Ischiofemoral impingement: spectrum of findings

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Ischiofemoral impingement (IFI) is a rare cause of hip pain that is due to an abnormal contact between the lesser trochanter of the femur and the ischium. This is the result of a narrowing of the ischiofemoral space, leading to muscular, tendon and neural changes.

This anomaly was first described in patients after total joint replacement but it has since been described in young patients with no history of trauma in association with anatomical or functional disorders.¹

Clinically, patients present groin pain, that frequently radiates distally from the posterior thigh, caused by irritation of the sciatic nerve. Pain may increase during specific motions such as hip flexion, abduction and/or internal rotation.

The purpose of our study is to describe the imaging findings in this pathology and analyze its incidence in young patients with hip pain and with no history of trauma, associated to dysplasia and other anatomical disorders.
Methods and Materials

We retrospectively revised all hip MRI carried out in our institution in the last 4 years (from January 2009 to December 2012). There were a total of 90 studies of 89 patients between 20 and 67 years old (mean age of 38). We reviewed the studies using the PACS.

We also reviewed all the clinical histories of our patients, paying special attention to the clinical onset symptoms and the radiology reports from the MRI studies, as well as the background and follow-up after treatment of our patients. We used the computer system of our institution (SAP).

1. MRI technique:

All MRI were performed in a 1.5 or 3T using a phased array coil.

Our protocol includes the standard sequences of a hip study: axial and coronal T1 and DP fat suppressed weighted images of the pelvic ring and T1 and DP fat suppressed weighted images localized at the hip in the three planes. In all cases both hips were imaged with MRI. Radial planes were realized in some cases. Contrast material was given in a few cases.

2. Measurements and other parameters taken into consideration:

Pelvic anatomy must be known precisely to be able to depict this abnormality, and there are different structures to be considered.

MRI images of all patients were analyzed for the following data:

1. Neck-shaft angle: the angle between the long axis of the femoral neck and the long axis of the femoral shaft on coronal images. In a normal adult, this is about 125°, being greater in newborns (150°) and smaller in elderly populations (120°). An increase in the inclination angle of the femur neck is defined as a coxa valga that will affect both knee and hip function.

2. Wiberg angle: also known as CE (centre-end of the roof). Angle formed by a line drawn from the centre of the femoral head to the outer edge of the acetabular roof, and a vertical
line drawn through the centre of the femoral head on a coronal plane. Angles greater that 25º are considered normal and angles less than 25º indicate dysplasia. ³ Fig. 1 on page 5

3. Anterior acetabular sector angle (AASA), posterior acetabular sector angle (PASA) and femoral anteversion. These measurements are particularly useful in the evaluation of acetabular dysplasia. ³ Fig. 2 on page 5

4. Ischiofemoral space (IFS): the smallest distance between the lateral cortex of the ischial tuberosity and the medial cortex of the lesser trochanter of the femur. The normal distance is 20mm or more, measured on axial planes². A distance of under 20mm is considered abnormal and IFI must be considered as responsible for the symptoms.

5. Quadratus femoris space (QFS): space between the hamstring tendons and the lesser trochanter on axial images. This is the space through which the quadratus femoris muscle passes. It is considered normal when the smallest distance is above 7mm.²

6. Hamstring tendon area (HTA): semimembranosis, semitendinosis, and the biceps femoris tendons form the hamstring tendons and may contribute to the narrowing of the QFS and the development of IFI.

7. The quadratus femoris muscle is a flat quadrilateral muscle that extends from the external border of the ischial tuberosity and inserts into the quadrate tubercle of the femur in the lesser trochanter. Changes in the intensity signal may be seen in acute and chronic cases of muscle entrapment, such as edema, fibrilar ruptures and fatty replacement.
Images for this section:

**Fig. 1:** Coronal T1 weighted image shows measurement of the right Wiberg angle with a normal result (>25).

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Fig. 2: Axial DP fat suppressed weighted image shows measurement of AASA and PASA.

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Results

1. Introduction:

Ischiofemoral impingement is caused by a narrowing of the ischiofemoral space and leads to muscular, tendon and neural changes.

Patients present with nonspecific hip and groin pain, raising a wide range of differential diagnoses.

2. Differential diagnosis of hip pain:

Positive results for IFI in our study were seen in 11 studies corresponding to 10 patients (12%) between 28 and 64 years old (mean age of 44). One patient had an operation after diagnosis and an MRI was repeated after surgery.

Other positive results from the MRI images included femoroacetabular impingement (FAI) in 32 patients (32%), trochanteritis in 4 patients (4.4%), sacroileitis in 3 patients (3.3%), bursitis in 2 patients (2.2%), avascular necrosis of the femoral head in 2 patients (2.2%), sequelae of Perthes in 2 patients (2.2%), 1 case of liposarcoma (1.1%) and 1 acetabular fracture (1.1%).

3. IFI and anatomy of the hip:

Our results show a tendency of ischiofemoral impingement to develop in patients with coxa valga, more frequently in women and in dysplastic hips.

3.1. Women and IFI:

Of the 10 patients with positive results for IFI, eight were young women (80%) and there were only two men (20%), which suggests that women may be more prone to impingement because of the wider positioning of the ischial tuberosities in the female pelvis.

3.2. IFI and coxa valga:
The neck-shaft angle was measured and the 10 patients (100%) had an enlarged angle corresponding to coxa valga. Fig. 3 on page 11 and Fig. 4 on page 11.

3.3. IFI and dysplasia:

Hip dysplasia is not uncommon in adults, and can vary from subtle acetabular dysplasia to complex sequelae of developmental dysplasia of the hip.

Dysplasia in adults is caused by a non resolved dysplasia from childhood or due to hormonal or mechanical factors. Bone and soft tissues are assumed to be normal and they are submitted to chronic forces that exceed their level of tolerance causing bone deformation and articular soft tissue changes that lead to articular degeneration. The femoral head is displaced ventrolaterally causing instability of the hip and adopting an exaggerated valgus position that contributes to IFS narrowing.

Five of our patients had a dysplastic-kind hip (50%), of which only one corresponded to a true dysplasia Fig. 5 on page 12 with a Wiberg angle < 25° (6°) and the other 4 corresponded to minor dysplasia or instabilities.

These instabilities can be classified according to the measurement of the other angles, AASA and PASA, as instability of the anterior column, the posterior column, or both. In our patients, two had affection of both columns, one had a posterior instability and one an anterior instability.

3.4. IFI and FAI:

Femoroacetabular impingement or FAI is a condition of too much friction in the hip joint causing damage to the articular cartilage or the labral cartilage. FAI generally occurs as two forms: Cam and Pincer. The Cam form describes the femoral head and neck relationship as aspherical, the Pincer form describes the situation where the acetabulum has too much coverage of the femoral head. Most of the time they coexist.

In our results, there was one case of IFI associated with FAI type PINCER due to acetabular retroversion. It corresponded to a young athlete man Fig. 6 on page 13.

3.5. Pure IFI:

Of the 10 patients with IFI, only 4 (40%) had a non dysplastic hip and no findings of FAI.
4. MRI signs:

Bilateral involvement was found in 8 cases (80%), more often with asymmetrical findings. 
Fig. 7 on page 14

1. Narrowing of the ischiofemoral space varied from 5mm to 1.5cm and severe clinical symptoms were not related to narrower spaces. All spaces were measured on an axial plane, T1 or T2 W. Fig. 8 on page 15

2. Changes in the quadratus femoris muscle were seen in 9 cases, from edema (most frequently) to fibrilar ruptures. The narrowing of the IFS can compress the muscle causing edema, inflammation and fatty replacement. Edema was seen as focal edema in the region of the muscle at the narrowest point of the IFS Fig. 9 on page 16 and also as diffuse edema extending outside the muscle Fig. 10 on page 17. These changes in the QFM can also cause a narrowing of IFS and QFS due to enlargement of the muscle.

Fibrilar ruptures were described in five cases Fig. 11 on page 18

When radiologists find changes in QFM, narrowing of the IFS should be studied. All our cases were acute onsets so no fatty infiltration was seen.

3. Hamstring tendon changes were described in 4 cases as enlarged tendons or fluid surrounding tendons due to inflammation, contributing to the narrowing of the QFS. Fig. 12 on page 19 Fig. 13 on page 20

4. Involvement of other structures can also be found: for example, the inflammation can extend further and affect the iliac psoas muscle, the external obturator muscle or the sciatic nerve.

The iliac psoas muscle was involved in three cases Fig. 14 on page 21, the external obturator muscle Fig. 15 on page 26 Fig. 16 on page 22 was affected in two cases and we had one case of sciatic nerve affection Fig. 17 on page 23

5. Incidental findings:
Incidental findings such as one case of trochanteritis and one case of schwannoma of the sciatic nerve Fig. 18 on page 24 were found in patients with positive results for IFI.

6. Treatment:

Optimal treatment in these patients remains unclear\textsuperscript{1}.

Usually, conservative treatment is the rule, with either oral drugs, such as nonsteroidal antiinflammatory, or echo-guided instillations to reduce pain. Physiotherapy is recommended.

Recently, surgery is beginning to have a role in these cases\textsuperscript{4}, with resection of the lesser trochanter that widens the ischiofemoral space, which appears to obtain positive clinical results and partial relief of symptoms. Fig. 19 on page 25
Fig. 3: A 39-year-old woman with bilateral hip pain. Coronal DP fat suppressed weighted image shows the measurement of neck-shaft angle of the left hip, defined as the angle between the long axis of the femoral shaft and the long axis of the femoral neck. In this case, it is increased (143.5°), which suggests the diagnosis of coxa valga. Fluid signal on the right side surrounding the lesser trochanter is also seen.

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**Fig. 4:** Coronal DP fat suppressed weighted image in a 49 year-old female with left hip pain demonstrates increase in the neck-shaft angle, defined as a coxa valga.

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**Fig. 5:** A 47 year-old woman with chronic bilateral hip pain. Coronal DP fat suppressed image shows decrease in the Wiberg angle corresponding to a true dysplasia.

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**Fig. 6:** A 28 year-old man with left hip pain. Axial DP fat suppressed image shows FAI due to acetabular retroversion.

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Fig. 7: A 47 year-old woman with chronic bilateral hip pain. Axial DP fat suppressed weighted image shows bilateral narrowing of the ischiofemoral space, more important on the left side.

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Fig. 8: Same patient as in Figure 6. Axial DP fat suppressed weighted image shows narrowing of the left ischiofemoral space.

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**Fig. 9:** A 47 year-old woman with bilateral hip pain. Axial DP fat suppressed image shows narrowing of both ischiofemoral spaces, more important on the left side, where changes in the quadratus femoris muscle are seen, indicating edema.

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Fig. 10: A 33 year-old female with dysplasia and right hip pain. Localized axial DP fat suppressed image shows narrowing of the ischiofemoral space and diffuse edema affecting the quadratus femoris muscle and external obturator muscle.

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Fig. 11: A 47 year-old woman with hip dysplasia and bilateral pain. Axial DP fat suppressed weighted images show narrowing of both ischiofemoral spaces and affection of the quadratus femoris muscle, more important on the left side, compatible with edema and fibrilar ruptures.

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Fig. 12: A 35 year-old female with left hip pain. Axial DP fat suppressed image demonstrates important narrowing of the ischiofemoral space (7mm) and edema of the quadratus femoris muscle. Thickening of the hamstring tendons is also seen.

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**Fig. 13:** Same patient as in Figure 4. Axial DP fat suppressed weighted image demonstrates thickening of the hamstring tendons on the left side with fluid signal around them. Narrowing of both ischiofemoral spaces and edema of both quadratus femoris muscles is also seen.

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**Fig. 14:** Same patient as in Figure 11. Axial DP fat suppressed weighted image shows high fluid signal in the left quadratus femoris muscle and in the right iliac psoas muscle. A cystic lesion in the left ischial tuberosity is visualized.

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Fig. 16: A 55 year-old woman with hip pain and a palpable small tumoration on the posterior lateral aspect of the right thigh. Axial DP fat suppressed weighted image shows narrowing of both ischiofemoral spaces with affection of both quadratus femoris muscles. The external obturator right bursa is distended, as is the ischiatic bursa. Fibrilar ruptures of the hamstring tendons are also visualized.

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Fig. 17: Same patient as in Figure 12. Localized axial DP fat suppressed weighted image shows thickening of the left sciatic nerve, narrowing of the ischiofemoral space and edema of the quadratus femoris muscle.

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Fig. 18: Same patient as in Figure 16. Coronal and axial DP fat suppressed weighted images and sagital T2 weighted image demonstrate a small oval hyperintense tumor corresponding to a sciatic nerve schwannoma.

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**Fig. 19:** A 45 year-old female with important hip pain. Axial T2 fat suppressed weighted image before and after surgical resection of the lesser trochanter. A decrease in the edema of the quadratus femoris muscle is seen after surgery.

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**Fig. 15**: Same patient as in Figure 10. Coronal DP fat suppressed weighted image shows edema of the external obturator.

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Conclusion

Ischiofemoral impingement is a rare pathology that causes hip pain in young patients but it seems to be more common than we thought, especially in cases of women with coxa valga and dysplasia. Fig. 20 on page 29

Radiologists and clinicians should bear this diagnosis in mind. We must take into account the imaging findings in this disorder in order to depict this anomaly. A correct MRI study with clinical correlation is usually sufficient to make the diagnosis.
Images for this section:

**Fig. 20:** Coronal DP fat suppressed weighted images from posterior to anterior show narrowing of the ischiofemoral space, hamstring tendon thickening and edema of the quadratus femoris muscle. The last image shows coxa valga. Same patient as in Figure 19.

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References