Iliopsoas compartment anatomy and pathology - A pictorial review

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Learning objectives

To review the anatomy, biomechanical function and spectrum of disease processes involving the iliopsoas compartment.
Background

The iliopsoas compartment is comprised of the psoas major, psoas minor and iliacus muscles [1-4]. The primary function of the psoas compartment musculature is flexion of the trunk and hips. These muscles extend from the mediastinum more superiorly to the lesser trochanter of the femur [3]. As a result of this configuration, pathologic processes such as infection, neoplasia or hemorrhage in the iliopsoas compartment are often due to contiguous spread from adjacent spinal, retroperitoneal and pelvic structures. Primary lesions are rarely encountered.

Infection is typically due to extension from vertebral osteomyelitis, pancreatitis, diverticulitis or pyelonephritis. Iliopsoas compartment malignancy most often extends directly from adjacent structures such as the kidneys, colon or pelvic organs [4]. Primary neoplasia of the iliopsoas compartment such as liposarcoma, leiomyosarcoma or hemangiopericytoma is exceedingly rare [3]. Spontaneous hemorrhage may occur in patients on anticoagulation therapy, secondary to underlying sarcoma or due to bleeding diathesis. Lastly, iliopsoas tendinopathy, tendon tears, bursitis and snapping hip syndrome are important considerations in patients with hip pain [5].
Imaging findings OR Procedure details

ANATOMY

- Muscle groups: psoas major, psoas minor, and iliacus muscles
- Attachments: Spans posterior mediastinum (T12/L1) to femur (lesser trochanter)
- Function: flexion of the trunk and hip
- Muscle groups are extraperitoneal and configuration facilitates contiguous spread of disease to the spine, retroperitoneal structures and pelvis

INFECTION

Iliopsoas infection is rare and often discovered in immunocompromised patients, such as those with HIV [4]. Infection may result from contiguous spread from adjacent infection or from hematogenous spread [6]. Spread of spinal tuberculosis to the psoas musculature has also been described, but this entity is exceedingly rare in developed countries [4].

On CT, iliopsoas abscesses appear as heterogeneous enlargement of the psoas musculature. Characteristic rim enhancement may be observed on contrast enhanced studies. Inflammatory changes in the adjacent retroperitoneal fat, obliteration of fat planes, presence of gas bubbles or adjacent osseous destructive changes are helpful secondary findings. [FIGURE 1-2]

On MRI, collections appear hypointense on T1 with centrally hyperintense T2 signal. Rim enhancement on post contrast sequences is also common [FIGURE 1-2]. These findings are generally nonspecific and may also be seen in the setting of metastasis or lymphoma [3]. Similar to CT, secondary findings and clinical picture can tremendously aide in diagnosis.

Treatment often consists of a combination of antibiotics, percutaneous and rarely open drainage. CT guided drain placement can be beneficial for the therapeutic as well as diagnostic value [FIGURE 3] [6].

NEOPLASM

As with other pathology affecting the iliopsoas compartment, the presence of primary tumor is exceedingly rare. Contiguous tumor spread from adjacent tumor of the kidneys, colon or pelvic organs is most common. Retroperitoneal fascial planes do not offer significant barrier for craniocaudal tumor extension in the iliopsoas compartment. [FIGURE 4]
A few rare primary tumors may be observed in the iliopsoas compartment including liposarcoma, fibrosarcoma and lymphoma [FIGURE 5-6]. Other tumors such as leiomyosarcoma and hemangiopericytoma have also been described in the literature [FIGURE 7]. Often, these tumors may be difficult to differentiate from other pathology such as retroperitoneal infection or bleeding. In those cases, biopsy is required to establish diagnosis.

HEMORRHAGE

Psoas compartment hemorrhage may be spontaneous or related to external factors such as trauma, anticoagulation or bleeding diathesis. Bilateral hemorrhage is rare. Imaging findings of blood are highly variable and depend on the age of hematoma. On CT, the presence of an iso- to hyperdense collection in an asymmetrically enlarged psoas muscle may suggest presence of hematoma. Fluid-Fluid levels may occasionally be seen. On MRI, characteristic hyperintense T1 signal may be observed in subacute hematoma. Chronic hematoma would appear as hypointense signal on both T1 and T2 weighted imaging [FIGURE 8] [1-2]. Sometimes hemorrhage maybe difficult to differentiate from tumor on CT, in which case follow up CT, MRI or biopsy is required.

SPORTS INJURY

Iliopsoas injury is an uncommon cause of hip pain typically encountered in athletes as a result of flexion injury [7]. As with the other musculoskeletal injury, iliopsoas injury includes spectrum of muscle strains, tendinosis, partial thickness and full thickness tears [8]. Spontaneous full thickness rupture has also been described in the elderly, however this entity is rare. MRI is the mainstay for imaging diagnosis, however ultrasound may be occasionally employed.

Low grade injury such as muscle strain or tendinosis appear sonographically as thickening of the tendon with diffuse heterogeneously hypoechoic appearance. On MRI, thickening of the tendon with increased intrasubstance T2 signal and peritendinous edema signal is usually observed.

Tendon tears are seen as focal or full thickness disruption of the muscle fibers on both ultrasound and MRI, with sensitivity of the latter modality being far superior. Tears tend to be localized near the distal attachment of the iliopsoas, at the lesser trochanter [FIGURE 9]. Variable retraction of muscle fibers may be observed in cases of full thickness tendon rupture. Hypoechoic peritendinous soft tissue edema is typical on ultrasound with similar findings of hyperintense T2 signal in the adjacent soft tissues on MRI [FIGURE 10].

Snapping hip syndrome is a painful condition in young athletes characterized by a snap or click sensation during movement. There are multiple subtypes, of which external
type is most common and refers to abnormal movement of the iliotibial band over the greater trochanter. The iliopsoas tendon is implicated in the internal type of snapping hip syndrome and refers to abnormal movement of the iliopsoas tendon with relation to the iliopectineal eminence or lesser trochanter [5]. Dynamic sonographic evaluation is the examination of choice for real time visualization of iliacus muscle fibers and iliopsoas tendon fiber snapping against the pubic bone. MRI may show sequelae of repeated stress on the muscle/tendon fibers including tendinosis and edema signal. Increased bursal fluid is a nonspecific finding which may also be present in this condition. Conservative treatment approaches or therapeutic peritendinous corticosteroid injection may be employed [9].

THERAPEUTIC PROCEDURES

Peritendinous iliopsoas injection is routinely performed at our institution for those with tendinosis and absence of primary hip pathology. Iliopsoas tendinosis and snapping hip syndrome are common cause of hip pain for which therapeutic corticosteroid injection offers pain relief with relatively quick onset of action. In cases of failure to relieve pain, alternative etiology for hip pain may be suggested [10].

There are well defined sonographic landmarks used to identify the iliopsoas tendon and the iliopsoas bursa. These structures can be easily identified using the iliopectineal eminence as a landmark. Using a lateral approach, a 22-gauge spinal needle is directed toward the iliopsoas bursa, between the tendon and hip capsule at the level of the iliopectineal eminence. In cases where the iliopsoas bursa is distended with fluid, the needle may be directed into the bursa. Successful injection may be confirmed by fluid distention of the bursa or the presence of peritendinous air bubbles post injection [FIGURE 11].
Fig. 1: Iliopsoas abscess due to contiguous spread from osteomyelitis. Axial CECT (A) and axial T1W contrast enhanced MRI (b) demonstrate a rim enhancing collection in the belly of the right psoas muscle (green arrows). In the same patient, sagittal T2W MRI (c) demonstrates destructive endplate changes(*) and T2 bright collection within the disc space (yellow arrow), consistent with diskitis/osteomyelitis.

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Fig. 2: Iliopsoas abscess due to contiguous spread from osteomyelitis. Axial CECT (A) and axial post contrast T1W MRI (B) demonstrate a rim enhancing collection in the right psoas muscle originating from the adjacent vertebra (yellow arrows). Pre (C) and Post (D) contrast sagittal T1W shows characteristic rim enhancement of the abscess (red arrows).

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Fig. 3: CT guided iliopsoas abscess drainage. Non-contrast CT images (A) demonstrate air and fluid filled collection in the right psoas musculature (white arrow) with subsequent images (B) from placement of drainage catheter (yellow arrow). Follow up CECT (C) shows eventual fistulization the abscess cavity with small bowel loops (red arrow).

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Fig. 4: Iliopsoas compartment metastasis in a patient with renal cell carcinoma. CECT in a patient with known renal cell carcinoma (*) shows bilateral psoas compartment metastasis (yellow arrows).
Fig. 5: Iliopsoas compartment liposarcoma. CECT (A) demonstrates a mixed fat and soft tissue attenuation mass arising from the right iliopsoas myotendinous junction (white arrow). Heterogeneous enhancement is shown on axial (B) and sagittal (C) T1W FS post contrast MRI sequences. (yellow arrows) Biopsy showed well differentiated liposarcoma.

Fig. 6: Retroperitoneal lymphoma with involvement of the iliopsoas compartment. Axial NECT (left image) and axial T1W MRI (right image) through the mid abdomen demonstrates a confluent mass in the retroperitoneum involving the bilateral psoas muscles (white arrows). Patient has known lymphoma with extensive retroperitoneal involvement, ultimately causing renal failure from ureteral obstruction.
**Fig. 7:** Iliopsoas compartment leiomyosarcoma. Transverse ultrasound image (A) demonstrates a heterogeneously echogenic lobular mass (green arrow). Axial CECT (B) revealed mild enhancement (white arrow). Axial T2W fat saturated MR image (C) demonstrates heterogenous hyperintense signal characteristics (yellow arrow). Axial T1W post contrast MR image (D) reveals avid enhancement of the mass which extends through the iliopsoas muscle (red arrow) and adjacent vertebral body (blue arrow). Pathology confirmed leiomyosarcoma.

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**Fig. 8:** Spontaneous and traumatic iliopsoas compartment hemorrhage. NECT image (left) show spontaneous bilateral psoas hematomas (yellow arrows). T1W contrast enhanced MRI (right) shows a right iliacus hematoma after a minor trauma (blue arrows). Both patients were on anticoagulation therapy.

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![NECT and MRI images showing spontaneous and traumatic iliopsoas compartment hemorrhage](image)

**Fig. 9:** Partial thickness split tear of the iliopsoas tendon. Coronal (left) and axial (right) T2W fat saturated (FS) sequences demonstrate partial thickness split tearing of the iliopsoas tendon proximal to its insertion (yellow arrows).

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![MRI images showing partial thickness split tear of the iliopsoas tendon](image)
**Fig. 10:** Full thickness tearing of the iliopsoas tendon. Coronal (left) and sagittal (right) T2W FS sequences show isolated full thickness tearing of the iliopsoas tendon (yellow arrow) with retraction of muscle fibers (red arrow) to the level of the femoral head.

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**Fig. 11:** Peritendinous iliopsoas corticosteroid injection technique. Axial T1W MRI (A) and sonographic images (B) of the left hip demonstrates the anatomic relationship of the iliopsoas tendon (yellow arrows) with the adjacent femoral head and iliopectineal eminence of the acetabulum. The tendon is usually positioned just lateral to the iliopectineal eminence and appears as rounded echogenic structure on sonographic images. Lateral approach injection is typically preferred (blue arrow). Needle is positioned between the tendon and adjacent hip capsule (white asterisk). Distension of the bursa or peritendinous microbubbles indicate successful injection.
Conclusion

Improved knowledge of the complex anatomy and familiarity with common clinical entities involving the iliopsoas compartment aids in the diagnosis of radiologically similar appearing pathology resulting in better clinical care.
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References