Quadratus Femoris Muscle edema as spectrum of Ischiofemoral impingement

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Purpose

Hip pain is a **very common** disease today and is a reason to demand the MRI implementation in public or private medical centres and physicians.

There is a **wide spectrum of diseases** involving the hip and groin regions, so a correct diagnosis is important **to prevent** therapeutic mistakes. Among others, the pathology of quadratus femoris muscle (QFM) is a common one, although until now, it was unknown. Recently, it has been described **several impingement syndromes** (in the knee, ankle), two of them affecting the hip: the femoroacetabular impingement and the ischiofemoral impingement. The last one is the entrapment of the QFM between the ischium and the lesser trochanter of the femur.

We have made a review describing the MRI findings associated with ischiofemoral impingement in patients with hip pain, because one of the causes for hip pain, is the QFM abnormalities caused among others, by ischiofemoral impingement.
Methods and Materials

We have reviewed retrospectively seven patients, six females and one male. Because it was a retrospective study, informed consent was not necessary.

All MRI examinations were performed on 1.5 Tesla MR (Intera and Achieva, Philips Medical Systems) using a phased array coil. Gadolinium was not necessary. The hips were positioned in a supine neutral position without fixing any structure. Both hips were imaged. Coronal T1W (TR/TE 575/18; NEX 4; matrix 428 x 318; slice thickness 4 mm; FOV 400 x 400 x70 mm) and STIR (TR/TE 2800/30; inversion time 140 ms; NEX 4; matrix 244 x 200; slice thickness 4 mm; FOV 360 x 384 x74 mm) sequences were obtained, also axial T2W and T2W with fat suppression (TR/TE 3000/30; NEX 2; matrix 456 x 283; slice thickness 3.6 mm; FOV 380 x 323 x93 mm). Then, gradient echo sequences were obtained in an oblique plane to both hips.

Six of our seven patients presented with hip pain, one of them associated with groin pain, other with contralateral sciatica. Only one did not complain of regional pain (nor hip, groin, buttock or sciatic) but with functional limitation. Five of them have undergone a lumbar MRI without pathological findings that could justify that pain or discomfort.

Faced with hip pain, it is important to evaluate carefully all regional structures that might be involved. That is why a systematic review of all anatomic structures of the pelvis is mandatory.

We have focused this review on a particular finding: the signal alteration of QFM showing edema. The quadratus femoris muscle covers the posterior aspect of the hip joint and has its origin in the ischium, inferolateral aspect, near the hamstring tendons. The muscle inserts on the posterior intertrochanteric ridge of the proximal femur. Along the anterior edge of the QFM is the obturator externus muscle. Posterior to the QFM belly there is a fatty pad overlying the sciatic nerve (fig. 1). So this nerve is in close relationship with the QFM. The inferior gemellus and fat are above the superior aspect of the QFM, and under it, lies the adductor magnus.

The radiologist, initially at the workstations, has to identify these muscles and the sciatic nerve: the QFM is better evaluated on axial images where its origin, insertion, anterior and posterior relations can be easily seen.

It is important to note the tight space that has the QFM belly on its way from its origin to the insertional point. We can distinguish two subdivisions: the ischiofemoral space and
the **quadratus femoris space**. The ischiofemoral space is the one between the lateral cortex of the ischium-ischial tuberosity and the medial cortex of the lesser trochanter (fig. 2). The quadratus femoris space is the one delimited by the anterolateral aspect of the hamstring tendons (semitendinosus, semimembranosus and biceps femoris muscles) and the posteromedial surface of the lesser trochanter. Frequently, as larger studies performed with MRI indicate, this distance is usually 20 and 13 mm respectively if there is no anatomic alterations. These spaces are well evaluated on axial images. Also the sciatic nerve, which is well defined by the surrounding fat.

On the other hand, the signal of the QFM is correctly evaluated on axial T2W images with fat suppression (fig. 3). If there is an impingement syndrome, the belly of the QFM becomes hyperintense on this sequence. It is important to differentiate the location of the edema. It is not the same that the signal alteration of the QFM will affect the miotendinous junction or the muscle belly. The first one lead us to a traumatic injury with strain of the myotendinous junction of QFM, and the latter lead us to a suffering pinched muscle, at the point of maximum constriction.

So the radiologist may review all **osseus and miotendinous structures** of the pelvis, particularly those involved in the ischiofemoral space and their relationships.
**Fig. 1:** Axial T2W image. Normal anatomy of the left hip. The QFM (Q), external obturator muscle (EO). Sciatic nerve (circle) and hamstring tendons (arrow). Ischium (I) and femur (F).

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Fig. 2: Axial T2W fat suppressed sequence: a left narrowed ischiofemoral space (red circle), comparing with the right, where the QFM can be seen perfectly.

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Fig. 3: T2W fat supressed axial sequence. An hyperintensity of the QFM is seen in the left hip (red arrow), not in the right (green arrow). This finding indicates muscle edema.

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Results

Our patients were six females and one male. This indicates that the configuration of the female pelvis predisposes to a narrowing of the ischiofemoral and quadratus femoris spaces. The pelvis is wider and shallower, and the ischial tuberosities are also wider.

We have considered of all patients with ischiofemoral narrowed space, those which presented QFM signal alteration (fig. 4). All of the patients except one complain of hip pain, with some specification: one also with groin pain, another one with a posterior leg irradiation, like sciatic pain. Only one did not complain of hip pain but with limitation of the right leg movements because of coxarthrosis. As a casual finding in this patient, the hypersignal of QFM was affecting the contralateral hip. The alterations of the QFM may cause hip, buttock, or groin pain, and the irritation of the sciatic nerve (posterior to the muscle) as an irradiated pain from the posterior tight.

All of our patients presented with a narrowed ischiofemoral space and also with an abnormal MR signal intensity of the QFM. A narrowed ischiofemoral space can be congenital: osteochondroma, prominent lesser trochanter, a valgus hip... or can be reduced in acquire conditions like fractures, degenerative arthritis, osteotomy. One patient presented a prominent lesser trochanter in the context of a hip dysplasia (fig 9 and 10). She had a flattened acetabulum and a distortion of the normal femoral head morphology. This alteration in the left hip configuration narrowed the space along which the QFM runs.

Threshold measurements are given by some authors to asses about the ischiofemoral space (about 20 mm). But now a days, there is no a clear validation of them in the literature.

The constant finding is the alteration of the normal MRI signal of the QFM, as edema (fig. 5). All the patients had an hyperintensity of QFM on fat supressed T2W images. Two of the seven cases presented a bilateral narrowed ischiofemoral space, but unilateral muscle hyperintensity (fig. 8). One of them did not complain of hip pain, and the other one presented with sciatic symptoms on the contralateral side to the affected muscle; consequently both were considered as a casual finding. It is importat to take into account that it is a diffuse edema of the muscle (opposed to focal edema at the musculotendinous junction in partial tears).

Another feature was an abnormal signal of the hamstring tendons that a patient presented, without partial tears in the hamstring attachment (figs. 6 and 7).
There are described other disorders in the literature such as edema of the iliopsoas tendon and hypertrophic changes of the ischial tuberosity, which accentuates the ischiofemoral space narrowing.

So in our patients, it was important the triad of hip pain, signal intensity alteration of the QFM and an ischiofemoral narrowed space as features to diagnosed an IFI.
Images for this section:

**Fig. 4:** Axial T2 fat supressed sequence. A: Right hip with normal ischiofemoral space, larger than the left (red mark). A normal QFM (green star). B: the pathologic left hip.

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**Fig. 5:** T2W fat supressed axial sequence: marked alteration of the QFM signal in a patient complaining of left hip pain.

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![MRI Image](image)

**Fig. 6:** The left hamstring tendons presented also an hyperintensity on T2W fat supressed sequences (red circle). When the impingement is significant, the hamstring tendons may be affected.

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Fig. 7: T2 fat supressed sequence. Consecutive axial images (1-4). A narrowed ischiofemoral space can be seen, with edema of the QFM. The affected hamstring tendons (red arrow) of the left hip are shown compared to the otherwise hip, which present an homogeneous hypointense signal (yellow).

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Fig. 8: A: Axial T2W image. It shows bilateral narrowed ischiofemoral spaces. B: Fat supressed T2 axial sequence. Only one of the two QFMs, left side, presents hyperintensity because of edema. This patient had no symptoms.

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Fig. 9: Coronal T1W sequence in a patient with hip dysplasia. The red arrows mark a left flattened acetabulum, an abnormal femoral head, and a secondary prominent lesser trochanter.

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Fig. 10: Hip dysplasia. A and B: abnormal femoral head (F) and a prominent lesser trochanter (red circle). C: Fat supressed sequence showing the signal alteration of the QFM, caused by the proximity of the lesser trochanter secondary to hip dysplasia (arrow). Also a hyperintensity of the adductor muscles is shown (asterisk).

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Conclusion

1 Hip pain is **highly prevalent** in the population. The increased use of MRI for the study of the hip is evident (conventional MRI or MR artrography).

2 Many conditions have been reported in the literature leading hip-groin pain, traumatologic or not: disc disease, spinal stenosis, muscle strains, femoroacetabular impingement, rheumatoid arthritis, inguinal hernias, pelvic inflammatory diseases... The symptoms are not specific, so this syndrome can be **underdiagnosed** or diagnosed as other pathology afore mentioned. The clinicians should be alert to detect increased pain with the maneuvers that impinge the muscle. So this entity, **more frequent than spected**, is important to emphasize these findings to properly orient the patient and treatment.

3 The diagnosis of IFI depends, as other impingement syndromes, on **clinical and imaging** features.

4 The most important imaging features are the **narrowed** ischiofemoral space (between the ischial tuberosity-lateral aspect of the ischium and the lesser trochanter of the proximal femur), and the QFM **hyperintensity** caused by edema.

5 When edema of the QFM is detected, the **ischiofemoral space should be carefully evaluated**, as its narrowing may be considered a potential cause of edema and hip pain.

6 These features make necessary the **knowledge of the radiologist** about the precise hip anatomy.
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