impingement decompression: scope in the anterolateral portal; radiofrequency probe in the anterolateral distal portal; rod in the ischiofemoral impingement (IFI) portal; cannula in the auxiliary posterolateral portal

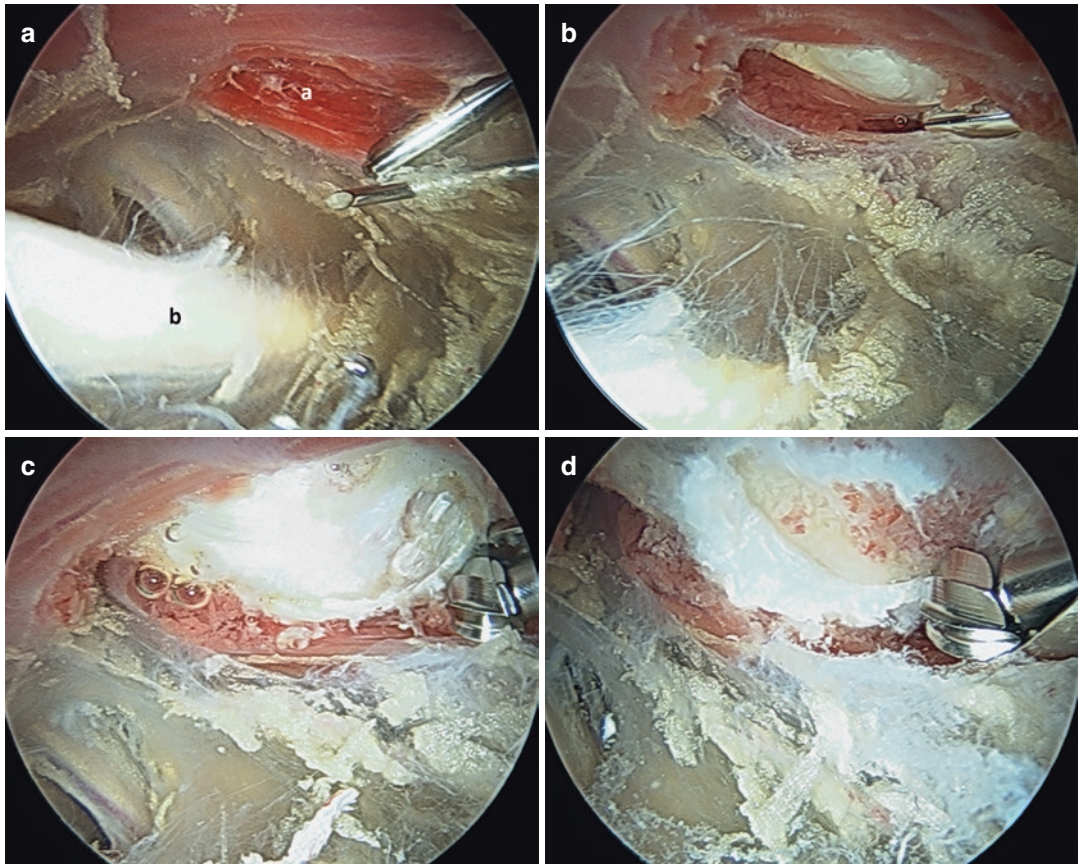

Fig. 7.7 (**a**–**d**) Right hip: endoscopic view showing the access to the lesser trochanter. This access is achieved via a small window in the quadratus femoris muscle. Quadratus femoris muscle (**a**); Sciatic nerve (**b**)

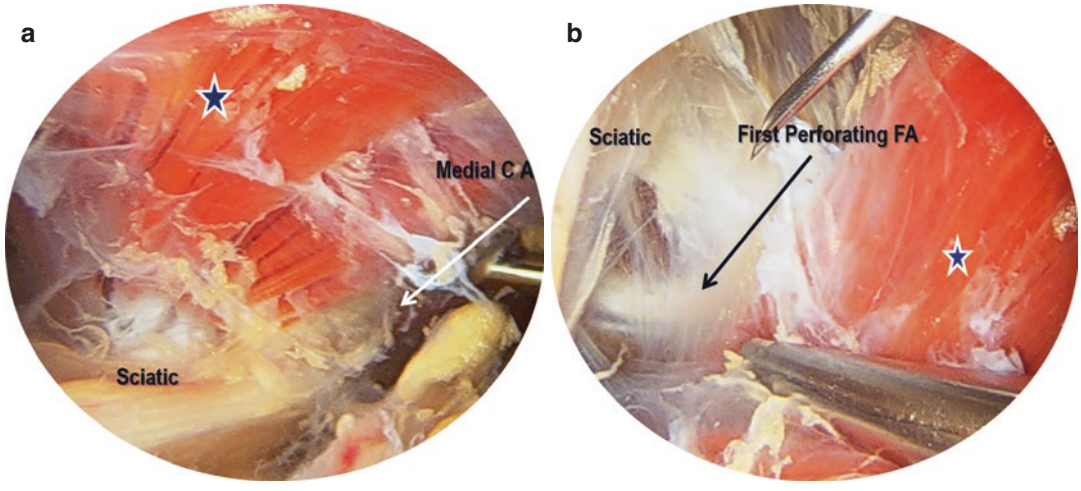

Fig. 7.8 (**a**, **b**) Left hip: endoscopic view showing the space for the window to access the lesser trochanter between the medial circumflex femoral artery (FA; proximal) and first perforating femoral artery (FA; distal). Star: Quadratus femoris muscle

- QFM debridement is indicated when tears are present. If advanced degenerative changes exist, complete muscle resection may be effective.
- Osteoplasty of the posterior one-third of the lesser trochanter is then carried out, aiming for an ischiofemoral space of at least 17 mm and leaving non-impingement bone and most of iliopsoas insertion intact (Fig. 7.9). This resection is done by progressive and careful abrasion. The posterior femoral cortex will define the level of resection. This particular subperiosteal approach maintains the insertion of the iliopsoas tendon on the anterior portion of the lesser trochanter and the femur.
- Confirm ischiofemoral space decompression with intraoperative endoscopy and fluoroscopy. Intraoperative dynamic tests are recommended to avoid under- or over-resection (Video 7.2).
- If hamstring repair is necessary, partial tearing debridement with an oscillating shaver and suture (one suture anchor per centimeter of detachment) is required.

Postoperative Care and Rehabilitation

- Initial postoperative instructions during the first 4 weeks include crutches and partial

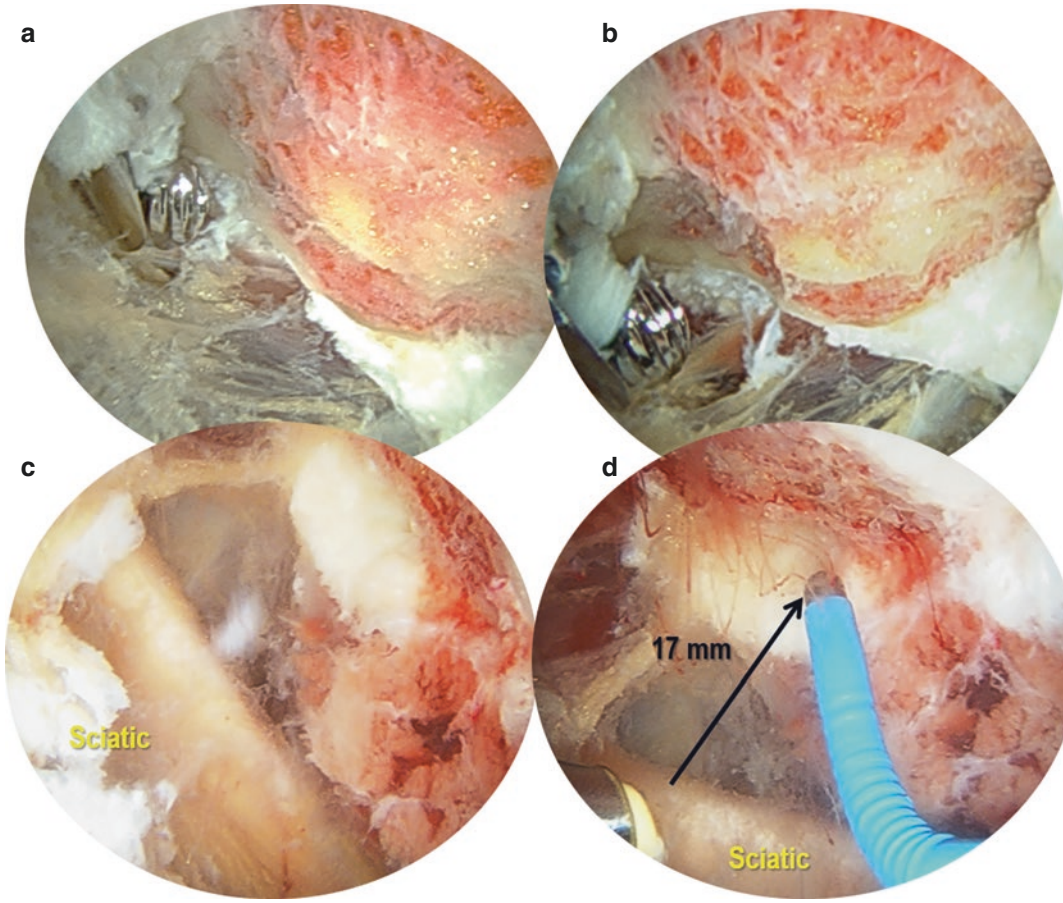

Fig. 7.9 Left hip: endoscopic treatment in patients affected by ischiofemoral impingement (IFI). Intraoperative endoscopic images show the lesser trochanter before (**a**, **b**) and after (**c**, **d**) performing the resection. The aim of the osteoplasty of the posterior one-third of the lesser trochanter is to obtain an ischiofemoral space (IFS) of at least 17 mm leaving non-impingement bone and the iliopsoas insertion intact

weight bearing and neutral hip flexors stretching. Important milestones for an adequate postoperative recovery are lumbopelvic alignment and stabilization to control hip extension and abductor strengthening; then, avoiding lower pelvic drop or excessive adduction of the lower limb during weight bearing [31].
- No active lifting of the leg is recommended in order to protect the remaining tendon insertion.
- Nerve glides can be applied under the limit of pain.

7.7 Avoiding Pitfalls and Complications

- Complications have involved hematomas brought on by early postoperative use of nonsteroidal anti-inflammatory drugs (NSAIDs) with excessive postoperative activity. We use tranexamic acid with the same protocol as in hip and knee arthroplasty to prevent this complication and the use of postoperative drain 18 h to control a possible bleeding.
- Scar formation around the sciatic nerve can be controlled with antiadhesion gels in order to prevent painful scar neuropathy.
- Excess bone debris must be evacuated to minimize heterotopic ossification risk.

7.8 Results

- Several treatment strategies have been reported for IFI, and most of them have good short- to medium-term outcomes with a low rate of complications. A systematic review by Nakano et al. found 17 relevant papers. No comparative studies were included in the final records for qualitative assessment, which means all the studies were case series and case reports. Eight studies (47.1%) utilized nonsurgical treatment including injection and prolotherapy, followed by endoscopic surgery (five studies, 29.4%) then open surgery (four studies, 23.5%). Mean age of the participants was 41 years (11–72 years). The mean follow-up was 8.4 months distributed from 2 weeks to 2.3 years. No complications or adverse effects were found from the systematic review. Of the 17 studies in the systematic review, five studies reported on the use of endoscopic surgical management [10, 20–22, 32]. All of them reported on partial or entire resection of the LT and good short- to medium-term outcomes (from 4 months to 2.3 years) without any neurological or vascular complication [33].
- We have reviewed and evaluated our results of 14 patients (15 hips; 14 females; 9 right, 6 left) treated in our clinic for ischiofemoral impingement and endoscopic posterolateral trans-quadratus approach decompression of the lesser trochanter between November 2011 and April 2018. Mean age was 38 years (20–52 years). The mean modified Harris Hip Score increased from 58 points preoperatively to 92 points at the final follow-up. No complications or adverse effects were found.
- Most of the studies lacked quantitative metrics in their analysis and hence quantitative conclusions could not be drawn for recommending one treatment strategy over another, so future studies should address comparative effectiveness of the various treatment options in this arena [33].

7.9 Conclusion

IFI is an underrecognized condition and its etiology is multifactorial. The endoscopic approach seems to have many advantages when compared with the open approach especially in terms of the extent of soft tissue damage, but it requires high technical skills.

Tips and Tricks

- In ischiofemoral syndrome the aim of the osteoplasty of the posterior one-third of the lesser trochanter is to obtain an IFS of at least 17 mm, leaving non-impingement bone and the iliopsoas insertion intact.
- Visualizing through the peritrochanteric portal, the examination begins at the gluteus maximus insertion at the linea aspera.
- Access to the lesser trochanter is achieved via a small window in the quadratus femoris muscle located between the medial circumflex femoral artery (proximal) and first perforating femoral artery (distal).
- Use tranexamic acid with the same protocol as in hip and knee arthroplasty to prevent hematomas; use postoperative drain 18 h to control a possible bleeding.
- Intraoperative dynamic tests are recommended to avoid under- or over-resection.

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