

An Isolated Iliac Wing Stress Fracture in a Marathon Runner

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Abstract

Iliac stress fractures are uncommon and are usually insufficiency fractures related to osteoporosis. Only 2 previous case reports of iliac stress fractures in runners that extended into the sacroiliac joint, and 1 previous case of an isolated iliac wing stress fracture not involving the sacroiliac joint were found in the English language literature.

We report on a second case of an isolated stress fracture of the iliac wing in a female marathon runner and the associated diagnosis of the female athlete triad.

Iliac stress fractures can be an occult cause of hip pain in athletes and should be included in the differential diagnosis of hip pain in a marathon runner.

To our knowledge, there has been only 1 reported case in the English language literature of an isolated stress fracture of the iliac wing not extending into the sacroiliac joint. In 2003, Atlihan and colleagues⁷ reported on a 35-year-old woman who had experienced 2 and a half months of activity-related lateral-sided hip pain that became acutely more severe while running a marathon. Magnetic resonance imaging (MRI) showed a horizontal fracture of the ilium 4 cm cephalad to the hip joint with surrounding soft-tissue and muscle edema. The patient was treated with rest and restricted activity, and the fracture healed.

We report a second case of an isolated iliac wing stress fracture, also in a woman marathon runner, which was associated with the female athlete triad. The patient provided written informed consent for print and electronic publication of this case report.

Case Report

A 24-year-old woman with a history of healed tibial shaft and sacral stress fractures, both previously treated with rest, presented 1 day after completing a marathon with reports of right-sided lateral hip pain. The patient started having moderate right-sided hip pain several days before the race and self-medicated with approximately 4 to 5 g of ibuprofen daily as well as 1 g of acetaminophen on the day of the race. During mile 18 of the race her pain became severe, but she completed

Pelvic stress fractures are uncommon in athletes. Tibial stress fractures comprise approximately half of all athletic-related stress fractures.¹ Pelvic stress fractures in athletes usually involve the sacrum and although they are uncommon, several cases of sacral stress fractures have been reported in the literature previously.²⁻⁴ Furthermore, there have been cases of iliac wing stress fractures in athletes extending into the sacroiliac joint.^{5,6}

Figure 1. MRI at initial presentation showing (A) coronal, (B) axial, and (C) sagittal images of the right iliac wing stress fracture with resultant surrounding soft-tissue edema.



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Figure 2. Anteroposterior pelvis showing a horizontal stress fracture across the right iliac wing.

the marathon by walking the rest of the course. She noted 1 episode of hematuria once in the days preceding the race and 1 episode after the race. She also vomited once on the morning after the race.

Her medical and surgical history included tibial stress fracture 2.5 years prior and sacral stress fracture 1.5 years prior. She denied any tobacco or excessive alcohol use. Her menarche was late at age 16, and she had oligomenorrhea throughout high school and college. She described a pattern consistent with exercise bulimia, namely disordered and restrictive eating coupled with compulsive exercise. Her periods became regular at age 21 and remained so since then.

On physical examination, the patient was 5'2" and weighed 130.1 lb (body mass index 23.8 kg/m²). She had mild ecchymosis and swelling laterally over her gluteals and pain laterally on

active and passive range-of-motion of the hip. She was neurovascularly intact. We ordered an MRI of the bilateral hips and pelvis out of concern for a hip labral tear. The MRI revealed an isolated stress fracture of the right iliac wing with surrounding soft-tissue edema (Figures 1A-1C). Further imaging studies, including radiographs and a computed tomography (CT) scan, confirmed this to be an insufficiency fracture of the ilium not extending into the acetabulum or the sacroiliac joint. The fracture did have a sclerotic component as well as some callus formation, but also had an acute component with a small butterfly fragment and was minimally displaced (Figures 2, 3A, 3B). Given that the fracture was minimally displaced and extra-articular, we treated it nonoperatively with restricted weight-bearing on the injured side. Routine labs obtained once the stress fracture was diagnosed revealed a creatinine of 2.7 mg/dL and a serum urea nitrogen (BUN) of 54 mg/dL with a normal serum potassium level. Given her acute renal failure, we admitted the patient to the hospital and immediately started her on intravenous fluids and a Foley catheter placed to monitor her urine output. Urinalysis revealed red blood cells with muddy brown casts consistent with acute tubular necrosis. Her creatinine level continued to rise to a peak level of 4.8 mg/dL on hospital day 3. Hemodialysis was considered but not employed, as her renal function improved with continued fluid hydration and she remained non-oliguric.

Using normal saline at a rate of 125 ml/hr, her creatinine trended downward to 1.8 mg/dL on hospital day 9, the day of discharge. Her pain gradually improved with narcotics, and she was out of bed with physical therapy on hospital day 2, maintaining toe touch weight-bearing (20 lbs) on her injured side. She was discharged on hospital day 9 with resolving acute renal failure.

The patient returned for follow-up at 4 weeks after her day of admit with completely resolved acute renal failure (BUN/Cr=10/0.5). Radiographs of her pelvis revealed healing fracture



Figure 3. (A) CT scan at initial presentation showing an axial view of the fracture with a small butterfly fragment as well as a (B) 3D reconstructing view showing the fracture traversing horizontally-obliquely across the iliac wing extending from the anteroinferior iliac spine to just anterior to the posterior superior iliac spine.

and callus formation. She was instructed to begin progression to weight-bearing as tolerated. Four months after her injury, her fracture was completely healed radiographically (Figure 4), and she was permitted to return to all of her previous activities. We advised her to see, and gave her a referral to, a metabolic bone disease specialist, although she never followed up with this.

Discussion

Stress fractures can be due to intrinsic or extrinsic factors or a combination of both. Intrinsic factors include metabolic bone disease, osteoporosis, menstrual and hormonal abnormalities, and poorly vascularized watershed areas of bone.⁸ Intrinsic factors are associated with insufficiency fractures and are most common in the elderly osteoporotic population. Extrinsic factors contributing to risk of stress fracture include diet, training regimen, and equipment.⁸ Extrinsic factors are associated with overuse stress fractures and commonly occur in young active individuals who increase their training at a rapid pace, classically seen in long distance runners and military recruits in the first few weeks of basic training.

While stress fractures in this population of patients are common, the location of the stress fracture of our patient was not. Based on the sclerosis and callus present on CT scan along with a slightly displaced butterfly fragment, it is likely that the patient had a stress fracture present for several weeks prior to the marathon, which acutely displaced during the race, resulting in increasingly severe pain, as well as soft-tissue injury. Mechanically, her iliac wing eventually failed due to the repetitive loads of a cephalad traction force of the abdominal muscles and opposing caudad force of the abductors both inserting on the iliac crest. The patient did have a prior history of tibial stress fracture as well as sacral stress fracture, both of which had healed, with no evidence on advanced imaging of her pelvis that the sacral fracture was still present. We therefore consider her iliac wing fracture to be an isolated stress fracture, unrelated to the prior pelvic fracture.

Isolated acute traumatic fractures of the iliac wing are uncommon, but are usually the result of a direct blow to the side. A retrospective study of 120 pelvic fractures found 10 to be isolated iliac wing fractures, all the result of high energy injury, and only 2 of which required surgery, 1 that was rotationally displaced, and the other because it was compressing the abdominal contents.⁹ Multiple studies have reported on fractures of the iliac wing as a result of iatrogenic bone graft harvest.^{10,11}

Other studies have reported on iliac wing insufficiency fractures in combination with other fractures of the pelvic ring secondary to osteoporosis in elderly women.¹² Fractures of the iliac wing are common components of osteoporotic pelvic fractures, high energy lateral compression pelvic fractures, and anterior column acetabular fractures. A retrospective study of osteoporotic pelvic fractures in a population of postmenopausal women (age range 55 to 82 years) reported 11 iliac wing insufficiency fractures and classified 3 types of iliac wing insufficiency fractures related to their anatomic location on the ilium: supra-acetabular, oblique iliac, and superomedial



Figure 4. Anteroposterior pelvis at 4 months after presentation showing a healed stress fracture of the iliac wing.

iliac.¹³ None of these fracture types fits the fracture pattern that our patient exhibited.

Our patient meets the criteria for the female athlete triad. Even though she never followed up with a metabolic bone specialist and therefore did not receive a dual-energy x-ray absorptiometry scan, we surmise that her Z-score would have been low based on her poor bone health and 3 stress fractures. The triad has 3 parts that are all on a continuum and related to one another—menstrual irregularities, low energy availability with or without an eating disorder, and compromised bone health. Her energy output exceeded her energy input, effectively starving her bones of minerals, protein, and nutrients, which at the same time causes hypoestrogenemia that further compromised bone strength. The patient also had a low vitamin D level at presentation; however, vitamin D deficiency is common in elite athletes of both sexes, occurring up to 73% of the time. By itself this finding does not suggest a problem with disordered eating.¹⁴

The female athlete triad is becoming increasingly more recognized by orthopedic surgeons and should always be considered when the diagnosis of stress fracture is made in a female. While the exact incidence of the triad varies across age and sport group, it is more common in endurance athletes, sports with weight classes, and aesthetic sports such as ballet.^{15,16} The American College of Sports Medicine recommends that clinicians screen for female athlete triad in all female athletes during preparticipation physicals, annual health screenings, and if any 1 of the triad's clinical conditions is diagnosed.¹⁷

Stress fractures of the ilium have been associated with other pathologies. For instance, in 2008, Touhy and Nattiv⁵ reported on a 17-year-old adolescent boy collegiate track athlete who presented with gluteal and groin pain for 2 months prior to presenting. He was found to have a posterior iliac stress fracture that extended into the sacroiliac joint, though not involving the iliac wing. The patient was later found to have ankylosing spondylitis with a positive HLA-B27 serum marker. His injury healed with rest and restricted activities. More recently,

Battaglia and colleagues⁶ reported on another case of iliac stress fracture in a marathon runner extending into the sacroiliac joint. She was successfully treated with nonsteroidal anti-inflammatory drug (NSAID) therapy and rest, and was able to return to running by 7 weeks after diagnosis.

Acute renal failure is not often a consideration in young athletes who present with stress fractures. However, in our patient the coexistence of acute renal failure was most likely due to the combination of dehydration and the large amounts of ibuprofen the patient had been taking in the days preceding the race. It was unlikely that the patient experienced any significant amount of rhabdomyolysis given that her creatine kinase reached only a mildly elevated level of 416 U/L, which might be expected in any runner after a race. Acute renal failure in the setting of NSAID usage is associated with concurrent volume depletion and dehydration, which this patient likely also had, given she had just run a marathon.^{18,19} NSAID related acute tubular necrosis (ATN) in athletes is possibly more common than recognized, but the vast majority of these patients never have blood checked and are therefore never diagnosed.

Stress fractures of the ilium extending into the sacroiliac joint have been described previously, and based on the available case reports, seem to be associated with long distance running. To our knowledge, however, an isolated stress fracture of the iliac wing not associated with iatrogenic injury or blunt trauma has only been reported once previously in the English language literature.⁷ This is the second case of such an injury. Isolated iliac wing fractures that are closed and have minimal displacement can be treated successfully through nonoperative means. When they are a component of an acetabular or pelvic fracture, operative intervention is based on the amount of displacement of the fracture, presence and extent of hip joint involvement, and associated fractures of the pelvic ring. When a marathon runner presents with lateral sided hip pain without any trauma, practitioners should consider an iliac wing stress fracture as part of the differential diagnosis, and when a stress fracture is diagnosed, the physician should have a low threshold for ordering a full metabolic workup to rule out associated conditions and metabolic abnormalities.

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