

9.1 Introduction

The snapping hip, according to the region concerned, is classified in three categories: external, internal, and intra-articular. The conflict of iliotibial band (ITB) with the greater trochanter region determines the hip external snap. Intra-articular pathologies in differential diagnosis with internal snapping hip are due to articular loose bodies, labral injury, or articular instability [1, 2]. The underlying causes of a conflict or mechanisms that may determine the onset of a snapping hip are shown in Table 9.1.

9.2 External Snapping Hip

The most common cause of snapping hip syndrome is irritation of the greater trochanter by the ITB. The ITB is a large flat tendinous structure that originates on the anterior superior portion of the iliac crest, crosses over the greater trochanter of the femur, and inserts onto the lateral condyle of the tibia.

When the hip is extended, the ITB is posterior to the greater trochanter. As the hip moves into flexion, the ITB moves anterior to the greater trochan-

ter. Ordinarily, it glides smoothly over the greater trochanter with assistance from the underlying bursae [3]. When the posterior portion of the iliotibial tract or the anterior border of the gluteus maximus becomes thickened, however, this results in snapping of the tendon over the greater trochanter. The bursae can then become inflamed and further exacerbate the condition [4]. Coxa vara may predispose to a snapping hip. Other predisposing factors are hyperplasia of the trochanteric bursa, narrower bi-iliac width, prominent greater trochanters, and increased distance between the greater trochanters. A case of snapping hip secondary to

Table 9.1 Snapping hip

Internal snapping hip
Tendon impingement at the level of iliopectineal eminence
Iliopsoas impingement with the acetabular component in a THA
Tendon snap at the level of the upper branch of the pubic bone
Conflict with the anterior acetabular margin
Conflict between two components of a bifid tendon
Impingement of the tendon at the level of the anterior inferior iliac spine
External snapping hip
Thickening of the posterior ITB or the gluteus maximus
Trochanter deformities
Big offsets in THA
Intra-articular snapping hip
Osteochondromatosis, fragment results of articular fractures, loose bodies
Labral tears
Instability

R. Zini
 Maria Cecilia Hospital GVM Care and Research,
 Cotignola, Ravenna, Italy

M. Panasci, M.D. (✉)
 San Carlo di Nancy Hospital - GVM Care and Research,
 Rome, Italy
 e-mail: manliopa@gmail.com

fibrosis of the band/muscle related to multiple intramuscular injections has also been reported [5].

9.2.1 Physical Examination

External snapping hip is seen in athletes who undergo repetitive knee flexion, such as runners, dancers, and cyclists. Athletes will have pain over the greater trochanter of the femur, the lateral thigh, or radiating pain down to the knee. Patients often report hip instability symptoms. If severe enough, the snapping sensation will occur during normal ambulation. Once this area becomes inflamed, running or rising from a seated position may hurt continuously. On physical examination, in addition to evidence of the shot, which is often caused voluntarily by the patient, it can consist of tenderness upon insertion of IBD or the greater trochanter, with occasional painful side irradiation in the thigh. Patients may demonstrate a positive Ober test because of increased tension of the ITB.

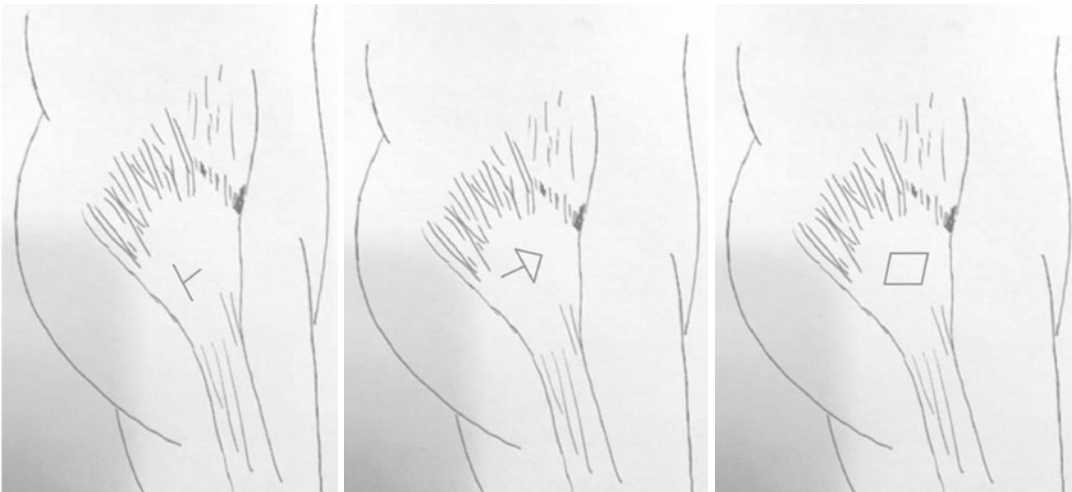
9.2.2 Imaging

Diagnosis of snapping hip is a clinical one. Although dynamic ultrasound best demonstrates the snapping hip, cross-sectional imaging with MRI can demonstrate findings associated with external snapping

hip, namely, the thickened iliotibial band or the muscle, and the associated secondary change of atrophy of the rest of the gluteus maximus muscle. Both signs should be looked for to confirm the diagnosis. Any intra-articular pathologies should be investigated with plain X-rays and MRI which could also reveal a trochanteric bursitis or a tear of the gluteus medius or minimus.

9.2.3 Treatment

This condition can be asymptomatic and however in some patients can cause pain and disability. Conservative therapy is, in most cases, decisive; physical therapy, with emphasis on stretching, strengthening, and alignment, can often help. Sometimes, treatment with a corticosteroid injection to the area can relieve inflammation. However, when the remission of symptoms is unsatisfactory, a surgical approach is indicated. A pioneer in this field was James Glick, who described the lateral approach and was also key to the development of specialized instrumentation required for this procedure. In 2006 Ilizaliturri was the first to underline comparable results between endoscopic and open procedures (Picture 9.1). We have recently published a modified endoscopic iliotibial band release with excellent results in terms of snapping phenomenon resolution, patient satisfaction, and return to previous level of activity [6, 7].

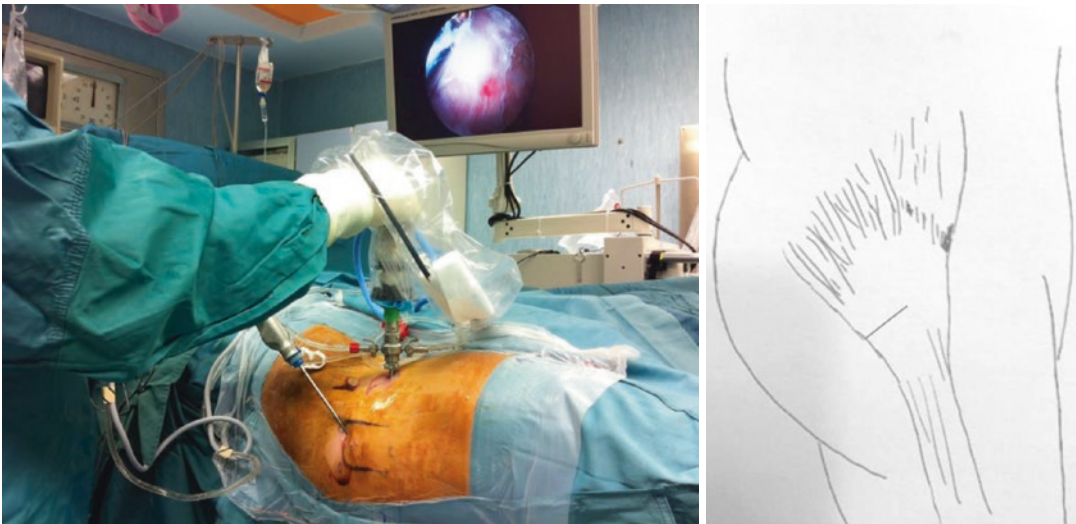


Picture 9.1 The Ilizaliturri technique

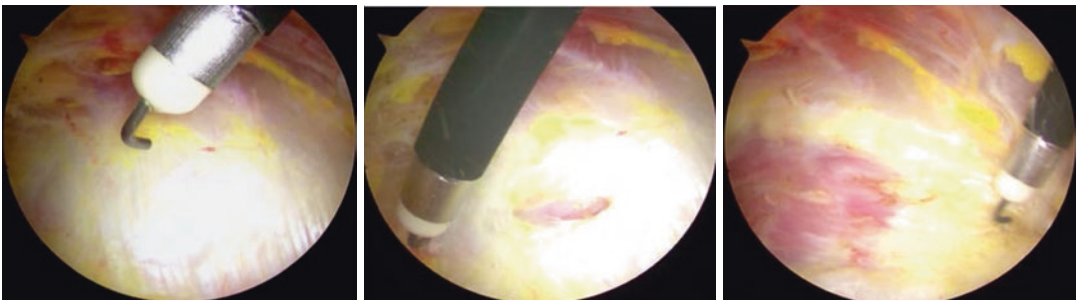
9.2.4 Surgical Technique

Both lateral and supine position can be used for the treatment of the external snapping hip. We usually prefer the supine position when a concomitant hip arthroscopy is performed (Picture 9.2). When using the lateral decubitus position, prepping and draping of the operating area and the leg is carried out in the standard fashion. The leg is draped so that the hip can be moved during surgery. With the operating area ready, the greater trochanter (GT) is outlined, and a spine needle is used to locate and to mark the apex of GT. Two portals, one anterior and one posterior, are created at the level of the snapping tract of the ITB. The 30° 4-mm scope is then introduced through the pos-

terior portal, and water inflow with an arthroscopy pump at low pressure is started to develop a space between the subcutaneous tissue and the ITB. The space superficial to the ITB is further developed with the shaver until the ITB can be easily identified. A hooked radiofrequency (RF) probe is introduced through the anterior portal, and hemostasis is carried out on the subcutaneous tissue if necessary. A horizontal cut is made into the ITB and a defect is created into the ITB. The trochanteric bursa, if inflamed, can easily be resected through the defect using a shaver and a RF ablator (Picture 9.3). The snapping should be tested at different times during the procedure so that adequate resection is obtained. It is appropriate at the end of the



Picture 9.2 *Left:* the supine position can be easily used to perform the ITB release. *Right:* personal technique with horizontal section of the fibers



Picture 9.3 *From left to right:* an horizontal cut is made and a defect is created into the ITB

procedure to perform a coagulation of small vessels and cut and place a drain for about 12 h [8, 9].

9.2.5 Outcome

Physicians agree that, in the majority of patients, a conservative approach will be successful; only a select few patients will require operative intervention. The endoscopic approach allows to reach the same or better results in terms of snapping and pain resolution with lower incidence of local complication. The most frequently reported complication in the literature has been the incomplete relief of symptoms after operative intervention. This can be minimized with an accurate preoperative diagnosis; it also is fundamental to test the snap with provocative maneuvers at different times during the procedure so that an adequate resection could be obtained with particular attention to detect any focal thickening at the anterior edge of the gluteus maximus. In case of pain association, a complete bursectomy should be performed. There is limited literature regarding the results of endoscopic treatment for the external snapping hip syndrome, but early reports are encouraging. Ilizaliturri et al. created a diamond-shaped resection and release; after which, the trochanteric bursa was debrided. Ten of 11 hips (10 patients) were relieved of their snapping, and all were relieved of pain at a minimum of 1-year follow-up. No patient required revision surgery, and all patients returned to preoperative levels of activity [6]. Polesello et al. performed a gluteus maximus tenotomy to decrease tension on the iliotibial band. Seven of 9 hips (8 patients) were relieved of pain and snapping postoperatively, with 1 patient requiring a revision operation. All patients returned to their preoperative level of activity, and no patients complained of weakness at a minimum follow-up of 22 months [9]. We have published a study with 15 patients (3 men and 12 women) with symptomatic exter-

nal snapping hip treated with an endoscopic release of the iliotibial band. The average age was 25 years (range 16–37 years). VAS score was significantly reduced with respect to the preoperative value with 60% of the patients pain-free. No revision procedures were indicated and all the patients returned to their previous level of activity [10].

9.3 Internal Snapping Hip

The treatment of the different pathologies of the iliopsoas tendon, in the case of relapsing tendonitis for conflict with adjacent structures or arising from problems such as those of patients with spasticity, has been traditionally performed by orthopedic surgery through an open approach. Continuous improvements in surgical techniques finally allowed using endoscopy to reach and treat the most common tendon disorders, ensuring better accuracy and greater respect of the anatomical structures.

9.3.1 Anatomy

The iliopsoas tendon is composed of the union of the great psoas muscle and iliac. These two, clearly separated proximally, come together on the femur at the level of the lesser trochanter.

The strong tendon lies in its course on the anterior portion of the capsule, at about 2 o'clock. It is at this level that a bursa can be found, which often have a direct communication with the coxofemoral joint.

The iliopsoas tendon injuries are frequently associated with pain, click, and strength reduction. This clinical condition, along with the anatomical and pathological findings described, is called internal snapping hip. It is noted that the snapping is present asymptotically in approximately 10% of the population, and those most frequently affected by this clinical syndrome are athletes, especially dancer [11–13].

9.3.2 Diagnosis

The diagnosis of internal snapping hip is essentially clinical. With the hip in extension, the tendon is located medial to the femoral head. During hip flexion, the tendon moves laterally passing the front portion of the femoral head. The presence of a painful shutter during such maneuver together with the iliopsoas-positive test (flexion of the hip against resistance) confirms the diagnosis. The snap is never visible, sometimes may not be audible, but is palpable at the level of the reported area of pain and apprehension always associated with a response by the patient [14–16].

The iliopsoas muscle contributes to pelvic stability and is involved constantly in most sports activities. One reason why the muscle is at risk could be that its workload includes both eccentric and concentric work. When the injury is iliopsoas related, the pain is localized anterior of the proximal thigh, more laterally in the groin, may radiate to the anterior aspect of the femur, and sometimes produces some lower abdominal pain lateral to the rectus abdominis. Frequently, the muscle is also tight, and palpation just distal to the inguinal ligament is often painful. Palpation is performed above the inguinal ligament and lateral to the rectus abdominis. The iliopsoas can also be palpated in the area just below the inguinal ligament lateral to the femoral artery and medial to the sartorius muscle, the only area where the iliopsoas is directly palpable. The Thomas test should be performed to assess the tightness of the iliopsoas and to ascertain whether passive stretching is painful. Incomplete extension of the hip when performing the Thomas test is a sign of a tight iliopsoas muscle. Pressure by the examiner's hand to extend the hip further is a test for pain on passive stretching. The abovementioned tests for the iliopsoas were all found to be reproducible. Muscle weakness and pain when flexing the hip joint against resistance at 90° is often found. Sitting with

the legs stretched and then elevating the heels might result in pain since the only active hip flexor in this position is the iliopsoas. This is the Ludloff's sign.

9.3.3 Imaging

Radiological study for these patients is essential to rule out any underlying conditions. Radiographs should be requested to include an anteroposterior, axial (or frog-leg), and Dunn at 90° to rule out a possible femoral-acetabular impingement. Ultrasound is a very valuable tool for dynamic evaluation of the tendon and can be taken into account in case of a possible infiltrative treatment, but its ability to diagnose shooting is currently insufficient.

MRI is usually used in case of diagnostic doubts or to better study the hip in order to rule out any intra-articular pathologies that might get in the differential diagnosis of hip internal shutter [16].

9.3.4 Conservative Treatment

The conservative treatment, in agreement with the literature data, is considered the gold standard for patients suffering from this syndrome. The therapeutic approach consists in reduction of sports activity, physical therapy, and anti-inflammatory. The rehabilitation program includes the strengthening of the muscles of the pelvic girdle, stretching and strengthening of the iliopsoas, assisted mobilization, and exercises to reduce the lumbar lordosis. After a period of about 3 weeks, in case the symptoms persist, it is possible to perform ultrasound-guided infiltration with local anesthetic and corticosteroids at the level of the bursa and in the peri-tendon area. Endoscopic treatment may be indicated if, for at least 3 months of treatment, the symptoms have not improved or the patient has reduced the activity level [17].

9.3.5 Surgical Technique

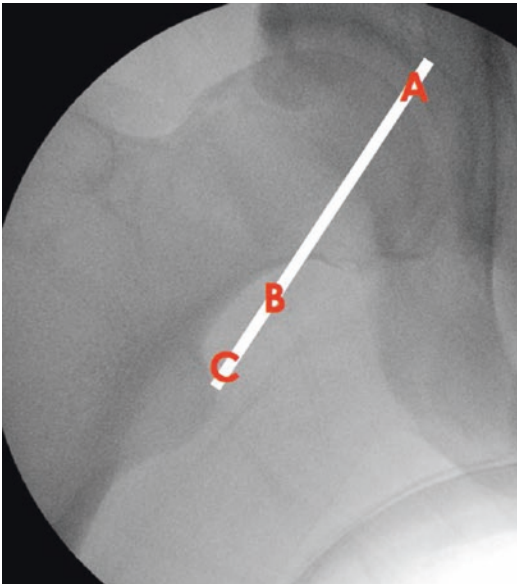
The endoscopic surgical technique for the treatment of the iliopsoas tendon was described for the first time by T. Byrd and subsequently revisited by several authors [18–20]. We can recognize three different anatomical areas where the release can be performed: the lesser trochanter, the peri-orbicular region, and the perilabral region (trans-capsular technique) (Picture 9.4).

The release to the lesser trochanter level is performed with the support of fluoroscopy. It guides both the optics and the instrument positioning, which converge at the level of the lesser trochanter; once isolated, a bursectomy and a complete detachment of all fibers are performed (Picture 9.5).

The release technique at the level of the peri-orbicular region is performed without traction and with the use of an accessory portal. Through the anterior portal, a capsulotomy of about 2 cm is performed, thus allowing a partial release of the tendon (Picture 9.6).

The release level of the perilabral region can be achieved with the use of standard portals

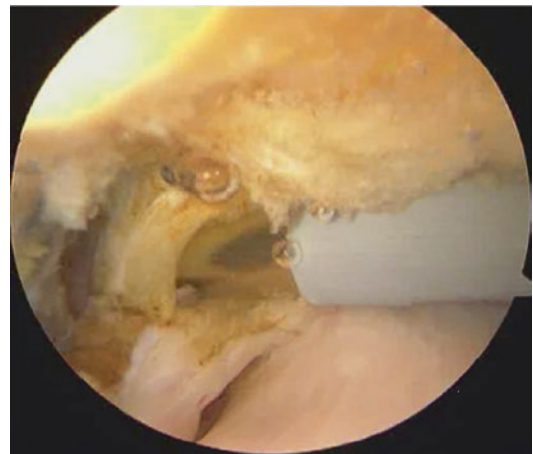
used for access to the central compartment structures; we routinely use the anterolateral and mid-anterior portals. With leg still in traction, a trans-capsular window at about 2–3 o'clock is performed; at this level the tendon is located just above the joint capsule and can be easily recognized for its pearly color. The release is achieved through radiofrequencies going medial-lateral to protect the femoral nerve branches (Picture 9.7).



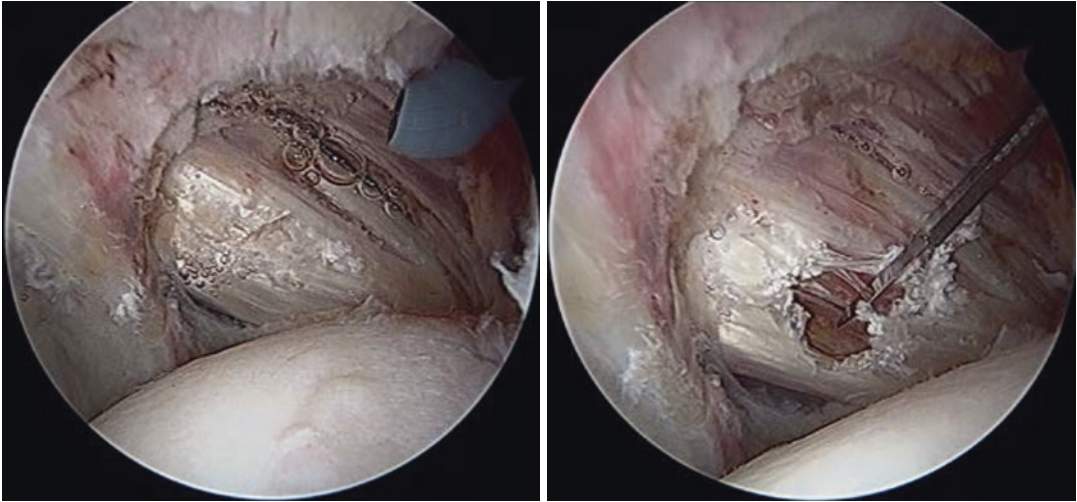
Picture 9.4 Different levels where a IP release can be performed. (A) Central compartment. (B) Peripheral compartment. (C) Lesser trochanter



Picture 9.5 Lesser trochanter IP complete release



Picture 9.6 Peripheral compartment partial release



Picture 9.7 Central compartment IP partial release

Our choice to perform the trans-central capsular technique is based on these considerations:

- To achieve an elongation anatomically closer to the intra-articular structures
- To preserve the distal insertion at the level of the lesser trochanter
- To avoid the use of accessories portals to reach the tendon

9.3.6 Postoperative Rehabilitation

Patients undergoing an iliopsoas tendon release follow a rehabilitation protocol which prohibits the strengthening exercises of the hip flexors for the first 6 weeks, in order to promote muscle recovery of the bending strength. Strengthening exercises of the quadriceps and abductors may instead start from the first postoperative day. Stretching is recommended to prevent the formation of adhesions and capsular contracture.

In case of treatment of intra-articular pathologies or the peripheral space, to the information already given, those specific according to performed surgical gestures will be added.

9.3.7 Outcome

The results of arthroscopic treatment for the pathology of the iliopsoas tendon were evaluated by different studies, and different release techniques used seem to give the same results in clinical terms. The arthroscopic treatment, compared to the traditional open technique, combines a less invasive approach and respect of adjacent structures, with the possibility of intra-articular and peritrochanteric space treatment pathology that may be present (labrum tears, FAI etc.) [21, 22].

Ilizaliturri et al. have performed various studies on release techniques, from the one at the level of the lesser trochanter to the trans-capsular at the level of the acetabular margin. Their latest work includes a comparative evaluation of the two techniques, demonstrating broad equivalence in terms of clinical results for both [23]. Wettstein et al. have reported the trans-capsular technique results of nine patients showing a 100% success rate with a minimum of 3-month follow-up [24, 25].

Byrd reported his results with the release at the lesser trochanter, with resolution of symptoms in 100% of cases. The same author also indicates the presence of intra-articular lesions in 50% of treated subjects [19].

In one of his works, Ilizaliturri describes as the trans-capsular release technique may have a higher risk of recurrence, but neither in literature nor in our experience this possible complication has been clinically relevant; there is instead an evident security, simplicity, and easy reproducibility of the trans-capsular proximal technique in any condition compared to other endoscopic techniques [24, 25].

Our series on professional athletes suffering from internal snapping hip is at this time of 21 cases, all treated with a trans-capsular proximal technique and for which we are executing a strength test comparing hind limb flexion, in order to assess flexion strength. The results at 3 months do not show a significant strength loss compared to the contralateral, reinforcing the idea that the partial release is capable of resolving the pathology, leaving the ability of muscle response, particularly important especially in athletes.

References

- Allen WC, Cope R. Coxa saltans: the snapping hip revisited. *J Am Acad Orthop Surg.* 1995;3:303–8.
- Brignall CG, Brown RM, Stainsby GD. Fibrosis of the gluteus maximus as a cause of snapping hip. *J Bone Joint Surg Am.* 1993;75-A:909–10.
- Zoltan DJ, Clancy WG, Keene JS. A new operative approach to snapping hip and refractory trochanteric bursitis in athletes. *Am J Sports Med.* 1986;14:201–4.
- Faraj AA, Moulton A, Sirivastava VM. Snapping iliotibial band. Report of ten cases and review of the literature. *Acta Orthop Belg.* 2001;67:19–23.
- Farr DO, Selesnick H, Janecki C, Cordas D. Arthroscopic bursectomy with concomitant ilio-tibial band release for the treatment of recalcitrant trochanteric bursitis. *Arthroscopy.* 2007;23:905.e1–5.
- Ilizaliturri Jr VM, Martinez-Escalante FA, Chaidez PA, Camacho-Galindo J. Endoscopic iliotibial band release for external snapping hip syndrome. *Arthroscopy.* 2006;22:505–10.
- Ilizaliturri Jr VM, Camacho-Galindo J. Endoscopic treatment of snapping hips, iliotibial band and iliopsoas tendon. *Sport Med Arthrosc.* 2010;18:120–7.
- Glick JM, Sampson TG, Gordon RB, Behr JT, Schmidt E. Arthroscopy by lateral approach. *Arthroscopy.* 1987;3(1):4–12.
- Polesello GC, Queiroz MC, Domb BG, Ono NK, Honda EK. Surgical technique: Endoscopic gluteus maximus tendon release for external snapping hip syndrome. *Clin Orthop Relat Res.* 2013;471(8):2471–6.
- Zini R, Munegato D, De Benedetto M, Carraro A, Bigoni M. Endoscopic iliotibial band release in snapping hip. *Hip Int.* 2013;23(2):225–32.
- Alpert JM, Kozanek M, Li G, Kelly BT, Asnis PD. Cross-sectional analysis of the iliopsoas tendon and its relationship to the acetabular labrum: an anatomic study. *Am J Sports Med.* 2009;37:1594–8.
- Polster JM, Elgabaly M, Lee H, Klika A, Drake R, Barsoum W. MRI and gross anatomy of the iliopsoas tendon complex. *Skeletal Radiol.* 2008;37:55–8.
- Winston P, Awan R, Cassidy JD, Bleakney RK. Clinical examination and ultrasound of self-reported snapping hip syndrome in elite ballet dancers. *Am J Sports Med.* 2007;35(1):118–26.
- Register B, Pennock AT, Ho CP, Strickland CD, Lawand A, Philippon MJ. Prevalence of abnormal hip findings in asymptomatic participants: a prospective, blinded study. *Am J Sports Med.* 2012;40:2720–4.
- Tatu L, Parratte B, Vuillier F, Diop M, Monnier G. Descriptive anatomy of the femoral portion of the iliopsoas muscle: anatomical basis of anterior snapping of the hip. *Surg Radiol Anat.* 2001;23:371–4.
- Wahl CJ, Warren RF, Adler RS, Hannafin JA, Hansen B. Internal coxa saltans (snapping hip) as a result of overtraining: report of 3 cases in professional athletes with a review of causes and the role of ultra-sound in early diagnosis and management. *Am J Sports Med.* 2004;32:1302–9.
- Lee KS, Rosas HG, Phancoo JP. Snapping hip: imaging and treatment. *Semin Musculoskelet Radiol.* 2013;17(3):286–94.
- JWT B. Hip arthroscopy: evolving frontiers. *Oper Tech Orthop.* 2004;14:58–67.
- Byrd JWT. Snapping hip. *Oper Tech Sports Med.* 2005;13:46–54.
- Byrd JW. Evaluation and management of the snapping iliopsoas tendon. *Instr Course Lect.* 2006;55:347–55.
- Gruen GS, Scioscia TN, Lowenstein JE. The surgical treatment of internal snapping hip. *Am J Sports Med.* 2002;30:607–13.
- Jacobson T, Allen WC. Surgical correction of the snapping iliopsoas tendon. *Am J Sports Med.* 1990;18:470–4.
- Ilizaliturri Jr VM, Buganza-Tepole M, Olivos-Meza A, Acuna M. Central compartment release versus lesser trochanter release of the iliopsoas tendon for the treatment of internal snapping hip: a comparative study. *Arthroscopy.* 2014;30(7):790–5.
- Ilizaliturri Jr VM, Chaidez C, Villegas P, Briseño A, Camacho-Galindo J. Prospective randomized study of 2 different techniques for endoscopic iliopsoas tendon release in the treatment of internal snapping hip syndrome. *Arthroscopy.* 2009;25(2):159–63.
- Ilizaliturri Jr VM, Villalobos Jr FE, Chaidez PA, Valero FS, Aguilera JM. Internal snapping hip syndrome: treatment by endoscopic release of the iliopsoas tendon. *Arthroscopy.* 2005;21(11):1375–80.