

Practical Orthopaedic Sports Medicine & Arthroscopy 1st Edition

© 2007 Lippincott Williams & Wilkins



30

Snapping Hip Syndrome

J.W. Thomas Byrd MD

Key Points

- External coxa saltans is snapping due to the tensor fascia lata and iliotibial band flipping back and forth across the greater trochanter.
- Internal coxa saltans is snapping caused by the iliopectus tendon.
- Intra-articular coxa saltans refers to a variety of intra-articular lesions that can cause painful clicking or popping within the joint.
- Coxa vara and reduced bi-iliac width have been proposed as predisposing anatomic factors of external coxa saltans.
- Symptomatic cases of external coxa saltans are most commonly associated
 - P.522
 -
 -
 - with repetitive activities, but may occur following trauma.
- Snapping of the iliotibial band usually can be demonstrated by the patient better than it can be produced by passive examination.
- Radiographs and further investigative studies are rarely of benefit except to assess for other associated disorders.
- Surgical intervention rarely is necessary. Published results of a variety of surgical techniques to address recalcitrant snapping of the iliotibial band range from poor to excellent.
- Snapping of the iliopectus tendon can be difficult to differentiate from and may co-exist with intra-articular pathology.
- Certain activities, such as ballet, have a tendency to develop snapping of the iliopectus tendon as an overuse phenomenon.
- Endoscopic release of the iliopectus tendon seems to represent an excellent alternative to traditional open techniques for recalcitrant cases.
- When treatment is necessary, most patients will respond to a proper conservative strategy.

"Coxa saltans" is a popular term to describe snapping syndromes around the hip, with an external, internal, and intra-articular type described (1). External coxa saltans is snapping due to the tensor fascia lata and iliotibial band flipping back and forth across the greater trochanter. Internal coxa saltans refers to snapping caused by the iliopectus tendon. Intra-articular coxa saltans is a nonspecific term for a variety of intra-articular lesions that can cause painful clicking or popping emanating from within the joint.

Iliotibial Band

Snapping of the iliotibial band is visually evident. The patient will describe a sense that the hip is subluxing or dislocating but radiographs show that the hip remains concentrically reduced despite the outward appearance.

Etiology and Pathomechanics

The snapping occurs as the iliotibial band flips back and forth across the greater trochanter (Fig 30-1). This is often attributed to a thickening of the posterior part of the iliotibial tract or anterior border of the gluteus maximus (1,2). Coxa vara and reduced bi-iliac width have been proposed as predisposing anatomic factors (3,4). Tightness of the iliotibial band may also be an exacerbating feature. This condition has classically been described in the downside leg of runners training on a sloped surface, such as a roadside (5). Some patients can demonstrate this phenomenon as an incidental asymptomatic maneuver. Symptomatic cases are most commonly associated with repetitive activities, but the snapping may occur following trauma. It has also been reported as a postsurgical iatrogenic process (6,7).



Fig 30-1. As the iliotibial band snaps back and forth across the greater trochanter, the tendinous portion may flip across the trochanter with flexion and extension, or the trochanter may move back and forth underneath the stationary tendon with internal and external rotation.

Assessment

The snapping or subluxation sensation described by the patient is a dynamic process that they can usually demonstrate better than it can be produced by passive examination. The symptoms and findings are located laterally and the patient can usually produce this best while standing. The snap can be palpated over the greater trochanter and applying pressure to this point may block the snap from occurring. The Ober test evaluates for associated tightness of the iliotibial band.

The diagnosis is usually clinically evident. Radiographs and further investigative studies are rarely of benefit except to assess for other associated disorders. Ultrasonography may help to substantiate the diagnosis, but is rarely necessary. Magnetic resonance imaging (MRI) may demonstrate evidence of trochanteric bursitis or inflammation within the abductor mechanism.

Treatment

Once the diagnosis is established, most will respond to conservative measures. These include modification of activities to avoid offending factors, oral anti-inflammatory medication, therapeutic modalities, and a gentle stretching and conditioning program directed specifically at the iliotibial band. Corticosteroid injection in the trochanteric bursa does not resolve the snapping, but may alleviate the symptoms so other measures can be effective.

The published results of surgical intervention for recalcitrant snapping of the iliotibial band range from poor to excellent. Various techniques have been described, but it is generally accepted that the common goal, regardless of the method, is to eliminate the snapping by some type of relaxing procedure of the iliotibial band. The success of the operation may be less dependent on the exact technique as much as careful patient selection. In fact, the published results of the same operation among two different military populations ranged from "less than optimal" to "excellent and predictable" (8,9).

It is important to remember that snapping of the iliotibial band is usually a dynamic process, better demonstrated by the patient than observed by passive examination, and there may be a deliberate or voluntary component to this snapping phenomenon. Thus, the surgeon must carefully evaluate that patient's motivation and emotional stability. The patient is causing no harm by living with the condition but, if they have exhausted all efforts at conservative treatment, then surgical intervention is an appropriate final step for select recalcitrant cases. The patient must be aware that, while the results of surgery may be successful at eliminating the snapping, there is a risk that they may still experience similar or different pain or dysfunction. For correctly diagnosed cases that do not respond to surgical intervention, it is unlikely that there is a reliable subsequent salvage procedure.

Most recent published literature has been based on the Z-plasty technique popularized by Brignall and Stainsby in 1991 (10) (Fig 30-2). They reported eight hips in six patients, mean age 19 years, all with resolution

of the snapping and excellent pain relief. Three hips in two patients experienced occasional aching, and one patient underwent a second, more extensive Z-plasty in order to achieve a successful outcome. Faraj et al. (11) in 2001, reported on 11 hips in 10 patients, mean age 17.3 years. All experienced resolution of pain and snapping, although three patients developed painful scars requiring desensitization treatment for 2 to 6 months. In 2002, Kim et al. (8) reported on three active duty soldiers with a successful result in only one case. Conversely, a report by Proventure et al. (9) in 2004 included eight hips in seven active duty military personnel with six of the seven returning to full military duties. One underwent subsequent surgical intervention and was eventually medically discharged from the service. Of note, this study excluded an unknown number of patients who had other concomitant diagnoses, prior fracture, childhood hip pathology, or had undergone previous surgical procedures. In 1986, Zoltan et al. (12) described seven athletic individuals treated with excision of an ellipsoid-shaped segment of the iliotibial band over the greater trochanter (Fig 30-3). All experienced resolution of the snapping, were able to return to sports activities, and considered themselves significantly

P.523

improved, although only three were asymptomatic. One patient underwent a subsequent revision procedure with further excision of the iliotibial band in order to achieve a successful outcome.



Fig 30-2. Illustration of the incision and transposition Z-plasty technique originally described by Brignall and Stainsby. (From Brignall CG, Stainsby GD. The snapping hip, treatment by Z-plasty. *J Bone Joint Surg Br.* 1991;73:253-254; with permission.)

The largest single series was published by Larsen and Johansen (4) in 1986 with 31 hips in 24 patients who underwent resection of the posterior half of the iliotibial tract at its insertion with the gluteus maximus. The details of this study were brief, but they reported that 22 (71%) were pain-free, six (19%) had persistent snapping without pain, three (10%) had persistent snapping with pain, and there were no major complications. Two of the three with pain underwent revision surgery with good results.

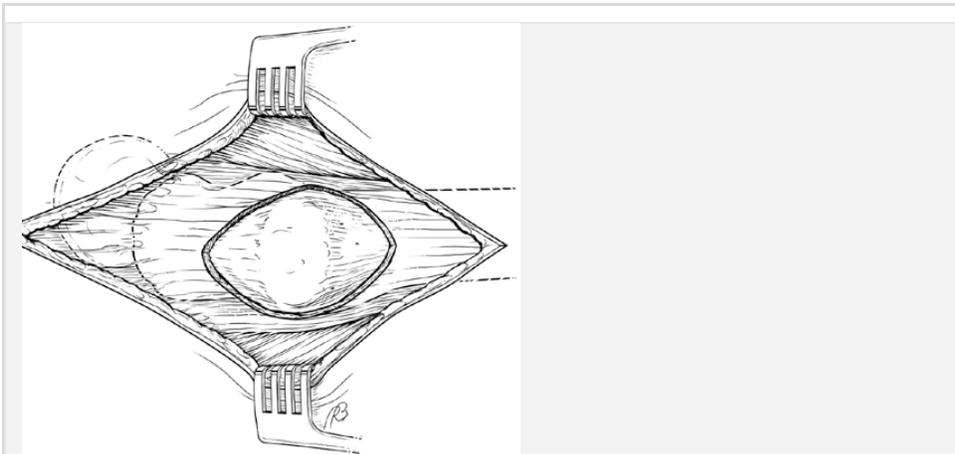
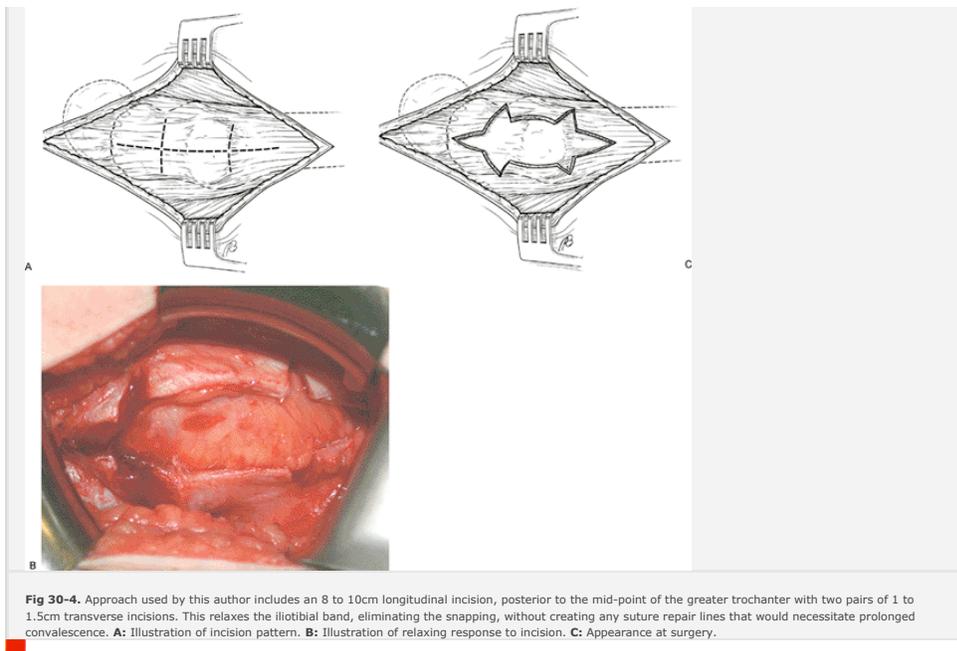


Fig 30-3. Ellipsoid-shaped segment excision of the iliotibial band over the greater trochanter described by Zoltan et al. (From Zoltan DJ, Clancy WG Jr, Keens JS. A new operative approach to snapping hip and refractory trochanteric bursitis in athletes. *Am J Sports Med.* 1986;14(3):201-204; with permission.)

In 1979, Brooker (13) described a cruciate incision of the iliotibial band over the greater trochanter as a successful method of management for severe trochanteric bursitis. William Allen from Missouri (*personal communication*, 1995) has proposed a modification of the cruciate incision in the management of the snapping iliotibial band. This is a method that these authors have employed which includes an 8 to 10 cm longitudinal incision just posterior to the midpoint of the greater trochanter in the thickest portion of the iliotibial band along with two pairs of 1 to 1.5cm transverse incisions (6) (Fig 30-4). Limited experience in five cases has resulted in complete resolution of the snapping, excellent patient satisfaction, and no complications. The advantage of this technique is that it is simple, it accomplishes the desired effect, it minimizes violation of the iliotibial band, and there are no repair lines that must be counted upon to heal. This also facilitates a liberal, although structured, postoperative rehabilitation program. Crutches are used only for comfort as the gait pattern is normalized, typically in 10 to 14 days. Gentle stretching and flexibility is emphasized, although aggressive stretching is not necessary. Recent experience has begun to emerge on the role of trochanteric bursoscopy (14,15). A natural progression of this may be toward endoscopic release of the iliotibial band. The concern is either inadequate or excessive resection. Currently, the open method still seems to be better suited for quantitating the extent of tendinous release.

P.524



Iliopsoas Tendon

Snapping of the iliopsoas tendon can be difficult to differentiate from intra-articular pathology and the two may co-exist (16,17). It is also estimated that snapping of the iliopsoas tendon is an asymptomatic incidental observation in at least 5% of an active population (16).

Etiology and Pathomechanics

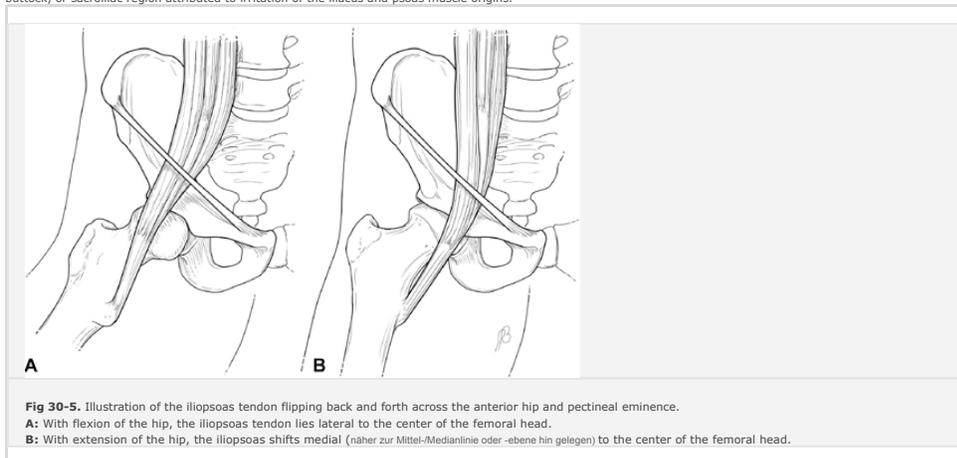
Certain activities, such as ballet, have a predilection for developing this process as an insidious overuse phenomenon (3). Snapping may occur as a consequence of injury, but the structural change that precipitates the snapping is elusive. It is well accepted that the snapping phenomenon occurs as the iliopsoas tendon subluxes from lateral to medial while the hip is brought from a flexed, abducted, externally rotated position into extension with internal rotation (Fig 30-5). It is less clear which structure is responsible for impeding the translation of the iliopsoas, thus creating the snapping phenomenon (18,19). This issue has some importance as authors have proposed various surgical techniques based on which structure seems to be most responsible for the snapping (20,21). The most popular theories are that the tendon snaps back and forth across the anterior aspect of the femoral head and capsule, or that it lodges across the pectineal eminence at the anterior brim of the pelvis (20,22). A less commonly proposed concept is that it can snap across an exostosis of the lesser trochanter.

Assessment

Characteristically, the patient will describe a painful clicking sensation emanating from deep within the anterior groin (= crease or hollow at the junction of the inner part of each thigh with the trunk, together with the adjacent region and often including the external genitals.). Usually, this is audible, but sometimes it may occur more as

a sensation experienced by the patient rather than what the examiner can objectively observe.

The most specific examination maneuver is performed with the patient lying supine, bringing the hip from a flexed, abducted, externally rotated position down into extension with internal rotation, producing the associated pop (1). Applying pressure over the anterior joint may block the tendon from snapping and assist in confirming the diagnosis. Some patients may also describe an element of aching rising from the flank, buttock, or sacroiliac region attributed to irritation of the iliac and psoas muscle origins.



Radiographs are an integral part of the assessment, but there are no findings specific for involvement of the iliopsoas tendon. Similarly, MRI findings are rarely specific for involvement of the iliopsoas, but may reveal indirect evidence if there is inflammation within the surrounding iliopsoas bursa (Fig 30-6). Iliopsoas bursography can be quite specific for snapping of the iliopsoas tendon when the tendon is visualized under fluoroscopy flipping back and forth in concert with the patient's snapping sensation (24,25) (Fig 30-7). Problems with this technique include that it requires that the patient be able to produce the snapping while lying supine on the fluoroscopy table, and the fluoroscopy imaging unit may block the patient's ability to produce the snap in a position where it can be visualized. Concomitant injection of bupivacaine may have some diagnostic value and injecting corticosteroid may potentially have some therapeutic benefit. Ultrasonography may also be quite good at visualizing the dynamic motion of the iliopsoas tendon (26). The advantages are that it is noninvasive and can easily allow comparison with the uninvolved hip. It does require a high resolution ultrasound unit and an experienced ultrasonographer.



Fig 30-6. MRI T-1 weighted axial image reveals iliopsoas bursitis characterized by high-signal fluid (arrow) surrounding the right iliopsoas tendon (Courtesy of J.W. Thomas Byrd, MD.)

Treatment

Once the diagnosis has been established,

- the treatment for most people is little more than assurance that this is a normal variant and that the snapping is not indicative of future problems.
- For symptomatic cases, standard conservative methods include identifying and modifying offending activities and
- a gentle stretching and flexibility program to **reduce tension in the iliopsoas**, while incorporating a core stabilization program.

Oral anti-inflammatory medications are routinely employed and a corticosteroid injection in the iliopsoas bursa may be tried, although this is rarely curative. When a patient fails conservative measures, careful attention should be given to assess for influencing motivational and emotional factors.

P.526



Fig 30-7. Iliopsoas bursography silhouettes the iliopsoas tendon (arrows) with contrast. **A:** In flexion, the iliopsoas tendon lies lateral to the femoral head. **B:** In extension, the iliopsoas tendon moves medial. (Courtesy of J.W. Thomas Byrd, MD.)

Surgery consists of relaxation of the iliopsoas to eliminate the snapping. This is accomplished by partial or complete release of its tendinous portion. Various open techniques have been described, mostly influenced by the authors' interpretation of the principal location of the snapping.

Surgery to address snapping of the iliopsoas tendon has been most influenced by Allen et al. (1,22,23). They felt the tendon most commonly snapped across the anterior femoral head and capsule and described an anterior approach to address the tendon at this level. They initially used a vertical incision but then switched to a much more cosmetic transverse incision (Fig 30-8). They release the posteromedial tendinous portion of the iliopsoas, leaving the anterior muscular portion intact, effectively producing a lengthening of the musculotendinous unit. Their cohort consisted of 20 hips in 18 patients (22). Seventy percent had complete resolution of snapping, 25% had partial resolution and, overall, 85% were subjectively improved. Complications included 50% with reduced skin sensation, 15% with subjective weakness, and 10% underwent re-operation.

Gruen et al. (20) hypothesized that the tendon was most taut over the pelvic brim and proposed fractional lengthening of the iliopsoas tendon at this location. They described an ilioinguinal approach used in 11 patients (Fig 30-9). They reported 100% resolution of snapping with overall 83% patient satisfaction. Complications included 45% subjective weakness and one patient who underwent multiple re-operations.

Dobbs et al. (21) hypothesized that fractional lengthening of the tendon over the iliopectineal eminence might lead to less postoperative loss of hip flexion strength. They described a modified iliofemoral approach used in 11 hips of 9 adolescent children (Fig 30-10). All were satisfied with the results of the procedure, and none had detectable loss of flexion strength; however, one patient developed recurrent snapping and two experienced an area of decreased skin sensation. They acknowledged that, although the approach was extensive, it did provide excellent visualization, which is important because they emphasized the extreme caution necessary to correctly identify the tendon from the femoral nerve, which lies in close proximity at this level.

P.527

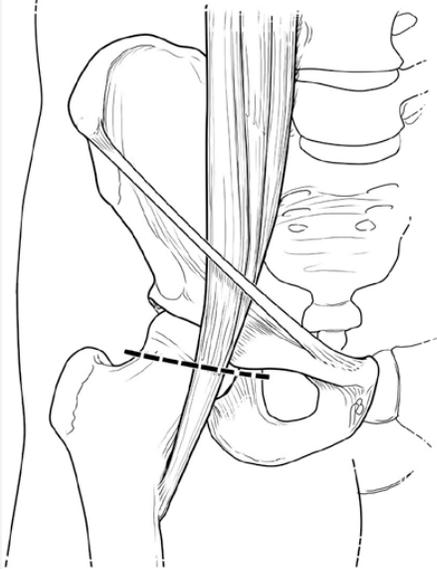


Fig 30-8. Anterior approach for iliopsoas release described by Allen and Cope utilizing a cosmetic transverse incision. (From Allen WC, Cope R. Coxa saltans: the snapping hip revisited. *J Am Acad Orthop Surg.* 1995;3(5):303-308; with permission.)

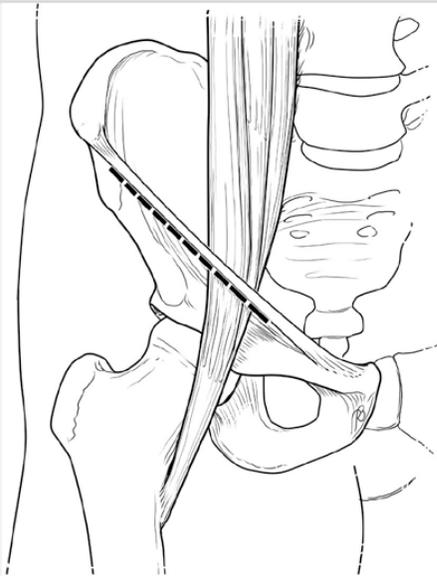


Fig 30-9. Ilioinguinal approach for release of the iliopsoas over the pelvic brim described by Gruen, et al.

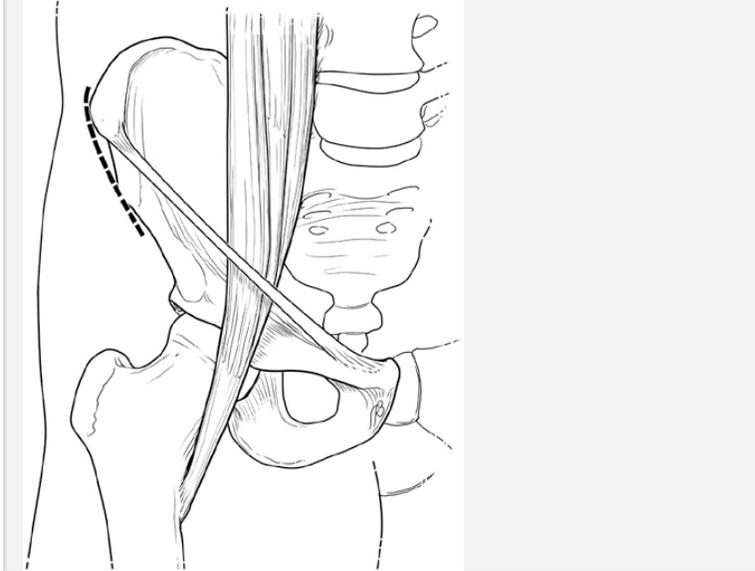


Fig 30-10. Modified iliofemoral approach for release of the iliopectineal eminence described by Dobbs, et al.

Taylor and Clark (27) advocated a medial approach, citing cosmesis and avoidance of sensory deficits associated with the anterior approach as its principal advantages (Fig 30-11). They reported on 16 hips in 14 patients where the tendinous portion of the iliopectineal band was released from the lesser trochanter, leaving its muscular portion in tact. All patients were subjectively improved with 57% experiencing complete resolution of the snapping and 36% partial resolution. Fourteen percent experienced persistent weakness of hip flexion above 90 degrees.

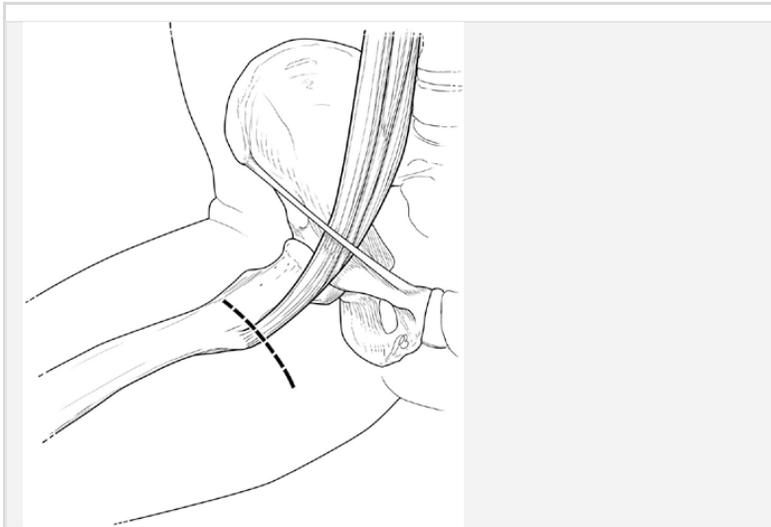


Fig 30-11. Medial approach for release of the iliopectineal band from its insertion on the lesser trochanter: described by Taylor and Clarke.

Recently, these authors have gained experience with an endoscopic method of releasing the tendinous portion of the iliopectineal band at the lesser trochanter (16,28). Among the open techniques, this most closely simulates the method described by Taylor and Clark (27).

The hypothesis is that the solution to snapping of the iliopectineal band centers on relaxation of the musculotendinous structure. Successful results have been reported with relaxation at various levels. Thus, the principal feature is to develop a technique that reliably allows relaxation of the iliopectineal band with the least amount of morbidity. In this regard, these authors have found the endoscopic method to satisfy this criterion. Also, it has been recognized that snapping of the iliopectineal band can occur in association with intra-articular pathology. Thus, the endoscopic method accommodates simultaneous arthroscopic assessment of the joint.

Endoscopic release of the iliopectineal band is a continuation of routine hip arthroscopy as previously described using a standard supine technique on a fracture table (29,30). After completing arthroscopy of the hip, the instruments are removed and the traction released. The hip is flexed 15 to 20 degrees, which slightly relaxes the iliopectineal band, and the hip is externally rotated. This brings the lesser trochanter more anterior for access to the endoscopic portals.

A portal is established distal to the standard anterolateral hip portal at the level of the lesser trochanter using fluoroscopic guidance. An ancillary portal is then established for

P.528

instrumentation (Fig 30-12A). The iliopectineal bursa is the largest bursa in the body. Adhesions within the bursa can be cleared, providing excellent visualization of the iliopectineal band.

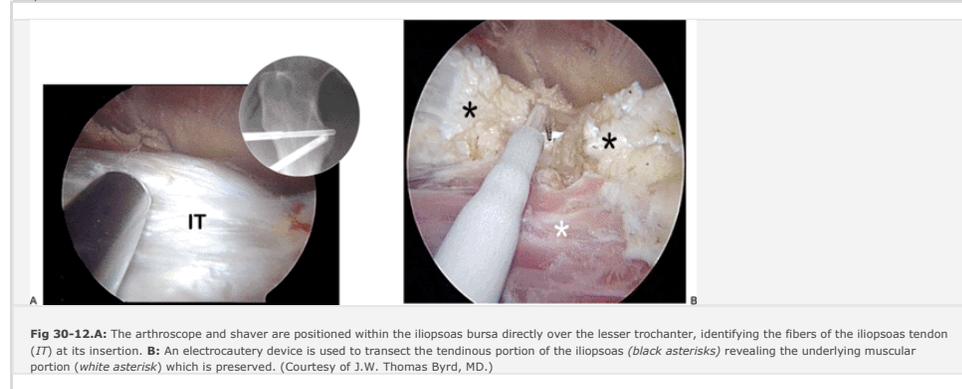
The tendinous portion of the iliopectineal band is then transected directly adjacent to its insertion on the lesser trochanter, using either an arthroscopic bovie or other thermal device (Fig 30-12B). As the tendon is released, it will retract 1 to 2 cm, exposing its muscular remnants which are preserved.

Postoperatively, the patient is maintained on crutches for approximately 2 weeks until their gait pattern is normalized. Aggressive hip flexion strengthening is avoided for the first 6 weeks but otherwise the patient follows a normal post-arthroscopy protocol.

Preliminary experience in nine cases with at least 1 year follow up has been quite good (16). There was 100% resolution of the snapping and patient satisfaction, with no complications. No patient has experienced subjective weakness; however these authors have been cautious to select only patients with severe recalcitrant symptoms and it is likely that their improved function due to pain relief may have overshadowed any residual strength deficit. Also five of these nine cases (56%) had associated intra-articular pathology addressed at the time of releasing the iliopectineal band. This is similar to the experience of Ilizaliturri, et al. who found associated intra-articular pathology in four of seven cases (57%) who underwent successful endoscopic release of the iliopectineal band (17). It is postulated that failure to address this intra-articular pathology in conjunction with open procedures could be a factor in poorer outcomes.

For recalcitrant cases, endoscopic release of the iliopectineal band seems to represent an excellent alternative to traditional open techniques. It is an outpatient procedure that allows concomitant assessment for hip joint pathology and excellent cosmesis. The results are at least comparable to those reported for open methods, with minimal morbidity. However, few patients require surgery for snapping of the iliopectineal band, regardless of whether it is performed open or endoscopic. When the surgeon is certain of the diagnosis, the patient must still demonstrate convincing evidence that he or she is an appropriate candidate for the procedure. They must acknowledge that they would not be deterred by the chance of residual weakness. This is especially important for athletes where weakness could be an inhibiting factor to resuming their

competitive career.



Conclusions

Snapping hip, or coxa saltans, most clearly encompasses two distinct entities, the external type due to the iliotibial band and the internal type due to the iliopectoral tendon (1). With an understanding of the anatomy, etiology, and pathomechanics, the characteristic history and examination findings will usually lead the clinician to the correct diagnosis. Further investigative studies may occasionally assist in substantiating this. An intra-articular type of coxa saltans has also been proposed (1). This term is less clear as it encompasses numerous intra-articular lesions that can cause symptoms. It may be a challenge to distinguish whether the source of the patient's symptoms is entirely extra-articular, or whether there may be an intra-articular component. It is not uncommon that patients may present with an element of both. The treatment strategy for hip joint pain may vary sharply from the symptomatic management employed for the extra-articular disorders. The prevalence of asymptomatic snapping hips in the normal population is unknown. Similarly, the incidence of

symptomatic cases is not well-defined. However, it is clear that when treatment is necessary, most will respond to a properly constructed conservative strategy. It is rare that surgical intervention is necessary. Various techniques have been described with moderate success. The ultimate goal is the least invasive procedure with the lowest potential complications that accomplishes the desired effect of correcting the painful snapping. Certainly it is important to select an operation that adequately addresses the structural problem but, perhaps more important to this success is selecting the appropriate patient. This is only partly determined by the anatomic lesion and perhaps more so by the patient's motivation and expectations of what the procedure may accomplish.

References

1. Allen WC, Cope R. Coxa saltans: the snapping hip revisited. *J Am Acad Orthop Surg.* 1995;3(5):303-308.
2. Brignall CG, Brown RM, Stainsby GD. Fibrosis of the gluteus maximus as a cause of snapping hip. *J Bone Joint Surg Am.* 1993;75(6):909-910.
3. Reid DC. Prevention of hip and knee injuries in ballet dancers. *Sports Med.* 1988;6(5):295-307.
4. Larsen E, Johnsen J. Snapping hip. *Acta Orthop Scand.* 1986;57:168-170.
5. Clancy WG. Runners' injuries part two: evaluation and treatment of specific injuries. *Am J Sports Med.* 1980;8:287-289.
6. Byrd JWT. Snapping hip. *Oper Tech Sports Med.* 2005;13(1): 46-54.
7. Larsen E, Gebuhr P. Snapping hip after total hip replacement. *J Bone Joint Surg Am.* 1988;70:919-920.
8. Kim DH, Baechler MF, Berkowitz MJ, et al. Coxa saltans externa treated with Z-plasty of the iliotibial tract in a military population. *Military Medicine.* 2002;167:172-173.
9. Provencher MT, Hofmeister EP, Muldoon MP. The surgical treatment of external coxa saltans (the snapping hip) by Z-plasty of the iliotibial band. *Am J Sports Med.* 2004;32(2):470-476.
10. Brignall CG, Stainsby GD. The snapping hip, treatment by Z-plasty. *J Bone Joint Surg Br.* 1991;73:253-254.
11. Faraj AA, Moulton A, Sirivastava VM. Snapping iliotibial band, report of ten cases and review of the literature. *Acta Orthopaedica Belgica.* 2001;67(1):19-23.
12. Zoltan DJ, Clancy WG Jr, Keens JS. A new operative approach to snapping hip and refractory trochanteric bursitis in athletes. *Am J Sports Med.* 1986;14(3):201-204.
13. Brooker AF Jr. The surgical approach to refractory trochanteric bursitis. *Johns Hopkins Medical Journal.* 1979;145:98-100.
14. Bradley DM, Dillingham MF. Bursoscopy of the trochanteric bursa. *Arthroscopy.* 1998;14(8):884-887.
15. Fox JL. The role of arthroscopic bursectomy in the treatment of trochanteric bursitis. *Arthroscopy.* 2002;18(7):E34.
16. Byrd JWT. Evaluation and management of snapping iliopectoral tendon. *Tech Orthop.* 2005;20:45-51.
17. Ilizaliturri VM, Chaidze PA, Valero FS, et al. Arthroscopic release of the "snapping ilio-pectoral tendon" (SS-90). *Arthroscopy.* 2004;20:41-42.
18. Tatu L, Parratte B, Vuillier F, et al. Descriptive anatomy of the femoral portion of the iliopectoral muscle. Anatomical basis of anterior snapping of the hip. *Surg Radiol Anat.* 2001;23:371-374.
19. Lyons JC, Peterson LFA. The snapping iliopectoral tendon. *Mayo Clin Proc.* 1984;59:327-329.
20. Gruen GS, Scioscia TN, Lowenstein JE. The surgical treatment of internal snapping hip. *Am J Sports Med.* 2002;30(4):607-613.
21. Dobbs MB, Gordon JE, Luhmann SJ, et al. Surgical correction of the snapping iliopectoral tendon in adolescents. *J Bone Joint Surg Am.* 2002;84(3):420-424.
22. Jacobson T, Allen WC. Surgical correction of the snapping iliopectoral tendon. *Am J Sports Med.* 1990;18(5):470-474.
23. Schaberg JE, Harper MC, Allen WC. The snapping hip syndrome. *Am J Sports Med.* 1984;12(5):361-365.
24. Harper MC, Schaberg JE, Allen WC. Primary iliopectoral bursography in the diagnosis of disorders of the hip. *Clin Orthop.* 1987;221:238-241.
25. Vaccaro JP, Sauser DD, Beals RK. Iliopectoral bursa imaging: efficacy in depicting abnormal iliopectoral tendon motion in patients with internal snapping hip syndrome. *Radiology.* 1995;197: 853-856.
26. Pelssers V, Cardinal E, Hobden R, et al. Extraarticular snapping hip: sonographic findings. *AJR Am J Roentgenol.* 2001;176:67-73.
27. Taylor GR, Clarke NMP. Surgical release of the "snapping iliopectoral tendon." *J Bone Joint Surg.* 1995;77(6):881-883.
28. Byrd JWT. Hip arthroscopy: evolving frontiers: Op Tech in Orthop. Special issue: Novel Techniques in Hip Surgery, Beaulieu PE, Garbuz DS (eds), 14(2):58-67;2004.
29. Byrd JWT. Hip arthroscopy: the supine position. *Instr Course Lect.* 2003;52:721-730.
30. Byrd JWT. Hip Arthroscopy. *J Am Acad Orthop Surg.* Publication pending.