

Mastering the Physical Examination of the Athlete's Hip

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Abstract

In this review, we describe precise methods for evaluating the athlete's hip or groin with an emphasis on recognizing the most common extra-articular and intra-articular pathologies, including adductor strains, athletic pubalgia, osteitis pubis, and femoroacetabular impingement with labral tears.

Take-Home Points

- Perform a comprehensive examination to determine intra-articular pathology as well as potential extra-articular sources of hip and pelvic pain.
- Adductor strains can be prevented with adequate rehabilitation focused on correcting predisposing factors (ie, adductor weakness or tightness, limited range of motion, and core imbalance).
- Athletic pubalgia is diagnosed when tenderness can be elicited over the pubic tubercle.
- Osteitis pubis is diagnosed with pain over the pubic symphysis.
- FAI and labral injury classically present with a C-sign but can also present with lateral hip pain, buttock pain, low back pain, anterior thigh pain, and knee pain.

Hip and groin pain is a common finding among athletes of all ages and activity levels. Such pain most often occurs among athletes in sports such as football, hockey, rugby, soccer, and ballet, which demand frequent cutting, pivoting, and acceleration.¹⁻⁴ Previously, pain about the hip and groin was attributed to muscular strains and soft-tissue contusions, but improvements in physical examination skills, imaging modalities, and disease-specific treatment options have led to increased recognition of hip injuries as a significant source of disability in the athletic population.^{5,6} These injuries make up 6% or more of all sports injuries, and the rate is increasing.⁷⁻⁹

In this review, we describe precise methods for evaluating the athlete's hip or groin with an emphasis on recognizing the most common extra-articular and intra-articular pathologies, including adductor strains, athletic

pubalgia, osteitis pubis, and femoroacetabular impingement (FAI) with labral tears.

Hip Pathoanatomy

The first step in determining the etiology of pain is to establish if there is true pathology of the hip joint and surrounding structures, or if the pain is referred from another source. Although a comprehensive discussion of the plausible causes of hip and groin pain is beyond the scope of this review, it is important to have a general understanding of possible diagnoses, as this knowledge lays the groundwork for performing the physical examination (**Table 1**).^{3,10}

Patient History

The physical examination is guided by the patient's history. Important patient-specific factors to be ascertained include age, sport(s) played, competition level, seasonal timing, and effect of the injury on performance. Regarding presenting symptoms, attention should be given to pain location, timing (acute vs chronic), onset, nature (clicking, catching, instability), and precipitating factors. Acute-onset pain with muscle contraction or stretching, possibly accompanied by an audible pop, is likely musculotendinous in origin. Insidious-onset dull aching pain that worsens with activity more commonly involves intra-articular processes. Most classically, this pain occurs deep in the groin and is demonstrated by the C sign: The patient cups a hand with its fingers pointing toward the anterior groin at the level of the greater trochanter (**Figure 1**).¹¹ A history of burning pain, night pain, pain with sitting, weakness, or neurologic symptoms with radiculopathy suggests a spinal process.

A comprehensive hip evaluation can be performed with the patient in the standing, seated,

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Table 1. **Differential Diagnoses of Hip and Groin Pain**^{3,10}

Intra-Articular Pathology	Extra-Articular Pathology	Nonmusculoskeletal Pathology
Femoroacetabular impingement	Athletic pubalgia/sports hernia	Intra-abdominal pathology (inguinal or femoral hernia, abdominal aortic aneurysm, appendicitis, diverticulitis, inflammatory bowel disease, lymphadenitis)
Labral tears	Osteitis pubis	Genitourinary pathology (adnexal torsion, ectopic pregnancy, nephrolithiasis, orchitis, pelvic inflammatory disease, prostatitis, urinary tract infection)
Chondral defect	Muscular pathology: strains or tendinopathies	
Loose bodies	Snapping hip (internal or external)	
Osteoarthritis	Ischiofemoral or trochanteric-pelvic impingement	
Developmental hip dysplasia	Capsular laxity	
Traumatic femoral head or neck fracture	Piriformis syndrome	
Dislocation or subluxation	Iliotibial band friction syndrome	
Ligamentum teres rupture	Bursitis: trochanteric, ischial, psoas	
Femoral neck stress fracture	Psoas abscess	
Capsular laxity	Pubic ramus fracture (traumatic or stress fracture)	
Avascular necrosis	Apophyseal avulsion fracture (anterior-superior iliac spine, iliac crest, anterior-inferior iliac spine, pubis, ischial tuberosity, greater trochanter, lesser trochanter)	
Legg-Calvé-Perthes disease	Lumbar spine pathology	
Slipped capital femoral epiphysis	Referred knee pain	
Transient synovitis	Peripheral nerve compression (genitofemoral, iliohypogastric, ilioinguinal, lateral femoral cutaneous, obturator, or pudendal nerves)	
Septic arthritis		
Pigmented villonodular synovitis		

supine, lateral, and prone positions, as previously described (**Table 2**).^{6,12,13} Now we describe the physical examination for the most common etiologies presenting in athletes.

Extra-Articular Hip Pathologies

Adductor Strains

The adductor muscle group includes the adductor magnus, adductor brevis, gracilis, obturator externus, pectineus, and adductor longus, which is the most commonly strained. Adductor strains are the most common cause of groin pain in athletes, and usually occur in sports that require forceful eccentric contraction of the adductors.¹⁴ Among professional soccer players, adductor strains represent almost one fourth of all muscle injuries and result in lost playing time averaging 2 weeks and an 18% reinjury rate.¹⁵ These injuries are particularly detrimental to performance because the adductor muscles help stabilize the pelvis during closed-chain activities.³ Diagnosis and adequate rehabilitation focused on correcting predisposing factors (eg, adductor weakness or tightness, loss of hip range of motion, core imbalance) are paramount in reinjury prevention.^{16,17}

On presentation, athletes complain of aching



Figure 1. C sign—patient cups hand with fingers pointing toward anterior groin at level of greater trochanter—highlights deep groin pain and signifies intra-articular pathologic process.

Table 2. **Example of Comprehensive Hip Physical Examination Performed With Patient in 5 Different Positions**^{6,12,13}

Patient Position				
Standing	Seated	Supine	Lateral	Prone
General: laxity, body habitus, posture	Neurologic	Passive range of motion	Passive and active range of motion	Craig test
Gait: swing, stance foot progression, Trendelenburg gait, antalgic gait	Circulation	Palpation: adductor origin, pubic tubercle, abdominals	Palpation: greater trochanter	Palpation: ischial tuberosity
Spine: scoliosis, lordosis	Skin	Resisted adduction	Ober test	Strength testing
Pelvis: shoulder height, iliac crest	Lymphatic	Resisted sit-up	FADIR (flexion, adduction, internal rotation)	Ely test
Trendelenburg test	Hip internal- and external-rotation range of motion	Thomas test	Lateral compression test	Hyperextension
		Straight leg raise	Lateral rim impingement	
		Anterior and posterior impingement tests		
		Stinchfield test		
		McCarthy hip extension test		
		FABER (flexion, abduction, external rotation)		
		Straight leg raise		



Figure 2. Assessment for adductor strains. (A) Demonstration of tenderness to palpation at or near adductor origin. (B) Pain may also be exacerbated with resisted adduction.

groin or medial thigh pain. The examiner should assess for swelling or ecchymosis. There typically is tenderness to palpation at or near the origin on the pubic bones, with pain exacerbated with resisted adduction and passive stretch into abduction during examination. Palpation of adduc-

tors requires proper exposure and is most easily performed with the patient supine and the lower extremity in a figure-of-4 position (**Figure 2A**). Resisted adduction can also be tested with the patient supine and the hips and knees brought into flexion. The test is positive if the patient experienc-



Figure 3. Assessment for athletic pubalgia. (A) Athlete may experience pain with palpation over pubic tubercle, abdominal obliques, and/or rectus abdominis insertion. (B) Pain may also be reproduced with resisted sit-ups.

es focal pain in the proximal aspect of the adductor muscles while trying to bring the legs together against the examiner's resistance (**Figure 2B**).

Athletic Pubalgia

Athletic pubalgia, also known as sports hernia or core muscle injury, is an injury to the soft tissues of the lower abdominal or posterior inguinal wall. Although not fully understood, the condition is considered the result of repetitive trunk hyperextension and thigh hyperabduction resulting in shearing at the pubic symphysis where there is a muscle imbalance between the strong proximal thigh muscles and weaker abdominals. This condition is more common in men and typically is insidious in onset with a prolonged course recalcitrant to non-operative treatment.¹⁸ In studies of chronic groin pain in athletes, the rate of athletic pubalgia as the primary etiology ranges from 39% to 85%.^{9,19,20}

Patients typically complain of increasing pain in the lower abdominal and proximal adductors during activity. Symptoms include unilateral or bilateral lower abdominal pain, which can radiate toward the perineum, rectus muscle, and proximal adductors during sport but usually abates with rest.¹⁸ Athletes endorse they are not capable of playing at their full athletic potential. Symptoms are initiated with sudden forceful movements, as in sit-ups, sprints, and valsalva maneuvers like coughs and sneezes. Valsalva maneuvers worsen pain in about

10% of patients.²¹⁻²³

On physical examination with the patient supine, tenderness can be elicited over the pubic tubercle, abdominal obliques, and/or rectus abdominis insertion (**Figure 3A**). Athletes may also have tenderness at the adductor longus tendon origin at or near the pubic symphysis, which may make the diagnosis difficult to distinguish from an adductor strain. Furthermore, resisted hip adduction, as described above, can elicit discomfort in 88% of patients.²¹ However, resisted sit-ups may help distinguish athletic pubalgia from other etiologies (**Figure 3B**). In this maneuver, the patient is supine with hips and knees flexed. The examiner stabilizes the contralateral pelvis and resists the patient's attempted sit-up by pushing on the ipsilateral shoulder. The test is positive if the patient experiences pain at the inferolateral edge of the distal rectus abdominis.

Osteitis Pubis

Osteitis pubis is a painful overuse injury that results in noninfectious inflammation of the pubic symphysis from increased motion at this normally stable immobile joint.³ As with athletic pubalgia, the exact mechanism is unclear, but likely it is similar to the repetitive stress placed on the pubic symphysis by unequal forces of the abdominal and adductor muscles.²⁴ The disease can result in bony erosions and cartilage breakdown with irregularity of the pubic symphysis.



Figure 4. Assessment for osteitis pubis. (A) Demonstration of palpation directly over pubic symphysis and (B) lateral compression test.

Athletes may complain of anterior and medial groin pain that can radiate to the lower abdominal muscles, perineum, inguinal region, and medial thigh. Walking, pelvic motion, adductor stretching, abdominal muscle exercises, and standing up can exacerbate pain.²⁴ Some cases involve impaired internal or external rotation of the hip, sacroiliac joint dysfunction, or adductor and abductor muscle weakness.²⁵

The distinguishing feature of osteitis pubis is pain over the pubic symphysis with direct palpation (**Figure 4A**). Examination maneuvers that place stress on the pubic symphysis can aid in diagnosis.²⁶ For example, in the lateral compression test, the examiner places direct downward pressure on the greater trochanter with the patient in the lateral decubitus position (**Figure 4B**). The test is positive if the patient experiences discomfort at the pubic symphysis.^{26,27}

Intra-Articular Hip Pathology: Femoroacetabular Impingement

In athletes, FAI is a leading cause of intra-articular pathology, which can lead to labral tears.^{28,29} FAI lesions include cam-type impingement from an aspherical femoral head and pincer impingement from acetabular overcoverage, both of which limit internal rotation and cause acetabular rim abutment, which damages the labrum.

Athletes present with activity-related groin or hip pain that is exacerbated by hip flexion and internal rotation, with possible mechanical symptoms from labral tearing.³⁰ However, the pain distribution varies. In a study by Clohisy and colleagues,³¹ of patients with symptomatic FAI that required surgical intervention, 88% had groin pain, 67% had lateral hip pain, 35% had anterior thigh pain, 29% had buttock pain, 27% had knee pain, and 23% had low back pain.

Careful attention should be given to range of motion in FAI patients, as they can usually flex their hip to 90° to 110°, and in this position there is limited internal rotation and asymmetric external rotation relative to the contralateral leg.³² The anterior impingement test is one of the most reliable tests for FAI (**Figure 5A**).³² With the patient supine, the hip is dynamically flexed to 90°, adducted, and internally rotated. A positive test elicits deep anterior groin pain that generally replicates the patient's symptoms.²⁹ The posterior impingement test is also performed with the patient supine; the unaffected hip is flexed and held by the patient while the affected limb is extended and externally rotated by the examiner (**Figure 5B**). Buttock pain can result when the femoral head contacts the posterior acetabular cartilage and rim.^{6,33} Mechanical symptoms, such as labral tears, can be assessed with the Stinchfield test and the McCarthy hip extension



Figure 5. Assessment for femoroacetabular impingement includes (A) anterior impingement test and (B) posterior impingement test.

test. The Stinchfield test is performed by having the patient perform a straight leg raise to 45° and resist downward pressure. Pain indicates an intra-articular etiology, as the psoas muscle puts pressure on the anterolateral labrum.⁶ In the McCarthy hip extension test, the affected hip is taken from flexion into extension as the examiner rolls it in arcs of internal and external rotation. The test is positive if pain is reproduced when the hip is extended.³⁴

Conclusion

Careful, directed history taking and physical examination are essential in narrowing the diagnostic possibilities before initiating a workup for the com-

mon intra-articular and extra-articular causes of hip and groin pain in athletes. **Table 3** highlights the discussed physical examination maneuvers that can be used to diagnose and differentiate adductor strains, athletic pubalgia, osteitis pubis, and FAI.

Figure 6 highlights the location of pain commonly

Table 3. Physical Examination Pearls for the Most Common Hip Pathologies in Athletes

Adductor Strain

- Tenderness to palpation at origin of adductor muscles near pubis
- Pain with resisted hip adduction
- Pain with passive hip abduction stretch

Athletic Pubalgia

- Tenderness to palpation over pubic tubercle, abdominal obliques, and rectus insertion
- Pain with valsalva maneuver or cough
- Pain with resisted sit-ups
- Pain with resisted hip adduction

Osteitis Pubis

- Tenderness to palpation directly over pubic symphysis
- Lateral compression test

Femoroacetabular Impingement

- Minimal or no tenderness to palpation about hip
- Limited and/or asymmetric internal or external range of motion with hip flexed to 90°
- Anterior impingement test
- Posterior impingement test
- Stinchfield test
- McCarthy hip extension test

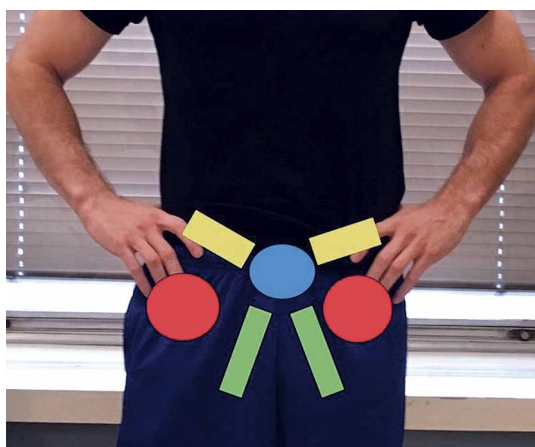


Figure 6. Localization of pain by pathology. Yellow rectangles: athletic pubalgia. Blue oval: osteitis pubis. Green rectangles: adductor strains. Red circles: femoroacetabular impingement.

associated with each of these conditions. With these significant injuries, accurate diagnosis is required to ensure athletes receive appropriate treatment and return to play as quickly and safely as possible. With these significant injuries, accurate diagnosis is required to ensure athletes receive appropriate treatment and return to play as quickly and safely as possible.

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