Knee ultrasonography: scanning technique and MRI correlation

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Learning objectives

The purpose of this article is to describe the technique for performing an ultrasound examination of the knee by using didactic schemes of the correct positioning of the probe, illustrations of the normal anatomy of the knee as seen on ultrasound and its correlation with magnetic resonance.

Background

Even though advanced imaging of the knee is most commonly performed using magnetic resonance imaging, ultrasonography remains an important imaging modality for the evaluation of this joint. In fact, and despite not being the best method for the evaluation of the deep and intra-articular structures, ultrasound evaluation of superficial structures of the knee usually is quite successful.

Besides the decreased cost when compared to MRI, dynamic assessment, comparison with the contralateral side and the ability to correlate patient's symptoms to a specific area are all valuable advantages of ultrasound over other modalities.

In most cases, the knee examination is focused in one compartment only, based on clinical findings. However, for a complete evaluation of the knee it is useful to divide the joint into four compartments: anterior, medial, lateral and posterior (Tab. 1).

Knee compartment	Important Structures
Anterior	Quadriceps tendon Suprapatellar joint recess Parapatellar (medial and lateral) joint recesses Trochlear and femoral condyle articular cartilage Patellofemoral (medial and lateral) ligaments Patellar tendon
Medial	Medial collateral ligament Medial meniscus (body and anterior horn) Semimbranosus tendon Pes anserinus tendon
Lateral	Lateral collateral ligament Lateral meniscus (body and anterior horn) Biceps femoris Popliteus muscle Common peroneal nerve Iliotibial band
Posterior	Medial head of gastrocnemius and bursa Popliteal neurovascular bundle Menisci (posterior horns) Anterior cruciate ligament Posterior cruciate ligament

Table 1: The most important structures that can be found in each knee compartment.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

Images for this section:

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Table 1: The most important structures that can be found in each knee compartment.

Findings and procedure details

Technique

The patient should be lying supine with the knee in 20-30º flexion (except for the evaluation of the posterior aspects of the knee, best evaluated with the patient prone and with the knee extended).

The transducer in use should have a 5 to 12-MHz linear array, and the musculoskeletal preset should be selected.

A thorough ultrasound evaluation of the knee must follow a sequence: beginning anteriorly, then progressing to medial and lateral sides, and finally to the posterior compartment. This systematic approach ensures an efficient sonographic examination of the knee.

Ultrasound evaluation of the different knee compartments will be described step by step and the ultrasound appearance of normal knee anatomy will be correlated with the normal appearance on knee MRI.

Anterior knee

The anterior compartment of the knee is examined with the patient supine, with the knee in slight flexion (supported by a cushion, for example), placing the tension in the extensor mechanism and avoiding anisotropy related to the concave surface of both quadriceps and patellar tendons when in full extension (Fig. 1).

Fig. 1: Position of the knee to evaluate the anterior compartment.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

The most important structures in the anterior compartment that can be evaluated with ultrasound examination are the:

- quadriceps tendon;

- suprapatellar and parapatellar joint recesses;

- trochlear and femoral condyle articular cartilage;

- patellofemoral ligaments;

- patellar tendon.

Quadriceps tendon

The quadriceps muscle (rectus femoris, vastus medialis, vastus lateralis and vastus intermedius) is the group of anterior thigh muscles that, like the patellar tendon, take part in the extensor mechanism of the knee. The different components of the quadriceps are connected to the patella by the quadriceps tendon.

To correctly evaluate all the different structures stated above, they should be scanned in long and short axes.

Beginning with the probe in long axis (centrally positioned over the upper border of the patella) the trilaminar appearance of the quadriceps tendon, with the rectus femoris as the anterior layer, the combined vastus medialis and lateralis as the middle layer, and the vastus intermedius as the deepest layer, can be appreciated (Fig. 2).

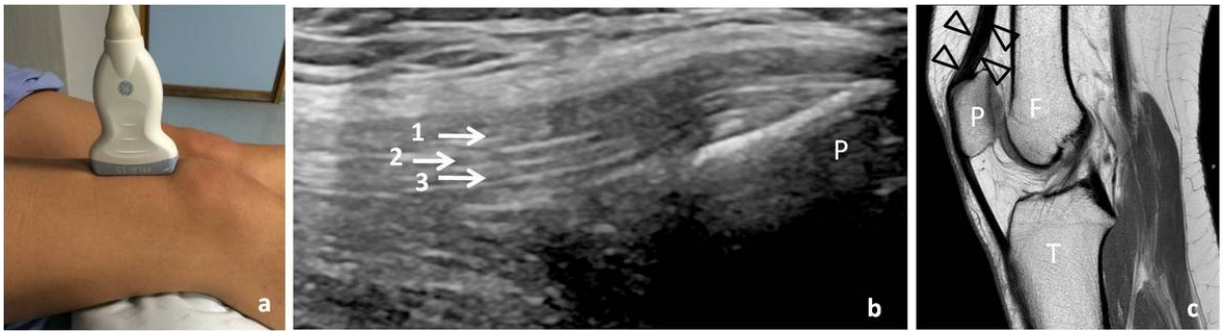

Fig. 2: Probe position to evaluate the quadriceps tendon long axis (a). The longitudinal scan (b) shows the trilaminar appearance of the tendon: the anterior layer from rectus femoris (arrow 1), the middle layer from vastus medialis and lateralis (arrow 2) and

the deep layer from vastus intermedius (arrow 3). The MRI scan (c) shows the patellar insertion of the three layered quadriceps tendon (arrowheads). P, patella; F, femur; T, tibia.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

Shifting the transducer to the short axis one can verify that the myotendinous junction of the rectus femoris is located anteriorly when compared to the junctions of the vastus muscles (Fig. 3).

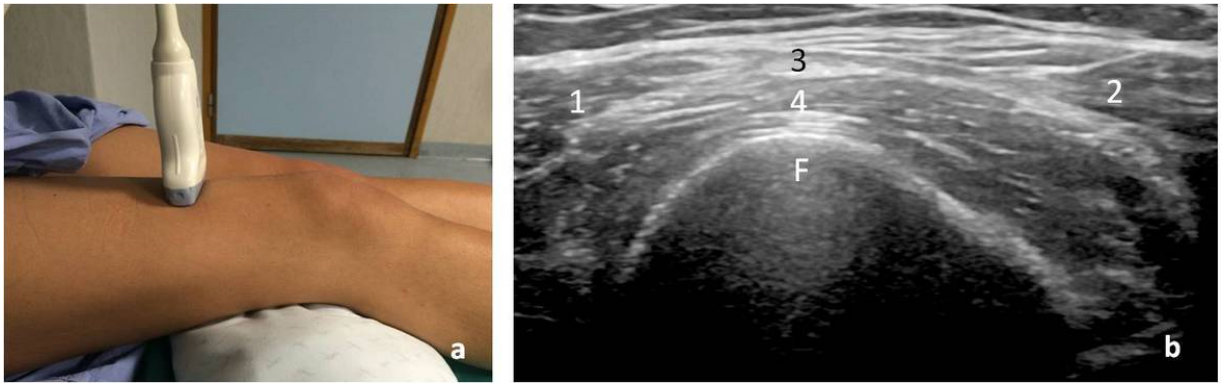

Fig. 3: Probe position for the evaluation of quadriceps tendon short axis (a). The axial scan (b) also shows the usual stratified appearance of the quadriceps muscle. 1. Vastus lateralis muscle 2. Vastus medialis muscle 3. Rectus femoris muscle 4. Vastus intermedius muscle; F, femur; T, tibia.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

Suprapatellar and parapatellar joint recesses

Returning to the quadriceps tendon in long axis, the suprapatellar fat pad can be found just cranially to the patella, separated from the slightly posterior prefemoral fat pad by the S-shaped suprapatellar synovial recess (Fig. 4).

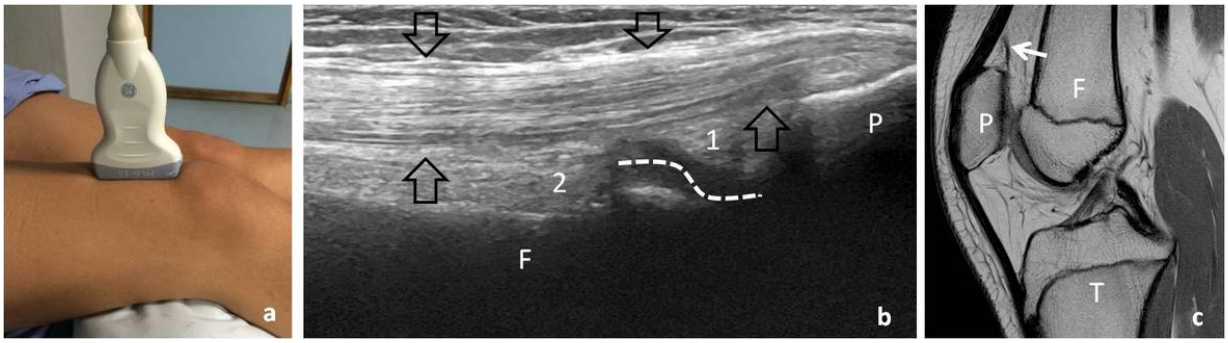

Fig. 4: Probe position for the evaluation of the suprapatellar recess (a). The ultrasound scan (b) shows the S-shaped suprapatellar synovial recess (dashed white line) separating the suprapatellar fat pad (1) from the prefemoral (2) fat pad. The quadriceps tendon (black arrows) runs anteriorly to the recess. The MRI scan (c) also shows the anatomical relationships between the suprapatellar recess (white arrow) and the aforementioned structures; F, femur; P; patella; T, tibia.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

The probe is then moved laterally and medially, in the transverse plane, to evaluate the parapatellar joint recesses (Fig. 5).

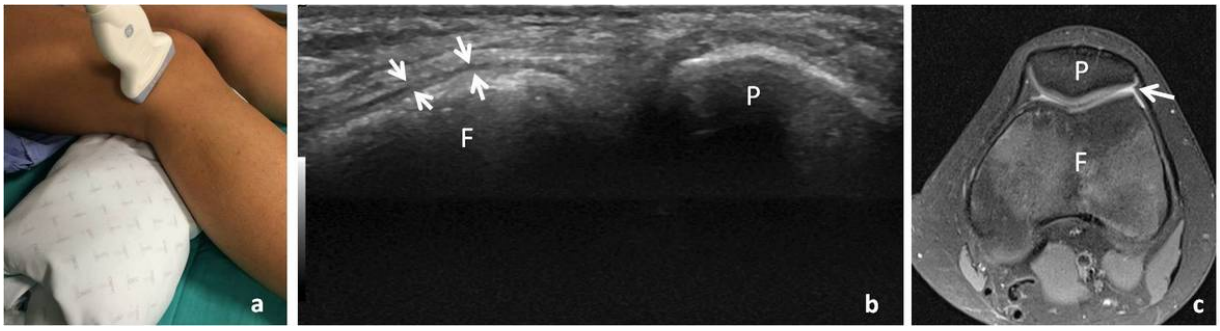

Fig. 5: Probe position to evaluate of the lateral parapatellar recess (a). The ultrasound scan (b) shows the lateral parapatellar recess (white arrows), a thin hypoechoic space anterior to the femur. The MRI scan (c) shows a physiological small amount of fluid in the lateral parapatellar recess (white line). F, femur; P; patella.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

Trochlear and femoral condyle articular cartilage

With the knee in full flexion, the V-shaped hypoechoic hyaline cartilage that covers the femoral trochlea can be examined on axial plane (Fig. 6).

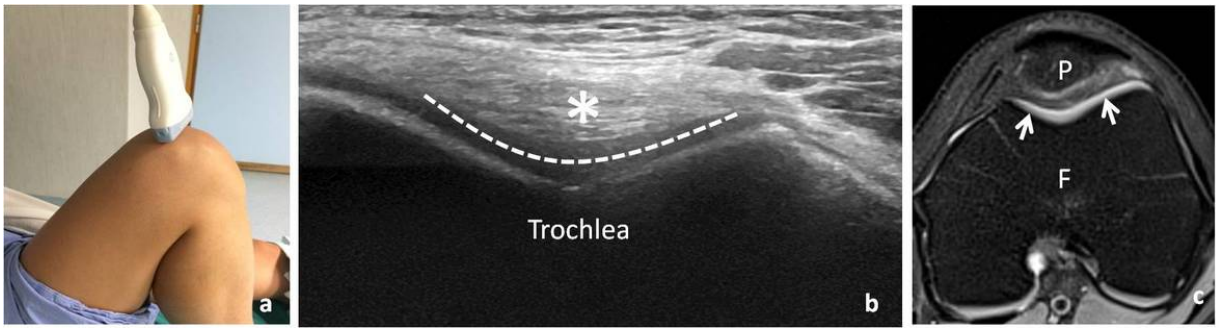

Fig. 6: Probe position for the assessment of the femoral trochlea (a). The axial scan (b) shows the V-shaped hypoechoic cartilage (dashed white line) covering the femoral trochlea. The quadriceps tendon (*) runs anteriorly. The femoral trochlea (white arrows) is also identified on the MRI scan (c). F, femur; P; patella.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

In the parasagittal plane the hyaline cartilage covering the anterior and central aspects of the femoral condyles can be seen as a hypoechoic line (Fig. 7).

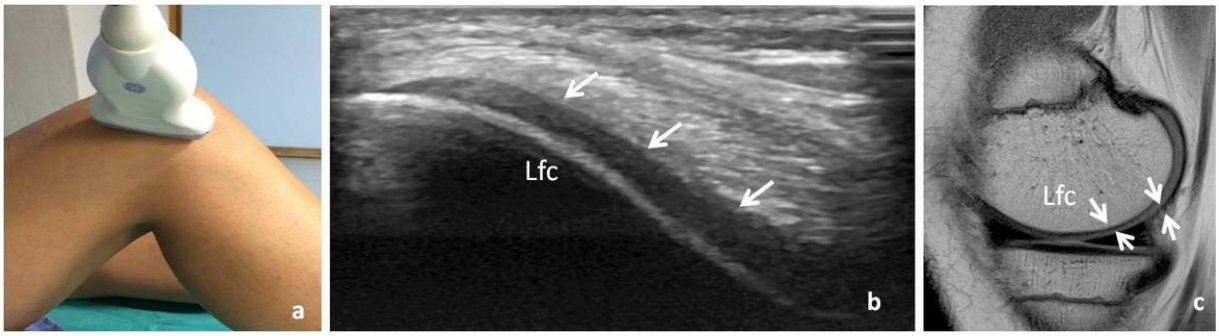

Fig. 7: Probe position for the evaluation of the lateral femoral condyle articular cartilage (a). The parasagittal scan (b) shows a hypoechoic line representing the hyaline cartilage covering the anterior aspect of the lateral femoral condyle (white arrows). This structure is easily assessed on knee MRI (c). Lfc, lateral femur condyle.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

Patellofemoral (medial and lateral) ligaments

The patellofemoral ligaments originate on the superomedial and superolateral aspects of the patella and progress distally where they form the medial collateral ligament and the iliotibial band, respectively. The ultrasound evaluation of the medial and lateral patellofemoral is effective by placing the probe obliquely with the lower extremity of the probe on the top of the patella and the upper extremity oriented to the inner and outer surfaces of the thigh, respectively (Fig. 8).

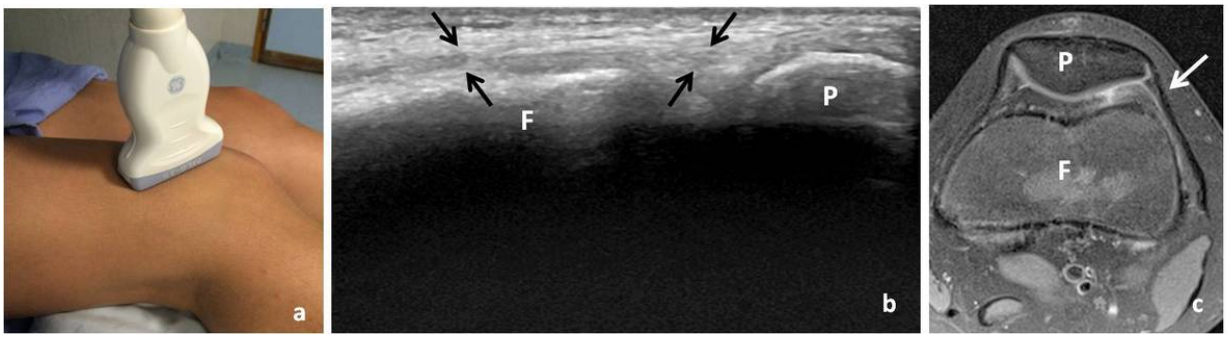

Fig. 8: Probe position to evaluate the lateral patellofemoral ligament (a). The ultrasound scan (b) shows the ligament (black arrows) as it inserts distally in the lateral border of the patella. On the MRI scan (c) the ligament (white arrow) appears as low-signal band that extends posteriorly to form the iliotibial band. F, femur; P, patella.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

Patellar tendon

Moving the transducer inferiorly below the patella, in the sagittal plane, the patellar tendon is easily identified as a striated hyperechoic tendon. Deep to the patellar tendon, the Hoffa infrapatellar fat pad appears minimally hyperechoic or isoechoic to muscle.

The patellar and tibial insertions of the patellar tendon should be evaluated for the presence of fluid, which can be physiologic if in small volumes in the distal insertion (Fig. 9).

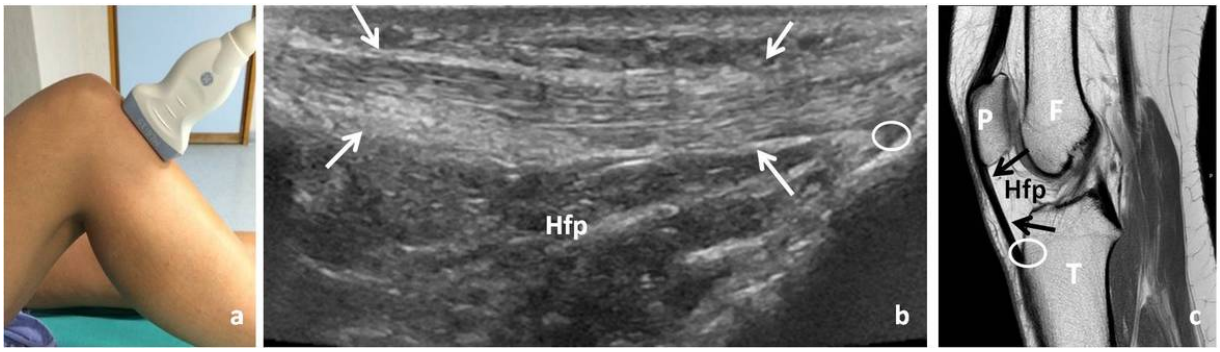

Fig. 9: Probe position for the evaluation of the patellar tendon (a). The ultrasound (b) and MRI scans show the normal appearance of the tendon (arrows). The Hoffa fat pad (Hfp) is posterior to the tendon. Near the tibial insertion of the tendon it is possible to identify the deep infrapatellar bursa (circle). F, femur; P, patella; T, tibia.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

Medial knee

The medial knee is examined with the patient supine, knee in slight flexion and external rotation of the hip, to allow access to the medial structures (Fig. 10).

Fig. 10: Position of the knee to evaluate the medial compartment.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

The most important structures to be evaluated are the:

- medial collateral ligament and anterior horn of medial meniscus (anteromedial corner);

- pes anserinus tendon and semimembranosus tendon (posteromedial corner).

Medial collateral ligament and medial meniscus (anteromedial corner)

The medial collateral ligament and medial meniscus, collectively referred as the anteromedial corner, are two closely spaced structures separated by an area of loose connective tissue. They are best evaluated in the long axis by placing the probe along the medial joint line, following the bony contour of the distal femur or proximal tibia.

The medial collateral ligament is composed of two layers: a thick hyperechoic and fibrillar superficial layer (or tibial collateral ligament, as it extends from the medial femoral condyle to the proximal tibia, approximately 5 cm below the joint) and a thinner deep layer (divided as meniscofemoral ligament proximally and meniscotibial ligament distally, since they extend from the meniscus to the femur and tibia, respectively).

Although easily found, only the body (with the probe in the coronal plane) and anterior horn (moving the transducer anteriorly to the oblique-sagittal plane) of the medial meniscus are assessed effectively. The medial meniscus is identified as a triangular reflective structure between the femur and the tibia, with a homogeneous spotted internal matrix (Fig. 11).

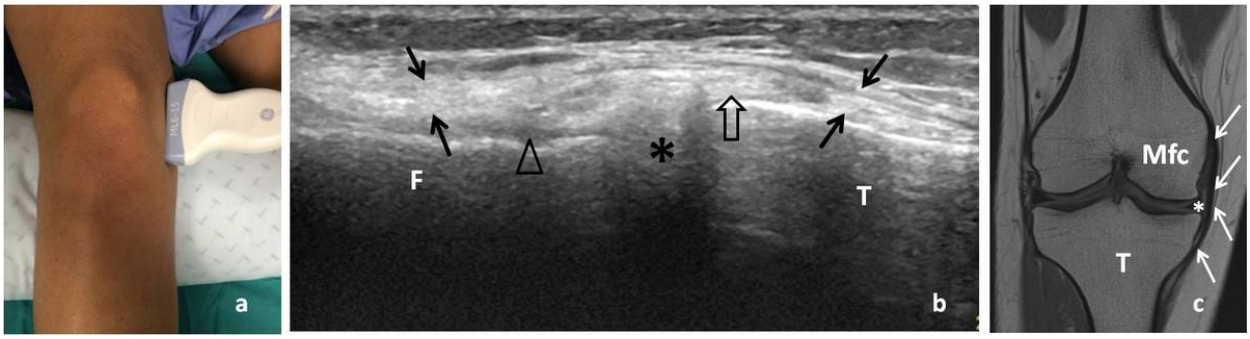

Fig. 11: Probe position for the evaluation of the anteromedial corner(a). The longitudinal ultrasound scan (b) shows the two layers of the medial collateral ligament: the superficial layer (or tibial collateral ligament, black arrows) and the deep layer constituted by the meniscofemoral ligament (arrowhead) and the meniscotibial ligament (void arrow). The MRI scan (c) shows the medial collateral ligament as a thin, well-defined, low-signal structure extending from the medial femoral condyle to the medial tibial metaphysis (arrows). The medial meniscus (*) is in close relationship with the ligament. Mfc, medial femural condyle; T,tibia.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

Pes anserinus and semimembranous tendon (posteromedial corner)

The posteromedial corner contains the tendon of semimembranosus muscle as well as the tendons of the pes anserinus complex (consisting of the conjoined tendons of the sartorius, gracilis and semitendinosus muscles, from front to back).

The evaluation of the pes anserinus tendon is effective in the coronal plane by moving the transducer distally to the medial collateral ligament, about 5 cm beyond the joint line. At this point, three hyperechoic tendons run superficial to the tibial collateral ligament, later converging onto the tibia, where they cannot be separated (Fig. 12).

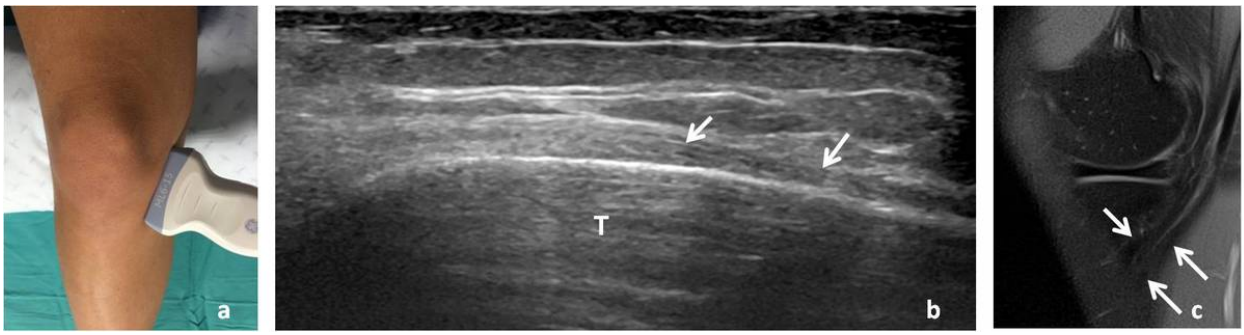

Fig. 12: Probe position for the assessment of the pes anserinus tendon (a). Ultrasound (b) and MRI (c) scans show the tibial insertion of the tendon (arrows). At this level the three tendons of the pes anserinus complex cannot be clearly individualized. T, tibia.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

For the evaluation of the semimembranosus tendon the patient should be lying prone and the probe should be placed in the axial plane in the medial distal thigh, where the semimembranosus tendon appears posterior to the semitendinous muscle. Semimembranous can then be followed distantly until the tendon forms (Fig. 13).

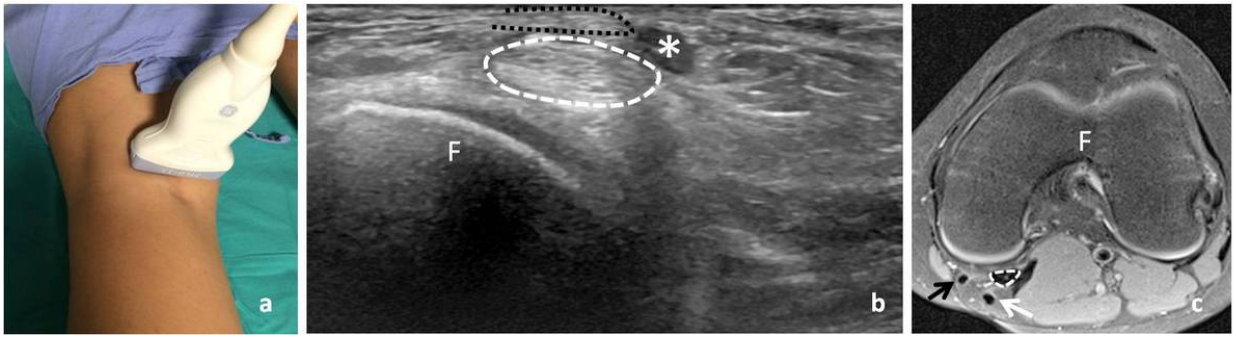

Fig. 13: Probe position for the evaluation of the semimembranosus tendon (a). Ultrasound axial plane (b) shows the semimembranosus tendon (dashed white line), posterior to the semitendinous (dashed black line) and gracilis (*) muscle. On the MRI scan (c) the anatomical relationships between the aforementioned structures (dashed white line, semimembranosus tendon; black arrow, gracilis muscle; white arrow, semitendinous muscle), are clear. F, femur.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

Lateral knee

For the examination of the lateral compartment of the knee the patient´s leg must be rotated internally, maintaining a slight knee flexion (Fig. 14).

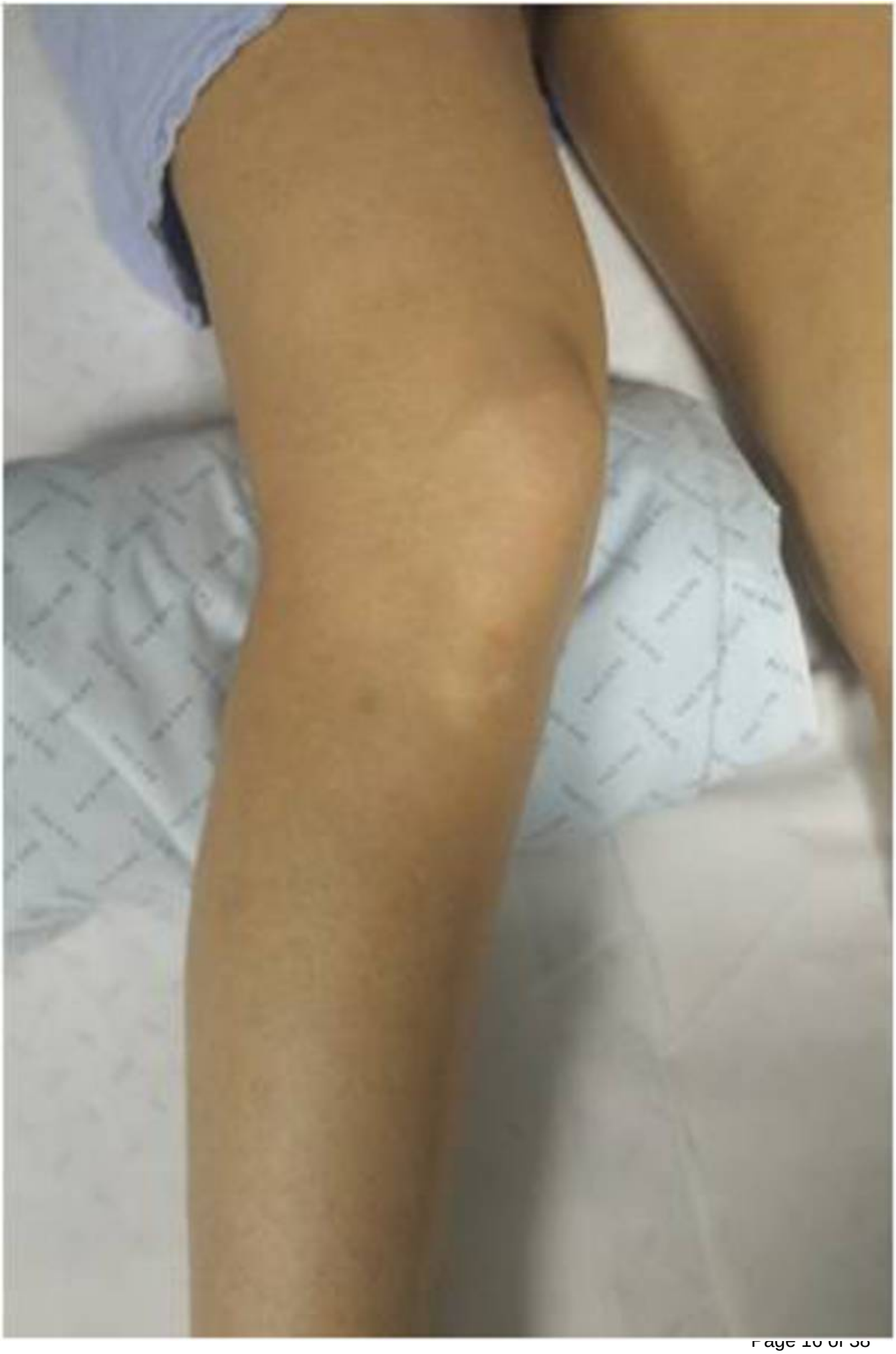

Fig. 14: Position of the knee to evaluate the lateral compartment.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

The most important structures to be evaluated are the:

- iliotibial band (anterolateral corner)

- lateral collateral ligament, lateral meniscus, popliteus muscle and biceps femoris

Iliotibial band (anterolateral corner)

Moving the probe laterally from the anterior knee long axis at the patellar tendon level, the iliotibial band can be identified as it extends distally to reach the Gerdy's tubercle. This structure appears as a thick hyperechoic band, easily separated from the surrounding subcutaneous fat and capsular structures (Fig. 15).

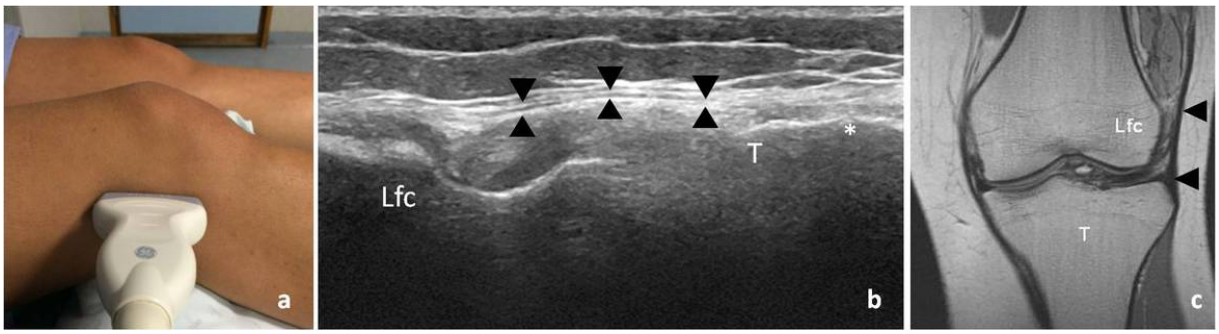

Fig. 15: Probe position to evaluate the iliotibial band (a). Ultrasound longitudinal plane (b) shows a thick hyperechoic band that corresponds to the iliotibial band (arrowheads). The distal insertion of this structure is the Gerdy's tubercle (*). On the MRI scan (c) this structure appears as a low-signal band (arrowheads).Lfc, lateral femoral condyle; T, tibia.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

Lateral collateral ligament, lateral meniscus, biceps femoris, popliteus muscle (posterolateral corner)

Keeping the probe in the coronal plane, it is then moved laterally to the point the proximal aspect of the transducer is fixed to the femur while the distal aspect is rotated posterior towards the fibular head. At this level, it is possible to identify the groove for the popliteus tendon (best evaluated from a posterior approach because of its curved

course), the anterior horn of the lateral meniscus and anteriorly the lateral collateral ligament, extending from the lateral femoral condyle to the lateral aspect of the fibular head. It has a similar ultrasound appearance to the medial collateral ligament, although it is thicker in long axis (Fig. 16).

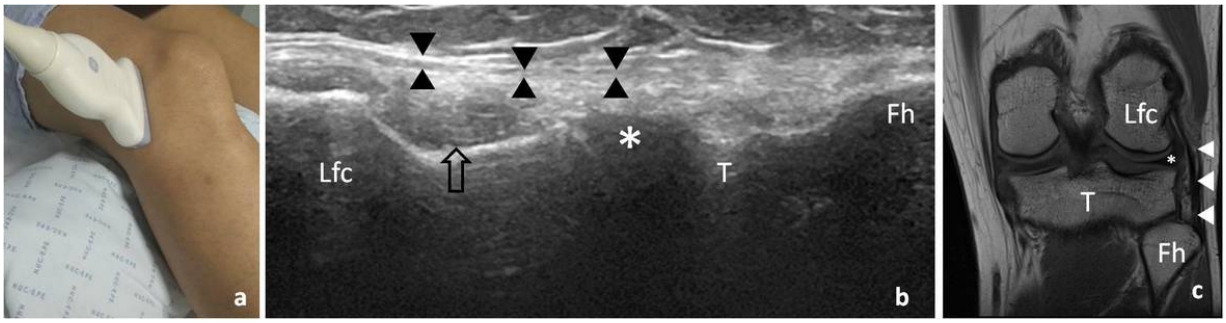

Fig. 16: Probe position for the assessment of the posterolateral corner (a). Ultrasound scan (b) shows the groove for the popliteus tendon (arrow) and the anterior horn of the lateral meniscus (*). The thick hyperechoic band representing the lateral collateral ligament runs anterior to the previously mentioned structures (arrowheads). On the MRI scan (c) the lateral collateral ligament is identified as a low-signal structure (arrowheads) extending from the lateral femoral condyle (Lfc) to the lateral aspect of the fibular head (Fh). T, tibia.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

Keeping the distal aspect of the transducer at the fibula and rotating the proximal end of the probe posteriorly one can identify the distal insertion of the biceps femoris at the fibular head, next to the lateral collateral ligament. These structures can be differentiated by the less fibrillar echotexture of the tendon when compared to the hyperechoic and fibrillar echotexture of the ligament (Fig. 17).

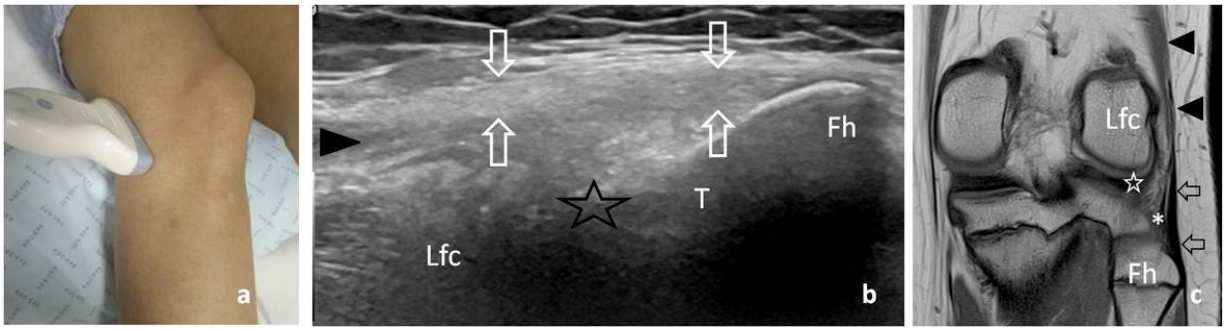

Fig. 17: Probe position to evaluate the biceps femoris (a). In the longitudinal scan (b) the hypoechoic biceps femoris muscle (arrowhead) progresses distally with the biceps femoris tendon (arrows) as it inserts in the fibular head (Fh). The MRI scan (c) shows

the biceps muscle (arrowheads) and tendon (arrows) next to to the slightly internal lateral collateral ligament (*) as these structures insert in the fibular head (Fh). Lfc, lateral femoral condyle; T, tibia; Fh, femoral head; *, lateral meniscus.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

Posterior knee

The posterior knee is best approached with the patient lying prone and placing the probe in the axial plane (Fig. 18).

Fig. 18: Position of the knee to evaluate the posterior compartment.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

The structures of interest include the:

- popliteal neurovascular bundle,

- posterior horns of the menisci and posterior cruciate ligament.

Popliteal neurovascular bundle

With the probe in the axial plane in the popliteal fossa, the popliteal neurovascular bundle (popliteal artery deeply, popliteal vein intermediately and the tibial nerve superficially) is identified between the heads of the gastrocnemius (Fig. 19).

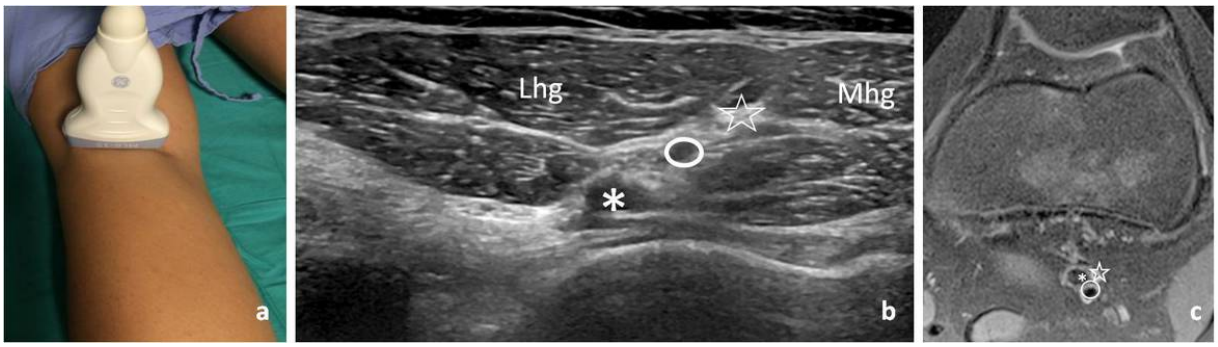

Fig. 19: Probe position to assess the popliteal neurovascular bundle (a). In the transverse ultrasound scan (b) one can identify the popliteal neurovascular bundle between the heads of the lateral (Lhg) and medial (Mhg) gastrocnemius. The popliteal artery (*) is posterior, the popliteal vein (circle) runs between the artery and the nerve and the tibial nerve (star) is superficial. These structures are also identified on the MRI scan. *, popliteal artery; circle, popliteal vein; star, tibial nerve.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

Menisci (posterior horns) and posterior cruciate ligament

Shifting the transducer to the sagittal plane, the probe is then moved over the medial and lateral aspects of the posterior knee, where the hyperechoic and triangular meniscus are identified (Fig. 20).

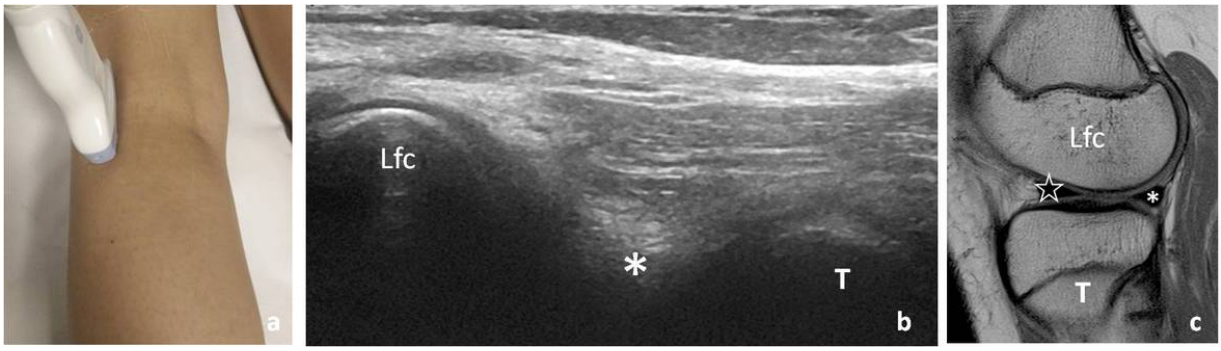

Fig. 20: Probe position for the evaluation of the posterior horns of the menisci (a). The longitudinal ultrasound scan (b) in the lateral aspect of the posterior knee shows the lateral posterior meniscus as a hyperechoic triangle (*). The MRI (c) shows the lateral meniscus. Unlike the medial meniscus (where the posterior horn is larger that the anterior horn), in the lateral meniscus both the anterior (star) and posterior (*) horns are about the same size. Lfc, lateral femoral condyle; T, tibia.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

Sagittal imaging in midline shows the posterior cruciate ligament (Fig. 21).

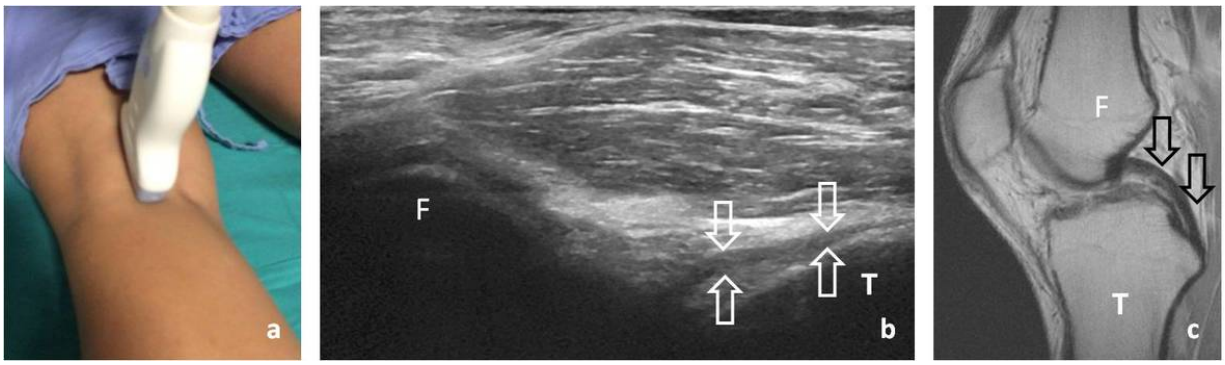

Fig. 21: Fig. 22: Probe position for the assessment of the posterior cruciate ligament (a). Sagittal imaging in midline (b) and MRI scan (c) show the posterior cruciate ligament (arrows). F, femur; T, tibia.
References: Radiology Department, Coimbra University Hospital - Coimbra/PT

Images for this section:

Knee compartment	Important Structures
Anterior	Quadriceps tendon Suprapatellar joint recess Parapatellar (medial and lateral) joint recesses Trochlear and femoral condyle articular cartilage Patellofemoral (medial and lateral) ligaments Patellar tendon
Medial	Medial collateral ligament Medial meniscus (body and anterior horn) Semimbranosus tendon Pes anserinus tendon
Lateral	Lateral collateral ligament Lateral meniscus (body and anterior horn) Biceps femoris Popliteus muscle Common peroneal nerve Iliotibial band
Posterior	Medial head of gastrocnemius and bursa Popliteal neurovascular bundle Menisci (posterior horns) Anterior cruciate ligament Posterior cruciate ligament

Table 1: The most important structures that can be found in each knee compartment.

Fig. 1: Position of the knee to evaluate the anterior compartment.

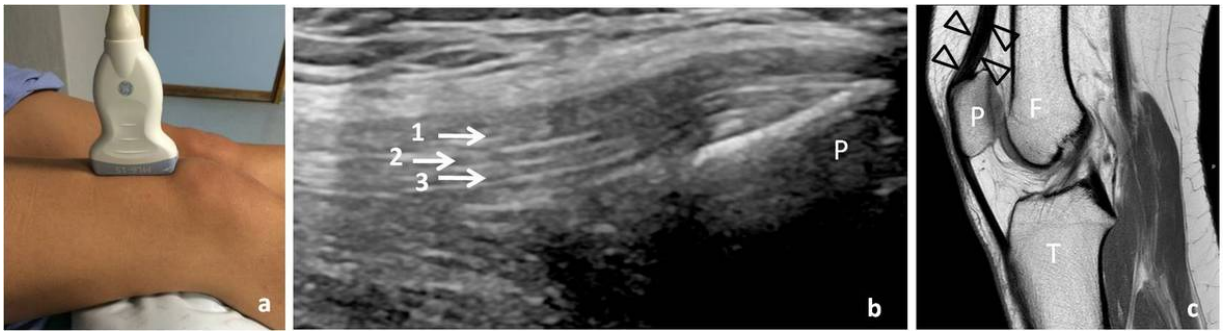

Fig. 2: Probe position to evaluate the quadriceps tendon long axis (a). The longitudinal scan (b) shows the trilaminar appearance of the tendon: the anterior layer from rectus femoris (arrow 1), the middle layer from vastus medialis and lateralis (arrow 2) and the deep layer from vastus intermedius (arrow 3). The MRI scan (c) shows the patellar insertion of the three layered quadriceps tendon (arrowheads). P, patella; F, femur; T, tibia.

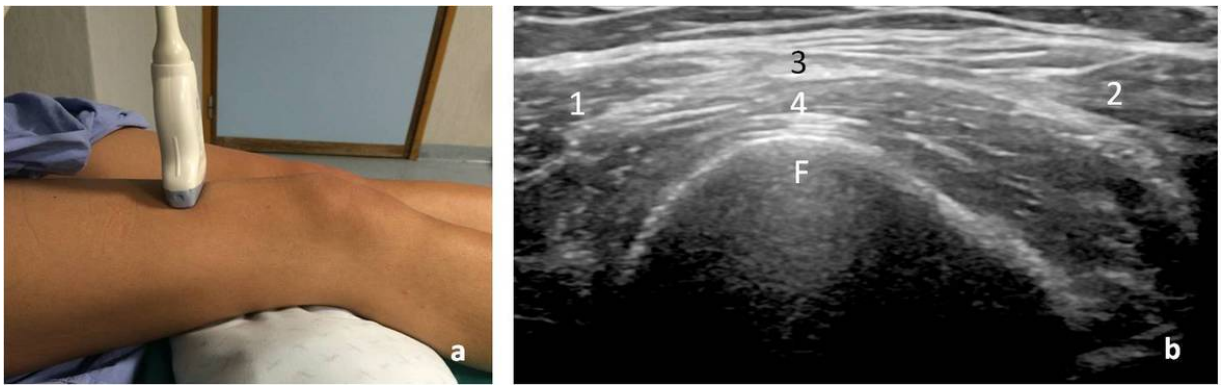

Fig. 3: Probe position for the evaluation of quadriceps tendon short axis (a). The axial scan (b) also shows the usual stratified appearance of the quadriceps muscle. 1. Vastus lateralis muscle 2. Vastus medialis muscle 3. Rectus femoris muscle 4. Vastus intermedius muscle; F, femur; T, tibia.

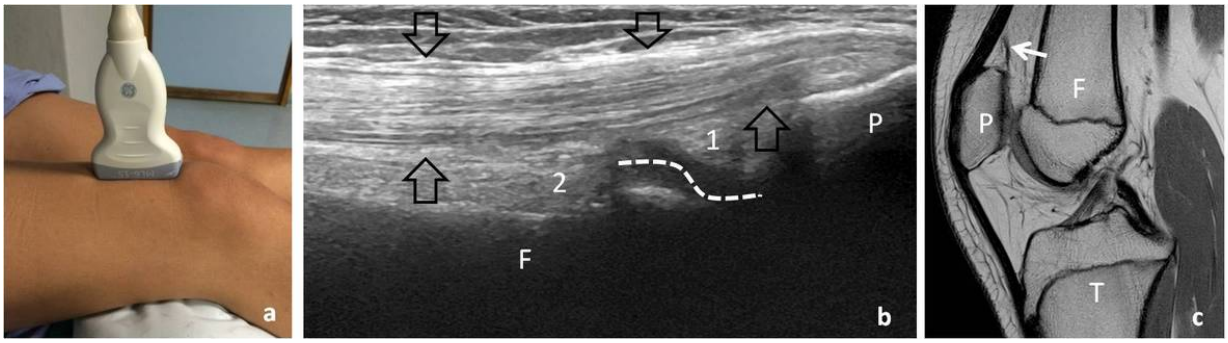

Fig. 4: Probe position for the evaluation of the suprapatellar recess (a). The ultrasound scan (b) shows the S-shaped suprapatellar synovial recess (dashed white line) separating the suprapatellar fat pad (1) from the prefemoral (2) fat pad. The quadriceps tendon (black arrows) runs anteriorly to the recess. The MRI scan (c) also shows the anatomical relationships between the suprapatellar recess (white arrow) and the aforementioned structures; F, femur; P; patella; T, tibia.

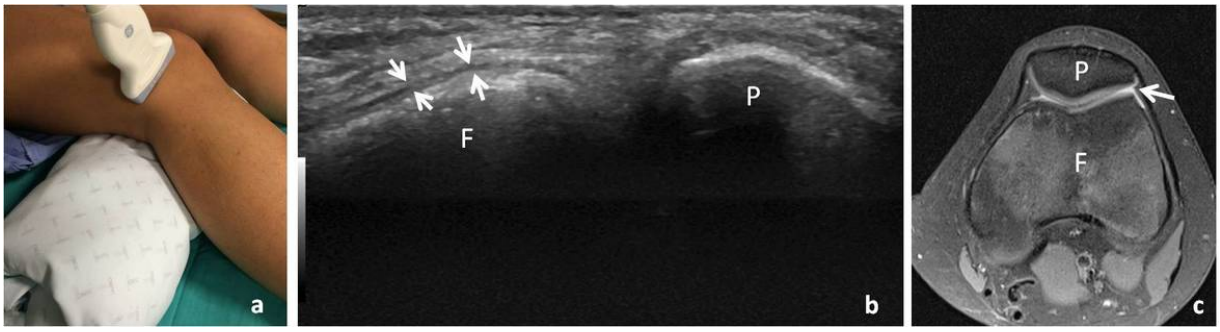

Fig. 5: Probe position to evaluate of the lateral parapatellar recess (a). The ultrasound scan (b) shows the lateral parapatellar recess (white arrows), a thin hypoechoic space anterior to the femur. The MRI scan (c) shows a physiological small amount of fluid in the lateral parapatellar recess (white line). F, femur; P; patella.

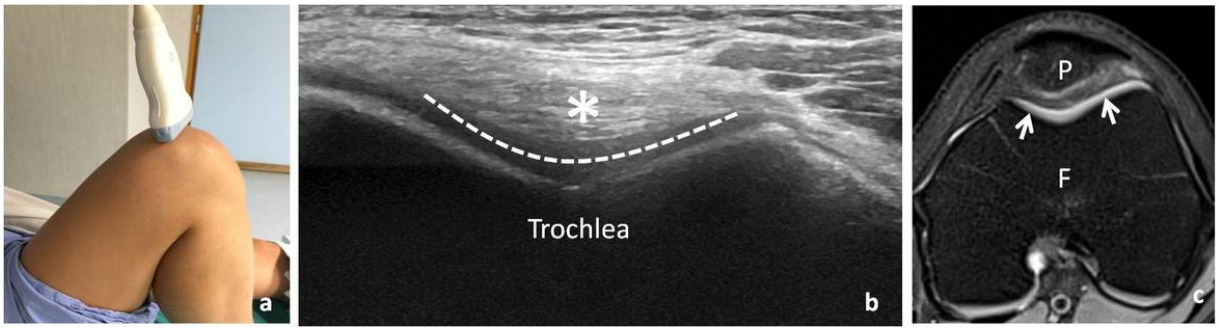

Fig. 6: Probe position for the assessment of the femoral trochlea (a). The axial scan (b) shows the V-shaped hypoechoic cartilage (dashed white line) covering the femoral trochlea. The quadriceps tendon (*) runs anteriorly. The femoral trochlea (white arrows) is also identified on the MRI scan (c). F, femur; P; patella.

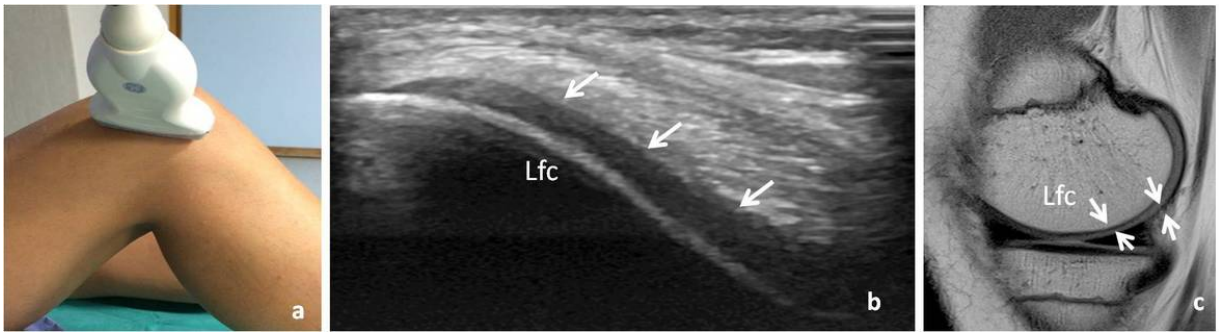

Fig. 7: Probe position for the evaluation of the lateral femoral condyle articular cartilage (a). The parasagittal scan (b) shows a hypoechoic line representing the hyaline cartilage covering the anterior aspect of the lateral femoral condyle (white arrows). This structure is easily assessed on knee MRI (c). Lfc, lateral femur condyle.

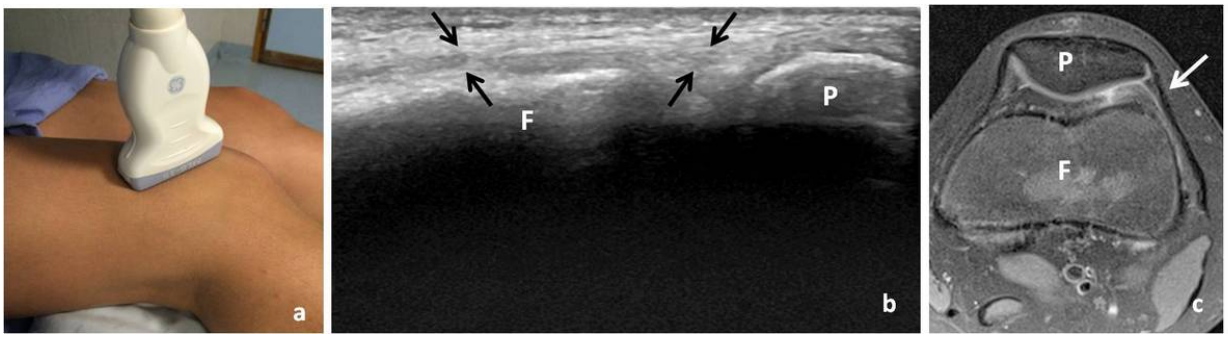

Fig. 8: Probe position to evaluate the lateral patellofemoral ligament (a). The ultrasound scan (b) shows the ligament (black arrows) as it inserts distally in the lateral border of the patella. On the MRI scan (c) the ligament (white arrow) appears as low-signal band that extends posteriorly to form the iliotibial band. F, femur; P, patella.

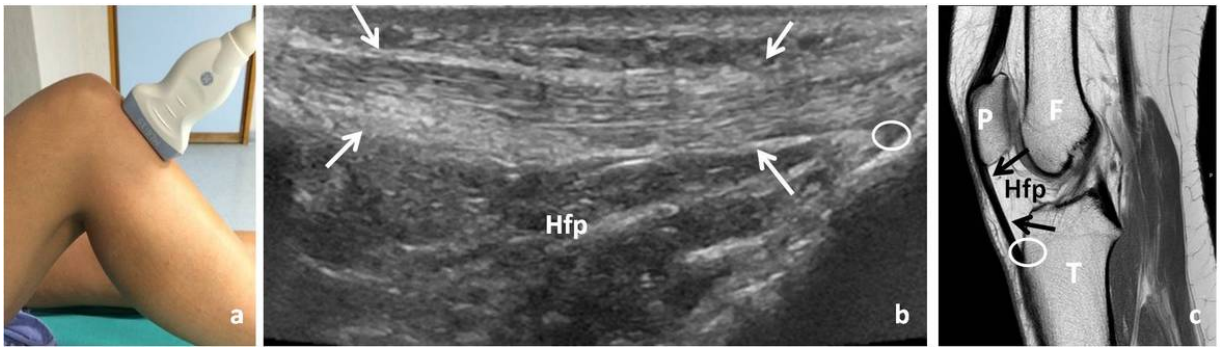

Fig. 9: Probe position for the evaluation of the patellar tendon (a). The ultrasound (b) and MRI scans show the normal appearance of the tendon (arrows). The Hoffa fat pad (Hfp) is posterior to the tendon. Near the tibial insertion of the tendon it is possible to identify the deep infrapatellar bursa (circle). F, femur; P, patella; T, tibia.

Fig. 10: Position of the knee to evaluate the medial compartment.

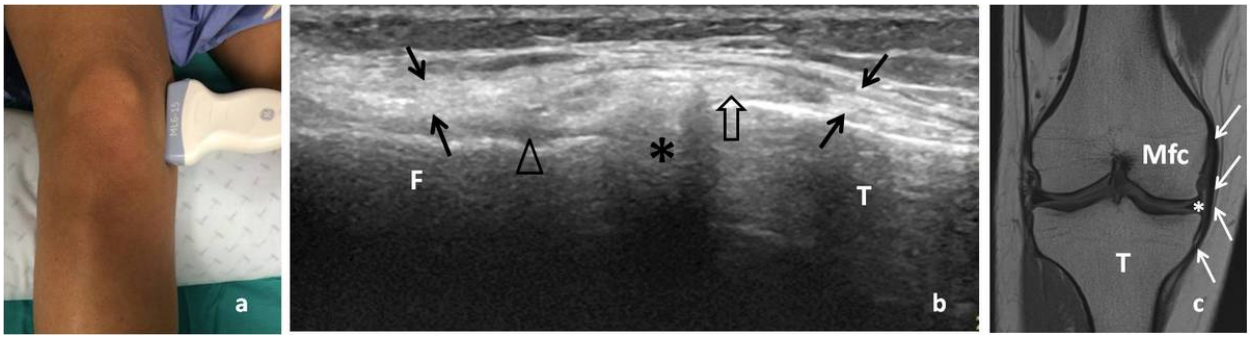

Fig. 11: Probe position for the evaluation of the anteromedial corner(a). The longitudinal ultrasound scan (b) shows the two layers of the medial collateral ligament: the superficial layer (or tibial collateral ligament, black arrows) and the deep layer constituted by the meniscofemoral ligament (arrowhead) and the meniscotibial ligament (void arrow). The MRI scan (c) shows the medial collateral ligament as a thin, well-defined, low-signal structure extending from the medial femoral condyle to the medial tibial metaphysis (arrows). The medial meniscus (*) is in close relationship with the ligament. Mfc, medial femural condyle; T,tibia.

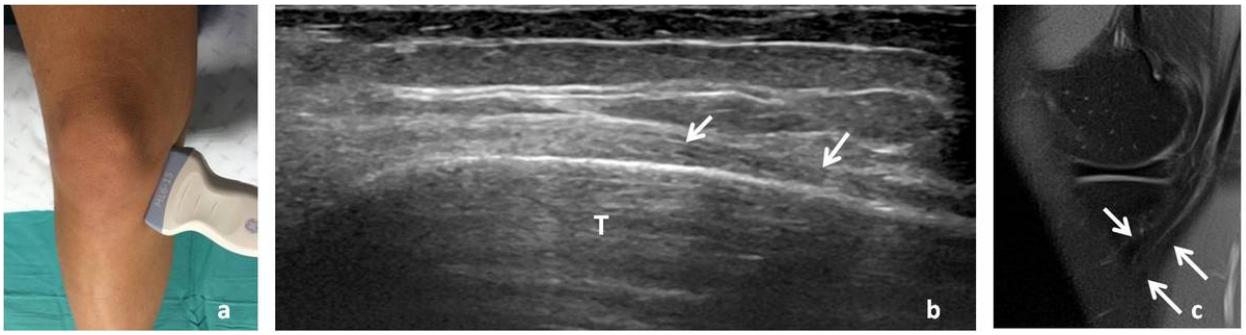

Fig. 12: Probe position for the assessment of the pes anserinus tendon (a). Ultrasound (b) and MRI (c) scans show the tibial insertion of the tendon (arrows). At this level the three tendons of the pes anserinus complex cannot be clearly individualized. T, tibia.

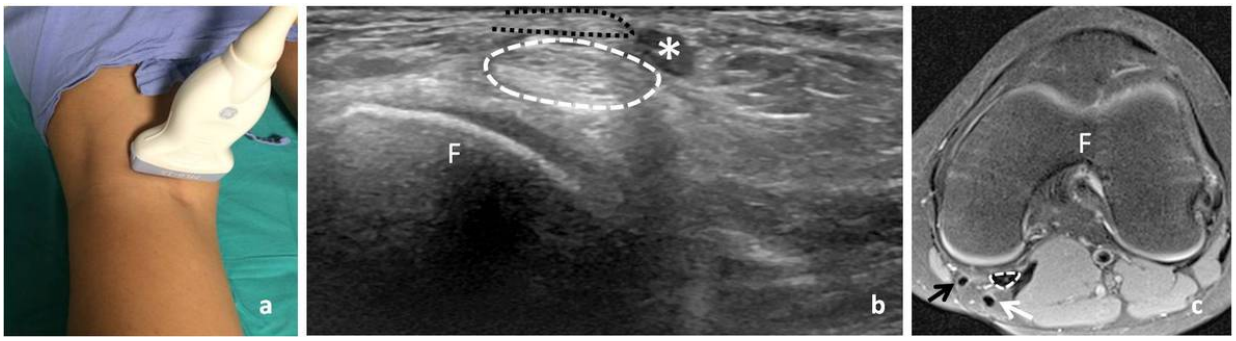

Fig. 13: Probe position for the evaluation of the semimembranosus tendon (a). Ultrasound axial plane (b) shows the semimembranosus tendon (dashed white line), posterior to the semitendinous (dashed black line) and gracilis (*) muscle. On the MRI scan (c) the anatomical relationships between the aforementioned structures (dashed white line, semimembranosus tendon; black arrow, gracilis muscle; white arrow, semitendinous muscle), are clear. F, femur.

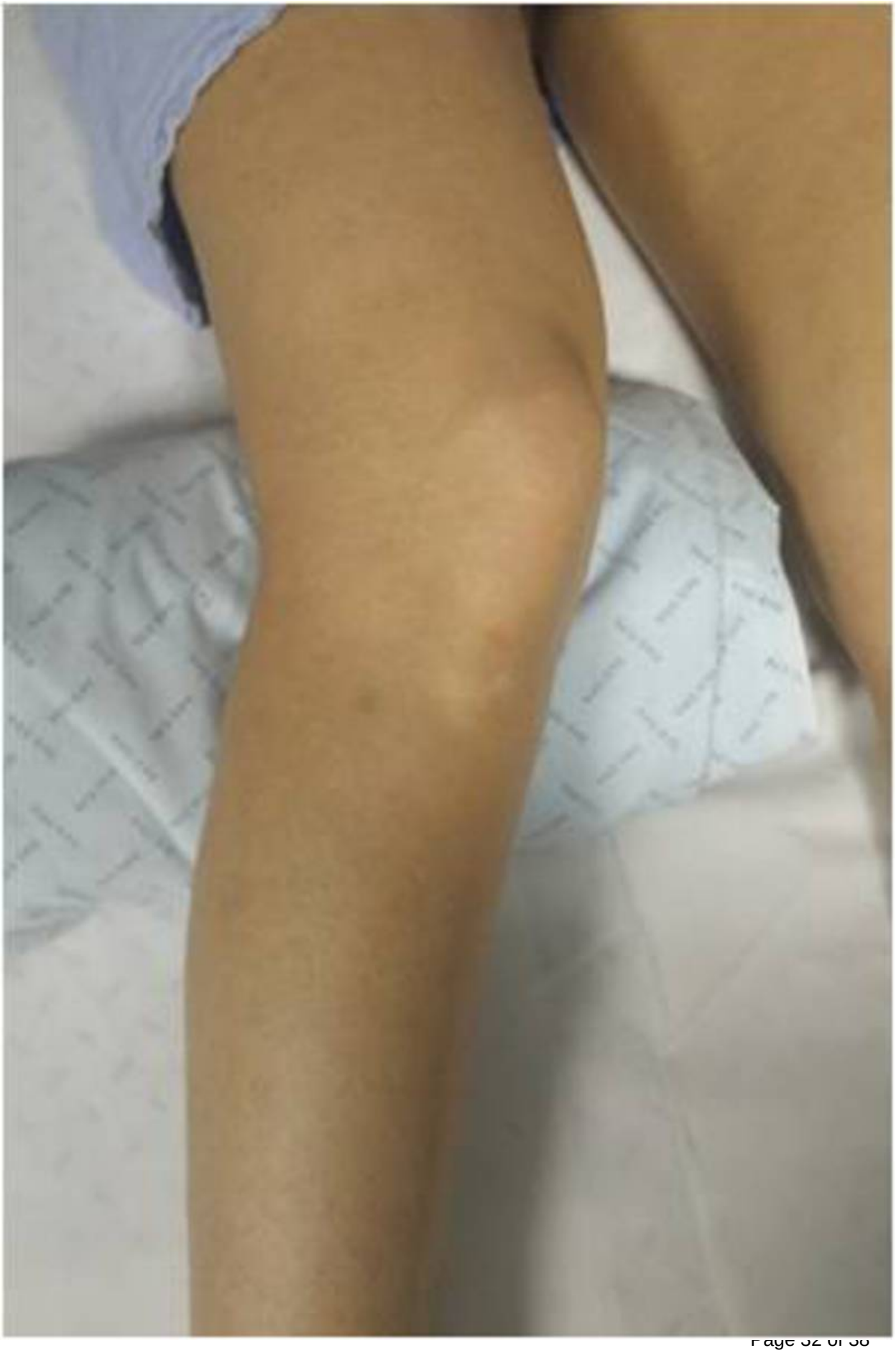

Fig. 14: Position of the knee to evaluate the lateral compartment.

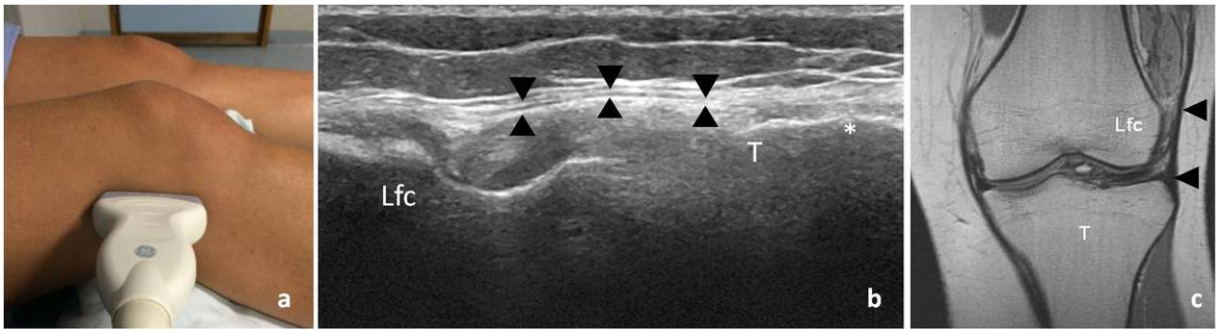

Fig. 15: Probe position to evaluate the iliotibial band (a). Ultrasound longitudinal plane (b) shows a thick hyperechoic band that corresponds to the iliotibial band (arrowheads). The distal insertion of this structure is the Gerdy's tubercle (*). On the MRI scan (c) this structure appears as a low-signal band (arrowheads).Lfc, lateral femoral condyle; T, tibia.

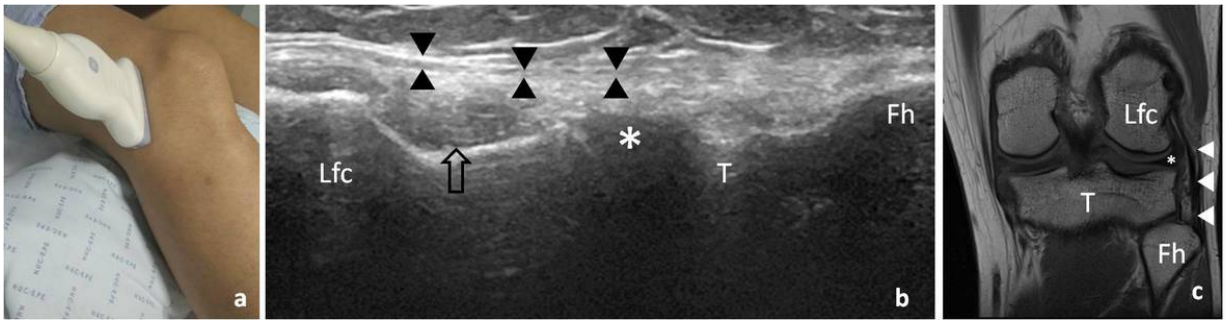

Fig. 16: Probe position for the assessment of the posterolateral corner (a). Ultrasound scan (b) shows the groove for the popliteus tendon (arrow) and the anterior horn of the lateral meniscus (*). The thick hyperechoic band representing the lateral collateral ligament runs anterior to the previously mentioned structures (arrowheads). On the MRI scan (c) the lateral collateral ligament is identified as a low-signal structure (arrowheads) extending from the lateral femoral condyle (Lfc) to the lateral aspect of the fibular head (Fh). T, tibia.

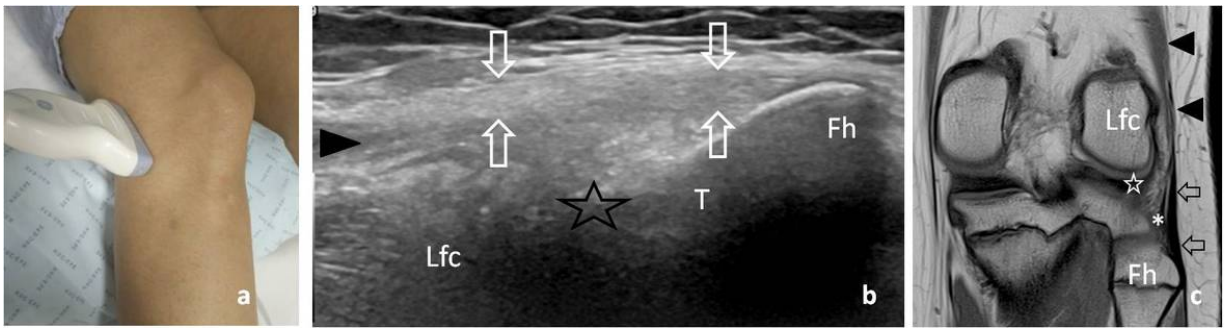

Fig. 17: Probe position to evaluate the biceps femoris (a). In the longitudinal scan (b) the hypoechoic biceps femoris muscle (arrowhead) progresses distally with the biceps femoris tendon (arrows) as it inserts in the fibular head (Fh). The MRI scan (c) shows the biceps muscle (arrowheads) and tendon (arrows) next to to the slightly internal lateral collateral ligament (*) as these structures insert in the fibular head (Fh). Lfc, lateral femoral condyle; T, tibia; Fh, femoral head; *, lateral meniscus.

Fig. 18: Position of the knee to evaluate the posterior compartment.

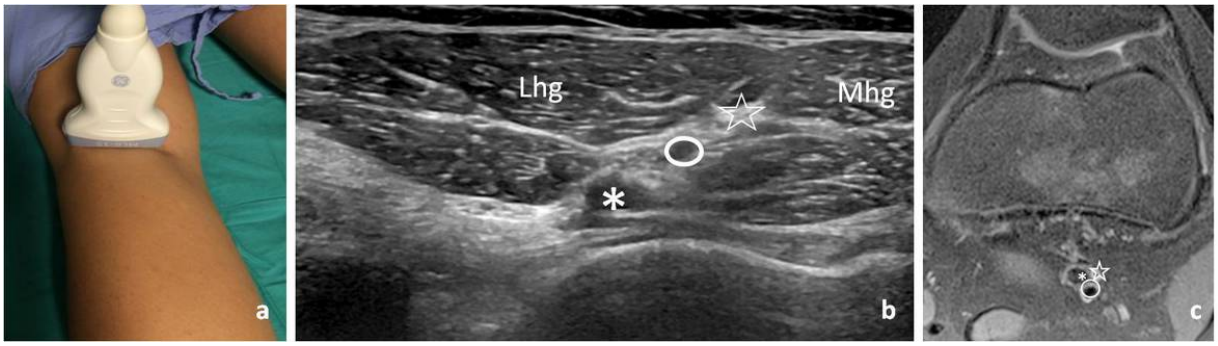

Fig. 19: Probe position to assess the popliteal neurovascular bundle (a). In the transverse ultrasound scan (b) one can identify the popliteal neurovascular bundle between the heads of the lateral (Lhg) and medial (Mhg) gastrocnemius. The popliteal artery (*) is posterior, the popliteal vein (circle) runs between the artery and the nerve and the tibial nerve (star) is superficial. These structures are also identified on the MRI scan. *, popliteal artery; circle, popliteal vein; star, tibial nerve.

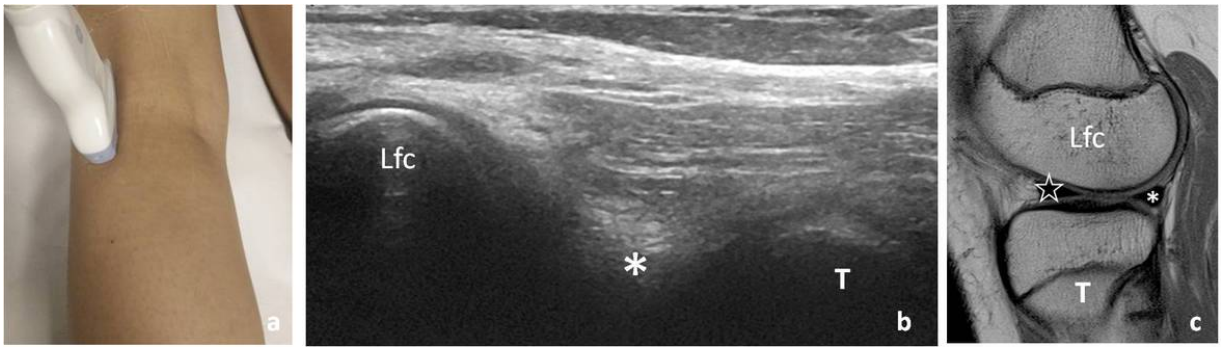

Fig. 20: Probe position for the evaluation of the posterior horns of the menisci (a). The longitudinal ultrasound scan (b) in the lateral aspect of the posterior knee shows the lateral posterior meniscus as a hyperechoic triangle (*). The MRI (c) shows the lateral meniscus. Unlike the medial meniscus (where the posterior horn is larger that the anterior horn), in the lateral meniscus both the anterior (star) and posterior (*) horns are about the same size. Lfc, lateral femoral condyle; T, tibia.

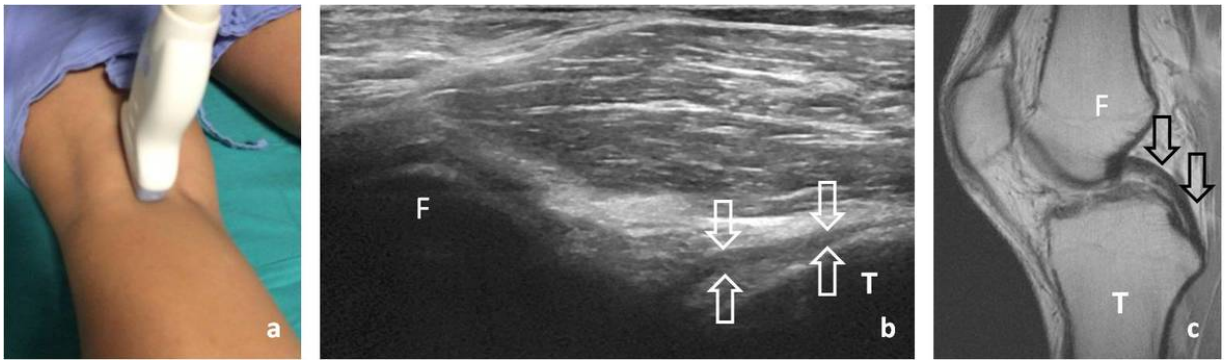

Fig. 21: Fig. 22: Probe position for the assessment of the posterior cruciate ligament (a). Sagittal imaging in midline (b) and MRI scan (c) show the posterior cruciate ligament (arrows). F, femur; T, tibia.

Conclusion

Although with some limitations, ultrasonography is a useful diagnostic imaging modality for the assessment of the knee. A deep knowledge of the normal anatomy and a systematic approach is important to ensure a good quality ultrasound examination and crucial to make the correct diagnosis.

Personal information

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