Athletic Injuries Involving the Hip

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Introduction

Hip pain in the adolescent patient can be due to a variety of factors, including acute injury or chronic overuse. The current chapter will cover four common causes of pain in this population. Pelvic apophysitis commonly occurs as a chronic overuse injury resulting from overload of these pelvic growth centers. Pelvic avulsion fractures are among the most common acute injuries in this population and generally are treated with conservative methods. Athletic pubalgia, or sports hernia, occurs less commonly in the adolescent compared to adults, and is a chronic overuse condition of the abdominal wall. Acetabular labral tears are the most common surgically treated injury in the adolescent patient and generally occur as the result of underlying bony deformity including femoroacetabular impingement (FAI) or acetabular dysplasia. The current chapter will cover these injuries and their arthroscopic treatment, while FAI and acetabular dysplasia are covered in separate chapters.

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Pelvic Apophysitis

Pelvic apophysitis can cause pain secondary to repetitive stress at various apophyses throughout the pelvis and proximal femur with apophysitis of the iliac crest occurring most commonly. Symptoms from apophysitis can also originate from the anterior inferior iliac spine (AIIS, from overpull of the direct head of rectus femoris) and from the ischial tuberosity (at the hamstrings origin). Similar to its presentation in the knee, apophysitis is generally a clinical diagnosis that can be supported by radiographic findings.

Radiographs in the setting of apophysitis may demonstrate fragmentation of the apophysis. Antero-posterior (AP) pelvis radiographs are useful as they allow a comparison to the contralateral hip. Although MRI is generally not necessary for diagnosis, MRI may demonstrate edema within the apophysis in clinically equivocal cases.

> ***"Pelvic apophysitis has clinical presentation, radiographic appearance, and treatment similar to other common sites of apophysitis".***

The treatment of pelvic apophysitis is similar to those occurring in other joints. Rest is important as many individuals have associated overuse from excessive or repetitive training. Ice and nonsteroidal anti-inflammatories (NSAIDs) can be helpful in symptom management after activities. Many cases of pelvic apophysitis will benefit from physical therapy to correct any underlying muscular imbalances playing a role in the development of pain. This commonly includes strengthening of weak core and hip musculature, as well as stretching of tight muscle groups including the hamstrings. Most cases of pelvic apophysitis improve with these conservative measures and are able to return to sports within 6 to 12 weeks. However, some patients have recurrent episodes of pain until reaching skeletal maturity. Ongoing maintenance strengthening and stretching programs remain important to avoid recurrent pain.

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Pelvic Avulsion Fractures

Avulsion fractures of the pelvis or hip are the result of a sudden large forceful concentric contraction through the musculotendinous unit or from sudden passive lengthening with an eccentric contraction. Avulsion fractures in the immature patient occur through the cartilaginous apophysis as the weak link between the musculotendinous unit and attachment. Avulsion fractures in the pelvis typically involve the anterior superior iliac spine (ASIS), AIIS, ischial tuberosity, iliac crest, and superior pubic symphysis as well as in the lesser trochanter of the proximal femur. These injuries usually occur in adolescents during sporting activities such as kicking a ball, running or jumping with the injury pattern correlating with the motion [1]. The cartilaginous growth plates at the apophyses are weaker than the musculotendinous unit and therefore fail first in tension, resulting in a bony cartilaginous fragment attached to the musculotendinous unit. Accordingly, these injuries occur in adolescents between the times of radiographic appearance of the apophyseal secondary ossification center and its fusion to the bony pelvis, becoming its respective tuberosity. The AIIS secondary ossification center appears (11.1–15.3 years) and closes (13.9–17.5 years) first while the iliac apophyses appear (12.6–15.3 years) and close last (16.0–23.9 years) [2]. As one would expect, AIIS avulsions occur more frequently in Risser 0 patients while iliac crest avulsions occur mainly in Risser 4 patients [3].

Avulsion fractures generally occur as the result of an acute injury, although some may report prodromal symptoms prior to the fracture consistent with apophysitis. Acute symptoms include sudden shooting pain, loss of muscular function, swelling and tenderness with local palpation and passive movement of the involved extremity. Diagnosis is confirmed radiographically using the AP pelvis film, although other views including the false profile may provide better visualization of certain avulsion fractures (ASIS, AIIS). Frog lateral radiographs are generally useful in this population to rule out slipped capital femoral epiphysis (SCFE). Rarely, advanced imaging (CT/MRI) is required unless operative intervention is being considered for displacement or residual symptoms due to subspine impingement or symptomatic non-union.

A meta-analysis investigating adolescent pelvic avulsion injures by Eberlach et al. included 596 patients from 14 studies and found a mean patient age of 14.3 years with 75.5% being male [4]. Affected sites were the anterior inferior iliac spine (33.2%), ischial tuberosity (29.0%), anterior superior iliac spine (27.9%), iliac crest (6.7%), lesser trochanter (1.8%) and superior corner of the pubic symphysis (1.2%) (Figs. 35.1 and 35.2) [4]. Different relative distributions of these fractures have been reported but this variation can be attributed to the demographics of their respective cohorts that are likely influenced by a number of factors including the predominant sport.

> ***"The three most common sites of pelvic avulsion fractures are AIIS, ischial tuberosity, and ASIS, occurring at relatively similar rates".***

The treatment of pelvic avulsion fractures is generally non-operative, with the vast majority healing well without residual symptoms. Recent studies have suggested a role of surgical treatment in certain severely displaced fractures. Although most patients heal uneventfully, even without surgical treatment, residual symptoms have been most commonly reported for fractures

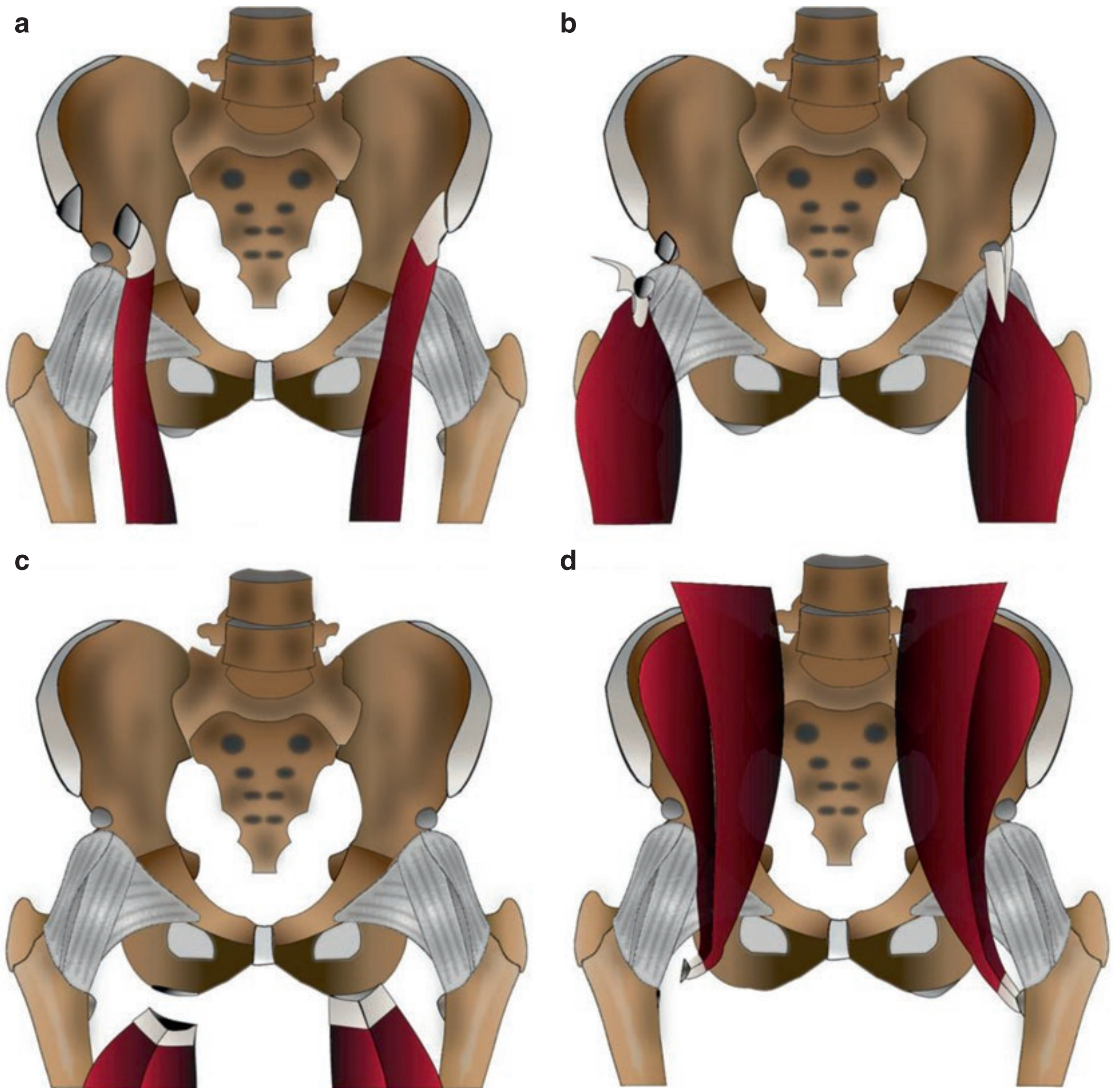

Fig. 35.1 Common locations of pelvic and hip avulsion fractures (**a**) anterior superior iliac spine, ASIS, (**b**) anterior inferior iliac spine, AIIS, (**c**) ischial tuberosity, and (**d**) lesser trochanter. (Copyright © Jonathan Schoenecker)

involving the ischial tuberosity (sitting pain or residual weakness) and AIIS (pain with deep hip flexion due to subspine impingement). While Eberlach et al. found that most patients were treated non-operatively (89.6%), the overall success rate was not different in those having surgery versus those receiving conservative treatment (88% vs. 79%, $p = 0.09$) [1]. Operative fixation has been recommended by some authors for displacement greater than or equal to 1.5 to 2 cm with fixation described using screws and suture anchors depending on surgeon preference and size of avulsed fragment [3–7]. In this meta-analysis, the complication rate was comparable between the conservative and operative groups (17% vs. 19%) including heterotopic ossification, re-injury, future fracture, recurrent pain and symptomatic hardware. Future prospective research studies are needed to better define the incidence of residual symptoms after pelvic avulsion fractures.

"Most pelvic avulsion fractures result in excellent outcome after conservative treatment. Surgical treatment may have a role in severely displaced fractures".

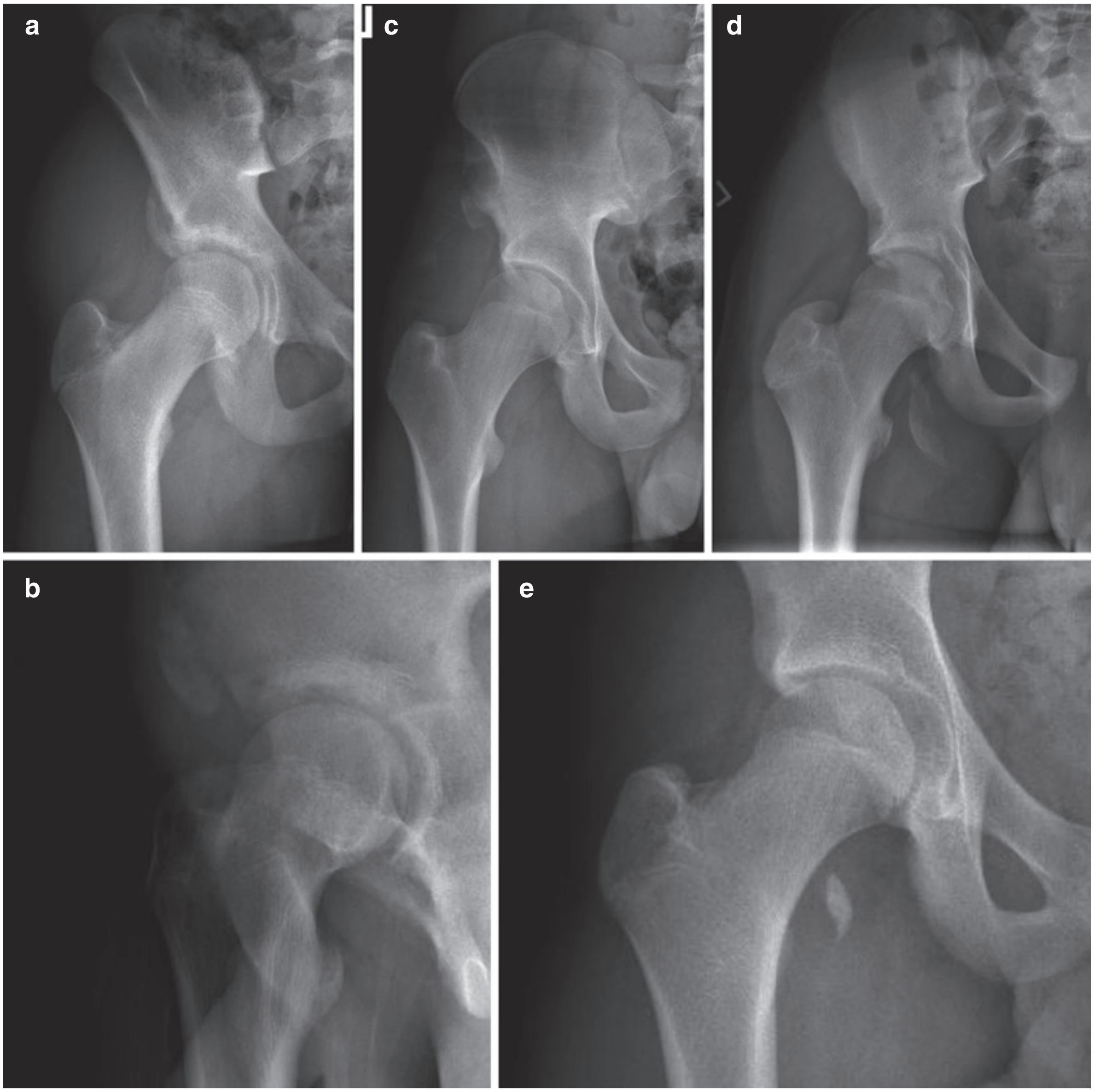

Fig. 35.2 Pelvic and Hip Avulsion Fractures. AIIS avulsion fracture seen on (**a**) AP pelvis and (**b**) false profile views. (**c**) ASIS avulsion fracture, (**d**) Ischial tuberosity avulsion fracture, and (**e**) lesser trochanter avulsion. *AIIS* anterior inferior iliac spine, *ASIS* anterior superior iliac spine

Anterior Inferior Iliac Spine (AIIS)

The most common mechanism for AIIS avulsions is kicking activities including soccer and track reported in 50 to 62% of injuries with bilateral involvement in 5% [3, 8]. Other causes include tennis (22%), gymnastics (7%), wresting (4%) and fencing (4%) [8]. The most common age is a patient of Risser 0 skeletal maturity with a closing or closed triradiate cartilage but this injury occurs throughout all 5 Risser stages [3]. The proportion of all pelvic avulsion fractures that include the AIIS ranges from 22% to 49% with one study reporting 85% of Risser 0 injuries to be AIIS despite soccer being a year round sport in the geographic region investigated. [3, 4, 8]

The upper portion of the AIIS gives origin to the direct head of the rectus femoris muscle which is active during hip flexion. A teardrop-shaped lower portion of the AIIS gives origin to the iliofemoral ligament and iliocapsularis muscle and borders the rim of the acetabulum. It is this intimate relationship with the acetabulum that can result in symptomatic subspine impingement of the hip after healing of an AIIS avulsion. Many AIIS avulsion fractures are minimally displaced with an average fracture displacement of 6.4 mm (±4.4 mm) [3]. Among all pelvic avulsion fractures, residual pain is highest after AIIS avulsions with one study reporting a 22.3% incidence and being 4.47 times more likely to occur as compared to any other avulsion fracture [3]. Additionally, the persistence of hip pain 3 months post AIIS injury is poorly prognostic of returning to sport [3]. This pain has been proposed to be a result of an anterosuperior labral tear associated with the AIIS fragment that may occur at the time of injury or subspine impingement from the AIIS fragment that progresses to femoroacetabular pincer impingement (FAI) [9–13].

Treatment for the majority of fractures is non-operative with a brief period of rest and crutch immobilization followed by protected weight bearing, progressive stretching and strengthening and gradual return to sport. [1, 3, 6, 8, 14] Useful adjuncts include sleeping with 3 to 4 pillows under affected leg and resting leg on a chair during the day to take tension off the healing apophysis. Consideration of open reduction and internal fixation for fractures displaced greater than 1.5 to 2 cm has been suggested by some authors [4, 5]. However, there is a role for waiting and evaluating the level of hip pain secondary to impingement after union [3, 9, 11, 13]. Hetsroni et al developed a classification system relating AIIS prominence with respect to the acetabular rim and were able to correlate type 3 morphology extending beyond the rim with loss of flexion and internal rotation [15]. This decision between late or early intervention is largely dependent on patient activity level and surgeon preference. Hip pain secondary to subspine impingement from malunion of AIIS avulsion fractures can be effectively treated using arthroscopic techniques and generally involve labral repair and/or subspine osteochondroplasty [11, 13, 16].

"AIIS or subspinous impingement is increasingly recognized as a potential cause of pain after AIIS avulsion".

Ischial Tuberosity (IT)

The most common mechanism of injury for ischial tuberosity avulsion fractures is during soccer and gymnastics, accounting for 72% of these injuries [8]. Contralateral injuries before or concurrently have been found in 12% of patients suggesting many of these injuries are overlooked as merely hamstring strains [3, 17]. IT avulsions tend to occur in slightly older patients than AIIS avulsions with the triradiate cartilage generally closed and Risser 0 but with injuries occurring all the way through to Risser 4 [3].

The semitendinosus and long head of the biceps have a common origin on the posterolateral aspect of the ischial tuberosity, whereas the semimembranosus has a separate origin at the anterolateral aspect [18]. During avulsions, generally the entire apophysis is displaced though a variant may exist where only 1 to 2 of the tendons avulse independently [19]. The average displacement associated with IT avulsion has been reported to be 9.5 mm (±11.6 mm). Patients with displacement greater than 20 mm were 26 times more likely to go on to nonunion (which may or may not be symptomatic) [3].

Treatment for the majority of IT avulsion fractures is non-operative with a brief period of rest and crutch immobilization (2 weeks) followed by protected weight bearing (4 weeks), progressive stretching and strengthening and gradual return to sport. [1, 3, 6, 8, 14] Useful adjuncts include sleeping prone with a few pillows under the knee to take tension off the IT apophysis. Indications for operative intervention remain relative but have been advocated for displacement greater than 1.5 to 2 cm and symptomatic non-union [3, 4, 6, 7]. Open suture anchor or screw fixation is most commonly utilized for fractures undergoing surgical treatment. The relative size and thickness of the apophyseal fragment plays a role in this decision making. Based on available literature on soft tissue proximal hamstring repairs, suture anchor fixation with the utilization of five small suture anchors to restore the hamstring footprint found to be biomechanically equivalent to an uninjured hamstring origin [20]. Potential complications of conservative treatment include non-union (symptomatic or asymptomatic) or heterotopic ossifications and the “hamstring syndrome” in which shortening and fibrosis develop at the hamstrings origin [14, 21]. The complications may be associated with chronic pain at the former fracture site and decreased ability to perform sports [8, 22]. One author reported pseudoarthrosis in half of the conservatively treated patients with displacement greater than 15 mm and an inability to achieve an excellent outcome in these patients [21].

Anterior Superior Iliac Spine (ASIS) and Iliac Crest (IC)

The most common activities associated with ASIS and IC avulsion fractures are soccer, athletics and gymnastics, accounting for 76% of these injuries [8]. During these activities, running and sprinting thought to be causative for approximately 50% of injuries but kicking and jumping have been suggested to play a role as well [3]. In-line activities place higher loads on the sartorius and ASIS while the addition of rotary movement recruits the tensor fascia lata. A combination of Tensor Fascia Lata, Sartorius and External Oblique forces lead to larger IC apophyseal fragments which extend posteriorly. ASIS and IC injuries tend to occur in older patients with 84% being Risser 4 [3].

The ASIS avulsion has been classified into 2 types; type I occurs at the origin of the Sartorius while type II occurs at the anterior aspect of the iliac crest where the tensor fascia lata originates [1]. Type I injuries have been reported to occur during in-line activities like running, jumping and kicking with the fragment displacing anterior and inferior. The type II injuries result from activities with the fragment displacing lateral and inferior [1]. The iliac crest avulsions result from a sudden application of muscle forces originating from the Sartorius, Tensor Fascia Lata and External Oblique. The average avulsion displacement has been reported to be 10.2 mm (±8 mm) and 6.6 mm (±8.1 mm) for ASIS and IC, respectively, with the IC fragments on average being larger compared to ASIS (45.8 mm vs. 28.7 mm, respectively). Symptomatic malunion or recurrent hip pain has been reported in 3% of conservatively treated ASIS avulsion patients [3].

Treatment for most ASIS and IC fractures is non-operative with a brief period of rest (2 weeks) and crutch immobilization followed by protected weight bearing, progressive stretching, strengthening and gradual return to sport [1, 3, 6, 8, 14]. Useful adjuncts include sleeping supine with a few pillows under the knee to take tension off the apophysis. Indications for operative intervention remain rare but some authors advocate surgical treatment for acute displacement greater than 1.5 to 2 cm and/or for symptomatic non-union [3, 4, 6, 7, 23, 24]. Open reduction and fixation using suture anchors, screws or k-wires have all been described [23, 24]. Complications of conservative treatment are limited to future hip pain from a bony malunion, non-union is rare [3]. Residual pain appears to be less common than after AIIS and IC fractures, which makes the need for surgical intervention even less likely. Operative treatment results in prominent hardware requiring removal in 30% [24].

Lesser Trochanter (LT)

LT avulsions are even less common entities than pelvic avulsions with LT avulsions making up approximately 3% of all pelvic avulsion fractures [3, 4, 8]. LT apophyseal avulsion occurs due do forceful hip flexion or sudden passive lengthening of the iliopsoas insertion do to an eccentric load. The injuries are rare and only briefly mentioned within the literature. Treatment is generally considered to be non-operative although a symptomatic non-union or displacement greater than 1.5 to 2 cm could be seen as a relative indication for operative treatment [4].

Athletic Pubalgia

Athletic pubalgia is a term describing several anatomic injury patterns (usually soft tissue injuries involving the lower abdominal or groin regions) that present in athletes with groin pain.

The term "sports hernia" has fallen out of favor as it is clearly a misnomer when used where there is no true hernia involved. More recently "core muscle injury" has emerged as a preferred nomenclature [25]. Athletic pubalgia is relatively uncommon in the adolescent athlete compared to adults, but can occur. Additionally, apophysitis of the pubic symphysis has also been recognized as an adolescent variant of athletic pubalgia.

"Core muscle injury has emerged as the preferred terminology, rather than sports hernia, athletic pubalgia, or a variety of other terms".

Groin injuries in athletes comprise a complex set of injuries to the musculature of the abdominal wall, the adductors**,** the hip joint, the pubic symphysis, and the sacroiliac joint [26–28]. Athletic pubalgia generally involves the abdominal wall and hip adductors. Athletic pubalgia is theorized to involve (1) the rectus abdominus or rectus-adductor aponeurosis, (2) a posterior inguinal floor defect, or (3) inguinal or genital neuropathy [29].

The term "pubic joint" was utilized by Myers to describe the complex biomechanics of the muscular envelope at the pubis symphysis. The pubic symphysis acts as the fulcrum for forces generated at the anterior pelvis. It represents the common attachment of the confluence of the rectus abdominis fascial sheath with the fascial sheath of the adductor longus which merge anterior to the pubis [30–32]. Imbalance between the rectus abdominis and adductor longus at their common attachment appears to be a major factor in the development of athletic pubalgia. The abdominal wall has a layered structure. From superficial to deep, the structures of the abdominal wall are skin, fascia, external oblique muscle/fascia, internal oblique muscle/fascia, transversus abdominis muscle/fascia and the transversalis fascia. The posterior fascia is deficient in the lower third of the rectus abdominus. Fibers from the rectus abdominus, conjoint tendon (confluence of the internal oblique and transversus abdominis fascia) and external oblique merge to form the pubic aponeurosis (also called the rectus abdominis/adductor aponeurosis), itself confluent with the adductor and gracilis origin. The conjoint tendon inserts anterior to the rectus abdominis on the pubis [33].

Weakness of the posterior inguinal canal floor plays a role in athletic pubalgia. The inguinal canal is formed anteriorly by the external oblique aponeurosis, posteriorly by the transversalis fascia and conjoint tendon, superiorly by transversalis fascia, internal oblique, and transversus abdominus, and inferiorly by the inguinal ligament (from external oblique aponeurosis). The inguinal canal contains the spermatic cord (in males), round ligament (in females) as well as the genital branch of the genitofemoral nerve (which supplies motor function to cremaster muscle and sensory function to the scrotum), the ilioinguinal nerve (sensory function to groin). The role of nerve-mediated pain in athletes with groin pain remains somewhat poorly understood and controversial. One possible source of pain has been theorized to be the result of entrapment of the genital branch of the genitofemoral nerve or ilioinguinal nerve [34]. Weakness of the posterior inguinal floor has been proposed to result in dynamic compression of the genital branch of genitofemoral nerve.

Meyers has described 17 different variants of athletic pubalgia, the most common of which are multiple tears or detachment of the anterior and anterolateral fibers of the rectus abdominis from the pubis and combined injuries to the rectus and adductors [35].

Athletic pubalgia is particularly common among those who participate in sports requiring repetitive twisting, pivoting and cutting motions, as well as activity requiring frequent acceleration and deceleration. Trunk hyperextension and hip hyperabduction place significant stress across the pelvis, including the rectus abdominus and adductors. Soccer, football, ice hockey and rugby have a particularly high incidence, with a lower incidence reported in basketball and baseball [36–38]. Meyers noted that in the 1980s, less than 1% of his patients with athletic pubalgia were female. Over the last two decades, however, that has changed dramatically, and female patients now represent 15% of patients presenting with athletic pubalgia [35].

Treatment of athletic pubalgia has become increasingly common in high level athletes involved in cutting/pivoting and acceleration/deceleration sports, including soccer, football, and ice hockey. Between 2012 and 2015, 4.2% of athletes at the NFL combine had undergone surgical treatment of athletic pubalgia (most commonly defensive backs and wide receivers) [38]. Feeley et al. described the "sports hip triad" of labral tears, rectus abdominus strain, and adductor strain [31]. The loss of internal rotation of the hip appears to play a role in the development of groin pain and osteitis pubis [39].

Most athletes report pain with athletic activities, but not at rest. Abdominal crunches or sit ups, coughing, or sneezing may also reproduce symptoms. Provocative testing can be useful to reproduce symptoms including simulated coughing, Valsalva maneuver, resisted sit-ups (46%), or resisted hip adduction [27]. With traditional assessment for inguinal hernia, there is no palpable hernia but this should be ruled out. There is usually tenderness around the conjoint tendon, pubic tubercle (22%), adductor longus (36%), superficial inguinal ring, or posterior inguinal canal [27, 40, 41].

Routine assessment of common sites of pathology in athletic pubalgia on hip MRI can be useful in athletes with groin pain, but dedicated protocols for pelvic MRI are optimal for visualization. Coronal oblique and axial oblique sequences through the rectus insertion and pubic symphysis should be obtained in addition to standard sagittal, coronal and axial sequences. MRI is 68% sensitive and 100% specific for rectus abdominis pathology when compared with findings at surgery as a gold standard, and 86% sensitive and 89% specific for adductor pathology. MRI is 100% sensitive for osteitis pubis [42]. Non-arthrogram studies may be preferred for in season athletes to avoid the potential for irritation secondary to intra-articular contrast administration.

The MRI should be evaluated in a systematic fashion for pathology consistent with athletic pubalgia. The pubic bones should be evaluated for edema, subchondral sclerosis and cysts suggestive of osteitis pubis [32, 43]. Evaluation of the tendinous insertions of the core muscles around the pubic symphysis should then be performed. Frequent findings include fluid signal within the rectus abdominis or adductor origin, thickening of either structure, peritendinous fluid, or partial or complete disruption of either tendon. Most commonly, there is confluent fluid signal extending from the anterior-inferior insertion of the rectus abdominis into the adductor origin, with corresponding fluid signal in the pubis [42].

Conservative management should be attempted prior to surgical intervention. If no previous treatment has been attempted at presentation, a conservative trial should include rest, non-steroidal anti-inflammatory medication, physical therapy, and injections in select situations. Physical therapy is focused on restoring core muscle strength and correcting any underlying imbalance between core muscle groups. If the athlete continues to be symptomatic after 6 to 12 weeks of non-surgical treatment, then surgery might be considered.

A variety of surgical procedures have been described for the treatment of athletic pubalgia; all with generally excellent reported outcomes in the literature. Procedures can be classified as primary repair, mesh-based repair, or minimal repair. Meyers has published the largest cohorts on the treatment of athletic pubalgia utilizing a "pelvic floor repair" [27]. This involves an open surgical approach with reattachment of the anteroinferior rectus abdominis to the pubis and a variation of an adductor release.

Acetabular Labral Tears

The acetabular labrum has been increasingly recognized as a significant pain generator in patients with hip pain, including adolescents. Similarly, the importance of the acetabular labrum to normal hip function and kinematics has evolved significantly in the last two decades. Tears of the acetabular labrum most commonly occur as detachments at the chondrolabral interface (Fig. 35.3). Advances in our understanding of pre-arthritic hip disease have shown that labral tears most commonly occur as the result of underlying bony deformity including femoroacetabular impinge-

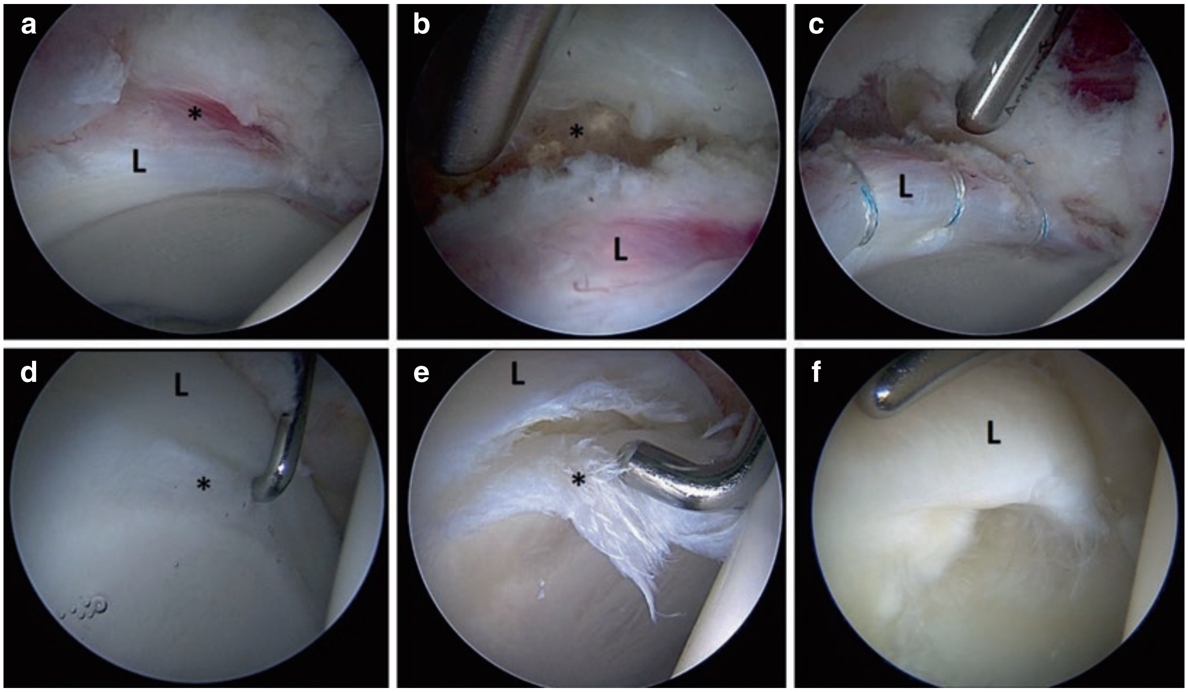

Fig. 35.3 Arthroscopic images demonstrating acetabular labral pathology. (**a**) Labral tear in setting of combined cam and pincer FAI with capsular sided bruising of labrum (*); (**b**) Demonstration of AIIS prominence (*) corresponding to labral pathology; (**c**) Appearance after labral repair of (**b**); (**d**) Mild labrochondral detachment (*); (**e**) Severe labral detachment with full-thickness articular cartilage delamination (*); (**f**) Hypertrophic detached labrum in setting of acetabular dysplasia. *FAI* femoroacetabular impingement, *L* labrum

ment and acetabular dysplasia [44]. Hip arthroscopy has become the gold standard for the treatment of labral pathology with multiple studies demonstrating improved results after labral repair compared to labral debridement [45–47].

The acetabular labrum is a triangular fibrocartilage structure attaching to the acetabular rim. The labrum is continuous with the transverse acetabular ligament at its anterior and posterior extents. The labrum is continuous with the adjacent articular cartilage surface, although labral sulci have been recognized as a normal variant (particularly posteriorly) [48]. The acetabular labrum effectively deepens the acetabular articulation and increases the surface area in contact with the femoral head. Unlike the meniscus in the knee, the acetabular labrum is not a load-bearing structure in the normal hip. In setting of acetabular dysplasia, the labrum does become a load-bearing structure and predisposes the labrum to progressive damage. The key sealing function of the acetabular labrum has been increasingly characterized. Early cadaveric studies suggested that the labrum could be excised with minimal negative effect on hip kinematics and function [49]. The subsequent mathematical and cadaveric investigations of Ferguson and colleagues were critical in establishing the function of the labrum in the hip seal [50, 51]. The hip seal is logical to any surgeon witnessing the dislocation of a hip through an open surgical hip dislocation or during a cadaveric dissection. Ferguson et al. [50, 51] demonstrated important mathematical and cadaveric evidence that the hip seal allows for intra-articular fluid pressurization during hip loading. This fluid pressurization protects the cartilage from the mechanical effects of this load. In their two-part study, Nepple and colleagues subsequently demonstrated the effect of a labral tear on the hip seal, as well as the ability of labral repair and even labral reconstruction to restore the sealing capacity of the hip labrum [52, 53]. They also demonstrated the stabilizing function of the acetabular labrum to distractive forces. The labrum appears to play a primary role in stability under small amounts of distraction (less than 2 mm), while the hip capsule/ligaments play a primary role with greater degrees of displacement.

> ***"The acetabular labrum functions most importantly as a seal to fluid follow within the hip during loading which protects the cartilage from overload".***

Labral tears in the hip commonly result from destabilization of the chondrolabral interface. Seldes et al. [54] originally classified two types of labral tears with Type 1 occurring as a detachment between labrum and articular cartilage and Type II occurring as intrasubstance cleavage. Beck et al. [55] further characterized labral tears based on improved understanding of the pathophysiology of FAI. The Beck classification of labral tears includes (a) normal, (b) degeneration, (c) full-thickness tear, (d) detachment, and (e) ossification [55]. Labral pathology is commonly accompanied by adjacent articular cartilage disease of the acetabular rim. In early disease, debonding (i.e. carpet effect) or partial thickness chondromalacia is commonly present, while later in the disease process full-thickness articular cartilage delamination of the acetabular rim is present.

> ***"Acetabular labral tears occur most commonly as a result of underlying femoroacetabular impingement or acetabular dysplasia".***

Hip arthroscopy is the most common treatment approach for acetabular labral tears. Open surgical hip dislocation remains a viable approach for the treatment of FAI, but it has been surpassed by hip arthroscopy as improved technology and experience have allowed for the treatment of many FAI pathologies with arthroscopy. Open surgical hip dislocation still has a role in the treatment of complex deformities (e.g. severe FAI, residual Perthes disease). In the dysplastic hip, the role of labral pathology has also been increasingly recognized [56]. Labral repair can be performed through the Smith-Peterson approach with associated arthrotomy, but is technically more precise with the use of arthroscopy (except in the setting of severe dysplasia) [56]. Hip arthroscopy allows for comprehensive assessment of intra-articular pathology and has demonstrated low complication rates [57]. Common complications of hip arthroscopy include lateral femoral cutaneous nerve neuropraxia (portal related) and pudendal neuropraxia (traction related).

Arthroscopic hip labral repair attempts to restore the native position and stability of the acetabular labrum. Arthroscopic access generally utilizes two or three arthroscopic portals, in addition to an interportal capsulotomy for access to the central compartment. Labral pathology can then be localized through a comprehensive arthroscopic assessment, but it is most commonly present in the anterosuperior quadrant [58–61]. The acetabular rim adjacent the labral tear is the exposed through elevation of the deep portion of the hip capsule. Any bony deformity of the acetabular rim or AIIS is then exposed and treated. Most surgeons now maintain any continuity of the chondrolabral interface rather than completely detaching the acetabular labrum prior to refixation. The labrum is then repaired via suture anchors placed in the acetabular rim. Labral anchor placement close to the articular surface and appropriate tensioning of sutures is key in order to maintain the native position of the acetabular labrum and avoid labral eversion which may disrupt its function. Basic science studies and clinical experience support the ability of the labrum to heal to the acetabular rim [54, 62].

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Key Evidence

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Take Home Points

- Hip pain in the adolescent patient can be due to acute injury or chronic overuse.
- Pelvic apophysitis commonly occurs as a chronic overuse injury resulting from overload of these pelvic growth centers.
- Pelvic avulsion fractures are among the most common acute injuries in this population and generally treated with conservative methods.
- Athletic pubalgia, or sports hernia, occurs less commonly in the adolescent compared to adults, and is a chronic overuse condition of the abdominal wall.
- Acetabular labral tears are the most common surgically treated sports-related injuries involving the hip in adolescence which generally occur in association with underlying bony deformity causing FAI or with acetabular dysplasia.

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Author Queries

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Queries	Details Required	Author's Response
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