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Case Report

Multimodality imaging evaluation for iliac crest apophysis avulsion injury

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ABSTRACT

A young cross-country athlete with left thigh pain, and a recent negative MRI of the left hip was referred to nuclear medicine for bone scan imaging. A 3-phase Tc-99m methylene diphosphonate bone scan was performed and revealed left iliac crest apophysis avulsion. This case illustrates that 3-phase bone scan is a great adjunct in the evaluation of sports injuries especially in athletes presenting with vague nonlocalizing symptoms, and prior negative radiographic or MRI imaging.

Introduction

An apophysis is a secondary site of ossification that serves as a site of attachment for muscles and tendons, hence also referred to as “traction epiphysis” [1]. Apophyseal injuries have been on the rise over the last decades due to increased kids and adolescents’ participation in competitive sports [2]. We describe a case of iliac crest avulsion injury, providing scintigraphic imaging correlates to plain film and MRI evaluation.

Case report

An 18-year-old female cross-country athlete presents to the orthopedic clinic with a 5-day history of left anterior thigh pain without any acute injury. She runs on average 50 miles per week and has a BMI of 19.8. Review of system was negative except for irregular periods. She is not on any medication. Physical exam revealed tenderness to palpation in the left anterior midthigh, concerning for a stress fracture. The range of motion in the knee and thigh were normal. She was referred for magnetic resonance imaging (MRI) of her left thigh to evaluate for a stress fracture and was started on a trial of nonsteroidal anti-inflammatory drugs. MRI of the left thigh was negative. On follow-up, her pain became sharp in nature and

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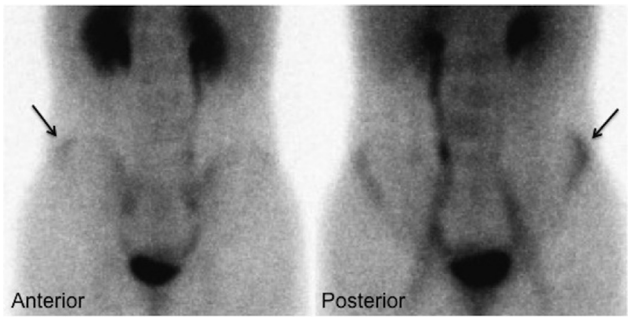

Fig. 1 – Anterior and posterior blood pool images of a Tc99m-MDP bone scan showing asymmetric increased blood pooling in the region of the left iliac crest apophysis.

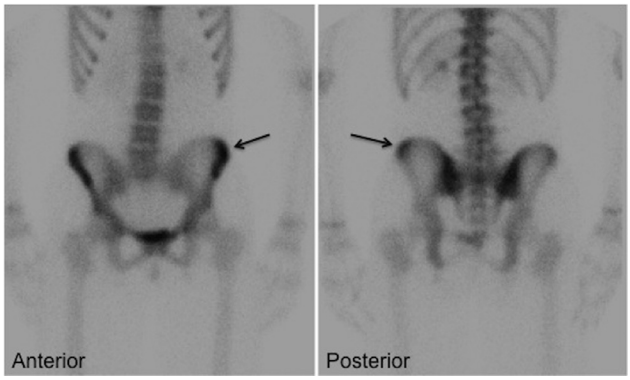

Fig. 2 – Anterior and posterior 3 hours delayed images of a Tc99m-MDP bone scan showing asymmetric increased radiotracer deposition in the region of the left iliac crest apophysis, better appreciated on the posterior views.

localized over her left hip and pelvis region. Symptoms were now induced by exercising for a short period of time and once elicited, were exacerbated even by slow walking.

A Tc-99m methylene diphosphonate bone scan was performed to help localize and provide etiology for her vague left hip and pelvic pain. The patient was advised to refrain from physical activity until her bone scan is completed.

Bone scan blood pool (Fig. 1), delayed planar (Fig. 2), and single-photon emission computed tomography (SPECT) (Fig. 3) images show asymmetric radiotracer uptake in the region of the left anterior iliac crest apophysis. Differential diagnosis for asymmetrical apophyseal uptake based on the bone scan findings in this patient includes apophysitis, or apophyseal avulsion fracture, or asymmetrical apophysis maturation (a normal variant). Infection and tumor were less likely considering clinical history. Review of the scout pelvis radiograph image (Fig. 4) obtained for the SPECT revealed a mildly displaced fracture in the region of the left iliac crest apophysis. Scintigraphic and radiographic findings are thus consistent with a subacute avulsion fracture of the left iliac crest apophysis. An MRI of the pelvis (Fig. 5) was obtained for follow-up and showed asymmetric bone marrow edema in left iliac crest apophysis consistent with the prior bone scan and radiographic findings.

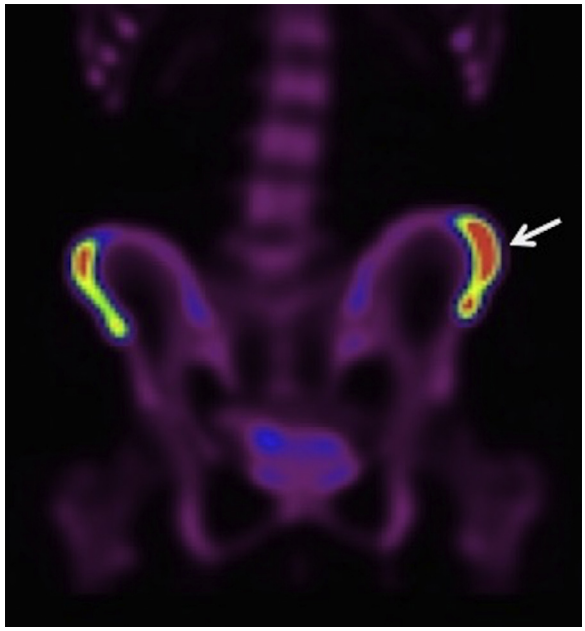

Fig. 3 – Bone scan SPECT 3D MIP reconstructed image demonstrating asymmetric increased radiotracer deposition in the region of the left anterior iliac crest extending inferiorly to the region of the left anterior iliac spine.

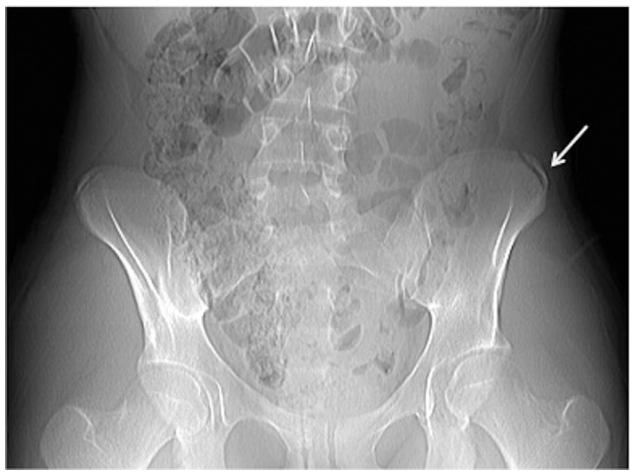

Fig. 4 – Frontal pelvis radiograph showing a mildly displaced avulsion fracture of the left iliac crest apophysis.

Discussion

The iliac crest apophysis is the site of attachment for the 3 lateral abdominal muscles (internal and external obliques, and transverse abdominis), gluteus muscles, and tensor fascia lata [1]. Iliac crest injuries are rare types of pelvic apophyseal injuries. They are seen in greater prevalence in adolescents who participate in long distance running and are thought to be often caused by repetitive microtrauma or can be associated

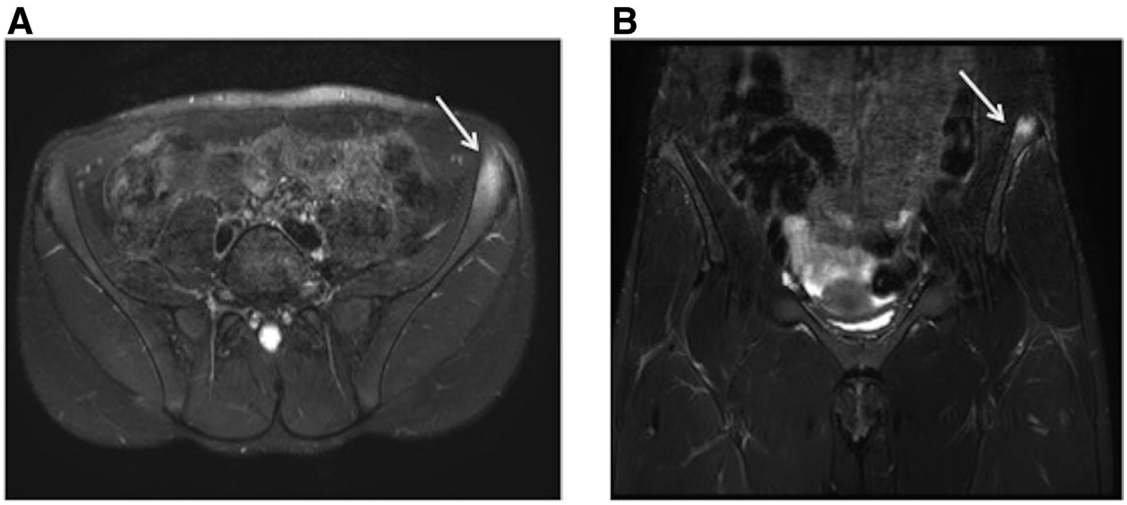

Fig. 5 – Axial (A) and coronal (B) STIR MRI images showing increased T2 signal in the region of the left iliac crest apophysis.

with an abrupt directional change of motion or kicking [3]. They tend to occur most often in males at age of 11-25 [1].

Radiographs are often the first line of imaging and are useful to evaluate separation of the iliac crest from the remaining iliac bone. However, in young kids whose iliac crest apophysis is still cartilaginous (iliac crest apophysis ossification typically starts at 13-15 years old), radiographic or even CT imaging may miss the diagnosis. MRI is more sensitive, because it can detect early bone marrow edema by showing increased signal on water sensitive series [2]. However, bone marrow edema is not specific for avulsion injuries and can be seen with other entities such as apophysitis [4]. Additionally, patients may have atypical or referred pain, which may lead to negative MRI evaluation, due to scanning of the incorrect site. For example, as illustrated in this case, the iliac crest was excluded from the field of view on patient's first MRI scan of the hip. The advantage of bone scan is that it can screen multiple joints and body sites in 1 exam, which is very helpful in patients presenting with vague nonlocalizing symptoms. Bone scans are also often positive at an earlier time than can be detected with radiographs [5–7].

However, in skeletally immature athletes, apophyseal injuries can be difficult to pick up on a planar bone scan due to the normal physiological background radiotracer uptake within the nonfused physis. Addition of the blood flow and pool images, correlation with prior anatomic imaging, and SPECT-CT will markedly improve the bone scan sensitivity and specificity for detection of apophyseal pathology [5–7].

Treatment is often conservative with nonsteroidal anti-inflammatory drugs, rest, decrease strenuous activity, and physical rehabilitation. Recovery is expected within 4-6 weeks, at which time patient can resume gradually their sports activities. Failure to detect these injuries or noncompliance with conservative treatment may also result in malunion or nonunion. Surgery may be rarely needed in patients with markedly displaced iliac crest avulsion (more than 3 cm), or if there is evidence of vessel or nerve encroachment [1].

Although uncommon in the general population, iliac crest apophysis avulsion fracture should be considered by radiologists when evaluating skeletally immature young athletes presenting with hip pain. Familiarity with risk factors and imaging appearance will allow early diagnosis and allow for conservative management, facilitating early recovery and potentially avoiding the need for surgical treatment and negative long-term sequelae.

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