

Proximal iliotibial band syndrome: what is it and where is it?

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Abstract

Objective To describe the clinical and MR imaging features of a unique strain at the iliac tubercle enthesis. While this strain appeared to correspond to the iliotibial band (IT band) enthesis, the literature regarding the IT band origin was discrepant. As such, our second goal was to prove that the IT band originated at the iliac tubercle, through cadaveric dissection.

Materials and methods Three musculoskeletal radiologists prospectively reviewed 67 consecutive bony pelvis MRI studies from October 2006 through September 2008 using either 3, 1.5, or 0.3 T units. Seven cases demonstrating

strain at the iliac tubercle enthesis were identified and reviewed by consensus. History and patient demographics were reviewed. Cadaveric dissection was performed to delineate the anatomy of the proximal IT band.

Results Seven out of 67 individuals, all women, were identified with strain at the level of the iliac tubercle (prevalence 10%). Four of seven were athletes, three were overweight. Patients presented with pain and tenderness at the iliac tubercle. Anatomic dissection confirmed that iliotibial band originates along the margin of the iliac crest with dominant fibers condensing on the iliac tubercle.

Conclusion Proximal IT band strain represents a unique injury that should be considered in patients who are female athletes or older overweight women who present with pain and tenderness at the iliac tubercle. Imaging of this entity must include the iliac tubercle, which is often excluded in standard hip MRI.

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Introduction

Overuse injuries involving the pelvis and hip are frequently encountered in individuals who participate in sports. Commonly diagnosed conditions include tears of the gluteus medius and gluteus minimus muscles, trochanteric bursitis, snapping hip syndrome, and in adolescents, stress injury of the iliac crest apophysis [1, 2]. We have identified a unique strain injury in a cohort of patients, all women, who presented with pain and tenderness at the iliac tubercle. The strain site was visualized as increased T2 signal at what appeared to be the enthesis of the IT band along the inferior margin of the iliac tubercle. A thorough

search of the English literature produced no previous reports of a strain-based injury at the proximal IT band enthesis. Review of the English anatomical literature revealed significant discrepancies in the nature of the proximal origin of the IT band. It has been described as being composed either from contributions of the fibers of the gluteus maximus and tensor fascia latae muscles without proximal attachment to the iliac crest, or as broad fascia with variable proximal attachments to the iliac crest.

The first goal of our study was to describe the imaging and clinical features of strain at the iliac tubercle enthesis. Since MRI suggested that the strain was localized to the IT band but the literature was discrepant with regard to its origin, our second goal was to clarify the proximal IT band anatomy through cadaveric dissection with imaging correlation.

Materials and methods

Clinical study

This study was performed following the Declaration of Helsinki principles.

Three musculoskeletal radiologists with 4–18 years experience prospectively reviewed 67 (41 female, 26 male) consecutive bony pelvis MRI studies performed at a single facility from October 2006 through September 2008 using either 3, 1.5, or 0.3 T units. Patients' age range was 18–93 years old (mean 49). The protocol included coronal and axial T1 and T2 fat-saturated FSE and sagittal STIR sequences. Cases of T2 signal abnormality with or without fascial disruption at the iliac tubercle enthesis were identified and reviewed by consensus. No additional pathology was identified on the symptomatic side within the field of view. There were no exclusion criteria. Chart review was performed to establish patient history, physical exam results, and demographics.

Anatomical study

Sixteen cadavers from a first-year medical anatomy course (nine male, seven female, age 55–88 years at time of death) were prepared by clearing skin and cutaneous tissue off of the thighs from a line above the superior margin of the iliac crest to one below the inferior attachment of the IT band at Gerdy's tubercle on the proximal anterolateral side of the tibia. Deep fascia (fascia lata, gluteal fascia, and IT band), tensor fasciae latae (TFL), gluteus maximus, and gluteus medius muscles were cleaned and defined. Photographs were taken with the cadaver in side-lying position and the lower limb unsupported, a position that places gravitational stress on the structures of the lateral side of the thigh imposing a tensile force at the iliac tubercle.

Results

Imaging findings

Seven out of 67 patients (prevalence of 10%) were identified with bright T2 signal at the iliac tubercle, with or without partial tear or detachment of what appeared to represent the proximal IT band (Fig. 1a, b). Four patients demonstrated a partial tear. The remainder of the patients demonstrated expansion and edema at the iliac tubercle enthesis consistent with strain. There was no evidence of intramuscular hemorrhage on T1 images. In a single individual imaged using a 0.3 T open MRI necessitating a larger FOV, the perifascial edema over the hip tracked contiguously along the course of the IT band to the iliac tubercle (Fig. 2a–c) and provided imaging evidence that the IT band attaches proximally to the tubercle. The findings were most apparent on the axial and coronal fat-sat FSE.

Clinical findings

All the patients were women 34–67 years old. Four of the seven women participated in sports, specifically running, prior to the onset of symptoms. The remaining three were older, nonathletes (50–67 years); two were moderately overweight and one had a history of treated contralateral iliac lymphoma. All athletes reported gradual onset of pain concentrated in the region of the iliac tubercle that worsened with activity for 1–2 months prior to imaging, suggestive of a chronic overuse injury. The nonathletes reported no known inciting trauma. Two of seven patients had available normal radiographs. One patient was initially evaluated by hip MRI, which was normal. She underwent protracted physical therapy and hip injections without relief. All seven women ultimately underwent diagnostic

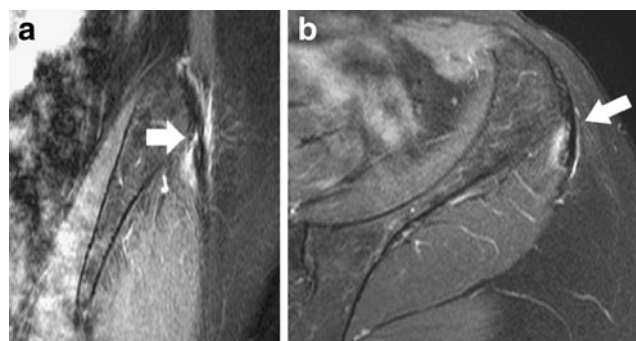


Fig. 1 Coronal (a) and axial (b) fat-suppressed T2-weighted images obtained using a 3 T MRI in a 50-year-old female runner with pain at the level of the iliac tubercle. Perifascial bright T2 signal (arrows) surrounds the proximal ITB near its enthesis. A medial surface partial tear just distal to the iliac tubercle is indicated by the arrow in the coronal plane (a)

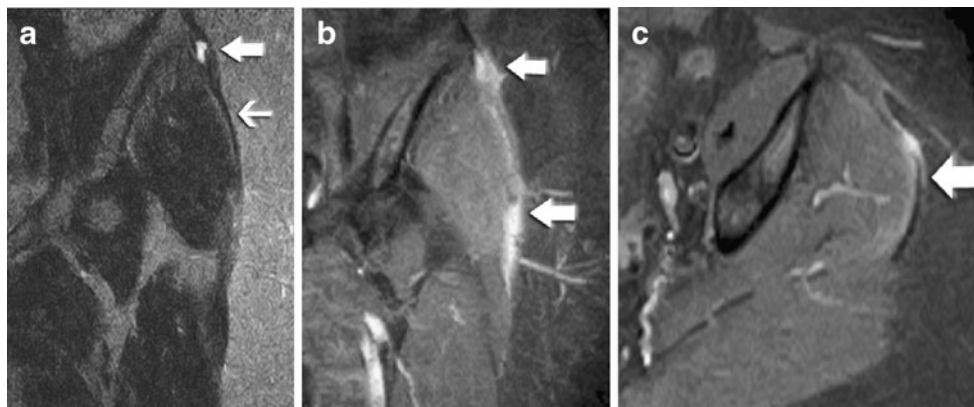


Fig. 2 Coronal T2-weighted (a), coronal STIR (b), and axial STIR (c) images obtained using an open 0.3 T MRI through the left hip and hemipelvis in a 67-year-old female with nontraumatic onset of pain. a An intrasubstance partial thickness tear at the iliac tubercle enthesis of the ITB (*bold arrow*), which is clearly contiguous with the ITB more

caudally (*thin arrow*) as it courses superficial to the gluteus medius muscle. In coronal and axial STIR images (b, c), the perifascial edema tracks continuously along the extent of the ITB (*bold arrows*) from its enthesis at the iliac tubercle to the intertrochanteric level

MRI of the bony pelvis that revealed a strain injury at the iliac tubercle enthesis of the IT band. All four athletes' symptoms resolved with rest after 1–2 months, and they were able to resume running.

Anatomical findings

The deep fascia (fascia lata) of the thigh attached onto the full extent of the inferior lip of the iliac crest (Fig. 3). At the iliac tubercle, the fascia was distinctly thickened and formed the iliotibial band, a longitudinal structure that received contributions from the tendons of the gluteus maximus and tensor fascia latae muscles at the greater trochanter. Distally the iliotibial band inserted onto Gerdy's tubercle.

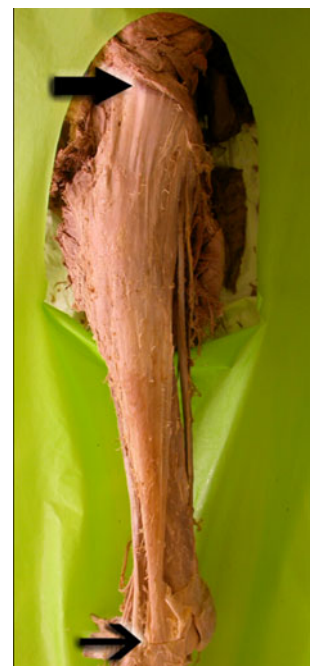
Discussion

The most well-known clinical symptomatology related to the iliotibial band is IT band friction syndrome (ITBFS), which presents with pain at the lateral distal thigh or knee related to repetitive sliding of the IT band over the lateral femoral condyle. It commonly occurs in long distance runners, cyclists, football players, and weight lifters and is the most common cause of lateral knee pain in runners [3–6]. ITBFS can be identified on an MRI as bright T2 signal within the lateral synovial recess, interposed between the IT band and the lateral femoral condyle [7, 8].

Pathology involving the proximal IT band has not been previously reported. In fact, a search of the anatomic literature revealed widespread discrepancies regarding the nature and proximal anatomic relationships of the IT band. Its proximal end has been described as either attaching to the iliac crest [9, 10] or as a merging and blending of the fibers of the gluteus maximus and tensor fascia latae tendons at the level of the

greater trochanter [11, 12]. It has also been described as a broad fascia attaching mainly to the iliac tubercle with additional minor attachments along the remainder of the iliac crest [13, 14]. Illustrations in both Netter's and Grant's atlases are of the latter description [15, 16]. Our dissections confirmed that the fascia arising from the iliac tubercle was distinctly thickened with longitudinally oriented fibers that were continuous along the lateral aspect of the thigh to an insertion on Gerdy's tubercle. At the level of the greater trochanter, the IT band received contributions from the TFL and gluteus maximus muscle tendons. Our anatomic findings were supported by imaging, which demonstrated abnormal signal at the iliac tubercle extending caudally along the course of the IT band (Fig. 2a–c).

Fig. 3 Cadaveric specimen with a *large arrow* identifying the distinctly thickened fascia arising from the iliac tubercle. The longitudinally oriented fibers are continuous along the lateral aspect of the thigh and insert onto Gerdy's tubercle, labeled with a *small arrow*



The IT band is unique to humans and is most likely part of the adaptive complex associated with erect posture and bipedal locomotion [9]. The IT band is thought to aid the gluteal abductors in maintaining pelvic position in the coronal plane by providing contralateral resistance (abduction) to pelvic sagging or dropping of the unsupported limb. This is substantiated by a case of a patient with trochanteric bursitis who underwent IT band release and subsequently developed a contralateral Trendelenburg sign [13]. A positive Trendelenburg sign connotes hip abductor weakness and is manifest as pelvic drop of the unaffected contralateral hip with single leg stance on the affected limb.

All patients in our cohort were female suggesting that women may be predisposed to injuries of proximal IT band. There is also a female predominance in trochanteric bursitis and tendinopathy of the gluteus medius and minimus muscles [17, 18]. Gender differences in extremity mechanics during running have been studied, and several authorities have postulated that the greater hip width to femoral length ratio in females results in increased hip adduction torque [19]. Females display greater peak hip adduction and internal rotation in all walking and running conditions [20]. We postulate that women are subject to greater strain of the hip abductors as well as the iliotibial band during active locomotion, which requires heightened abductor forces to maintain pelvic stability.

Our study is limited by its small sample size. Since the patients were referred by a variety of orthopedic and nonorthopedic clinicians with varying and limited details available on chart review, it was not possible to collect or compare potentially relevant morphometric data, such as BMI, lumbar lordosis, pelvic height, and iliac flare or Q angle. In addition, follow-up clinical information was not available in the nonathletes.

Conclusions

Patients with proximal IT band strain injuries present with pain and tenderness along the iliac crest over the iliac tubercle. These patients are often misdiagnosed or treated for presumed hip-related pathology, as was the case for one patient in our series who was initially evaluated with hip MRI, with pain refractory to physical therapy and multiple therapeutic hip injections. The diagnosis may be elusive since FOV for standard hip MRI typically excludes the proximal IT band entheses. Proximal IT band strain represents a unique injury that should be especially

considered in patients who are female athletes, particularly runners, or older overweight women who present with pain and tenderness at the iliac tubercle.

Conflict of interest The authors declare that there is no conflict of interest.

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