Injury of the Gluteal Aponeurotic Fascia and Proximal Iliotibial Band: Anatomy, Pathologic Conditions, and MR Imaging[1]

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LEARNING OBJECTIVES

After completing this journal-based SA-CME activity, participants will be able to:

- Describe the relevant anatomic features of the fascia lata, iliotibial band, gluteal aponeurotic fascia, and tensor fasciae latae.
- List the various pathologic conditions that affect these structures in different subgroups of patients.
- Discuss the role of MR imaging in evaluating these injuries and excluding other potential sources of symptoms.

TEACHING POINTS

See last page

The fascia lata, or deep fascia of the thigh, is a complex anatomic structure that has not been emphasized as a potential source of pelvic and hip pain. This structure represents a broad continuum of fibrous tissue about the buttock, hip, and thigh that receives contributions from the posteriorly located aponeurotic fascia covering the gluteus medius muscle and from the more laterally located iliotibial band (ITB). At the pelvis and hip, the ITB consists of three layers that merge at the lower portion of the tensor fasciae latae muscle. The gluteal aponeurotic fascia and ITB merge at the buttock and hip before extending inferiorly to the Gerdy tubercle at the anterolateral tibia. Injuries to these anatomic structures are an underdiagnosed cause of pain and disability and may clinically mimic more common processes affecting the hip and proximal thigh. Categories of disease include overuse injuries, traumatic injuries, degenerative lesions, and inflammatory lesions. Familiarity with the anatomy and pathologic conditions of the fascia lata and its components is important in their recognition as a potential source of symptoms. This article illustrates the anatomy of this complex fascia through anatomic-pathologic correlation and describes the magnetic resonance imaging appearances of the pathologic conditions involving it.

Introduction

Chronic lateral hip pain is a common condition in middle-aged and elderly patients. The syndrome of chronic nontraumatic lateral hip pain has been ascribed to trochanteric bursitis, gluteal tendinopathy, and trochanteric tendinobursitis. More recently, due to recognition and understanding of the myriad anatomic structures and pathologic conditions that can give rise to pain in the region, the term *greater trochanteric pain syndrome* (GTPS) has been applied to this condition (1,2). Chronic lateral hip pain may also be associated with osteoarthrosis of the hip and lower back pain. Efforts

Abbreviations: FL = fascia lata, GA = gluteal aponeurotic, GTPS = greater trochanteric pain syndrome, ITB = iliotibial band, PD = proton-density, TFL = tensor fasciae latae, TIRM = turbo spin-echo inversion-recovery magnitude

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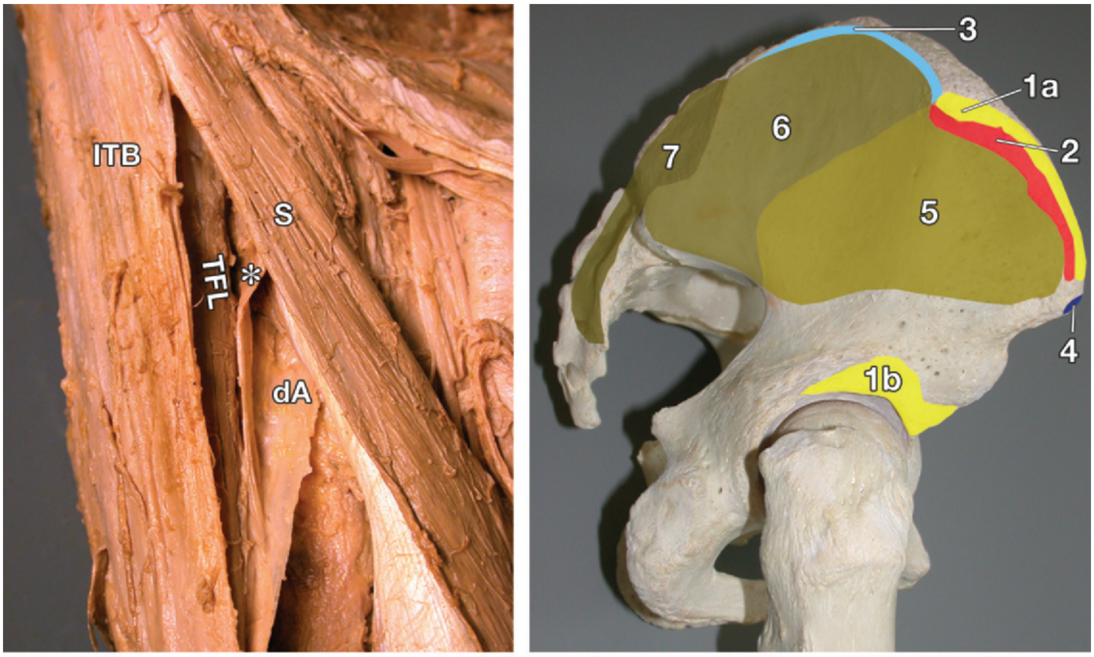


a. b.

Figure 1. **(a)** Photograph (anterior view) of a dissected right thigh shows the three layers of the ITB. Note the covering of the TFL by the superficial fibers *(ITB)* and intermediate fibers (*) of the ITB and the distal part of its deep anchor *(dA)*. The close relationship of the sartorius *(S)* and TFL muscles is apparent. **(b)** The origin of relevant muscles and other structures on the iliac bone is illustrated (right lateral view). *1a* = origin of the superficial layer of the ITB, *1b* = origin of the deep layer (deep anchor) of the ITB, *2* = origin of the TFL, *3* = attachment of the GA fascia, *4* = origin of the sartorius, *5* = origin of the gluteus minimus, *6* = origin of the gluteus medius, *7* = origin of the gluteus maximus.

to distinguish these various and often confounding sources of lateral hip pain have led to increased use of imaging studies, particularly in older patients with coexisting spine and hip disease.

In the younger, more athletic population, lateral hip pain syndrome has a different etiology, often related to overuse injuries resulting in gluteus minimus or medius tendon tears, traumatic trochanteric bursitis, snapping hip syndrome, and proximal iliotibial band (ITB) syndrome (3,4).

Various anatomic structures may be responsible for chronic lateral hip pain, with emphasis having been placed on the spine, sacroiliac articulation, hip articulation, and adjacent hip bursae and tendons. Disease affecting the deep fascia of the thigh, known as the fascia lata (FL), and its contributions, which include contributions from the ITB, tensor fasciae latae (TFL) muscle, and gluteal aponeurotic (GA) fascia covering the gluteus medius muscle, has not been emphasized in the imaging literature as a source of lateral hip pain. Clinically, pain arising from disease of these structures is typically misattributed to more common pathologic processes that affect the hip.

Teaching Point

In this article, we review the pertinent anatomy of the FL, discuss the various patterns of injuries we have encountered involving these structures, and illustrate the magnetic resonance (MR) imaging findings related to disease of the FL to inform radiologists of the spectrum of lesions in this structure that can lead to lateral hip pain.

Functional and Anatomic Considerations

The buttock and thigh are invested by a complex arrangement of fasciae and aponeuroses that act in concert with the musculature to help people maintain an upright posture while standing. While the term *fascia lata* consistently refers to the deep fascia that invests the thigh musculature, there is variation in the anatomy literature regarding its detailed anatomy, particularly its pelvic attachments. According to Netter (5), the FL is the uppermost segment of a stocking-like structure that invests the muscles of the hip and thigh and is noticeably thicker and stronger in regions where it receives tendinous contributions. It is thickest at the upper and lateral thigh, where it receives a fibrous expansion from the gluteus maximus and an attachment from the TFL (6). This thickened region of the FL, referred to as the ITB or iliotibial tract, is a prominent longitudinally oriented band of fascial tissue that extends distally along the entire lateral thigh and attaches distally at the Gerdy tubercle on the anterolateral tibia.

Figure 2. Anteroposterior radiograph of the right hip in a 40-year-old woman. The ITB appears as a thin aponeurotic band (arrowheads) attaching proximally to the iliac crest and descending inferiorly along the thigh, passing over the greater trochanter of the proximal femur. At the level of the greater trochanter, the ITB is surrounded by fat.

Proximally, the FL has a complete attachment to the pelvic bone, attaching to the pubic rami and inguinal ligament anteriorly; to the iliac crest laterally; and to the ischial tuberosity, sacrotuberous ligament, sacrum, and coccyx posteriorly (7). There is a distinct region of fascial thickening at the iliac tubercle—a bony prominence on the outer lip of the crest 5 cm behind the anterior superior iliac spine—that corresponds to the site of origin of some of the fibers of the ITB (4).

According to our analysis of 40 fixed cadaveric specimens, the ITB is a trilayered structure consisting of superficial, intermediate, and deep layers that fuse in the region of the greater trochanter. The superficial layer lies superficial to the TFL, a fusiform muscle that originates at the anterior part of the external lip of the iliac crest and the outer border of the anterior superior iliac spine and acts to abduct the thigh and rotate it inward. The intermediate layer of the ITB originates from the ilium just below the TFL origin and lies deep to the muscle belly. At the lower end of the TFL, the superficial and intermediate layers fuse; farther distally, they merge with the deep layer, a constant structure noted in our dissections that originates from the supraacetabular fossa between the hip capsule and tendon of the reflected head of the rectus femoris (Fig 1).

The ITB is reinforced on its posterior aspect by coarse tendinous fibers arising from the gluteus maximus muscle. All of the fibers arising from the superior gluteus maximus as well as the superficial fibers arising from its inferior portion insert into the posterior aspect of the ITB. Only the deep fibers from the inferior gluteus maximus descend toward the femur to terminate at the gluteal tuberosity, which is located between the greater trochanter and the linea aspera. The lateral intermuscular septum, one of two septa arising from the FL, extends from the iliotibial tract and also receives insertion of tendinous fibers from the gluteus maximus (8). The gluteus maximus acts to extend the femur at the hip joint and also acts as a tensor of the FL, steadying the femoral and tibial articular surfaces by way of its connections with the ITB when an individual is standing (6).

There is variation in the anatomy literature regarding the relationship between the FL and the more posteriorly located aponeurotic fascia of the gluteus medius. Our anatomic analysis of 40 fixed cadaveric specimens revealed two distinct aponeurotic structures covering the muscles of the gluteal region and adjacent thigh. The first of these is the laterally located ITB described earlier. The second distinct fascial structure is the posteriorly located GA fascia, which arises from the posterior outer lip of the iliac crest and extends distally to cover the gluteus medius before inserting on the ITB and the gluteal tuberosity of the femur. The GA fascia, which lies between the iliac crest and the superior border of the gluteus maximus, covers the anterior two-thirds of the gluteus medius (the posterior third being covered by the gluteus maximus) and separates the muscle from the superficial fascia and integument. The GA fascia partially serves as the flat tendon of origin of the gluteus medius; it also gives rise to a portion of the gluteus maximus adjacent to the inferior border of the gluteus medius. The most anterior fibers of the GA fascia adhere directly to the posterior fibers of the ITB.

The ITB can usually be identified on an anteroposterior radiograph of the hip as a vertical linear soft-tissue opacity lateral to the greater trochanter. It is outlined by superficial subcutaneous fat and a deep triangular collection of fat located between the planes of the ITB, TFL, and vastus lateralis muscles (Fig 2).

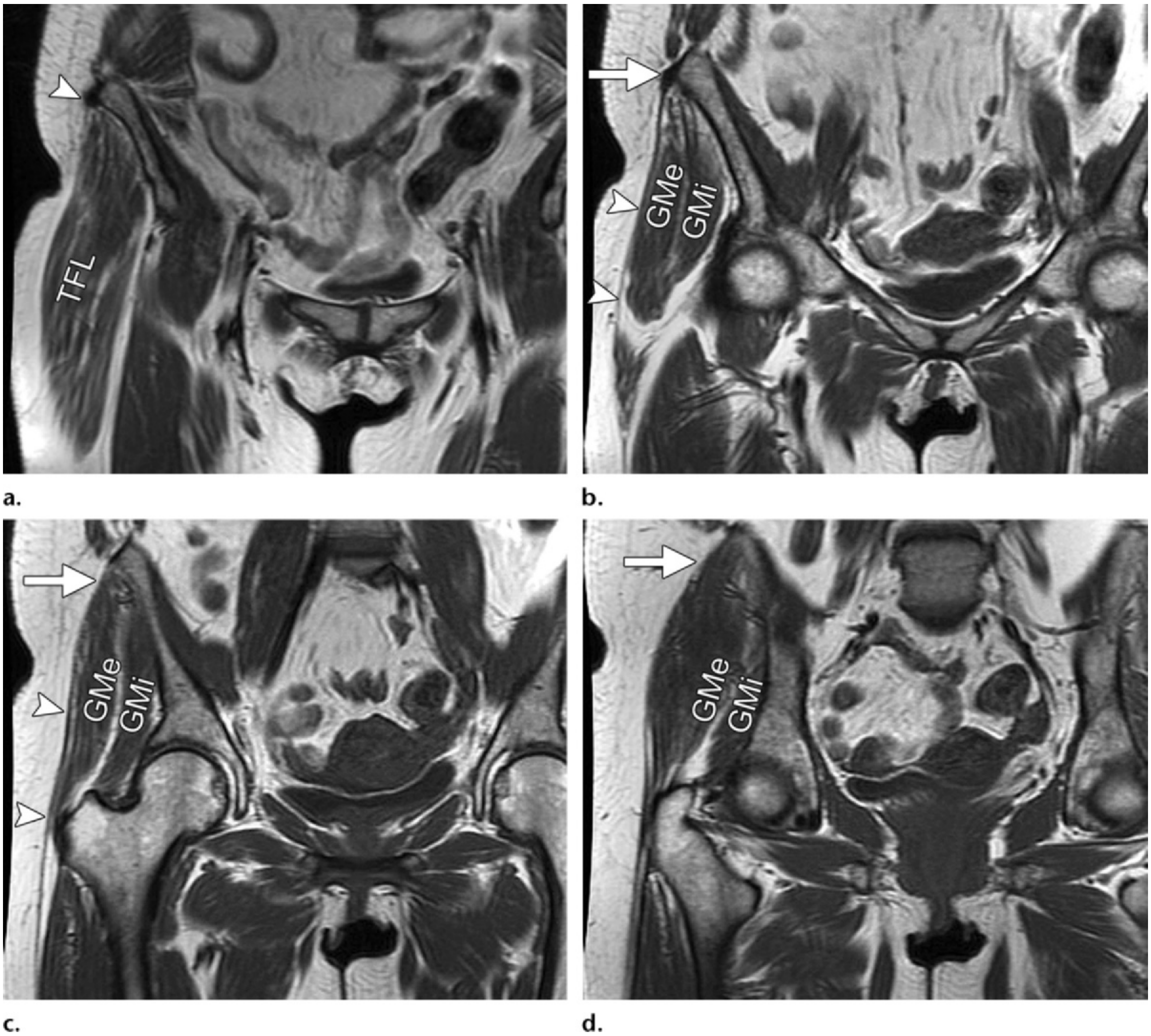
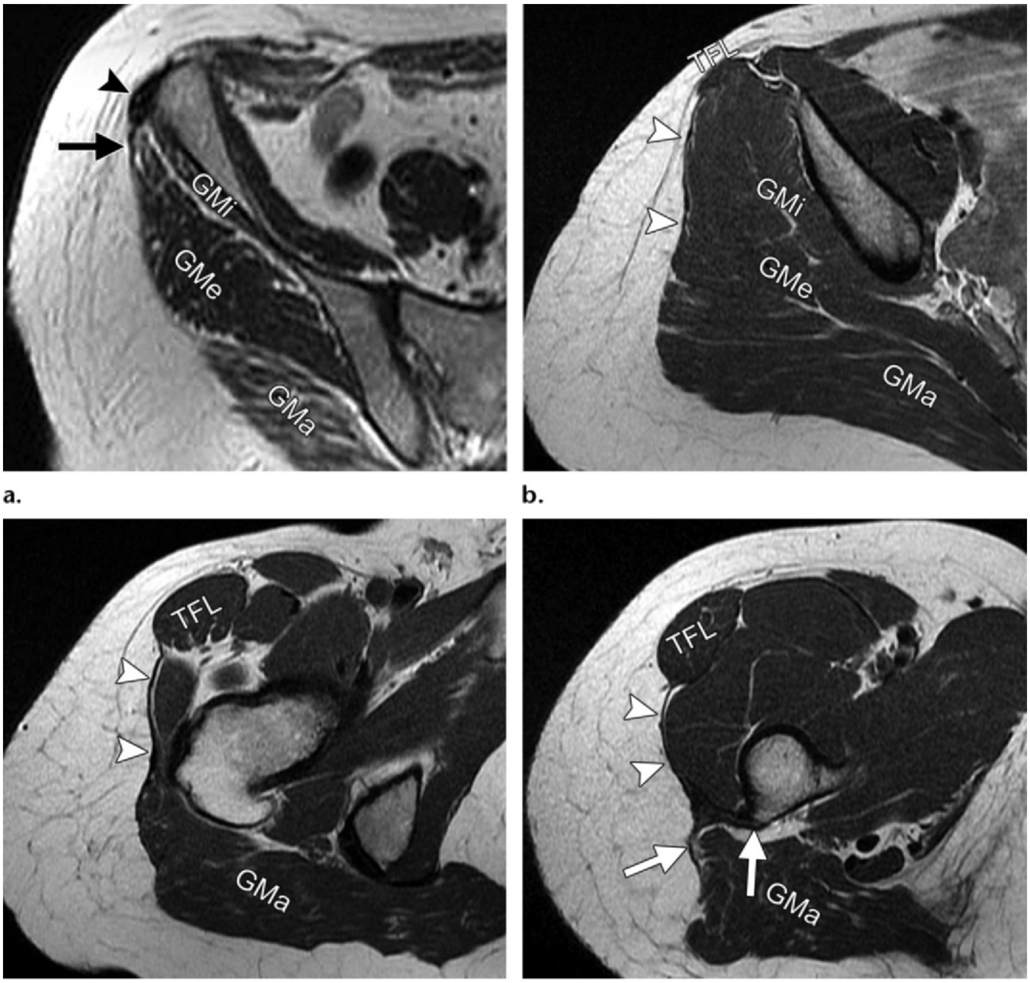


Figure 3. Coronal T1-weighted MR images (repetition time msec/echo time msec = 516/13) of the right hip in an asymptomatic volunteer show the attachment of the FL and its contributions from anterior to posterior. **(a)** The origin of the TFL, seen at the iliac crest, is covered by the ITB at the outer lip (arrowhead) of the iliac crest. **(b)** The more posterior portion of the ITB is well demonstrated at the iliac tubercle (arrow), as is the remainder of the ITB as it descends laterally along the thigh (arrowheads). Deep to the ITB are the gluteus medius *(GMe)* and gluteus minimus *(GMi)*. **(c, d)** At the level of the hip joint, some fat separates the ITB from the gluteal muscles, which helps define the ITB at radiography. Posteriorly, the GA fascia (arrow) covers the upper part of the lateral surface of the gluteus medius—also giving rise to the gluteus maximus at its inferior border—and blends with the posterior fibers of the ITB (arrowheads in **c**).

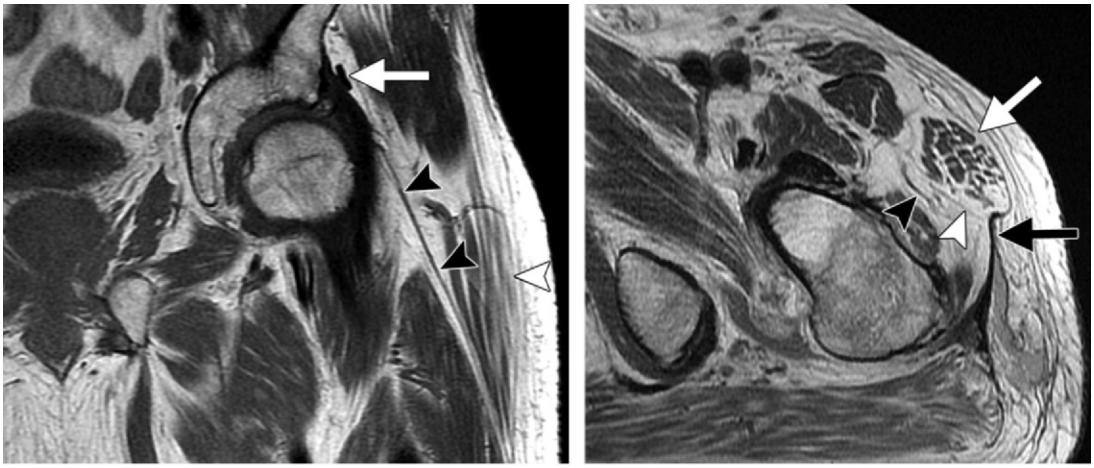
The components and anatomic arrangement of the fascial structures are far better seen at MR imaging, as images obtained in the axial and coronal planes allow clear delineation of the continuous iliac attachments of the ITB and GA fascia. It is difficult to separate their proximal attachments, and they can therefore be considered to form a continuous aponeurotic plane at their iliac attachment. Sequential coronal images obtained from anterior to posterior show the proximal origin of the TFL, which is covered on its outer surface by the ITB, followed by the GA reinforcements to the posterior fibers of the ITB by the gluteus medius and maximus (Fig 3).



a. b. c. d.

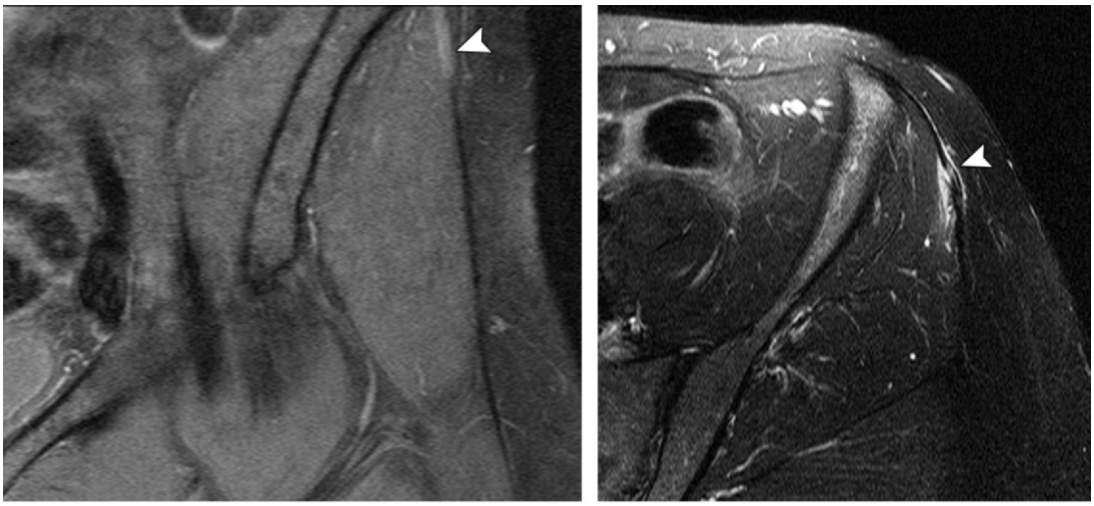
Figure 4. Axial proton-density (PD)–weighted images (2467/34) of the right hip show the relationships of the FL and its contributions from anterior to posterior. **(a)** The proximal attachment of the ITB and the origin of the TFL (muscle belly not shown) appear together at the outer lip of the iliac crest (arrowhead). The GA fascia (arrow) covers the gluteus medius *(GMe)* and is adherent to the posterior fibers of the ITB. The gluteus minimus *(GMi)* and gluteus maximus *(GMa)*, with origins from the ilium, are also seen. **(b)** More inferiorly, the proximal-most portion of the TFL is now identified, with its lateral border covered by the superficial fibers of the ITB (arrowheads). *GMa* = gluteus maximus, *GMe* = gluteus medius, *GMi* = gluteus minimus. **(c)** At the level of the greater trochanter, the ITB (arrowheads) appears as an aponeurotic structure covering the TFL anteriorly and the greater trochanter laterally and receiving insertional tendon fibers from the gluteus maximus *(GMa)*. **(d)** In the subtrochanteric region, the ITB (arrowheads) continues toward the knee, with superficial fibers from the gluteus maximus *(GMa)* tendon inserting on it and with deep fibers of the tendon inserting on the gluteal tuberosity of the proximal femur (arrows). Tendinous fibers of the gluteus maximus also insert on portions of the lateral intermuscular septum in this region.

Axial images obtained from superior to inferior show the TFL and the ITB anteriorly, with the posterior contributions to the ITB by the GA (Fig 4). In patients with increased body fat, the intermediate layer of the ITB deep to the TFL as well as the deep layer originating from the supra-acetabular fossa can be visualized (Fig 5).



a. b.

Figure 5. Intermediate layer and deep anchor of the ITB in a 55-year-old man with a nondisplaced intertrochanteric femur fracture. **(a)** Coronal T1-weighted MR image shows the deep anchor originating from the supraacetabular fossa (black arrowheads), covered by the reflected (indirect) head of the rectus femoris (arrow). The deep anchor covers the iliofemoral ligament of the hip capsule. Inferiorly, the deep anchor descends toward the lower end of the TFL (white arrowhead) and blends with the intermediate and superficial fibers of the ITB. **(b)** Axial PD-weighted image shows the deep anchor (black arrowhead) deep to the intermediate fibers (white arrowhead) of the ITB and the TFL (white arrow). These fibers will eventually merge inferiorly with the superficial fibers of the ITB (black arrow).



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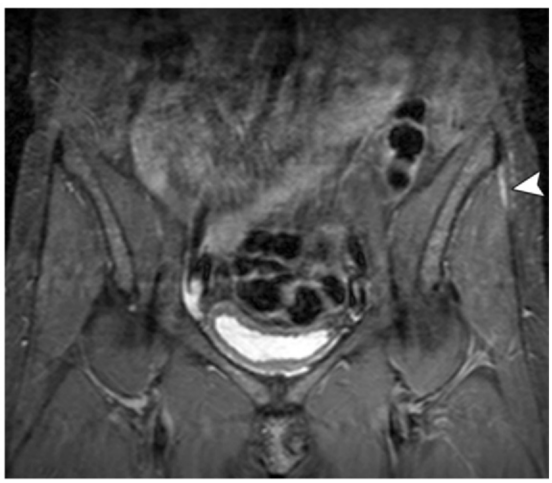

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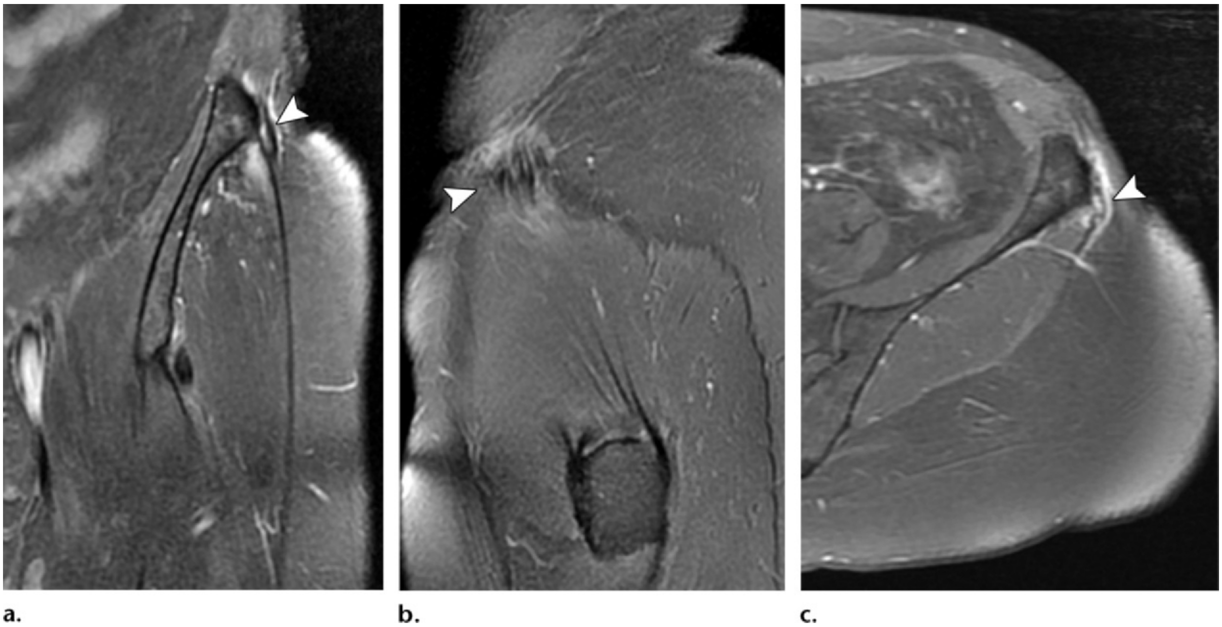


Figure 7. Lateral hip pain in a 33-year-old female runner. Coronal **(a)**, sagittal **(b)**, and axial **(c)** PD-weighted images (2570/14) show hyperintense intrasubstance signal in the ITB at its proximal attachment to the iliac tubercle (arrowhead), a finding indicative of partial tearing. Surrounding soft-tissue edema is also seen. No associated enthesophyte or marrow edema is noted in the iliac tubercle.

Pathologic Conditions

Few reports in the literature illustrate the pathologic conditions affecting the FL and its pelvic attachments in adults. Sher et al (4) described MR imaging abnormalities at the proximal ITB in seven women, four of whom were athletes, who presented with the gradual onset of iliac tubercle pain that worsened with activity. At MR imaging, hyperintense T2 signal was seen at the iliac tubercle, with or without partial tear or detachment of what the authors considered the proximal ITB. The increased T2 signal intensity was not in the iliac tubercle itself, but in the perifascial soft tissues near the tubercle. Four patients demonstrated a partial tear, while the remaining three demonstrated expansion and edema at the iliac tubercle enthesis, findings the authors considered indicative of a strain.

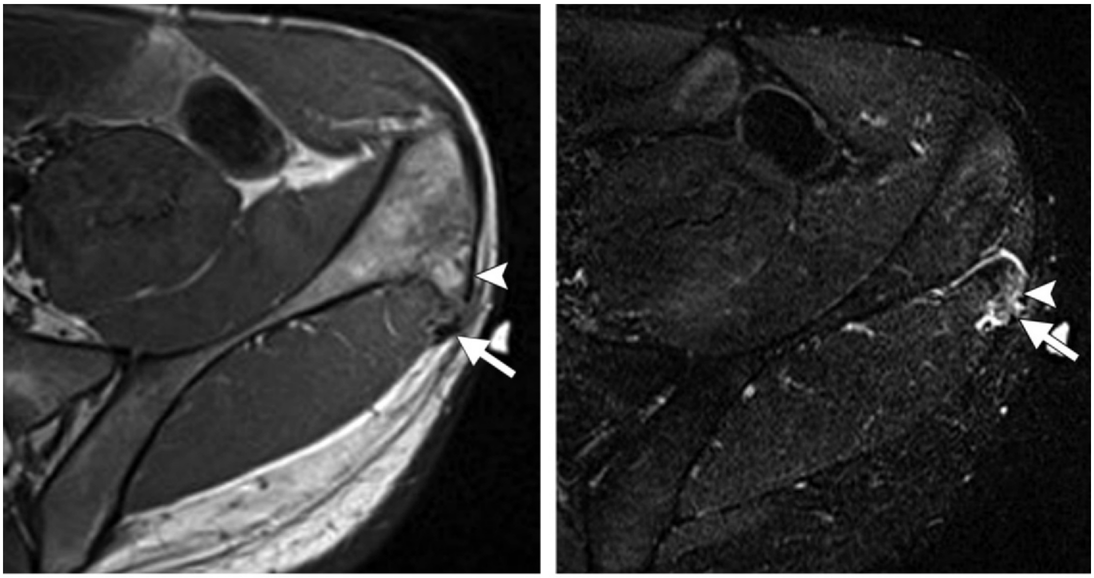
Sher et al (4) noted that the proximal portions of the FL may be missed with use of small-field-of-view imaging protocols dedicated to the hip. The authors indicated that the iliac attachments of the FL should be evaluated on images with a larger field of view that includes the entire iliac crest (Fig 6).

Overuse Injuries in Athletes

Among athletes with chronic repetitive trauma to the ITB, we have found imaging features of ITB injury similar to those reported by Sher et al (4), who coined the term *proximal ITB syndrome*. At MR imaging, findings of overuse injuries of the proximal GA fascia, ITB, and TFL are seen at and near the iliac attachments. These findings of parailiac fascial injury include increased signal intensity on images obtained with fluid-sensitive sequences, denoting edema about the attachments of these structures; thickening of the proximal attachments; and partial tearing, denoted by intrinsic fluidlike hyperintense signal (Fig 7).

Teaching Point

◀ **Figure 6.** Small-field-of-view versus large-field-of-view imaging in a 41-year-old female distance runner with a suspected stress fracture. **(a)** Coronal PD-weighted image (2570/14) obtained with a small field of view shows hyperintense signal along the ITB (arrowhead) but does not allow full evaluation of its most cranial portion. **(b)** The most superior section from an axial T2-weighted (4360/78) fat-suppressed dedicated hip sequence shows hyperintensity in the ITB and GA fascia, with a focal area of discontinuity and tearing (arrowhead), in addition to surrounding hyperintensity indicative of soft-tissue edema. The ITB was normal along most of the more inferior sections. **(c)** Turbo spin-echo inversion-recovery magnitude (TIRM) image (4000/41; inversion time, 230 msec) of the pelvis reveals the superior extent of the finding (arrowhead), with the entire iliac attachment seen with the larger field-of-view examination.



a. b.

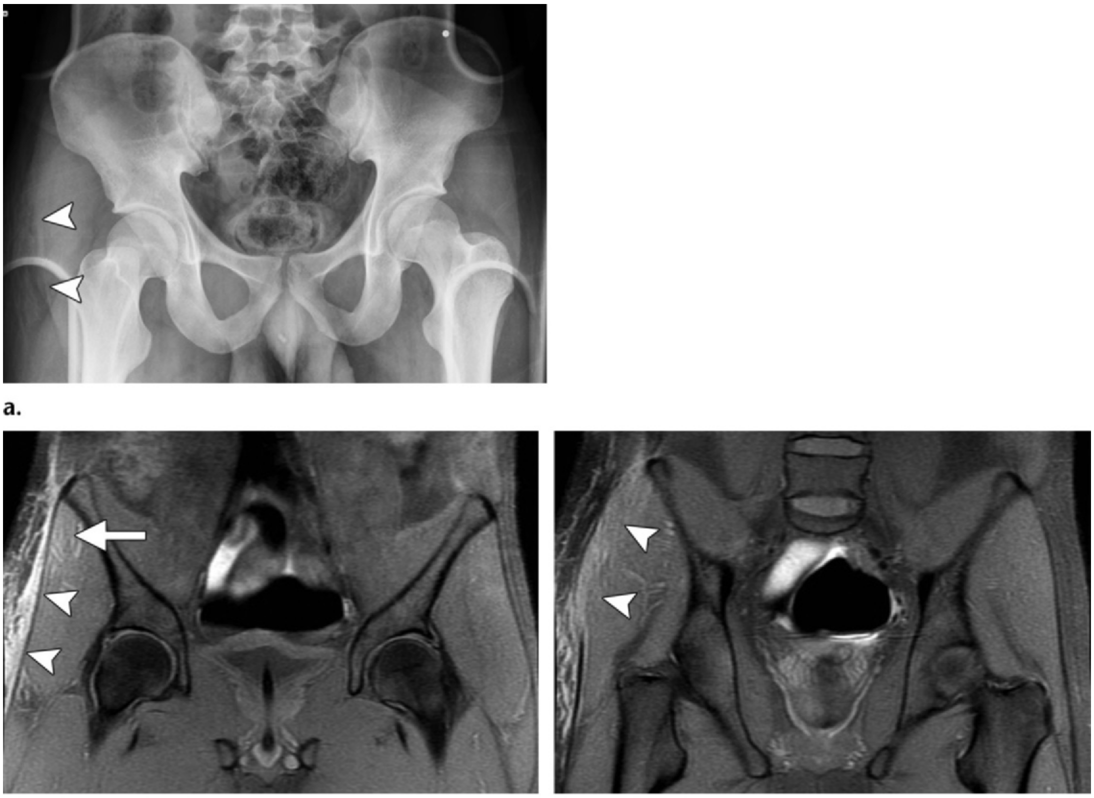
Figure 8. Suspected osteochondroma in a 22-year-old man engaged in aggressive weight training who had chronic refractory left hip pain. Radiographs (not shown) and MR images revealed an osseous excrescence arising from the iliac tubercle. **(a)** Axial T1-weighted image (1020/12) shows an enthesophyte arising from the iliac tubercle (arrowhead). There is focal thickening of the adjacent ITB–GA fascia continuum (arrow). **(b)** Axial TIRM image (4000/41; inversion time, 230 msec) shows hyperintense soft-tissue edema and focal tearing of the ITB–GA fascia at the enthesophyte (arrow) and marrow edema at the tip of the enthesophyte (arrowhead). The patient underwent surgical resection, with histologic findings showing benign lamellar bone surrounded by fibroadipose tissue, but without the overlying cartilage cap typically seen with an osteochondroma.

Infrequently, we have noted marrow edema in the iliac tubercle, a finding not reported by Sher et al (4) (Fig 8). We postulate that the development of marrow edema at the iliac tubercle is a manifestation of enthesopathy, similar to the inconsistent development of marrow edema in the calcaneus in patients with active plantar fasciitis (9,10). This enthesopathy is thought to be due to chronic microtrauma leading to periostitis and calcification (10,11). Enthesopathy at the fascial insertions along the iliac bone is typically asymptomatic; however, we postulate that the pattern of fascial thickening with marrow edema at the iliac tubercle may be associated with symptoms (Fig 8), as in patients with chronic plantar fasciitis.

According to Sher et al (4), although patients with fascial abnormalities had pain that was predominantly iliac related, the condition was frequently misdiagnosed, and patients were treated for hip-related disease. One of their patients underwent a long course of physical therapy and multiple attempted therapeutic hip injections without relief.

We have found a similar presentation in our patients, who have reported pain localized in the iliac crest and the absence of pain localized in the groin, greater trochanter, iliopsoas tendon, or hip joint. Failure to recognize a fascial abnormality led to unsuccessful treatment of hip and trochanteric lesions.

This presentation is in contradistinction to that in the study by Bass and Connell (12), who described the sonographic and clinical manifestations of tendinopathy and tears of the iliac origin of the TFL in athletes, with their patient cohort presenting instead with anterior groin pain. However, Bass and Connell (12) did also report focal pain over the anterior iliac crest in their patients. They identified sonographic findings of tears involving the deep and superficial fibers of the TFL at the iliac origin. In no case was there isolated involvement of the superficial fibers without involvement of the deep fibers. However, they did not discuss the proximal attachment of the ITB at the crest and thus did not distinguish it as a structure separate from the underlying TFL. Therefore, it is not known whether the disease involving the deep and superficial fibers of the TFL also involved the ITB.



a. b. c.

Figure 9. Traumatic injury in a 22-year-old man who presented with right hip pain after an all-terrain vehicle accident. The patient experienced blunt trauma to the right side of his body, resulting in multiple injuries including renal laceration, rib fractures, and pneumothorax. **(a)** Trauma anteroposterior radiograph of the pelvis shows nonspecific soft-tissue edema and obscuration of tissue planes over the lateral aspect of the right thigh (arrowheads) but does not reveal a fracture. Because of clinical suspicion for an occult fracture, MR imaging was performed. **(b)** Coronal PD-weighted (2050/7.5) fat-suppressed image of the pelvis reveals a sprain of the right proximal ITB attachment (arrowheads) with edema of the surrounding subcutaneous fat and within the underlying gluteus medius (arrow), likely related to contusion. **(c)** Image posterior to **b** shows tearing and discontinuity of the ITB and the GA fascia from the iliac attachment nearly to the level of the greater trochanter (arrowheads), which can be compared with the unaffected left side. Note also the slight bulge of the gluteus medius through the fascial defect.

In the series by Bass and Connell (12), six of 12 patients recovered, with return to previous levels of activity after various treatments (including rest, anti-inflammatory medication, cortisone injections, and surgery). The remaining patients had persistent, unresolved symptoms. These outcomes mirror our experience, in which patients with fascial injuries have had persistent pain even after a correct diagnosis and despite management with rest, anti-inflammatory medications, and physical therapy.

Traumatic Injury

The literature is limited regarding acute traumatic injury to the GA fascia, ITB, and TFL about the proximal thigh after a single episode of trauma. We have noted several cases of traumatic injury to these structures that was sustained during sporting activities, after mechanical falls, or after high-energy trauma such as a motor vehicle accident. Patients generally had nonspecific clinical and physical examination findings, such as focal tenderness to direct palpation over the lateral thigh and negative radiographs, leading to MR imaging for evaluation of occult fracture.

Radiographic and computed tomographic (CT) findings in fascial injury are subtle; occasionally, nonspecific edema that is indistinguishable from soft-tissue contusions may be seen surrounding the FL (Fig 9a). MR imaging allows depiction of tears of the FL and its expansions at and near its iliac attachments, extending inferiorly toward the

a. b.

Figure 10. Traumatic injury in a 54-year-old alcoholic man after multiple falls over the previous few days. **(a)** Conventional radiograph of the left hip shows a greater trochanteric fracture (arrowhead). MR imaging was performed to exclude intertrochanteric extension of the fracture. **(b)** Coronal T2-weighted image (2833/73) of the pelvis shows tearing of the ITB and GA fascia at the iliac attachment (arrow), with extensive intramuscular edema within the gluteus medius (arrowhead).

level of the greater trochanter. The appearance of these injuries ranges from sprains to complete tears of the FL, with areas of hyperintensity and discontinuity of the affected portions observed on images obtained with fluid-sensitive sequences (Fig 9b, 9c).

Teaching Point

In general, traumatic tears are higher in grade and involve more substantial portions of the FL in comparison with overuse injuries, which tend to be low-grade partial tears confined to the iliac attachment. As a result, a useful secondary sign of fascial disruption is peripheral bulging or frank herniation of the underlying musculature through the defect (Fig 9c). Areas of adjacent gluteal muscle edema may be seen, reflecting reactive edema, muscle contusion, or myotendinous strain.

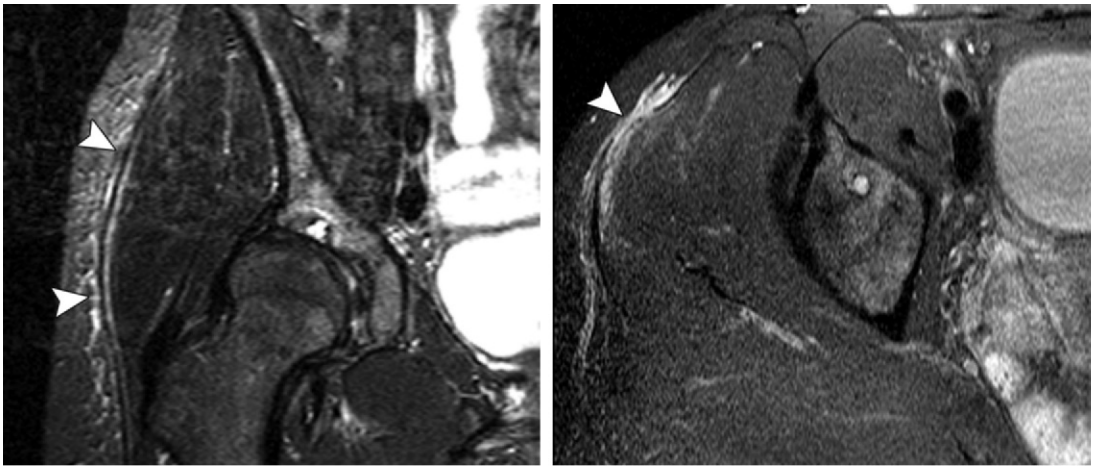
In patients with significant trauma, injuries to the FL may also occur concurrently with fractures of the pelvis and femora (Fig 10). Although there are no specific treatment protocols for these injuries, MR imaging helps exclude more serious injuries such as fractures and allows evaluation of other sources of unexplained pain.

Degenerative Lesions

Degenerative tears of the FL may occur in the absence of any recalled trauma or may result from relatively minor physical activities such as rising from a chair. In our experience, these degenerative tears of the FL and its components tend to occur in middle-aged and elderly women. Degenerative tearing likely accounts for the fascial signal intensity abnormalities observed in the three older nonathletic patients by Sher et al (4).

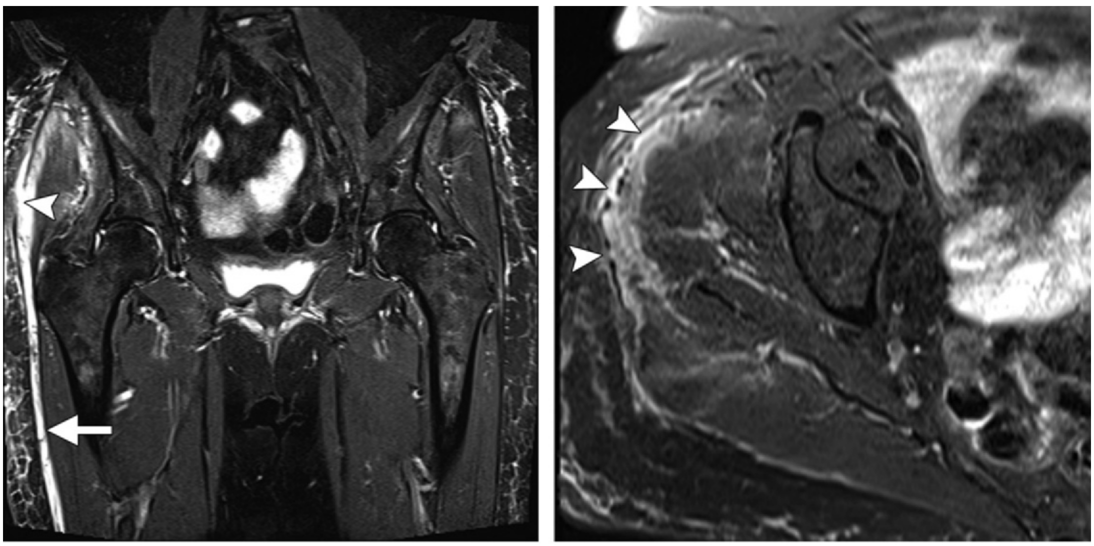
Pain is the usual presentation; in some cases, patients can recall the precise moment of onset and occasionally report the sensation of a preceding "pop." The degree of pain is variable, although it is occasionally severe enough that patients are immediately unable to bear weight. At clinical examination, patients may demonstrate swelling and ecchymosis anywhere from the inguinal ligament and iliac crest to the greater trochanter, along with palpable tenderness over the affected region.

MR images typically reveal injuries anywhere from the iliac crest to the greater trochanter. As with traumatic injuries, findings include hyperintensity surrounding the affected components of the FL on images obtained with fluid-sensitive sequences (Fig 11) as well as areas of discontinuity representing tearing (Fig 12). Similar to



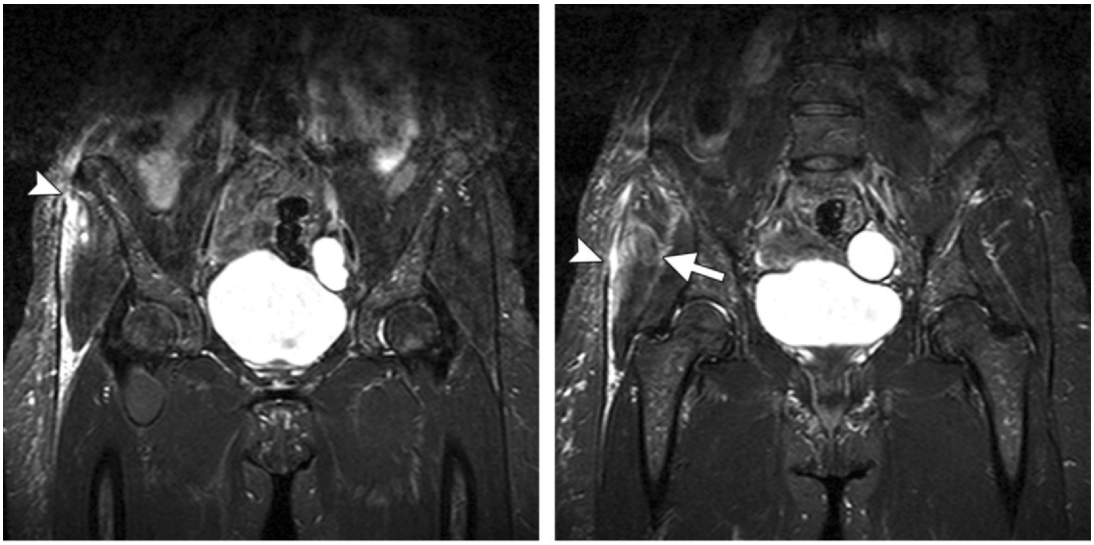
a. b.

Figure 11. Degenerative tearing in a 45-year-old woman who felt a sudden "pop" while standing. Radiographs showed only mild hip dysplasia with uncovering of the femoral head and a steep acetabulum. **(a)** Coronal TIRM image (6800/51; inversion time, 160 msec) of the right hip shows soft-tissue edema deep and superficial to the ITB (arrowheads). Degenerative subchondral cysts are seen within the acetabulum on a background of hip dysplasia. **(b)** Axial intermediate-weighted (2210/49) fat-suppressed image of the right hip shows focal tearing along the more anterior fibers of the ITB (arrowhead).



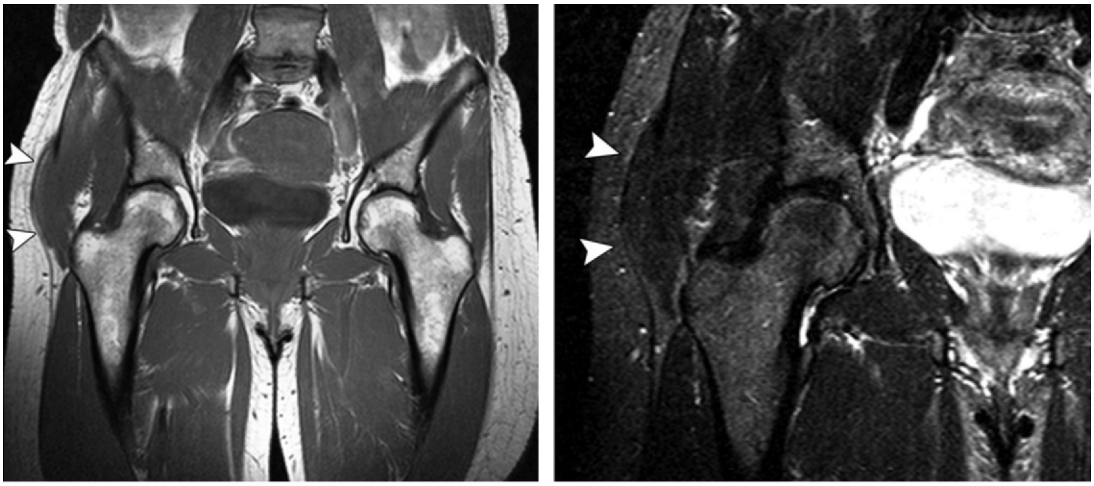
a. b.

Figure 12. Degenerative tearing in a 77-year-old woman with sudden onset of nontraumatic right hip pain and inability to bear weight after she twisted to the right while walking. Radiographic and CT findings were negative, so MR imaging was requested to evaluate for an occult fracture. **(a)** Coronal TIRM image (4000/43; inversion time, 150 msec) of the pelvis shows extensive soft-tissue edema deep to the ITB, with focal tearing at the level of the acetabular roof (arrowhead). Fluid and edema are seen tracking along the ITB inferiorly (arrow). **(b)** Axial intermediate-weighted image (2740/45) of the right hip shows multiple foci of tearing of the ITB (arrowheads). There is edema of the gluteus medius, which is likely reactive or due to strain rather than contusion given the absence of direct external trauma.



a. b.

Figure 13. Degenerative tearing in a 45-year-old woman with acute onset of severe nontraumatic right hip pain after she danced at a wedding 3 days earlier. **(a)** Coronal TIRM image (6410/56; inversion time, 160 msec) shows soft-tissue edema primarily deep to the ITB, with focal tearing and separation from its attachment at the iliac tubercle (arrowhead). **(b)** A more posterior image shows that the tearing is extensive, involving the GA fascia and extending to the midway point between the iliac crest and the greater trochanter (arrowhead). Adjacent edema of the gluteus medius (arrow) is also seen.



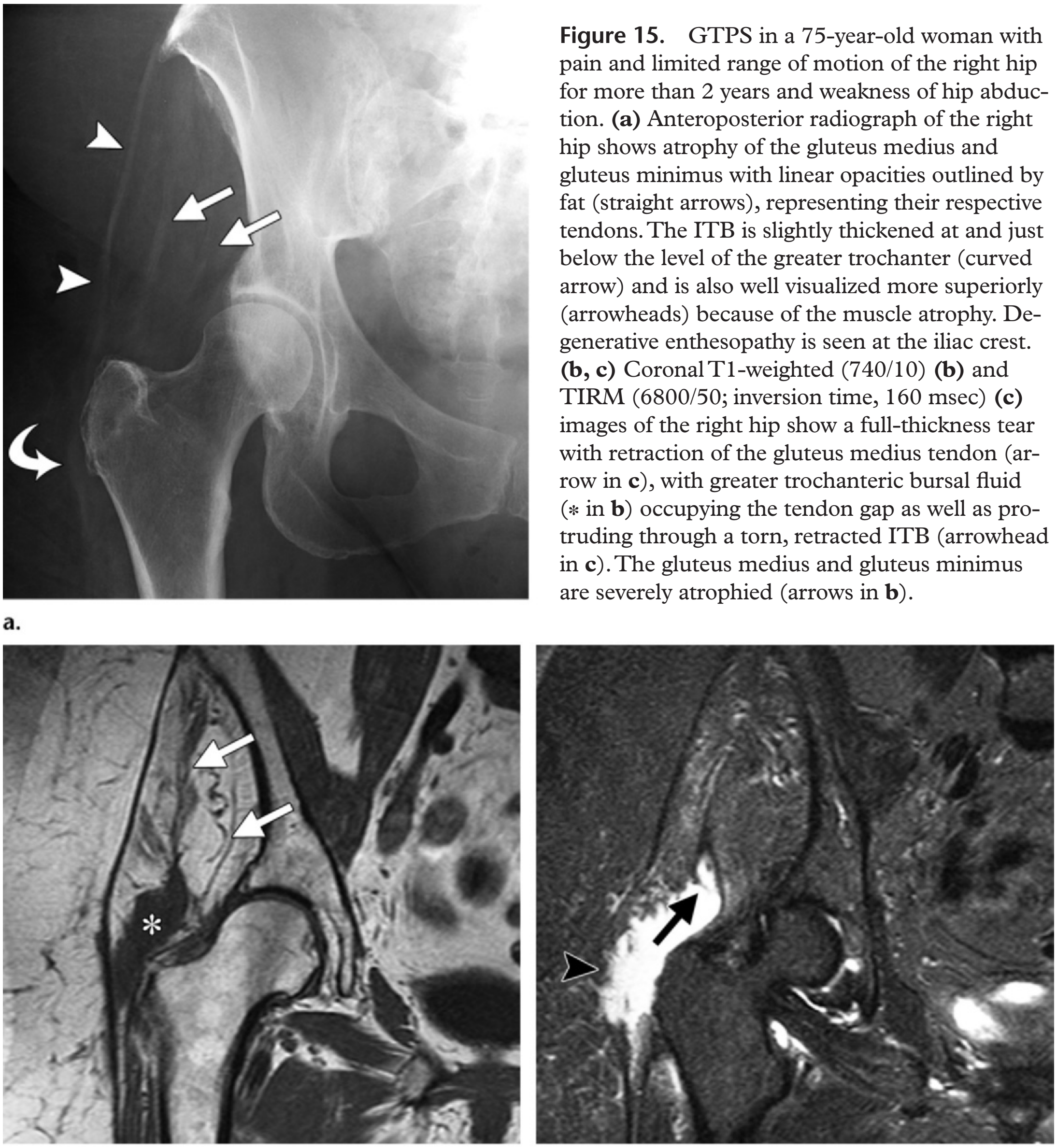
a. b.

Figure 14. Muscle herniation through a chronic tear of the FL in an active 50-year-old woman who experienced a muscle "strain" 6 months earlier during exercising. The patient continued to have deep gluteal pain on the right side without palpable tenderness in any particular location. **(a)** Coronal T1-weighted image (677/10) of the pelvis shows a fascial defect of the right ITB just above the level of the greater trochanter, with herniation of the lower portion of the gluteus medius through the fascial defect (arrowheads). The proximal attachment is normal. **(b)** Coronal TIRM image (8310/51; inversion time, 160 msec) shows no perifascial or intramuscular edema about the ITB (arrowheads), a finding compatible with the clinical history of a chronic injury.

findings with traumatic injuries, edema of the adjacent gluteal musculature may be seen; however, these signal intensity alterations are likely reactive or related to low-grade muscle strains, given the absence of direct external trauma when muscle contusions are also considered (Fig 13).

As seen in acute injuries, muscle herniations may be observed in the setting of chronic tears of the FL and may be diagnosed long after the initial injury. In these more chronic cases, MR imaging typically shows herniation of the gluteus medius through a broad fascial defect, without the significant muscle edema typically observed in acute injuries (Fig 14).

Teaching Point



a. b. c.

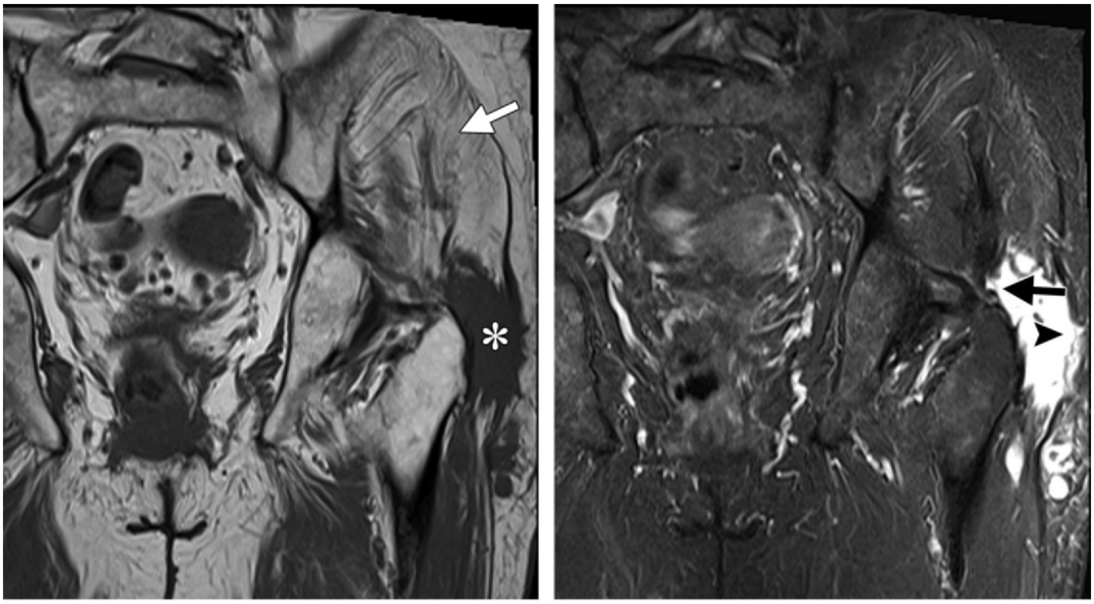
Figure 15. GTPS in a 75-year-old woman with pain and limited range of motion of the right hip for more than 2 years and weakness of hip abduction. **(a)** Anteroposterior radiograph of the right hip shows atrophy of the gluteus medius and gluteus minimus with linear opacities outlined by fat (straight arrows), representing their respective tendons. The ITB is slightly thickened at and just below the level of the greater trochanter (curved arrow) and is also well visualized more superiorly (arrowheads) because of the muscle atrophy. Degenerative enthesopathy is seen at the iliac crest. **(b, c)** Coronal T1-weighted (740/10) **(b)** and TIRM (6800/50; inversion time, 160 msec) **(c)** images of the right hip show a full-thickness tear with retraction of the gluteus medius tendon (arrow in **c**), with greater trochanteric bursal fluid (* in **b**) occupying the tendon gap as well as protruding through a torn, retracted ITB (arrowhead in **c**). The gluteus medius and gluteus minimus are severely atrophied (arrows in **b**).

In such patients, it is unclear whether the pain is the result of the tears in the FL, the muscle herniations, or a combination of both.

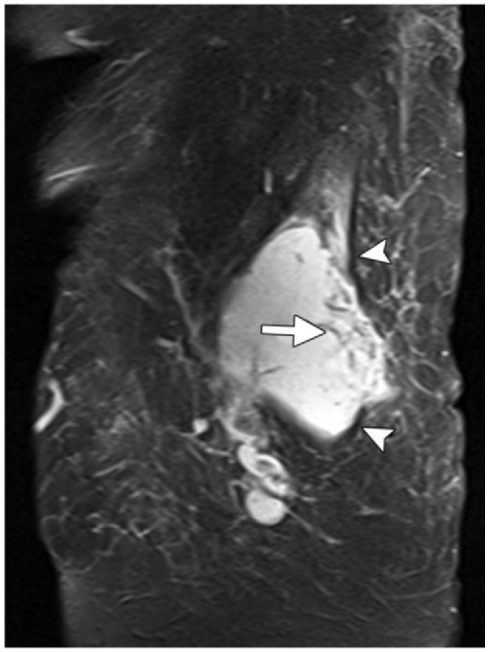
Inflammatory Lesions

Patients with chronic GTPS, which is due primarily to trochanteric tendinitis or tendinobursitis (2), may develop secondary abnormalities involving the FL. The term *greater trochanteric pain syndrome* was popularized by Lequesne et al (2), who described a series of eight patients without hip osteoarthrosis who presented with bursitis as well as tears of the gluteus minimus and medius tendons. The patients responded to surgical repair of the torn tendons and resolution of the associated bursitis.

This syndrome typically affects older women in their 60s to 70s and manifests as chronic hip pain that is refractory to conservative measures, including analgesics, nonsteroidal anti-inflammatory drugs, local steroid injections, rest, and physical therapy. Clinical findings of GTPS include hip pain and palpable tenderness about the greater trochanter, as well as pain with external rotation of a flexed thigh. The term *rotator cuff tear of the hip* has been applied to such patients with abductor tendon tears (3,13–17) (Fig 15).



a. b.



c.

Figure 16. GTPS in a 78-year-old woman with a history of cutaneous vasculitis and psoriatic arthritis who presented with left hip pain. MR imaging was performed for suspicion of steroid-induced avascular necrosis of the femoral head. **(a, b)** Coronal T1-weighted (739/11) **(a)** and TIRM (3570/50; inversion time, 150 msec) **(b)** images of the left hip show severe atrophy of the gluteus medius and gluteus minimus (arrow in **a**). A large bursal fluid collection (∗ in **a**) is seen over the greater trochanter. There is high-grade partial tearing of the gluteus medius tendon from its trochanteric insertion (arrow in **b**). The bursal fluid collection can be seen extending through a large disruption of the ITB (arrowhead in **b**). **(c)** Sagittal intermediate-weighted image (2651/43) shows the posterior extent of the bursal fluid collection (arrowheads), which protrudes through a defect and into the reinforcing fibers of the gluteus maximus tendon at the posterior aspect of the ITB. Synovitic debris is seen posteriorly (arrow).

Teaching Point

We have noted that a subset of patients with chronic bursitis had abnormalities affecting the overlying FL, primarily of the ITB over the greater trochanter, in addition to the typical MR imaging findings of trochanteric bursitis and gluteal tendon tears. These findings included hyperintense fluid collections in the greater trochanteric bursa that protruded through fascial defects of the overlying ITB on images obtained with fluid-sensitive sequences. In addition to tearing of the gluteal tendons, MR images showed fatty atrophy of the muscle bellies of the torn tendons, suggesting that involvement of the FL is a chronic, late-stage finding.

Tendon tearing may also involve the gluteus maximus tendon, with greater trochanteric bursal

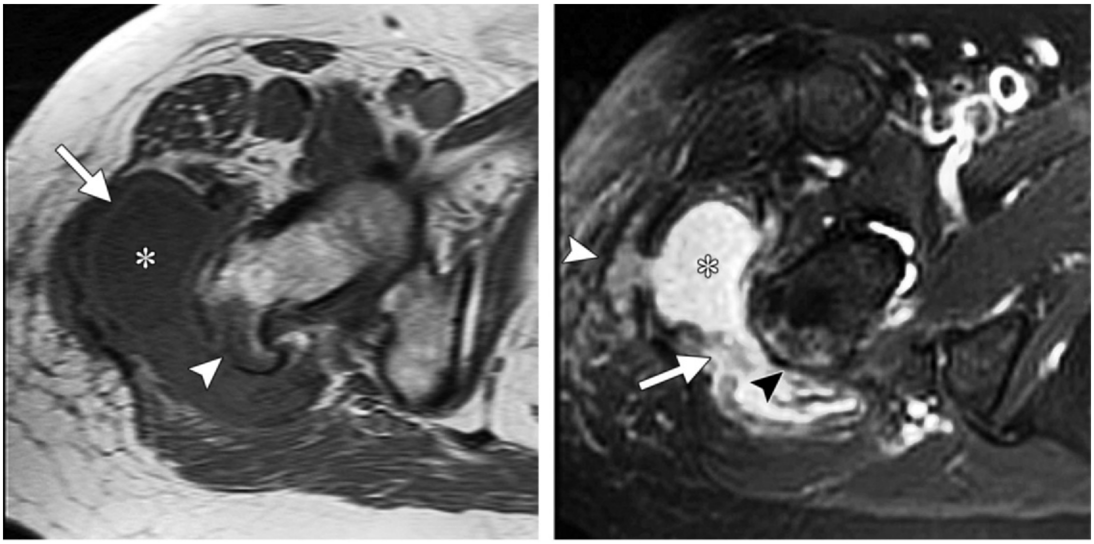


Figure 17. Infectious bursitis in a 63-year-old woman with a history of psoriatic arthritis and chronic right greater trochanteric bursitis with increasing hip pain and weakness with abduction. Because of a concern for septic bursitis, the patient was taken to the operating room for bursectomy. In addition to a gluteus medius tendon tear, "soupy" material was found eroding through the ITB. The soupy material showed growth of *Staphylococcus aureus*. Preoperative axial T1-weighted (745/20) **(a)** and T2-weighted (4060/83) **(b)** fat-suppressed images of the right hip show a greater trochanteric bursal fluid collection (*) with a thick rim of intermediate T1 signal intensity surrounding the fluid (arrow in **a**). The fluid extends through a focal defect in the ITB (white arrowhead in **b**). Synovitis and debris are shown in the dependent portion of the bursal fluid (arrow in **b**). A focal area of T1 hypointensity and T2 hyperintensity in the greater trochanter (arrowhead in **a**, black arrowhead in **b**) is indicative of early osteomyelitis.

fluid extending through the tendon tear (Fig 16). Although trochanteric bursitis is typically seen in the context of GTPS, we have encountered similar cases in patients with coexisting inflammatory arthropathies such as rheumatoid arthritis and the seronegative spondyloarthropathies (Fig 16). Infectious bursitis must also be considered in the appropriate clinical context and requires surgical management with incision and drainage and antibiotic therapy (Fig 17).

In general, the literature offers few descriptions of how patients with FL injuries are treated, regardless of injury type. In our experience, most patients have been treated conservatively with good clinical outcomes, although lesions associated with trochanteric bursitis and gluteal tendon tears may benefit from surgical intervention.

Conclusions

Disease of the GA fascia and ITB is an uncommon, easily overlooked, and frequently misdiagnosed cause of hip and proximal thigh pain. At this time, few reports have discussed the anatomy and pathologic conditions of lesions involving the FL, and little is known about how to diagnose and manage these conditions. We have identified several cases of disease affecting the FL that resulted in pelvic and hip pain and that fall into four broad categories. Overuse injuries are typically seen in athletic individuals, with findings of edema and partial tearing of the ITB at the iliac attachment. Traumatic injuries can occur along any portion of the FL, from the iliac crest to the proximal femur, and manifest as fascial tears, muscle contusions or strains, and muscle bulges or herniations. Degenerative lesions occur in the setting of minor activities in middle-aged women and can occur along any portion of the FL, with findings similar to those associated with traumatic injuries. Finally, involvement of the FL is seen in association with inflammatory greater trochanteric bursitis, gluteal tendon tears, and gluteal muscle atrophy in the context of GTPS. Improved understanding of the anatomy of the FL and increased awareness of the pathologic conditions affecting this region will lead to improved understanding of the diagnosis and management of lesions in this complex fascia.

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Injury of the Gluteal Aponeurotic Fascia and Proximal Iliotibial Band: Anatomy, Pathologic Conditions, and MR Imaging

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Page 1438
Disease affecting the deep fascia of the thigh, known as the fascia lata (FL), and its contributions, which include contributions from the ITB, tensor fasciae latae (TFL) muscle, and gluteal aponeurotic (GA) fascia covering the gluteus medius muscle, has not been emphasized in the imaging literature as a source of lateral hip pain. Clinically, pain arising from disease of these structures is typically misattributed to more common pathologic processes that affect the hip.

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At MR imaging, findings of overuse injuries of the proximal GA fascia, ITB, and TFL are seen at and near the iliac attachments. These findings of parailiac fascial injury include increased signal intensity on images obtained with fluid-sensitive sequences, denoting edema about the attachments of these structures; thickening of the proximal attachments; and partial tearing, denoted by intrinsic fluidlike hyperintense signal.

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In general, traumatic tears are higher in grade and involve more substantial portions of the FL in comparison with overuse injuries, which tend to be low-grade partial tears confined to the iliac attachment. As a result, a useful secondary sign of fascial disruption is peripheral bulging or frank herniation of the underlying musculature through the defect. Areas of adjacent gluteal muscle edema may be seen, reflecting reactive edema, muscle contusion, or myotendinous strain.

Pages 1448
As seen in acute injuries, muscle herniations may be observed in the setting of chronic tears of the FL and may be diagnosed long after the initial injury. In these more chronic cases, MR imaging typically shows herniation of the gluteus medius through a broad fascial defect, without the significant muscle edema typically observed in acute injuries.

Page 1450
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