Ischiofemoral impingement in young patients

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Learning objectives

To illustrate the pathogenesis and imaging findings of acquired ischiofemoral impingement in 3 young patients (age-range between 14-38 years-old) presenting with chronic pain in the groin or buttock.

Background

Ischiofemoral impingement (IFI) is a rare cause of hip pain related to narrowing of the space between the ischial tuberosity and the lesser trochanter, causing mechanical impingement of the intervening soft tissues. Most frequently, the quadratus femoris muscle (QFM) is involved. It is usually seen in middle-aged woman, but occurrence in younger patients is less frequent. IFI was first described in 1977 by Johnson in three patients with persistent hip pain after hip surgery, two after total hip arthroplasty and one after proximal femoral osteotomy.

The ischiofemoral space (IFS) is the narrowest osseous distance between the lateral cortex of the ischial tuberosity and the medial cortex of the lesser trochanter (Fig. 1 on page 5). In normal circumstances, this distance should be more than 23 mm, whereas a distance less than 13 mm is abnormal.

The quadratus femoris muscle is located at the posterior side of the hip joint. The origin is at the anterolateral border of the ischial tuberosity and the insertion is at the posterior side of the proximal femur (Fig. 1 on page 5). Its main function is external rotation and adduction of the hip.

The quadratus femoris space (QFS) measures the distance between the soft tissue landmarks of the superolateral surface of the hamstring tendons and the posteromedial surface of the distal iliopsoas tendon (Fig. 1 on page 5). A distance of 7 mm is abnormal, with 12 mm being a normal value.
**Fig. 1:** Normal axial T1-WI of the left hip. A normal QFM (thick arrow) is seen. The ischiofemoral space (line A) is defined by the narrowest distance between the lateral cortex of the ischial tuberosity (sphere) and the medial cortex of the lesser trochanter (star). The quadratus femoris space (line B) is delineated by the superolateral surface of the hamstring tendons (thin arrow) and the posteromedial surface of the distal iliopsoas tendon (curved arrow).

**References:** Department of Radiology, AZ Sint-Maarten, Mechelen-Duffel, Belgium

The etiology of narrowing of the IFS can be divided into three main categories: congenital, acquired and positional (Table 1). Most often, IFI is acquired and is seen in middle-aged or older women after valgus osteotomy or hip arthroplasty. Secondary IFI due to a solitary of bilateral exostosis (in patients with Hereditary Multiple Exostosis Syndrome) is a rare cause. In 20% to 45% of the patients, IFI is bilateral or occurs in young people, supporting the hypothesis of predisposing congenital narrowing.

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<tr>
<th>Congenital</th>
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<th>Positional</th>
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<td>Bone lesions</td>
<td>Soft tissue lesions</td>
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<th>Congenital</th>
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<td>Bone lesions</td>
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<td>Factor</td>
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<td>Posteromedial position of the femur¹</td>
<td>Expansile bone lesions</td>
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<td>Larger cross-section of the proximal femur¹</td>
<td>Degenerative hip disease³</td>
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<td>Prominence of the lesser trochanter</td>
<td>Valgus-producing osteotomy</td>
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<td>Low position of the ischiopubic ramus</td>
<td>Posttraumatic</td>
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<td>Female pelvic configuration²</td>
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¹ causing narrowing of the distance between the lesser trochanter and the ischial tuberosity

² wider pelvis, with greater distance between the ischial tuberosities in comparison to the male pelvis

³ causing cranial and medial migration of the femur

⁴ with hip held in flexion, abduction and endorotation

Table 1. Pathogenetic factors causing ischiofemoral impingement.

Clinically, IFI usually presents as chronic, non-traumatic groin or buttock pain in middle-aged women. This pain may radiate from the posterior side of the upper leg to the knee (ischialgia), caused by the pressure effect of an edematous QFM on the sciatic nerve. Other symptoms described in IFI are snapping, crepitation and locking.

There is no specific clinical test to diagnose IFI. However, pain can be provoked by exorotation of the hip, extension and adduction and stretching with the hip held in endorotation, flexion and abduction. Focal pressure at the ischial tuberosity can be painful.

The differential diagnosis of IFI includes a wide variety of intra- and extra-articular causes of hip or groin pain, such as degenerative hip disease, labral tear or adductor tendinopathy. When pain irradiates to the lower leg, IFI may even mimic lumbar discopathy, spinal stenosis and hamstring tendinopathy. Further potential differential diagnoses are summarized in Table 2 and are beyond the scope of this poster.
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<th><strong>Intra-articular</strong></th>
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<tr>
<td>Degenerative hip disease</td>
<td>Ischiofemoral impingement</td>
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<td>Labral tear</td>
<td>Strain/tear quadratus femoris muscle without narrowing of the ischiofemoral space</td>
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<td>Femoroacetabular impingement</td>
<td>Adductor-, hamstring- or iliopsoas tendinopathy/bursitis</td>
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<td>Spinal stenosis</td>
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<td>Inguinal hernias/mass lesions</td>
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<td>Urinary tract problems</td>
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**Table 2. Main differential diagnosis of ischiofemoral impingement.**

As previously mentioned, although IFI is usually encountered in middle-aged patients, we report 3 cases of the disease in relatively young patients (see next section on imaging findings).

**Images for this section:**
Fig. 1: Normal axial T1-WI of the left hip. A normal QFM (thick arrow) is seen. The ischiofemoral space (line A) is defined by the narrowest distance between the lateral cortex of the ischial tuberosity (sphere) and the medial cortex of the lesser trochanter (star). The quadratus femoris space (line B) is delineated by the superolateral surface of the hamstring tendons (thin arrow) and the posteromedial surface of the distal iliopsoas tendon (curved arrow).
1) The first patient was a 22-year old male, referred to the radiology department because of right groin pain, aggravating by external rotation of the hip.

Plain films (Fig. 2 on page 18) of the right hip revealed a large sessile exostosis at the medial aspect of the lesser trochanter, resulting in narrowing of the distance between the lesser trochanter and the ischial tuberosity.

Fig. 2: Initial anteroposterior radiography of both hips. A large exostosis is seen on the medial aspect of the right femoral neck (arrow), resulting in narrowing of the distance between the ischial tuberosity (star) and the lesser trochanter.

References: Department of Radiology, AZ Sint-Maarten, Mechelen-Duffel, Belgium

On magnetic resonance imaging (MRI) (Fig. 3 on page 19 and Fig. 4 on page 20), a marked narrowing of the ischiofemoral space with accompanying edema of
the quadratus femoris muscle (QFM) was seen. There also was a thin overlying layer of cartilage at the surface of the exostosis, as well as some foci of hyaline cartilage protruding into the exostosis. After administration of intravenous gadolinium contrast, a faint enhancement of the surface cartilage and the cartilaginous changes was observed. There were no signs of malignancy.

Fig. 3: MRI of the pelvis. Axial T1-weighted images (WI) show a significant narrowing of the ischiofemoral space (arrows) due to the exostosis, in comparison with the normal left side.

References: Department of Radiology, AZ Sint-Maarten, Mechelen-Duffel, Belgium
Fig. 4: MRI of the pelvis. Axial fat-suppressed T2-WI show focal edema of the muscle belly of the QFM (arrow), caused by impingement between the surface of the exostosis and the ischial tuberosity. Note the presence of a thin layer of cartilage at the surface of the exostosis (arrowheads).

References: Department of Radiology, AZ Sint-Maarten, Mechelen-Duffel, Belgium

Based on the imaging findings, the diagnosis of ischiofemoral impingement due to a benign exostosis at the femoral neck was made. Because of failure of the initial conservative treatment, a resection of the exostosis was planned. In order to evaluate the exact narrowing of the bony ischiofemoral space, computed tomography (CT) was performed (Fig. 5 on page 21), which confirmed a marked narrowing of the right IFS compared to the contralateral left side.
**Fig. 5:** Three-dimensional (3D) CT provides a more accurate evaluation of the narrowing of the bony ischiofemoral tunnel.

**References:** Department of Radiology, AZ Sint-Maarten, Mechelen-Duffel, Belgium

Histological examination of the resection specimen confirmed the diagnosis of a benign cartilaginous exostosis. The immediate postoperative recovery was uneventful.

2) The second patient was a 14-year old female gymnast, referred to the radiology department with sudden buttock pain after performing a split.

Initial plain films (Fig. 6 on page 22) of the pelvis showed an avulsion fragment projecting over the femoral neck. The history of the sudden pain during a split combined with this image was very suspicious for an avulsion fracture of the apophysis of the ischial tuberosity.
Fig. 6: Plain films of the pelvis revealed an avulsion fragment (arrows) projecting over the left femoral neck.

*References*: Department of Radiology, AZ Sint-Maarten, Mechelen-Duffel, Belgium

An additional CT-scan of the pelvis (Fig. 7 on page 23) could exactly locate the bony fragment posteriorly of the femoral neck and laterally of the ischial bone. The location is more clearly visible on the 3D-reconstructed images (Fig. 8 on page 24). The avulsion fragment is displaced laterally, cranially and ventrally compared to the ischial bone.
**Fig. 7:** CT-scan of the pelvis. Parasagittal reformatted image in bone window showing a bony fragment posteriorly of the femoral neck and laterally of the ischial bone.

**References:** Department of Radiology, AZ Sint-Maarten, Mechelen-Duffel, Belgium
Fig. 8: 3D-reconstruction of the pelvis showing the avulsion fragment being displaced laterally, cranially and ventrally compared to the ischial bone.

References: Department of Radiology, AZ Sint-Maarten, Mechelen-Duffel, Belgium

An MRI 6 months after the initial trauma (Fig. 9 on page 25 and Fig. 10 on page 26) showed a hypertrophic callus and partial remodellation of the avulsion fracture. The ischiofemoral space was narrowed and there was edema of the quadratus femoris muscle belly.
Fig. 9: MRI of the pelvis. T1-WI showing a hypertrophic callus (arrows). There is narrowing of the ischiofemoral space (arrowheads) due to the callus.

References: Department of Radiology, AZ Sint-Maarten, Mechelen-Duffel, Belgium
Fig. 10: MRI of the pelvis. T2-WI revealed edema in the quadratus femoris muscle belly, caused by the ischiofemoral narrowing.

References: Department of Radiology, AZ Sint-Maarten, Mechelen-Duffel, Belgium

After conservative treatment she could resume daily tasks. There were no complaints of the ischiofemoral impingement.

3) The third patient was a 37-year old female soccer player, referred to the radiology department because of sudden pain after kicking a ball backwards.

Plain films of the pelvis could not show any (avulsion) fractures. An MRI of the pelvis and both hips (Fig. 11 on page 27) revealed a complete tear of the proximal hamstrings. The tear was repaired arthroscopically.
**Fig. 11**: MRI of the pelvis and both hips. Parasagittal T2-WI reveals a proximal complete tear of the conjoint tendon of the hamstrings with retraction (arrowheads). There is an adjacent fluid collection (arrows).

**References**: Department of Radiology, AZ Sint-Maarten, Mechelen-Duffel, Belgium

5 months after the repair, the patient suffered from residual pain at the left ischial tuberosity and during exorotation. A new MRI demonstrated postoperative fibrosis between the fixated conjoined tendon and the more ventral situated semimembranosus tendon (Fig. 12 on page 29). The fibrosis caused narrowing of the ischiofemoral space resulting in edema of the quadratus femoris muscle belly (Fig. 13 on page 29).

**Fig. 12**: MRI of the pelvis and both hips. Coronal Dixon T2-WI showing thickening and irregular delineation of the left hamstrings inkeeping with peritendinous fibrosis tissue of intermediate SI (arrows) between the conjoined tendon and the semimembranosus tendon.

**References**: Department of Radiology, AZ Sint-Maarten, Mechelen-Duffel, Belgium
Fig. 13: MRI of the pelvis and both hips. Axial T2-WI demonstrating slight thickening and irregular delineation of the hamstrings causing narrowing of the ischiofemoral tunnel and resulting in slight edema of the quadratus femoris muscle belly (arrow).  

References: Department of Radiology, AZ Sint-Maarten, Mechelen-Duffel, Belgium

Images for this section:
Fig. 2: Initial anteroposterior radiography of both hips. A large exostosis is seen on the medial aspect of the right femoral neck (arrow), resulting in narrowing of the distance between the ischial tuberosity (star) and the lesser trochanter.
Fig. 3: MRI of the pelvis. Axial T1-weighted images (WI) show a significant narrowing of the ischiofemoral space (arrows) due to the exostosis, in comparison with the normal left side.
**Fig. 4:** MRI of the pelvis. Axial fat-suppressed T2-WI show focal edema of the muscle belly of the QFM (arrow), caused by impingement between the surface of the exostosis and the ischial tuberosity. Note the presence of a thin layer of cartilage at the surface of the exostosis (arrowheads).
**Fig. 5:** Three-dimensional (3D) CT provides a more accurate evaluation of the narrowing of the bony ischiofemoral tunnel.
Fig. 6: Plain films of the pelvis revealed an avulsion fragment (arrows) projecting over the left femoral neck.
Fig. 7: CT-scan of the pelvis. Parasagittal reformatted image in bone window showing a bony fragment posteriorly of the femoral neck and laterally of the ischial bone.
**Fig. 8:** 3D-reconstruction of the pelvis showing the avulsion fragment being displaced laterally, cranially and ventrally compared to the ischial bone.
Fig. 9: MRI of the pelvis. T1-WI showing a hypertrophic callus (arrows). There is narrowing of the ischiofemoral space (arrowheads) due to the callus.
Fig. 10: MRI of the pelvis. T2-WI revealed edema in the quadratus femoris muscle belly, caused by the ischiofemoral narrowing.
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**Fig. 12:** MRI of the pelvis and both hips. Coronal Dixon T2-WI showing thickening and irregular delineation of the left hamstrings inkeeping with peritendinous fibrosis tissue of intermediate SI (arrows) between the conjoined tendon and the semimembranosus tendon.
Fig. 13: MRI of the pelvis and both hips. Axial T2-WI demonstrating slight thickening and irregular delineation of the hamstrings causing narrowing of the ischiofemoral tunnel and resulting in slight edema of the quadratus femoris muscle belly (arrow).
Conclusion

Ischiofemoral impingement should be considered in the differential diagnosis of hip pain. Although it is usually seen in middle-aged women, it may be encountered in younger patients as we reported in this work.

As symptoms and clinical findings of IFI are often non-specific, imaging plays a crucial role in the diagnosis, evaluation of the predisposing anatomy and treatment planning. Although plain radiography may be useful to demonstrate predisposing bony abnormalities (e.g. exostosis), causing narrowing of the ischiofemoral space, evaluation of secondary effect on the intervening soft tissue is not possible. MRI is the preferential tool for direct assessment of both narrowing of the ischiofemoral space and associated soft tissue edema in the quadratus femoris muscle. CT-scan is very useful for pre-operative evaluation of the narrowing of the bony tunnel.

References


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