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Juan Pablo Ghisi, MD
Argus Diagnóstico Médico
Chief of the MRI Departament, Acute Care Hospital "Dr. Juan A. Fernández",
Ciudad Autónoma de Buenos Aires

Marcelo Ghioldi, MD
Sports Medicine, Acute Care Hospital "J.M. Ramos Mejía", Ciudad Autónoma de Buenos Aires
Team for Dance Research (EIDAN, by its Spanish Acronym) Coordinator

Case

A 16 year-old female ballet dancer consulting for circumscribed pain on the anterior-superior border of her left iliac crest, which is linked to dancing.

Findings in and interpretation of imaging studies

We started imaging studies with a conventional anterior-posterior pelvis X-ray (Figure 1), which did not show changes. As symptoms remained, we ordered pelvis MRI—the transverse plane using STIR sequence shows an increase in the signal (edema) in the anterior-superior area of the left iliac crest which also involves the anterior-superior iliac spine and which coincides acutely with the area of the pain (Figure 2). The coronal plane and also using STIR sequence shows a minimal inferior movement of the spinal process. It is associated with an increase in the signal (inflammatory changes) in the near soft tissues which involves the muscle fibers of the gluteus medius muscle (Figure 3). Although T1 sequences give an accurate anatomical idea, edema —in this case shown by a decrease in the signal—is not as obvious as in the fluid-sensitive sequences (Figure 4).

Figure 1. The anterior-posterior pelvis X-ray does not show changes. It shows that the iliac processes are not fused yet.

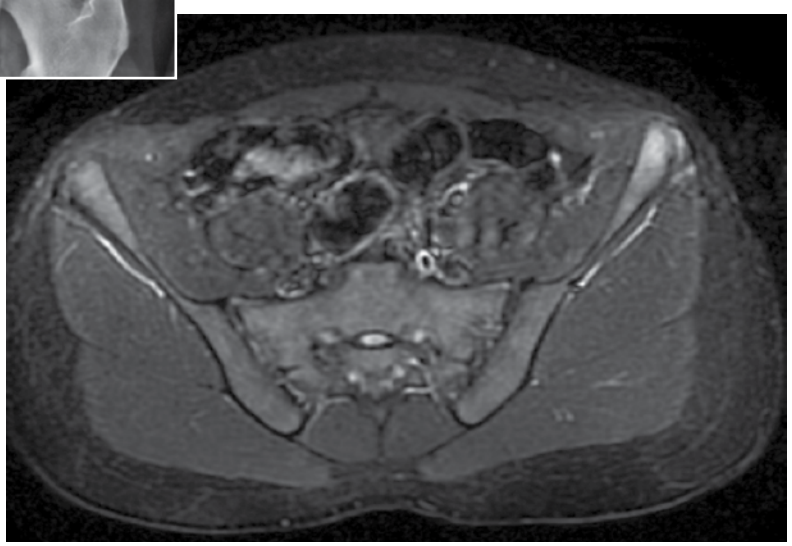

Figure 2. STIR transverse section MRI. It shows an increase in the signal in the superior-lateral area of the left iliac crest and also in the anterior-superior iliac spine.

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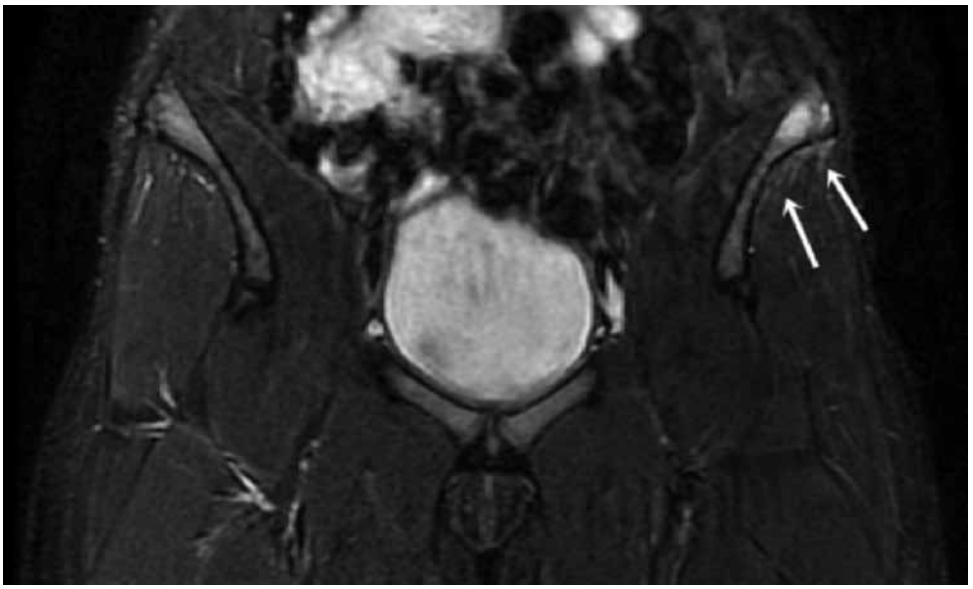

Figure 3. STIR coronal section MRI. Apart from the bone edema seen on the transverse plane, it shows edema of the near soft tissues which involves the proximal muscle fibers of the gluteus medius muscle (white arrows).

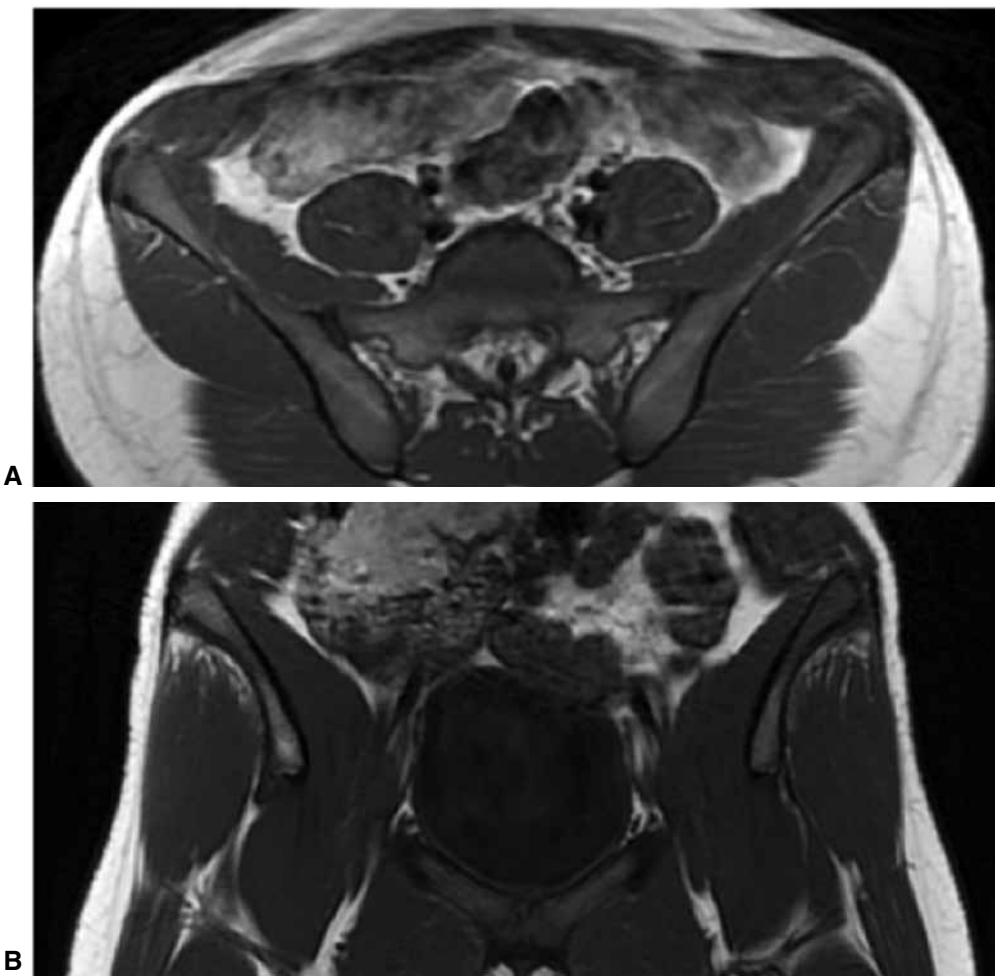

Figure 4. MRI. **A.** Trasnverse section; **B.** coronal section, T1 sequence. Bone marrow edema shows as a decrease in the signal.

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Second Part

Diagnosis

Avulsion fracture of the anterior superior iliac spine (ASIS)

Discussion

In the teenage competitive athlete, the pelvis is commonplace for process avulsion injuries. The bone processes most frequently involved are:

1) the ischial tuberosity (origin of the ischiotibial tendons)
2) the anterior inferior iliac spine, AIIS (origin of the right head of the rectus femoris muscle)
3) the anterior superior iliac spine, ASIS (origin of the sartorius muscle and some fibers of the tensor of the fasciae latae)
4) part of the pubic symphysis (origin of the short and long adductors, and also that of the gracilis muscle

The ASIS starts ossification between 13 and 15 years of age, and it fuses with the iliac bone between 21 and 25. In individuals with immature skeleton, the injuries caused by excessive traction strength on the muscle-tendon-bone unit tend to result in avulsion fractures of the bone processes, because the weakest biomechanic spot is the growth cartilage, especially at accelerated growth moments.

The mechanism of injury in bone process avulsions is usually the sudden concentric or eccentric muscle contraction while running, jumping or kicking a ball, what results in traction upon the unfused process. In the particular case of the ASIS, usually a strong sudden pull of the sartorius muscle follows with the hip extended and the knee bent. Physical activities most frequently involved are football, running and ballet.

At physical examination, patients show pain and weakness, swelling after physical activity, sensitive spots and abnormal walking. In the sub-acute or chronic stages, mostly when there is no history of traumatism, initial diagnosis is often neoplasm or infection. However, the patient's symptoms, the age of presentation and the biomechanic analysis of the mechanism of injury might suggest an avulsion fracture of any of the iliac spines, but the diagnosis is confirmed with imaging methods.

When a bone process avulsion is not displaced or when the bone process is not ossified yet, X-rays can be interpreted as normal or they may show very subtle findings; however, when there is exuberant bone callus, these kinds of injuries may resemble an osteosarcoma, an osteochondroma or an infection. MRI is usually very useful for diagnosis and medical management in these cases. Knowing where tendons are attached to the pelvis is essential for an appropriate diagnosis. The great advantage of MRI in the case of bone process avulsion is that it makes it possible to see directly the tendon attached to the avulsed bone process. The tendon involved can show laxity due to retraction; in general, there are variable grades of edema in the bone marrow underlying the tendon attachment and the surrounding soft tissues, especially in the images taken by sequences sensitive to water (protonic density or T2 with fat suppression technique, or STIR).

Fractures by avulsion or detachment of the iliac spines are considered stable injuries of the pelvic ring and they heal with rest and pain killers. Recovery time ranges from 3 weeks to 4 months. They are injuries associated with good prognosis and subject to surgical treatment only when the bone fragment is displaced more than 2 cm from its original position, or when there is pain or movement limitation of the hip due to exostosis.

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