Case Report

A rare case of avulsion fracture of the iliac crest apophysis in a young female athlete

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ABSTRACT

Avulsion fractures of the iliac crest in the adolescent are rare injuries poorly described in literature. The rarity of this injury along with the late ossification of the growth plate of the iliac crest can lead to misdiagnosis and improper treatment. In presence of high clinical suspicion and negative x-ray findings, second level imaging is advisable. Case reports and some case series report on successful outcome of both surgical and non-surgical treatment. We present the case of a fifteen year old female athlete who sustained an avulsion fracture of the iliac crest during a running race. The patient was treated conservatively and returned to previous sport activities after four months from injury. Mechanism of injury, diagnostic options and treatment opportunities are also described.

1. Introduction

Avulsion fractures of the apophysis of the pelvis are uncommon injuries usually described in young male athletes [1–3]. Some large series of avulsion fractures of the pelvis in skeletally immature patients are reported in literature and all agree that avulsion of the apophysis of the iliac crest is the most rare [2-5]. Of all avulsion fractures of the pelvis in children and adolescents, avulsion of the iliac crest account for about 2%. Patients usually sustain such injury as a result of sudden forceful contraction of the external oblique, the transverse and the internal oblique muscles which insert on this apophysis [6,7]. Following avulsion, lateral and inferior displacement can occur due the pull of tensor fasciae latae and gluteus medius. The broad muscle insertions of the pelvis usually limit amount of displacement [6].

In case of repetitive trauma the apophyseal growth plate may be at greater risk of an acute a injury induced by a less forceful traction [2].

Direct trauma has been also advocated as a possible mechanism of injury [6].

Running, jumping and sports which require explosive recruitment of the afore mentioned muscle groups, such as soccer, tennis, wrestling and artistic gymnastics, represent activities at major risk [3,6,8].

An adolescent complaining local tenderness, and acute pain over the iliac crest area as well as impossibility to weight bearing must raise suspicion for this infrequent kind of lesion.

Diagnosis with traditional imaging may not be straightforward since at certain stages of growth this apophysis may still be radiolucent; additional investigation may therefore be advisable.

We describe the rare case of a young female gymnast affected by avulsion of the iliac crest apophysis.

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2. Case report

A fifteen year old high level gymnast female presented to our emergency department unable to ambulate and complaining a left hip pain. She reported to be involved in an intense training program and claimed onset of pain as the consequence of an attempt to sprint while running at a constant pace during a race.

Physical findings were positive for pain and tenderness over the left iliac crest as well as inability to actively flex the hip or to perform a straight leg raise. She was asymptomatic for groin pain and no articular block of the hip joint or limb-leg discrepancies were detected.

An anterior to posterior (AP) X-ray of the pelvis demonstrated an avulsion fracture of the left iliac crest apophysis with minimal displacement (Fig. 1).

The patient was discharged and instructed to avoid weight bearing until pain subsidence as well as to limit active flexion and rotational movements of the trunk. Acetaminophen and ice were prescribed for pain control.

At 3 week follow-up she was able to ambulate without crutches and to carry out daily activities although palpation of the iliac crest revealed some residual pain. An AP and an internal obturator view of the left emipelvis ruled out any further fracture displacement (Fig. 2).

At 2 months the lesion was investigated with a pelvis MRI that demonstrated an advanced healing phase of the growth plate with minimal displacement (Fig. 3). Clinically all movements of the trunk and the left lower limb were pain-free with exception of discomfort at hyper-extension of the left hip. The patient was instructed to gradually resume physical activity and rehabilitation was uneventful. After four months from injury she was able to return to her habitual training program.

3. Discussion

Apophyseal avulsion injuries of the hip and the pelvis are uncommon injuries which mainly occur in young adolescent athletes [2].

A large radiological review of fractures around the hip in athletes indicated that prevalence of this injuries account for 16.4% [9]. Avulsion of the iliac crest are much more rare ad account for only 2% [4].

Although rare in common adolescent population they become quite more frequent in young high level athletes especially in sports which implicate a sudden forceful contraction of the muscles that insert on pelvic apophysis.

An apophysis is the site of attachment of a muscle and tendons unit to the parent bone and up until skeletal maturity it is separated from the parent bone by interposition of an ossification center. Therefore it represents a site of minor resistance as compared to the tendons that insert on it.

Ossification of the iliac crest growth plate takes place from anterior to posterior usually at a slow rate and it completes around 18
years of age. Therefore these lesions in the adolescent can be subtle to detect with X-rays. Presence of localized swelling and pain should raise a high level of suspicion and justifies second level investigation with CT-Scan and MRI may be appropriated.

CT-scan is possibly avoided in order to limit further exposure to radiations and, whenever available, MRI should be preferred.

Fragment avulsion is determined by the pull of the external oblique, transverse and internal oblique muscles. Fragment displacement is induced by the secondary traction of the gluteus medius and tensor fasciae latae muscles. This pattern of sequential muscle activation is observed in sports, such as soccer, that involve a “kick in the air” with forward motion of a lower limb over the supporting leg and a forceful pelvic rotation and trunk inclination [6]. Furthermore it can be observed in all those sports that require sudden changes in direction of the trunk and pelvis relative to the lower limb [1,3]. As pointed out by previous authors [3,6,8] the larger number of case reports described for soccer and tennis players and runners is explained by the large number of people participating in these sports. Nonetheless the growing number of individuals involved in less common activities such as elite gymnasts, wrestlers and jumpers could considerably increase the incidence of these lesions in sports once considered at low risk. This type of avulsion occurs usually with minimal displacement due to the broad and multiple muscle attachment on the iliac crest [8]. Therefore most authors report good clinical outcomes with conservative treatment [3,6–8]. Conservative treatment consists of bed rest and limb elevation until pain subsidence followed by early mobilization and protected weight bearing as tolerated [3,6–8]. Once the patient is confident with unprotected weight bearing, gradual stretching and strengthening should be encouraged. Symptomatic progression must be carefully supervised as early return to activity could result in recurrence of the injury [8]. Usually the fracture is securely healed by three months therefore return to competition can not take place earlier.

Surgical intervention is traditionally indicated for displacement greater than 3 cm or in case of nerve or vascular entrapment [10].

Li et al., in a series of 10 adolescent athletes who underwent operative treatment, object that conservative treatment can lead to malunion or formation of non-cosmetic exostosis [1]. Furthermore 12 weeks of convalescence may adversely interfere with an athlete’s sport season. In order to shorten recovery time he therefore recommends early open reduction and internal fixation especially in high level athletes. All cases where able to perform active exercises two days after surgery and returned to full athletic activity four weeks after surgery with no complications.

In our case the patient was not a high-end athlete and there was minimal fragment displacement (about 3 mm) as demonstrated by x-rays and MRI. We therefore decided for conservative treatment which prompted an uneventful recovery after two months and permitted return to previous sport activity level after four months.

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**Declaration of competing interest**

All authors declare no conflict of interest for the present study.

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None.

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**Fig. 3.** Magnetic resonance imaging performed two months after the trauma that demonstrated an advanced healing phase of the growth plate with minimal displacement.
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