

# Stress Injuries of the Ischiopubic Synchrondrosis

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## Abstract

A 12-year-old competitive runner with enlarged symptomatic right-sided ischiopubic synchrondrosis (IPS) is presented, highlighting the pertinent clinical and radiographic findings as well as the basic principles of conservative management and appropriate follow-up surveillance.

Magnetic resonance imaging (MRI) studies revealed remarkable asymmetric enlargement of the right inferior pubic ramus with axial fat-suppressed proton density MRI demonstrating an irregular low signal intensity intramedullary line within the right ischiopubic junction.

In symptomatic patients, a thorough review of radiologic imaging is warranted in order to confirm the diagnosis of IPS and investigate potential associated injuries. The pertinent radiographic findings vital to making an accurate diagnosis and treatment plan are reviewed.

Synchrondroses are temporary joints with limited or no motion in which 2 bones are joined by hyaline cartilage and fibrous tissue.<sup>1</sup> They occur during physiologic development and with skeletal maturation undergo bony union and disappear. Examples include epiphyseal growth plates, costochondral, subdental, and spheno-occipital joints.<sup>1</sup>

The ischiopubic synchrondrosis (IPS) forms during fusion of the inferior ischial and pubic rami, between the ages of 4 and 12 years.<sup>2</sup> Younger children are more likely to present with bilaterally enlarged IPS, as the initiation of fusion in the pelvis is symmetric.<sup>3</sup> As children approach puberty unilateral IPS enlargement becomes more common due to asymmetric completion of ossification. The IPS fuse bilaterally in 80% of children by 12 years of age.<sup>4,5</sup>

Caffey and Ross<sup>2</sup> in 1924 first coined the term *osteochondritis ischiopubica* for enlargement of the IPS, and considered it a pathologic process. Others that followed labeled it as *osteochondrosis* and *osteochondropathia*.<sup>2,3</sup> Enlargement of the IPS, whether unilateral or bilateral, has since been shown to be a

normal phenomenon in asymptomatic subjects.<sup>2-6</sup> The present case describes an adolescent patient with symptomatic unilateral IPS. Classic clinical presentation, diagnosis and treatment plan are outlined with emphasis on radiographic image findings.

The patient's legal guardian provided written informed consent for print and electronic publication of the case report.

## Case Report

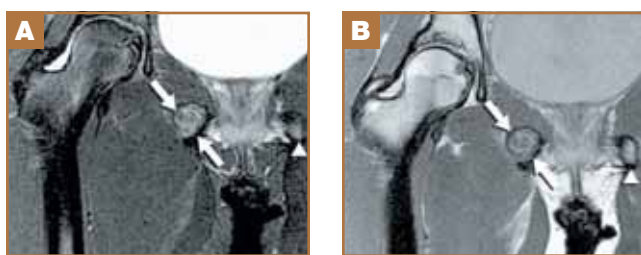
A 12-year-old girl competitive runner who presented with right hip and buttock pain of 4 months duration. She had pain on palpation over the ischial tuberosity and pubic pain with lunging. Strength and range of motion examinations were normal. Annotated plain anterior-posterior radiograph of the pelvis illustrated asymmetric focal cortical enlargement and irregularity at the right inferior ramus (Figure 1). Magnetic resonance imaging (MRI) studies revealed remarkable asymmetric enlargement of the right inferior ramus at the ischiopubic junction with reactive marrow edema on coronal views. Additionally, axial fat-suppressed proton density MRI demonstrated an irregular low signal intensity intramedullary line within the right ischiopubic junction with surrounding cortical expansion and reactive marrow edema (Figures 2, 3).

Based on the clinical presentation and radiographic evidence the diagnosis of stress fracture within the right IPS was

**Figure 1.** Frontal radiograph of the pelvis shows asymmetric focal cortical enlargement and irregularity at the right inferior ramus (arrows).



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**Figure 2.** Coronal STIR (A) and proton density (B) MRI of the pelvis demonstrate asymmetric enlargement of the right inferior ramus at the ischiopubic junction, with reactive marrow edema (arrows). Note the normal left inferior ramus (arrowheads).



**Figure 3.** Axial fat-suppressed proton density (A) and proton density (B) MRI of the pelvis demonstrate an irregular low signal intensity intramedullary line (arrowheads) within the ischiopubic junction, with surrounding cortical expansion and reactive marrow edema (arrows). There is no soft tissue mass or fluid collection.



**Figure 4.** Frontal radiograph of the pelvis in a 1 year 3 month old boy demonstrates normal development of the pelvis, with the tapered bony ends of the ischial and pubic rami separated by a cartilage plate (arrows).

made. The patient was treated conservatively with activity modification and serial follow-up MRI studies until resolution of abnormal findings was confirmed. She was asked to avoid high impact activities such as jogging, and encouraged to cross train with low impact cardiovascular exercise such as swimming and cycling. The patient was followed up clinically, and at 6 months returned to competitive running without adverse event.

### Discussion

Micro-instability and mechanical stress within the IPS caused by the asymmetric pull of the hip adductors, flexors, and

short external rotator muscles during high impact activities can result in stress reaction, stress fracture, and delayed union.<sup>3,5,7</sup> Herneth and colleagues<sup>5</sup> implicated increased mechanical stresses through the weight bearing, usually non-dominant, leg of kicking and jumping athletes as a cause for delayed IPS union. Their study of 32 children found 9 unilateral cases of IPS, all on the non-dominant side.<sup>5</sup> These findings are consistent with Hübner<sup>7</sup> who demonstrated delayed ossification of the IPS in children with hip diseases, including Legg-Calvé-Perthes, congenital coxa vara, and arthritis. In this group of patients the delay occurred on the side of the healthy hip.<sup>7</sup>

The radiographic appearance of the IPS evolves throughout its course to fusion. In general, young patients presenting with bilateral IPS are easily diagnosed radiographically, given the symmetric findings. Initially, the bony ends of the ischial and pubic rami are separated by a cartilage plate (Figure 4).<sup>8</sup> The bone edges are well aligned and tapered until the time immediately preceding fusion.<sup>8</sup> It is during early fusion when the IPS can present as a diagnostic challenge both radiographically and clinically. At this point, the bone ends enlarge and become irregular, giving a radiographic appearance of a radiolucent tumor-like lesion at the IPS fusion zone (Figure 1). The differential diagnosis of unilateral enlarged IPS includes osteomyelitis, stress fracture, posttraumatic osteolysis, and neoplasm.<sup>3-5,7-9</sup> It is therefore critical to recognize the enlarged IPS in an asymptomatic patient as physiologic and not pathologic. The bones will remodel after fusion and the fusiform enlargement will resolve. However, in some cases the enlargement may persist for many years.<sup>8</sup>

During IPS fusion, bone scintigraphy normally demonstrates mildly increased uptake due to active bone formation.<sup>9</sup> This has the potential to further convince the inexperienced clinician to pursue a diagnosis of osteomyelitis or neoplasia. However, uptake at the IPS should only be considered abnormal if it is greater than the value at the triradiate cartilage.<sup>9</sup> At our institution we don't routinely recommend bone scans in the evaluation of these patients, because of the lack of specificity.

MRI is recommended over other imaging modalities in the work-up of symptomatic IPS because of its superior soft tissue contrast.<sup>3,6</sup> The IPS commonly demonstrates a variegated MRI appearance in both symptomatic and asymptomatic patients. Therefore high-resolution MRI technique, with high matrix and thin slice thickness, is recommended for more accurate results. In both symptomatic and asymptomatic subjects, cortical expansion and irregularity can be seen together with hypointense marrow signal on T1-weighted sequences, bone marrow edema pattern on fat saturated T2 and short tau inversion-recovery (STIR) sequences, and marrow enhancement on postcontrast T1-weighted sequences.<sup>3,6</sup> Marrow signal abnormalities in asymptomatic patients are the result of the normal bone fusion process. A focal hypointense band on all sequences within the center of the fusiform swelling is a normal finding, thought to represent fibrous bridging.<sup>3,6</sup> However, this is noted in only 67.9% of cases.<sup>3,6</sup> Irregular low signal intensity lines within the IPS with surrounding cortical disruption are indica-

tors of a stress fracture in symptomatic patients (Figures 2, 3). Reactive marrow edema that extends beyond the expected site of normal IPS fusion, without cortical disruption or a fracture line, suggests stress reaction in symptomatic patients. An enhancing soft tissue mass that extends beyond the cortex of the IPS is seen in neoplastic processes (ie, Ewing's sarcoma) and eosinophilic granuloma. Intra- or extra-osseous peripherally enhancing fluid collections, periosteal reaction, sequestrum, and/or involucrum are indicative of osteomyelitis.

## Conclusion

The main objective of treatment in patients with asymptomatic IPS is to recognize the nonpathologic nature of the condition. If the IPS is classic in appearance, costly and invasive diagnostic testing should be avoided. Although the presence of IPS by itself is nonpathologic, it may predispose young athletes to stress injury and stress fracture.

Therefore, in symptomatic patients careful review of imaging studies should be done to search for these injuries. In our case such concomitant injuries were ruled out by close radiographic surveillance and the patient was treated conservatively with activity modification and serial follow-up MRI studies until resolution. She was asked to avoid high impact activities such as jogging, and encouraged to cross train with swimming and cycling.

IPS can be a normal finding in skeletally immature patients. It presents a diagnostic challenge in older children with unilateral enlargement of the synchondrosis. The irregular and variable appearance of IPS on radiographs, combined with increased uptake on bone scintigraphy and marrow signal abnormalities on MRI, can be misleading to inexperienced clinicians. In symptomatic patients, careful interview and physical exam must be employed to decide which patients may need further investigation. Symptomatic IPS should not be considered part of normal development. Clinicians should have a high index of suspicion for stress injury to the IPS in young athletes, as the IPS may institute micro-instability to the pelvic ring, predisposing to stress reaction, stress fracture, and

delayed union. Without a high index of suspicion, many of these injuries will be missed on plain radiographs. Therefore, symptomatic patients should be further evaluated with high-resolution MRI.

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