Groin Ultrasound Gross Anatomy and Ultrasound Findings

Indications

This protocol describes an approach to the ultrasound examination of patients with chronic groin pain of probable musculoskeletal origin. Soft tissue disorders that can be imaged include:

- Athletic "osteitis pubis"
- Conjoint tendon or adductor origin lesions
- Inguinal or femoral hernia
- Iliopsoas tendinitis or iliopsoas tendon "snap"
- Anterior acetabular labral tear

Remember that chronic groin pain can have many other causes. Therefore, ultrasound should not be performed or interpreted in isolation. At a minimum, the imaging work-up should include a nuclear bone scan to rule out unsuspected bone lesions and to help determine the significance of any abnormal ultrasound findings at the pubic bone or symphysis.

PHILIPS

Gross Anatomy

Figure 1: The acetabular labrum is a rim of fibrocartilage, triangular in cross-section, which attaches to the bony acetabular margin. The fibers of internal oblique and transversus abdominis fuse inferiorly to form the curving conjoint tendon which attaches at the pubic crest. The inguinal canal is an obliquely-orientated 3.8 cm long tunnel in the anterior abdominal wall which transmits the ilioinguinal nerve and either the spermatic cord (in males) or the round ligament of the uterus (in females). The entrance to the inguinal canal from the abdominal cavity is the "deep inguinal ring", which lies just lateral to the inferior epigastric artery. The "superficial inguinal ring" (the external opening of the inguinal canal) lies immediately superolateral to the pubic tubercle. The inguinal ligament, a thickened reflection of the external oblique aponeurosis, runs from the anterior superior iliac spine to the pubic tubercle. The femoral canal passes deep to the inguinal ligament and transmits the femoral artery, vein and nerve. The adductor origin includes the tendinous attachments of adductor longus and gracilis at the pubic bone. The symphysis pubis is a midline cartilaginous joint between the two pubic bones.

Imaging Protocol

A high frequency linear array transducer is preferred (e.g. L10-5 or L12-5), even in large patients. The patient lies supine with the hips adducted. Upright views may be added for hernia evaluation, although ultrasound can be difficult in this position. Liberal use of coupling gel avoids the need for a groin shave.

(A) Obtain a preliminary history

1. How long has the pain been present?
2. Does the pain localize to a particular site?
3. Was the onset of injury sudden or insidious?
4. What movements or actions precipitate the pain?
5. Is there any associated catching or clicking?

(B) Scan systematically

1. Anterior hip (Figure 2)
2. Iliopsoas (Figure 3)
3. Deep inguinal ring (Figure 4)
4. Femoral canal (Figure 5)
5. Superficial inguinal ring (Figure 6)
6. Conjoint tendon (Figure 7)
7. Symphysis pubis (Figure 8)
8. Adductor origin (Figure 9)

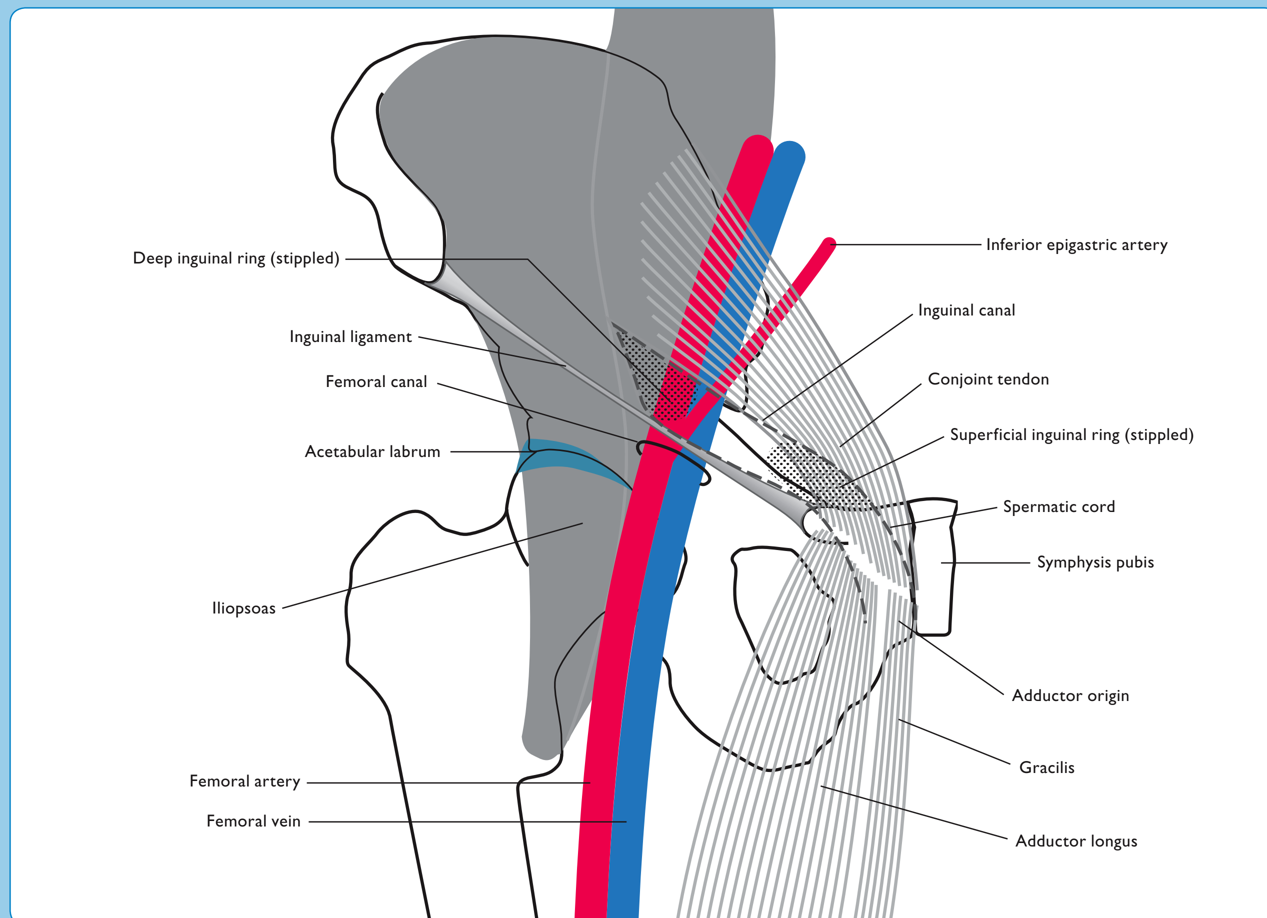

Figure 1. Gross anatomy (schematic) relevant to groin ultrasound

Ultrasound Findings

Anterior acetabular labrum

Figure 2a: Transducer position. Figure 2b: Torn anterior acetabular labrum. The finding of a labral or paralabral cyst (arrow) deep to the iliofemoral ligament (arrowhead) is diagnostic. The tear itself can sometimes be directly visible as a hypoechoic cleft within the echogenic labrum. A large and inhomogeneous (dysplastic) labrum may be noted in cases of underlying developmental hip dysplasia. Note: A negative ultrasound does not exclude the diagnosis of a labral tear. MR arthrography is the diagnostic gold standard, and the obliteration of symptoms with intra-articular bupivacaine (which should be instilled at the same time) is important in confirming the clinical relevance of a tear.

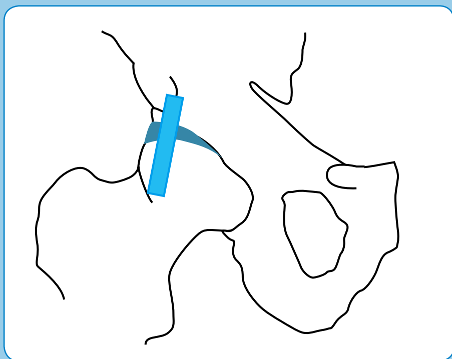

Figure 2a.

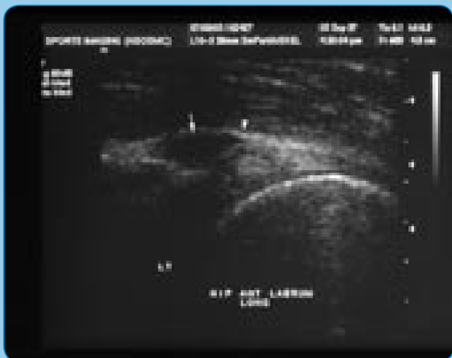

Figure 2b.

Iliopsoas

Figure 3a: Transducer positions. Position 1 is well suited to the observation of a "snapping" iliopsoas tendon. On real-time scanning, at the exact point of audible and/or palpable snap, the iliopsoas tendon suddenly shifts position. Figure 3b: Distended iliopsoas bursa. With the transducer in position 2 (see Figure 3a) a fluid collection (B) is seen anterior to the contiguous iliofemoral ligament. The bursal opening can be seen as a small window of communication with the hip joint (arrow). Note: Bursal effusion may be extensive and is a non-specific indicator of hip joint pathology. Iliopsoas tendinitis is a separate clinical entity characterized by normal grayscale appearances, tenderness to probing over the iliopsoas, and pain on resisted hip flexion.

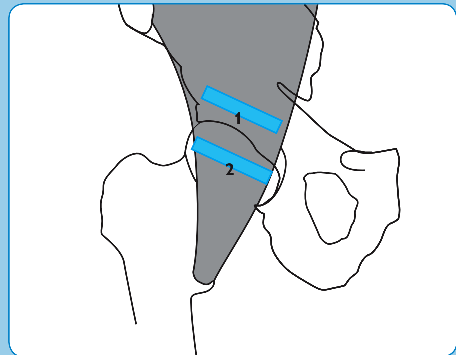

Figure 3a.

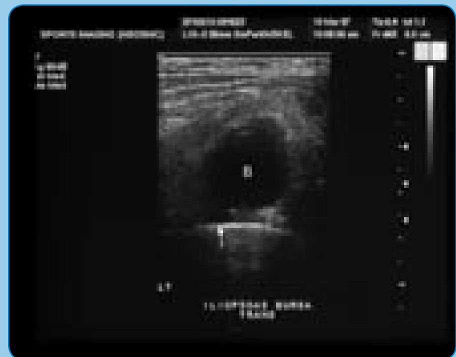

Figure 3b.

Deep inguinal ring

Figure 4a: Transducer positions: 1 – Short-axis view. 2 – Long-axis view. Figure 4b: Small indirect inguinal hernia (long-axis view of right inguinal canal). On abdominal straining, there is "ballooning" of the AP canal diameter (calipers) and simultaneous protrusion of lobulated fat through the deep inguinal ring. Abnormal "longitudinal glide" within the canal is appreciated on real-time scanning. Note: Arrowheads outline the leading edges of the indirect inguinal hernia. Hernias may also include bowel, may be present at rest, and are regarded as "incarcerated" if they do not reduce with graduated probe pressure.

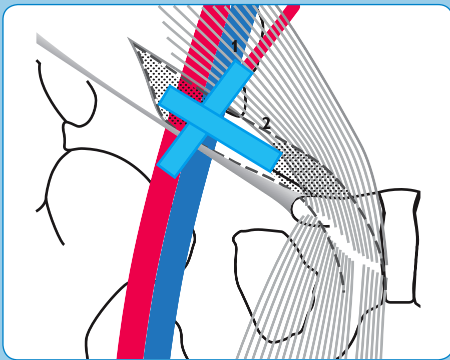

Figure 4a.

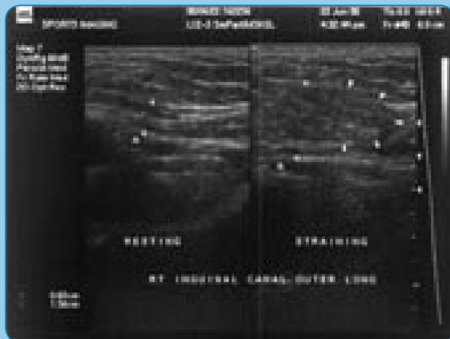

Figure 4b.

Femoral canal

Figure 5a: Transducer position. Figure 5b: Small femoral hernia. On abdominal straining, there is a 2 cm protrusion of bowel (arrowheads) into the femoral canal with simultaneous compression of the common femoral vein (v). Hernias may also be present at rest and are "incarcerated" if they do not reduce with graduated probe pressure. Note: Small protrusions of fat into the femoral canal are common on straining, but are unlikely to be significant if the femoral vein distends normally (rather than compresses) with the Valsalva maneuver.

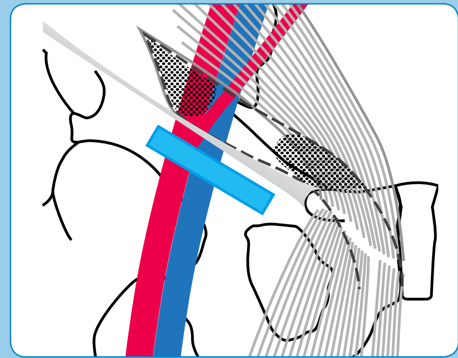

Figure 5a.

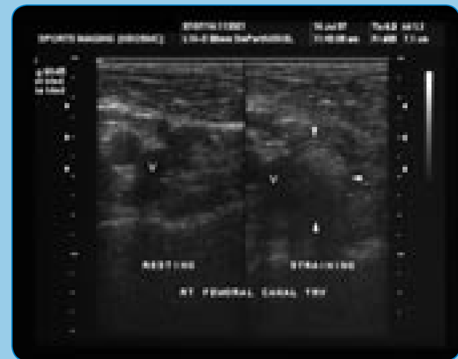

Figure 5b.

Superficial inguinal ring

Figure 6a: Transducer position: A short-axis view is obtained just lateral to the pubic tubercle. Figure 6b: Normal canal: On abdominal straining, the posterior inguinal wall (arrows) becomes straight and tilts toward the vertical. Figure 6c: Incipient direct inguinal hernia: On abdominal straining, there is convex anterior bulge of the posterior inguinal wall (arrows) and "ballooning" of the spermatic cord in its craniocaudal diameter (calipers). Note: Hernias may also be present at rest. An asymptomatic hernia on the contralateral side is not uncommon.

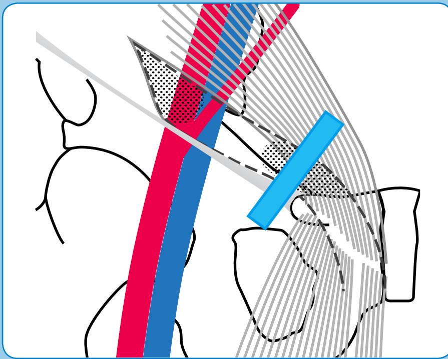

Figure 6a.

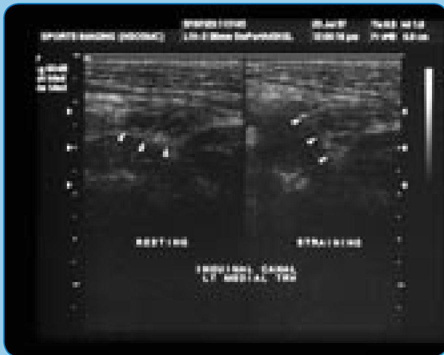

Figure 6b.

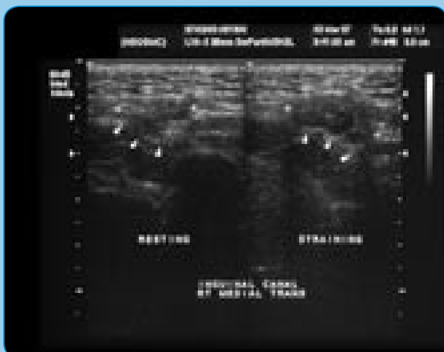

Figure 6c.

Conjoint tendon

Figure 7a: Transducer position. Figure 7b: Normal conjoint tendon (calipers). c = pubic crest. Figure 7c: Conjoint tendon injury. In this case the tendon insertion at the pubic crest appears swollen, a small avulsed bone fragment is present (arrow), and localized tenderness was noted on probing with the transducer. Note: Comparison views of the conjoint tendon should be routine, as there is a wide range of normal variation. Chronic tendinitis produces hypoechoic swelling and localized tenderness, and may be indistinguishable from a chronic partial tear.

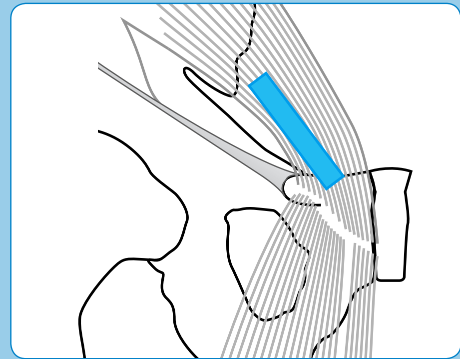

Figure 7a.

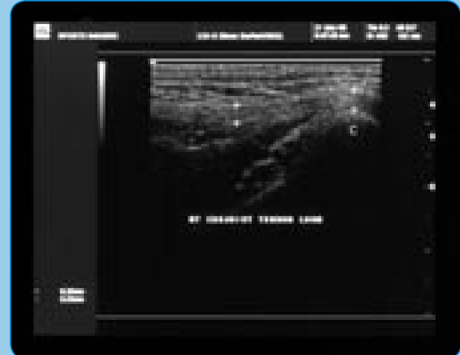

Figure 7b.

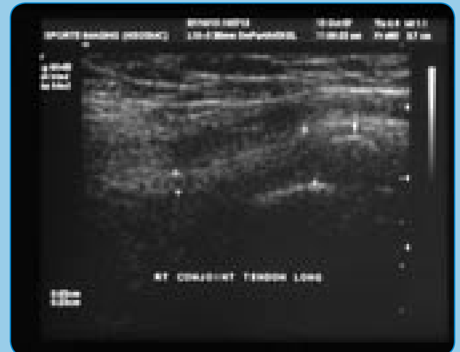

Figure 7c.

Symphysis pubis

Figure 8a: Transducer position. Figure 8b: Athletic osteitis pubis. A composite split-screen image shows relative tendon swelling (arrowhead) and bone surface irregularity (arrow) at the left pubis. Mild tenderness was also noted at this location on probing with the transducer. Note: Athletic osteitis pubis is actually a "chronic tendinitis" at the mixed fiber enthesis of conjoint insertion and adductor origin, producing changes which are nearly always either unilateral or asymmetrically bilateral. Bone surface irregularity may extend to the symphyseal margins. Tendon changes may be most pronounced at either the conjoint or adductor attachments.

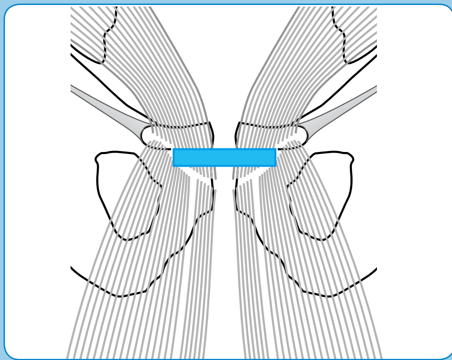

Figure 8a.

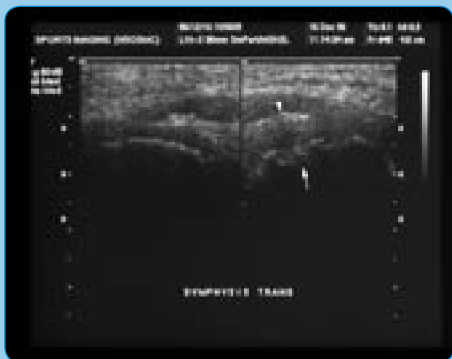

Figure 8b.

Adductor origin

Figure 9a: Transducer positions: 1 – Short-axis view. 2 – Long-axis view. Figure 9b: Adductor tendon injury. Long-axis views show tendon swelling and heterogeneous echotexture at the right adductor origin (arrowheads) by comparison with the left (arrows). Localized tenderness was also noted on probing with the transducer. Note: Chronic adductor origin tendinitis produces hypoechoic tendon swelling with associated mild tenderness. Bony pitting is common and tiny punctate echogenic foci of tendon calcification are sometimes seen. Partial tears vary in appearance.

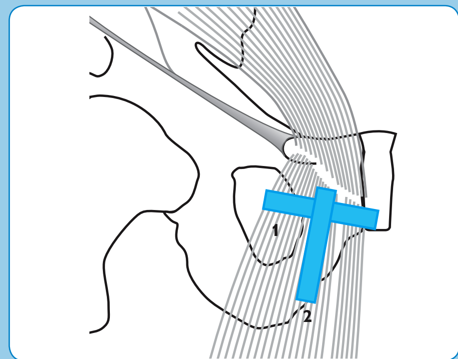

Figure 9a.

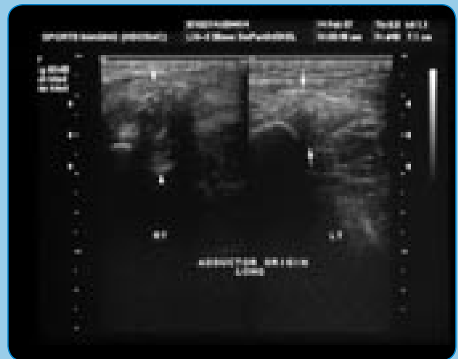

Figure 9b.

Pitfalls

- Failure to identify key anatomical landmarks, i.e. scanning in the wrong place. In particular, normal inguinal canal structures can be difficult or impossible to identify when compressed by the transducer. Be careful not to apply too much pressure with the transducer!

- Failure to detect a hernia due to poor patient cooperation (ineffective straining). Try commands such as:
  "Take a big breath in, hold it and push down hard" (Valsalva maneuver)
  "Push your tummy out hard"
  "Tighten your tummy muscles hard"

- Lipoma of the spermatic cord can be mistaken for an indirect inguinal hernia in males. Cord lipoma is a common entity that usually appears as a smooth finger-like projection of fat parallel to the cord vessels within the inguinal canal (at rest), and is associated with "longitudinal glide" on straining. Unlike indirect inguinal hernias, cord lipomata rarely "balloon" the canal on short-axis views.

- Hydrocele of the canal of Nuck can be mistaken for an indirect inguinal hernia in females.

- A normal hypoechoic appearance of the bone-cartilage interface at the margin of the hip joint can be mistaken for the tear of the anterior acetabular labrum.

- Failure to demonstrate a "snapping" iliopsoas tendon can be due to inability of the patient to reproduce the snap at the time of scanning or in a position that allows transducer access.

- Failure to achieve a relevant diagnosis due to inadequate correlation of the ultrasound findings with (a) the x-ray and isotope bone scan results, and (b) the wider clinical setting. Remember that hernias, physiological bone changes ("tug" lesions) and even acetabular labral tears are common as incidental findings in the general population and have a rising incidence with advancing age. Although truly present, they may NOT be the cause for symptoms.

REFERENCES

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Orchard JW, Read JW, Neophyton J, Garlick D. Groin pain associated with ultrasound finding of inguinal canal posterior wall deficiency in Australian Rules footballers. Br J Sports Med 1998, 32: 134-139.

CLINCAL SOURCES

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