Adult hip ultrasound: a didactic approach for a correct examination

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Learning objectives

The aim of our educational exhibit is to describe a systematic technique for ultrasound (US) evaluation of the hip structures, by illustrating their normal anatomy and US appearance. We will provide anatomical didactic schemes, showing correlations with sonographic images.
Background

High resolution hip US, commonly performed with high frequency (7-15 MHz) linear probes, has become a first level examination to investigate multiple painful conditions that may affect the hip region, which is a crossroad for muscular, tendinous, vascular and nervous structures between the trunk and the lower extremity.
Findings and procedure details

We could divide the hip into four quadrants and normally it's important to focus the US examination above all to the quadrant affected by the clinical symptomatology. Here it is a list on what structures should be identified in each quadrant:

- **Anterior** quadrant: sartorius, tensor fasciae latae and rectus femoris muscles, iliopsoas muscle and bursae, femoral neurovascular bundle and anterior synovial recess;

- **Medial** quadrant: adductors muscles and tendons;

- **Lateral** quadrant: gluteal muscles and tendons;

- **Posterior** quadrant: ischio-crural (hamstrings) muscles and tendons, sciatic nerve.

US images with the corresponding detailed anatomical scheme, indicating also patient and probe correct positioning, are showed below:

1. **ANTERIOR QUADRANT**

   - **Sartorius and tensor fasciae latae**: with the patient supine, start the examination from the anterior superior iliac spine (ASIS) placing the probe in the axial plane, to visualize the short tendons and muscle bellies of the sartorius and the tensor fasciae latae (Fig.1). Analyze them by means of axial and sagittal planes. Shifting the probe caudally over the muscle bellies, the sartorius directs medially to reach the medial thigh passing over the rectus femoris muscle, whereas the tensor fasciae latae directs laterally, superficially to the vastus lateralis.

   - **Rectus femoris muscle**: place again the probe over the ASIS and move it caudally to reach the anterior inferior iliac spine (AIIS) to examine the direct tendon of the rectus femoris (Fig.2). Rotate the transducer of 90° to perform also long-axis planes and note an hypoechoic area with posterior acoustic shadowing under the direct tendon. It represents the anisotropic effect due to different orientation of the indirect tendon fibers, which direct more externally and obliquely with respect to the direct tendon, inserting on the acetabular tubercle (Fig.3-4).

   - **Iliopsoas muscle and bursae**: perform a series of axial scans medial to the rectus femoris and lateral to the femoral neurovascular bundle, until you visualize the iliopsoas muscle belly and its hyperechoic tendon. It is located in a postero-medial eccentric position in the context of the muscle belly (Fig.5) and it inserts on the corresponding smaller trochanter; study it on axial and longitudinal orientations. The iliopsoas synovial bursa is located
between the anterior capsule of the hip joint and the iliopsoas muscle, but it is normally collapsed and can be detected with US only when dilated by pathologic fluid; in 15% of cases it could communicate with the hip articular space.

- **Femoral neurovascular bundle**: is located medially to the rectus femoris and iliopsoas muscle and tendon. In latero-medial direction, it consists of the femoral nerve, the common femoral artery and the femoral vein (Fig.6). In this region, it could be useful to check for possible enlarged lymph nodes.

- **Hip joint**: with an oblique sagittal scan over the femoral neck, you can see the joint space located medially and distally to ASIS. It is possible to identify the anterior portion of the fibrocartilaginous labrum of the acetabulum, the anterior capsular profile (a hyperechoic linear structure) and the femoral head coated by the hypoechoic articular cartilage (Fig.7). At the base of the femoral head there is the anterior capsular recess which is not appreciable in normal conditions. Notice that in obese patients, lower frequency or convex probes may help the examination.

2. **MEDIAL QUADRANT**

- **Adductor muscles and tendon**: the patient is placed with the thigh abducted and externally rotated and the knee bent.

Identify the osseous landmark of the anterior surface of the pubis and with a sagittal scan analyze the insertional components of the adductor muscles. We will recognize a thick short conjoint tendon and three muscular layers: from the most superficial to the deepest, the adductor longus, adductor brevis and adductor magnus (Fig.8). Analyze every muscle belly by orientating the probe with axial and longitudinal planes.

3. **LATERAL QUADRANT**

- **Gluteal muscles and tendons**: patient lies on the opposite hip assuming an oblique or true lateral position. Find the greater trochanter with axial scan and then move slightly cranially until you recognize three muscle bellies with their corresponding myotendinous junctions: from anterior to posterior side, the gluteus minimus (deep), the gluteus medius (with its anterior and posterior tendons) and gluteus maximus (more superficial). Over them, the tendinous component of the tensor fasciae latae appears as a hyperechoic band, separated by fatty cleavage tissues and a synovial bursae. (Fig.9). This bursa is not visible in normal conditions, like the trochanteric bursa of gluteus maximus and gluteus medius.

4. **POSTERIOR QUADRANT**
• **Ischiocrural muscles and tendons (Hamstrings):** investigate this region with the patient prone. Start the US examination with axial planes from the ischial tuberosity, a useful landmark to visualize the tendon insertion of the ischiocrural muscles. In the latero-medial direction we identify the conjoint tendinous insertion of the long head of the biceps femoris with the semitendinosus and therefore the tendon of the semimembranosus, which muscle is very thin and has a very short proximal tendinous component (Fig.10-11).

• **Sciatic nerve:** the sciatic nerve is seen as an oval shaped structure with fascicular echo pattern emerging under the piriformis muscle, lateral to the hamstring insertion on the ischial tuberosity. Study it on both transverse (Fig.12) and longitudinal planes.
**Fig. 1:** Correct probe position, US image (axial plane) and anatomic scheme for the study of the insertion of sartorius and tensor fasciae latae tendons. ASIS: anterior superior iliac spine; TFL: tensor fasciae latae; Sa: sartorius.

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**Fig. 2:** Correct probe position, US image (axial plane) and anatomic scheme for the study of the proximal insertion of the rectus femoris (direct tendon). AIIS= anterior inferior iliac spine; IPs= iliopsoas; Arrowheads= proximal insertion of rectus femoris direct tendon.

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Fig. 3: Correct probe position and US image (longitudinal plane) for the study of the proximal insertion (direct tendon) of rectus femoris. IPs= iliopsoas; RF= rectus femoris; AIIS= anterior inferior iliac spine.

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Fig. 4: Correct probe position and US image (longitudinal plane) for the study of both the direct tendon (arrowheads) and indirect tendon (asterisk) of the rectus femoris. Note the hypoechoic aspect of the cranial part of the indirect tendon, as a result of a different orientation of its fibers (anisotropy), that goes more externally and obliquely with respect of the direct tendon.

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**Fig. 5:** Correct probe position, corresponding US image (axial plane) and anatomical scheme for the study of myotendinous junction (asterisk) of iliopsoas muscle (IPs). FH = femoral head.

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**Fig. 6:** Correct probe position, axial US scan and anatomical model for the visualization of the neurovascular bundle: femoral artery (A), femoral vein (V) and femoral nerve (N). Pe: pectineus muscle.

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Fig. 7: Correct probe position and corresponding US image (longitudinal plane) showing the femoral head (FH) (coated by the hypoechoic cartilage), the acetabulum (Ac), the acetabular labrum (asterisk) and the anterior joint profile (arrowheads). IPs = iliopsoas muscle.

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Fig. 8: Correct probe position, US image (longitudinal plane) and anatomical scheme showing the tendinous component (asterisk) of the insertion on the pubis of adductor longus (AL), adductor brevis (AB) and adductor magnus (AM) muscles.

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**Fig. 9:** Correct probe position, US image (axial plane) and anatomical scheme showing the insertion of the gluteus minimus (asterisk), gluteus medius (white point) and gluteus maximus (black point) on the femoral greater trochanter (GT). Arrowheads= tensor fasciae latae. Note: the gluteus minimus muscle is located in a deeper plane.

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**Fig. 10:** Correct probe position, axial US image and anatomic scheme for the study of the insertion of the hamstrings on the ischial tuberosity (IT). 1= biceps femoris; 2= semitendinosus; 3= semimembranosus.

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**Fig. 11:** Correct probe position, corresponding longitudinal US image and anatomical scheme show the tendon insertion (asterisk) of the semitendinosus (ST) and semimembranosus (SM) on the ischial tuberosity (IT). BF= biceps femoris.

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**Fig. 12:** Correct probe position and axial US image showing the short axis of the sciatic nerve (arrowhead).

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Conclusion

US examination of the hip can provide excellent results, but only if the US operator is thoroughly familiar with both the normal anatomy and the US anatomy and carries out the examination following an accurate and efficient technique.
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References


