Current Concepts

Differential Diagnosis of Pain Around the Hip Joint

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Abstract: The differential diagnosis of hip pain is broad and includes intra-articular pathology, extra-articular pathology, and mimickers, including the joints of the pelvic ring. With the current advancements in hip arthroscopy, more patients are being evaluated for hip pain. In recent years, our understanding of the functional anatomy around the hip has improved. In addition, because of advancements in magnetic resonance imaging, the diagnosis of soft tissue causes of hip pain has improved. All of these advances have broadened the differential diagnosis of pain around the hip joint and improved the treatment of these problems. In this review, we discuss the causes of intra-articular hip pain that can be addressed arthroscopically: labral tears, loose bodies, femoroacetabular impingement, capsular laxity, tears of the ligamentum teres, and chondral damage. Extra-articular diagnoses that can be managed arthroscopically are also discussed, including: iliopsoas tendonitis, “internal” snapping hip, “external” snapping hip, iliotibial band and greater trochanteric bursitis, and gluteal tendon injury. Finally, we discuss extra-articular causes of hip pain that are often managed nonoperatively or in an open fashion: femoral neck stress fracture, adductor strain, piriformis syndrome, sacroiliac joint pain, athletic pubalgia, “sports hernia,” “Gilmore’s groin,” and osteitis pubis. Key Words: Athletic groin injury—Chronic groin pain—Greater trochanteric pain syndrome—Hip arthroscopy—Hip pain—Snapping hip.

With the current explosion in hip arthroscopy procedures, patients are being referred in ever increasing numbers for the evaluation of hip pain. Many of these patients are athletic and unwilling to limit their activity or, in the case of a professional or collegiate athlete, retire from their sport because of their hip pain. As a result, in recent years, the understanding of the functional anatomy around this joint has been improved and refined. In addition, advancements in magnetic resonance imaging (MRI) have improved the ability to diagnose soft tissue causes of hip pain. All of these advances have significantly broadened the differential diagnosis of pain around the hip joint and improved our treatment of these problems (Table 1).

Several conditions causing hip pain have only recently become better understood. Pain around the hip was often treated with prolonged conservative management, such as activity restriction, and if that failed, open procedures. Many of these patients are currently being treated arthroscopically and are having great success at returning fully to their activities, including sporting activities of all levels. Not all causes of pain around the hip are intra-articular, however, and not all can be treated arthroscopically. The distinction between the various causes of hip pain is important for treating these patients. In this review, we discuss the various causes of pain around the hip, the keys to making the diagnosis, and evidence-based treatments.
INTRA-ARTICULAR CAUSES OF HIP PAIN

Labral Tears

Tears of the acetabular labrum are currently the most common indication for hip arthroscopy. Degenerative labral tears were initially described in patients with developmental dysplasia of the hip (DDH) and degenerative osteoarthritis. Structural labral abnormalities with resultant labral pathology were subsequently described in a number of disorders, including Perthes’ disease, previous trauma, previous slipped capital femoral epiphysis, and in association with femoroacetabular impingement (FAI). Of late, activities requiring repetitive pivoting or hip flexion have also become a recognized cause of labral tears. As a result, athletes participating in hockey, football, soccer, ballet, or running appear to be at increased risk of labral tears.

Patients generally have a gradual onset of symptoms, but they may occasionally relate the onset of pain to a traumatic event. Most patients describe a combination of dull and sharp groin pain, occasionally with associated buttock pain. This is worse with activity, walking, and prolonged sitting. About half of patients describe associated catching or painful clicking (mechanical symptoms). On examination, they may ambulate with a Trendelenburg gait or limp and often have a positive impingement sign. The impingement test places the hip in 90° of flexion, addition, and internal rotation. It is considered positive if it produces groin pain. Patients often have relief with an intra-articular injection. Radiographs may show mild degenerative changes or an associated condition like mild DDH, FAI, acetabular anteversion, or acetabular retroversion, predisposing the patient to labral tears. The most reliable study for diagnosis of labral tears appears to be small-field magnetic resonance arthrography (MRA), which has shown upwards of 90% sensitivity and 100% specificity in diagnosing labral tears. For patients who cannot undergo MRA, contrast-enhanced computed tomography (CT) has shown similar sensitivity and specificity.

Hip arthroscopy is indicated for patients with suspected labral tears based on clinical exam, MRA, and persistent hip pain for more than 4 weeks. Good short-term results have been described for both arthroscopic labral debridement and labral repair. Patients with structural abnormalities should undergo an appropriate corrective procedure (e.g., femoral neck osteoplasty/acetabular rim trimming with labral refixation for FAI or pelvic osteotomy for significant DDH).

Loose Bodies

Intra-articular loose bodies can be ossified or non-ossified, osteochondral, chondral, fibrous, or foreign. They are frequently associated with other pathologic processes occurring around the hip, including synovial chondromatosis, pigmented villonodular synovitis, osteochondritis dissecans, degenerative osteoarthritis, and avascular necrosis. Arthroscopic removal of varied foreign bodies has been described in the hip, including shrapnel and bullet fragments, and iatrogenic foreign bodies including needles, broken drain tubing, and polymethylmethacrylate cement.

Patients describe mechanical symptoms including catching, locking, clicking, or giving way. They may have anterior groin pain or note hip stiffness. Occasionally, they have a history of dislocation or other low-energy trauma. The most common find-
ings on examination are limited range of motion (ROM), catching, or grinding. Ossified or osteochondral loose bodies are the most easily identified on plain radiographs or CT scans because they are radio-opaque. MRI with gadolinium contrast or MRA are more useful for identifying cartilaginous loose bodies and are useful for characterizing associated synovial or soft tissue pathology (Fig 2).

Symptomatic loose bodies within the hip can cause the destruction of hyaline cartilage with resultant degenerative arthritis. Arthroscopy is the emerging gold standard for removal of a loose body; open approaches provide limited visualization of the articular surface and are associated with considerable morbidity. Loose body removal is the most widely accepted indication for hip arthroscopy, allowing simultaneous inspection of the synovium and joint surface. Because of the constrained nature of the hip, loose body removal can be technically challenging. Smaller pieces can be removed with suction lavage, but larger fragments may require a Kerrison rongeur or pituitary grasper instead of more delicate arthroscopy tools. If an associated synovial condition is suspected, synovial biopsy or debridement may also be indicated.

Femoroacetabular Impingement

Two types of FAI were described by Ganz as a significant cause of hip pain and labral degeneration. Cam impingement results from abnormalities at the femoral head–neck junction, impacting the acetabulum and causing cartilage and labral wear. Pincer impingement results from acetabular overcoverage, resulting in impingement of a normal femoral head–neck junction on the acetabular rim. The most common type of FAI, however, occurs from mixed cam and pincer pathology at the anterior femoral neck and anterior-superior acetabular rim (Fig 3).

Patients have sharp anterior pain with deep flexion, internal rotation, or abduction. In more extensive lesions, patients may describe lateral or posterior pain with external rotation, or pain with stair-climbing and prolonged sitting. Athletes may have difficulty squatting or difficulties with lateral and cutting movements. FAI has been described most often in hockey players, but also occurs in golfers, dancers, football, and soccer players. On examination, patients have significantly limited flexion and internal rotation. A positive impingement test occurs with groin pain at 90° of flexion and maximal internal rotation. The figure-of-four or flexion-abduction-external rotation (FABER) maneuver is tested with the patient in the supine position on the exam table. It is considered positive if the distance between the lateral knee and exam table differs between the symptomatic and contralateral hip, or if the maneuver elicits groin pain.

FIGURE 1. Labral tears occur frequently in association with cam impingement, as shown in these T1- and T2-weighted MRI scans. (A) There is increased offset at the femoral head–neck junction and asphericity (circle) resulting in the characteristic osseous “bump” (thick arrow) at the head–neck junction as shown in the T1-weighted image. (B) The resulting labral pathology (longer thin arrow) at the anterior head–neck junction is shown in the T2-weighted image of the same patient.
Patients with suspected FAI should undergo antero-posterior pelvis and cross-table lateral radiographs to assess for the characteristic “pistol-grip” femoral head in cam impingement, or for acetabular retroversion and crossover in pincer impingement. MRI and MRA are also indicated for measurement of the alpha-angle, quantifying the asphericity of the femoral head, and for the evaluation of resultant labral tears, cartilage damage, and fibrocystic change at the femoral head–neck junction.

Surgical treatment of FAI is performed to improve clearance for hip motion and relieve femoral head abutment on the acetabular rim. Open treatment of FAI involves surgical hip dislocation and osteoplasty, with full visualization of both the femoral head and acetabular rim. Open surgical dislocation is associated with a longer recovery time and a delayed return to sporting activities. Arthroscopic osteoplasty for both cam and pincer impingement has been described for professional athletes with good results. Hip arthroscopy for FAI begins with confirmation of impingement from the peripheral compartment, and evaluation and treatment of associated labral or chondral pathology.

**Figure 2.** Synovial chondromatosis is one cause of multiple symptomatic loose bodies within the hip joint. Magnetic resonance imaging with gadolinium contrast or magnetic resonance arthrogram is useful for identifying cartilaginous loose bodies. (A) Sagittal and (B) axial T1-weighted magnetic resonance imaging scans of synovial chondromatosis in the hip. Arrows indicate loose bodies within the joint capsule. (A, acetabulum; FH, femoral head; GT, greater trochanter; I, ischium.)

**Figure 3.** (A) Cam femoroacetabular impingement demonstrating decreased offset at the femoral head–neck junction. (B) In flexion and internal rotation, the aspherical portion of the head produces shear at the cartilage/labrum transition zone, causing peripheral cartilage damage. (C) Pincer femoroacetabular impingement demonstrating local and/or global acetabular overcoverage. (D) In flexion, the femoral neck abuts the acetabular rim, crushing the labrum. Over time, chronic leverage of the head in the acetabulum results in a “contre-coup” chondral injury to the posterior-inferior acetabulum. (Reprinted with permission.)
Pincer impingement involves trimming of the acetabular rim with takedown and subsequent repair of the acetabular labrum. Following arthroscopic debridement, 93% of a series of professional athletes returned to their previous level of play, although their average time to return was not described. More recently, 75% of patients undergoing arthroscopic treatment for FAI had good to excellent results 1 year postoperatively.

Capsular Laxity

Capsular laxity of the hip is an emerging concept and remains somewhat controversial. The hip has intrinsic osseous stability augmented by the labrum and capsuloligamentous structures. Secondary muscular stabilizers include the iliopsoas anteriorly. Traumatic laxity or instability results from an acute dislocation event causing stretching of the capsule or labral damage and predisposing the patient to recurrent dislocation. Traumatic subluxations may be the result of lower-energy trauma, and are more difficult to diagnose. Atraumatic instability can occur as a consequence of overuse or repetitive rotation with axial loading. These movements result in so-called microinstability and are a described cause of labral injury. Certain patients may also be
predisposed to instability, particularly those with generalized ligamentous laxity, acetabular dysplasia, or labral pathology.\textsuperscript{4,25,26} Traumatic hip dislocation is not subtle; low-energy mechanisms include a forward fall on the knee with the hip flexed, while the classic high-energy mechanism is a dashboard motor vehicle accident. Hip subluxation occurs from a lower-energy forward fall on the flexed knee and hip. These patients present with painful and limited ROM on exam. Patients with more chronic hip instability may be able to voluntarily sublux or dislocate their hip. Stretch of the capsular structures can cause anterior hip pain and is tested with prone passive extension and external rotation.\textsuperscript{25,26}

Athletes who play sports involving axial loading and hip rotation may develop atraumatic hip instability and resultant hip pain.\textsuperscript{25-28} Golfers note pain with a golf swing during a drive, and football players describe pain while throwing to the sideline. On examination, these patients also have anterior hip pain with prone passive extension and external rotation.\textsuperscript{25,26} With capsular laxity, the iliopsoas may become a more important dynamic stabilizer, resulting in stiffness, localized pain, or even flexion contracture.\textsuperscript{25}

Anteroposterior pelvis, Judet, and frog-lateral radiographs should be obtained for all capsular laxity patients.\textsuperscript{25} In patients with more subtle symptoms, predisposing anatomic factors, namely acetabular version and subtle dysplasia, should be assessed. MRI or MRA may be indicated to show labral tears, microfracture, or femoral head contusions, iliofemoral ligament disruption, joint effusions, and cartilage lesions.\textsuperscript{25,26} Some authors also advocate repeat MRI just before planned hip arthroscopy to evaluate for early avascular necrosis before placing the patient in traction.\textsuperscript{25}

The treatment of acute traumatic dislocations with associated fracture is well described in the literature, and will not be addressed further in this review. For subluxation or dislocation without associated fractures, the patient should remain toe-touch weight bearing on the affected side for 6 weeks. They can, however, begin early active and passive ROM as tolerated, avoiding flexion past 90° and internal rotation more than 10°.\textsuperscript{25,26} Intra-articular loose bodies are an indication for open or arthroscopic debridement.\textsuperscript{1,14} Arthroscopic labral and posterior capsular repair may be helpful for patients with recurrent hip dislocation.\textsuperscript{25,26}

Patients with suspected atraumatic instability should undergo a trial of nonsteroidal anti-inflammatory drugs (NSAIDs) and physical therapy.\textsuperscript{25} If hip pain persists, arthroscopy may be indicated for labral repair and capsular plication (Fig 5).\textsuperscript{25} Although good results have been reported for this procedure,\textsuperscript{26} caution is warranted in patients with generalized ligamentous laxity, avascular necrosis on MRI, or significant dysplasia. The latter group may require open bony procedures to address their dysplasia.\textsuperscript{25}

In addition, there is a subset of patients with capsular laxity that also develop secondary impingement...
signs, and may require concomitant FAI surgery.\textsuperscript{27} This is analogous to secondary impingement in the multidirectionally lax shoulder where occult recurrent humeral head subluxation causes rotator cuff and biceps tendon impingement on the acromion (Fig 6).\textsuperscript{30}

### Ligamentum Teres Tears

Lesions of the ligamentum teres are of unclear significance and are often described in association with other conditions.\textsuperscript{31-33} Three types of tears have been described: complete tears associated with dislocation, partial tears associated with a subacute event, and degenerative tears associated with joint pathology.\textsuperscript{31,34} Associated pathology includes avulsed bone or cartilage fragments and labral tears.\textsuperscript{31-33}

Patients describe nonspecific symptoms of catching, popping, locking, or giving way.\textsuperscript{31,33} Exam findings are also nonspecific, although the hip joint should be definitively identified as the source of symptoms.\textsuperscript{1,33,34} Patients should have pain with hip logroll and may obtain relief with an intra-articular injection.\textsuperscript{33,34} On arthroscopy, the ruptured ligament should be debrided and the associated conditions (e.g., loose bodies or labral tears) should be addressed.\textsuperscript{33}

### Chondral Damage

Chondral damage in the hip has multiple traumatic and atraumatic etiologies. These include labral tears, loose bodies, dislocation, FAI, avascular necrosis, acetabular dysplasia, and previous slipped capital femoral epiphysis.\textsuperscript{35,36}

Symptoms are often nonspecific. Patients may report mechanical symptoms consistent with degenerative labral pathology or generalized pain, stiffness, and decreased ROM consistent with an inflammatory process.\textsuperscript{35} Patients may have a history of trauma, athletic activity, or a generalized inflammatory disorder.\textsuperscript{35} On examination, the position of the hip at rest should be noted; abduction, flexion, and external rotation provide the most capsular volume and suggest an effusion or synovitis.\textsuperscript{35} Gait, leg-length discrepancy, ROM, and impingement should be assessed.\textsuperscript{35}

Degeneration is often seen on plain radiographs of the affected side and is a poor prognostic sign.\textsuperscript{37,38} MRI is useful for evaluation of associated soft tissue pathology. MRA is more specific for labral pathology and chondral lesions than traditional MRI, although the gold standard for assessing cartilage pathology in the hip remains arthroscopy.\textsuperscript{7,8,35}

Arthroscopy is useful for assessing cartilage damage and addressing soft tissue pathology. Microfracture can be considered in focal or contained lesions less than 2 to 4 cm in diameter on the weight bearing surface.\textsuperscript{35,36} It is contraindicated for partial thickness defects, in lesions with associated bony defects, and for patients more than 60 years of age.\textsuperscript{35,36} Any unstable or calcified cartilage should be debrided, taking care to maintain subchondral integrity.\textsuperscript{35,36} Microfracture holes are made with an awl, analogous to techniques described for the knee.\textsuperscript{35,36} For cases where the articular cartilage has started to peel off of the anterior acetabular rim and

![Figure 6](https://example.com/fig6.png)

**Figure 6.** (A) Extracapsular arthroscopic image of capsular laxity and secondary femoroacetabular impingement following capsulotomy and osteoplasty (closed arrow) for cam impingement. (B) Analogous to the treatment for shoulder laxity, capsular plication with nonabsorbable suture (asterisk) is performed after labral repair and other intra-articular procedures. In this image, a second, completed, plication stitch is visible in the background. (C, capsule; FH, femoral head.)
delaminate, options include microfracture of the base and suture repair of the cartilage (Fig 7).

Postoperatively, continuous passive motion can be used, and patients should remain toe-touch weight bearing on the affected side for 6 to 8 weeks, advancing to full weight bearing after 8 weeks. Initial physical therapy focuses on regaining ROM, progressing to regaining muscular endurance, and finally regaining power and strength. The return to impact sports is delayed for at least 4 to 6 months postoperatively. In a small study of second-look arthroscopy patients an average of 20 months after the initial arthroscopy, the investigators observed a 91% fill rate, ranging from 25% to 100%. Unfortunately, the prognosis for patients with degenerative lesions undergoing arthroscopy is poorer than that for patients with other diagnoses, and these patients frequently progress to arthroplasty.

EXTRA-ARTICULAR CAUSES OF HIP PAIN

Iliopsoas Tendonitis and Internal Snapping Hip

There are 3 types of coxa saltans or snapping hip: intra-articular snapping caused by several conditions, including loose bodies and labral pathology; internal snapping caused by the iliopsoas tendon moving over a bony prominence; and external snapping from the iliotibial (IT) band or gluteus maximus tendon snapping over the greater trochanter.
Internal snapping of the iliopsoas tendon over the iliopsoapectineal eminence, femoral head, or lesser trochanter may or may not be painful. A greater incidence of snapping hip has been noted in ballet dancers, although it is often not bothersome in this population. In a series of athletes with groin pain, iliopsoas tendonitis was the most common cause of groin pain in runners. Pain or discomfort associated with internal snapping is an indication of associated iliopsoas tendinitis, either as a result of acute inflammation or more chronic degeneration and tendinopathy.

Patients report anterior groin pain associated with extending the hip from a flexed position, and intermittent catching, snapping, or popping of the hip. Because the iliopsoas is also a flexor of the trunk on the hip, iliopsoas tendonitis may occasionally present with associated low back pain. On examination, the iliopsoas tendon is tender to palpation or may be painful with resisted hip flexion. Moving the patient from the FABER position into extension, adduction, and internal rotation often elicits a palpable snap.

Ultrasound examination by a trained musculoskeletal examiner may show tendinopathy with thickening or hypoechochogenicity within the tendon, bursitis with fluid surrounding the tendon, or increased blood flow with color Doppler imaging. Dynamic ultrasound is also diagnostic as the tendon can be seen snapping over the iliopseocal eminence.

Initial management of painful iliopsoas tendonitis consists of NSAIDs and physical therapy. If patients continue to have pain, an ultrasound-guided injection with lidocaine and corticosteroid can provide relief and predict the response to surgical release. For patients who have recurrent pain after local injection, arthroscopic release at the musculo-tendinous junction or near the tendon insertion on the lesser trochanter has been described with good results.

Iliotibial Band/Greater Trochanter Bursitis and External Snapping Hip

External coxa saltans is less common than internal or intra-articular coxa saltans and is, as mentioned previously, a result of a thickened IT band or gluteus maximus tendon snapping over the greater trochanter. The repetitive friction between the greater trochanter and IT band can, over time, cause inflammation of the interposing bursa and trochanteric bursitis. These patients often have spinal or other hip disorders which cause gait alterations and the resultant trochanteric bursitis.

Patients describe pain over the greater trochanter radiating down the lateral thigh, and may have difficulty lying on their side because of direct compression of the bursa. The disorder is more common in middle-aged women; however, it has been seen in younger populations and may be more common in runners. On examination, patients have pain with direct compression of the trochanteric bursa. The Ober test for IT band tightness is performed with the patient lying on the nonaffected side and the knee flexed to 90°, as the symptomatic hip is brought from abduction to adduction. Often, snapping can be elicited with the patient lying on his or her side as the hip is brought from flexion to extension and internal to external rotation. Gait should also be evaluated, because an associated back or hip abnormality affecting gait can result in bursitis.

Plain radiographs can be obtained to evaluate any suspected intra-articular pathology; they occasionally show calcifications within the bursa, but are generally negative. Dynamic ultrasound is useful, because the IT band can be seen snapping over the greater trochanter. Associated bursitis or gluteal tendinopathy can be assessed at the same time. Small-field MRI has been used as the gold standard, but is not necessary to make the diagnosis of trochanteric bursitis.

Greater trochanteric bursitis and painful external snapping should initially be managed nonoperatively with rest, NSAIDs, and stretching or physical therapy. An injection of corticosteroid or local anesthetic into the trochanteric bursa may calm the associated inflammation and provide diagnostic information if the patient has relief with injection. Surgical IT band release or debridement of the bursa is indicated if the patient has continued symptoms after 6 months of nonoperative therapy. Although this has classically been described as an open procedure, arthroscopic trochanteric bursectomy and IT band release has been described with good results at an average of 1 year postoperatively.

Gluteus Minimus and Medius Injury

The greater trochanter and gluteal tendons have been compared to the rotator cuff of the shoulder. As in the shoulder, tendinopathy and subsequent tearing of the gluteal tendons may represent a progression of injury and degeneration, from tendinitis and edema to progressive tendon thickening, partial tearing, and ultimately to complete avulsion or tearing at the gluteal insertion.
is more common in women, perhaps because of the wider female pelvis.50-52

Patients present with dull lateral hip pain, focal tenderness at the gluteal insertion, and weak hip abduction.51 Other provocative tests include passive and resisted external rotation with the hip flexed to 90°, and pain on one-leg stance for 30 seconds or more.51 Although patients should have plain radiographs taken of the affected side, these are generally negative, and only occasionally show calcification at the tendon insertion.50 MRI findings are based on the severity of injury. Tendon pathology is most commonly seen near the insertion on the greater trochanter. The earliest stage is thought to be peritendonitis, with adjacent soft tissue edema and intact tendons, progressing to tendinosis as evidenced by increased signal within the tendon and tendon thickening. MRI can distinguish between partial and complete tears and evaluate fatty atrophy of the gluteal muscles and calcification at the tendon insertion.50 Ultrasound can also be used for evaluation, particularly as tendon thickening and increased fluid can be directly correlated to the site of pain.50

As in the treatment of trochanteric bursitis, the initial management of gluteal tears should consist of nonoperative measures, including physical therapy and diagnostic or therapeutic injection.49,51 A technique for endoscopic repair of gluteus medius and minimus tears has been described; however, no results have been published evaluating the efficacy of this approach.49

**Stress Fracture**

No arthroscopic management has yet been described for the treatment of stress fracture. These fractures have been subdivided into 2 categories: fatigue fractures, which occur when normal bone is subject to repeated abnormal stresses, and insufficiency fractures, which occur when normal stress is applied to abnormal bone.53,54 The femoral neck was the most common location of stress fracture in the pelvis or femur,55 although stress fractures of the sacrum, pubic rami, acetabulum, and femoral head can also occur.55 Within the femoral neck, fractures located to the superior surface are under tension and are at risk of displacement because they are mechanically unstable.53,54 Conversely, fractures on the inferior surface of the femoral neck are under compression and are mechanically stable.54

Patients present with exercise-induced pain in the hip, groin, or thigh, or they may have referred pain to the knee.53,56 In several studies, female gender and amenorrhea, low aerobic fitness when starting an intense exercise program, smoking, and steroid use have been associated with an increase risk of stress fracture.53,56 There may be no specific findings on physical examination other than diffuse radiating pain localized to the hip or groin.55 Although all patients should have plain radiographs of the affected side, these may have only 10% sensitivity if symptoms are relatively early.53,55 MRI and bone scan are more sensitive, although in one large series, the median time from the onset of symptoms to the diagnosis of fracture from MRI was still 30 days.53,55

Tension-sided femoral neck fractures should be pinned to prevent displacement and subsequent avascular necrosis.54 Compression-sided femoral neck fractures can be treated with 6 to 8 weeks of limited weight bearing.54 At an average of 18 years follow-up, there was no higher incidence of avascular necrosis or osteoarthritis in patients who had sustained a nondisplaced femoral neck fracture.54

**Adductor Strain**

Adductor longus strain is a significant cause of groin pain in athletes, particularly in hockey, soccer, and rugby players.42,57-60 and arthroscopic management is not indicated for this condition. As a whole, the adductor muscle group acts with the lower abdominal muscles to stabilize the pelvis during lower extremity activities.57 Athletes participating in sports that require repetitive kicking, quick starts, or changes in direction have a higher incidence of chronic groin pain and adductor muscle strain.43,57-60 The origin of the adductor longus at the pubic symphysis has a relatively smaller tendon area compared to that of the muscular attachment, which may predispose this area to strain.57 In addition, there is some evidence that athletes with adductor weakness, abductor–adductor imbalance, or decreased preseason hip ROM are more predisposed to groin strain during the season.58,61

Patients typically present with aching groin or medial thigh pain and may or may not relate a specific inciting incident;57 however, acute rupture and osseous avulsion of the proximal adductor longus has also been reported.62 On examination, there is tenderness to palpation with focal swelling along the adductors and decreased adductor strength and pain with resisted adduction.42,57,59 The diagnosis can be made with focal findings on examination42; however, MRI with gadolinium may be useful to confirm the diagnosis or
differentiate between adductor strain, osteitis pubis, and sports hernia.59,60

Management is nonoperative with rest, ice, compression, and gentle physical therapy or ROM.57,59 Injection at the adductor longus enthesis is helpful for patients refractory to conservative management.59 In cases of acute rupture, open surgical repair with suture anchors has been described with good results.62 Patients may return to sports or other activities after regaining full strength and ROM with resolution of the pain.57 Given the predisposition to adductor strain in the setting of muscle imbalance, attention should be given to preseason adductor strengthening and hip ROM to prevent in-season groin strain injury.59,61

Piriformis Syndrome

Sciatic nerve compression and irritation by the piriformis muscle is a potential cause of lower back and posterior thigh pain.63-65 There is 1 described arthroscopic technique67; however, most authors describe nonoperative or open management of this condition.63-66 Piriformis syndrome can be caused by anatomic variations in either the muscle or the nerve, piriformis hypertrophy or spasm, and muscular fibrosis following trauma.63,64 Classically, the sciatic nerve emerges from the greater sciatic notch below the piriformis muscle; however, the anatomy is quite variable, and the nerve can split above the piriformis, with 1 or 2 branches emerging above, through, or below the muscle.63

Patients with suspected piriformis syndrome describe pain at the sacroiliac joint or sciatic notch.63,66 They frequently have leg pain radiating from the hip down to the foot or ankle in the sciatic nerve distribution.53-66 In comparison to radicular causes of sciatica, numbness or weakness may be rare.68 Sitting on a hard surface or for long periods of time worsens the pain, while walking relieves the compression and pain.63,65,66 There is generally tenderness to palpation at the sciatic notch or greater trochanter.63-66 Occasionally, a spindle-shaped mass in the region of the piriformis can be palpated.63 Symptoms can be reproduced with resisted abduction or adduction of a flexed and internally rotated thigh, also known as the Lasègue, Freiburg, or Pace signs, which place the sciatic nerve on stretch.63-66 In contrast to patients with radicular causes of sciatica, the straight-leg raise is frequently negative.66

Patients with piriformis syndrome have often already been evaluated for possible nerve root impingement. An MRI of the lumbar spine will fail to show any disk herniation, whereas an MRI of the pelvis may show piriformis muscle atrophy or hypertrophy and edema surrounding the sciatic nerve at the level of the piriformis.65,66 Treatment of piriformis syndrome begins with NSAIDs, muscle relaxants, and gentle physical therapy to relieve muscle spasm and associated nerve inflammation.63-66 For patients with persistent pain, ultrasound or magnetic resonance–guided local injection may be both diagnostic and therapeutic;64,66 In a large case series, some patients had resolution of symptoms after 1 or 2 injections66; for patients with only transient relief, injection appeared to be predictive of the results following surgical release.66 For these patients, surgical release of sciatic compression via a transgluteal approach was associated with good results.66 Endoscopic piriformis release has also been described in a small series, with good short-term results.67

HIP MIMICKERS

Sacroiliac Joint Pain

The sacroiliac (SI) joint is a synovial joint with a fibrous surrounding capsule. The anterior and posterior capsules are relatively thin, but are augmented by the intersosseous ligament posteriorly and the anterior joint ligament, which blends into the iliolumbar ligaments.68 Joint morphology changes with age. Flat joint surfaces are present before puberty, but with age, bony elevations and depressions develop to enhance joint stability.68 The synovial cleft also narrows progressively, with ankylosis in some patients over 50 years of age.68 There are multiple possible etiologies of SI joint pain, including hyper- or hypomobility, cumulative trauma, degenerative arthritis, infection, ligamentous strain, stress fractures, and sacroilitis or inflammatory arthropathies.68 There are no indications yet described for SI joint arthroscopy.

SI joint pain is referred to the area near the posterior superior iliac spine; most patients report buttoc k pain that may radiate into the thigh and may be mistaken for discogenic sciatica.69,70 Patients may have tenderness along the SI joints or sacral sulcus; however, there is no scientific validity to the currently described provocative examination maneuvers for SI joint pathology.68-70 It is important to perform a complete neurologic exam to exclude other potential pathologies (e.g., L5 radiculopathy or tumor).68-70

Plain anteroposterior, inlet, and outlet radiographs of the pelvis should be obtained. If SI joint
instability is suspected, single-leg stance views should be obtained, looking for displacement. CT scan, MRI, and bone scans can be obtained to evaluate specific etiologies of SI joint pain, although these are not specific for idiopathic pain. Complete relief of pain after image-guided SI joint injection is considered diagnostic.

Treatment depends on the etiology of the SI joint pain. Physical therapy to identify and correct flexibility and strength deficits is appropriate, with use of modalities limited to the acute phases of pain. There is evidence that vertical shear loads on the SI joint can be minimized by strengthening of the rectus abdominus and pelvic floor musculature, reducing SI joint pain. Medical management should include antirheumatic agents for patients with spondyloarthropathies and NSAIDs for more limited inflammation. Image-guided cortisone injections are indicated after 4 weeks of conservative management, but may be useful for confirming the diagnosis earlier. Pelvic belts can provide some pain relief and limit motion of the SI joint by up to 30%. Manipulation is contraindicated in sacral stress fractures and ideally is used only for a limited time as the patient transitions to a structured exercise program. More invasive therapies include radiofrequency neurotomy and surgical arthrodesis. These therapies are controversial, and should only be considered for patients with confirmed SI joint pain who have not improved following less invasive therapies.

Athletic Pubalgia/Sports Hernia/Gilmore’s Groin

Another cause of chronic groin pain in athletes has variously been termed athletic pubalgia, sports hernia, and rectus abdominus injury. There is debate as to the exact etiology of this condition. One larger series defined athletic pubalgia as disabling lower abdominal and inguinal pain possibly resulting from a hyperextension injury to the rectus insertion on the pubic symphysis, destabilizing the anterior pelvis. It has alternatively also been described as an occult hernia caused by weakness or tearing of the posterior inguinal wall without a clinically recognizable hernia. Gilmore’s groin is a subset of this, consisting of tears in the external oblique aponeurosis and conjoint tendon, with dehiscence between the conjoint tendon and inguinal ligament. This condition can be managed with endoscopic mesh repair, typically by a general surgeon. Sports requiring repetitive twisting and turning of the proximal thigh and lower abdomen (e.g., ice hockey, soccer, skiing, rugby, and tennis) may have a higher incidence of sports hernia. It is thought to result from simultaneous trunk hyperextension and thigh hyperabduction leading to shearing across the pubic symphysis. Athletes with muscular imbalance between strong thigh muscles and weaker abdominal muscles may have higher shearing forces across the symphysis and may be more prone to this injury.

Patients typically have an insidious onset of pain with activity, resolving with rest, and radiating into the adductor, perineum, rectus, inguinal ligament, or testicular areas. This is aggravated by sudden movements—coughing, sneezing, sit-ups, sprints, or kicking—ultimately limiting their performance. On examination, there is no detectable hernia, although they may have tenderness around the conjoined tendon, pubic tubercle, superficial inguinal ring, or posterior inguinal canal. They may have pain with resisted sit-ups, hip adduction, or the Valsalva maneuver. In one study, MRI was found to be sensitive and specific for both rectus abdominus and adductor tendon injuries. Other studies, including radiographs, ultrasound, or bone scan, should be used as necessary to rule out other etiologies of chronic groin pain.

Treatment initially consists of NSAIDs, icing after activity, massage, and rest, with gradual return to activity if the pain improves. Physical therapy should focus on core strengthening and improving hip or pelvic muscle imbalances. Surgical exploration and repair of the weak posterior inguinal wall or pelvic floor is indicated after 6 to 8 weeks of targeted nonoperative therapy. Both open and laparoscopic repairs have been described, with or without the use of mesh. The results of repair and return to play thereafter are generally good. Most patients return to full activity within 2 to 6 weeks of laparoscopic repair and 1 to 6 months after open repair.

Osteitis Pubis

The definition of osteitis pubis continues to be debated in the literature and varies from overuse and functional pelvic instability to a term reserved for describing complications following retro- or parapubic surgery. No arthroscopic management for this condition has been described. It is one cause of chronic groin pain in sports requiring significant twisting, turning, or kicking. Several etiologies have been proposed in the athletic population including adductor or rectus injury, overuse, or anterior instability. In addition, there may be a correla-
tion between decreased preseason hip rotational ROM and the development of osteitis pubis. Osteitis pubis has also been described in pregnant and postpartum females, patients with rheumatologic disorders, and with infection following urologic or gynecologic procedures.

Patients present with sharp or aching anterior pelvic pain located over the symphysis. This may radiate into the lower abdominal muscles, perineum, or thigh adductors, and they may describe associated adductor spasm. On examination, they have tenderness with palpation over the symphysis and pubic rami and pain with adductor stretching and rising from a seated position.

In relatively acute cases, plain radiographs may be normal; however, in chronic cases, radiographs can show cystic changes, sclerosis, and widening or narrowing at the symphysis. Instability may be evident on a one-legged stance film. Bone edema spanning the symphysis with cystic or other degenerative changes or adductor microtears may be visible on MRI. Bone scan may show increased uptake at the symphysis, although can take months to become positive in some athletes.

Nonoperative management is similar to other causes of chronic groin pain and includes NSAIDs, physical therapy focusing on core stability, muscle balance, and rotational hip ROM, and activity modification. Local corticosteroid injection may be diagnostic for localizing pain and provide some therapeutic benefit. The results of injection are often transient, but may be predictive of the response to surgery. Surgical options for patients who have an incomplete response to less invasive therapy include wedge resection at the symphysis, symphysiodesis, posterior wall mesh repair, or curettage. In an athletic population, curettage was associated with complete or near complete resolution of symptoms in nearly 80% of patients. A case series described early return to sport following mesh reinforcement of the posterior pubic area in elite athletes. In a small nonathletic series of patients with osteitis pubis, the results of wedge resection and arthrodesis were less predictable.

CONCLUSIONS

The differential diagnosis of pain around the hip and groin is broad and includes intra-articular pathology, extra-articular soft tissue and tendon pathology, and mimickers, including the joints that make up the pelvic ring. Many potential causes of hip pain have overlapping symptoms or physical exam findings. A careful history and physical examination in combination with appropriate imaging and diagnostic or therapeutic injections generally leads to the correct diagnosis and appropriate therapy.

REFERENCES


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