CLINICAL VIGNETTE

Stress Fracture of the Pelvis and the Female Athlete Triad

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Introduction

Stress fractures of the pelvis are relatively rare. Patients often present with nonspecific signs and symptoms such as groin or lower back pain in the absence of an inciting traumatic event, making identifying pelvic stress fractures a diagnostic challenge. Delay in diagnosis can lead to significant morbidity such as prolonged return to normal physical activities, chronic pain, delayed union or nonunion, avascular necrosis, and even catastrophic fracture displacement. Therefore, it is important for the clinician to be aware of this possibility in the differential.

Case Report

A 30-year-old female fitness instructor with past medical history of anorexia nervosa restrictive type presented with lower back, sacral, and gluteal pain all on the right side for one month. Her pain started the day after she ran a 16 mile race on cobblestone streets. She reported no pain leading up to the race and no significant change in her workout routine or weekly mileage. She continued exercising and ran her usual 20 miles a week despite her symptoms. She had intermittent pain while walking, constant pain while running, and the pain was worse with deep squats. There was no pain at rest. The pain did not improve with 3 weeks of physical therapy and several visits to a chiropractor. She finally stopped running one week prior to presentation with improvement of her symptoms.

Review of systems was notable for amenorrhea with her last menstrual period about one year ago. She is an ex-gymnast and sustained an ankle fracture while performing on the vault and a wrist fracture while performing a simple back tuck at the age of 10. She also recalled several toe and finger fractures.

On physical exam she appears very thin with a BMI of 18.55 kg/m^2 (height and weight were obtained with shoes and clothes on). Temperature was normal. She was bradycardic with HR of 56. Neck exam was normal without thyromegally. On musculoskeletal exam, she had a normal gait with full range of motion of the back and right hip without pain. She was able to hop on the right leg without pain. FABER (flexion-abduction-external-rotation) and Gaenslen's tests were negative. She was nontender to palpation over the lumbar spinous processes, sacroiliac joint, sacrum, and gluteal musculature. Strength was 5/5 at the hip, knee, and ankle. Sensation to light touch was intact in the right leg. Patellar and Achilles reflexes were 2+. Of note, she did not want to know her weight on exam.

MRI of the pelvis revealed a nondisplaced fracture of the right sacral ala with surrounding edema (Figures 1, 2). Workup of her amenorrhea and anorexia nervosa were notable for prepubertal levels of LH, FSH, and estradiol. Serum calcium, phosphorous, 25-OH vitamin D, and thyroid function tests were all within normal limits. A DEXA scan was ordered, but she never followed up on this.

It was recommended that she stop all high impact exercises involving her lower extremities. She was sent to a supervised physical therapy where she worked on hip and core strengthening and began a graduated return to activities protocol that started with low impact exercise with stationary cycling and swimming. She was able to progress to jogging without pain at 4 weeks. Total treatment time was 6 weeks before she was released to all activities without restrictions.

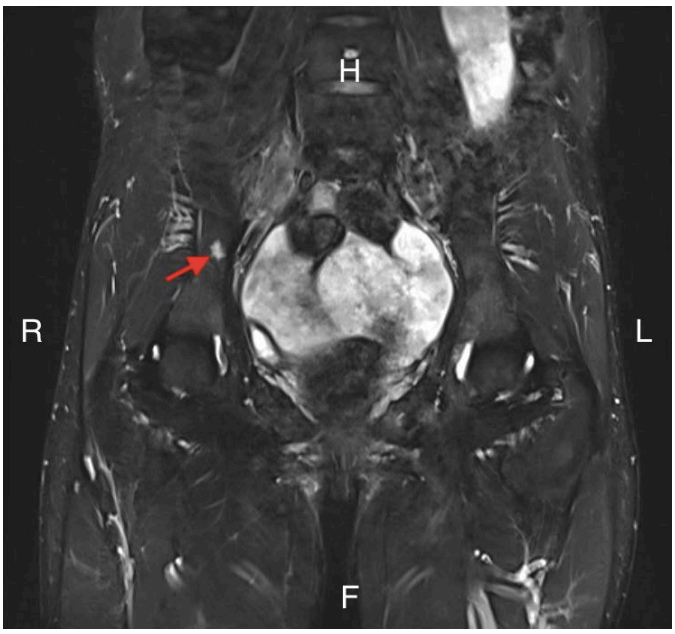

Figure 1: MR of the pelvis coronal view inversion recovery sequence. Red arrow points to a stress fracture of the right sacral ala.

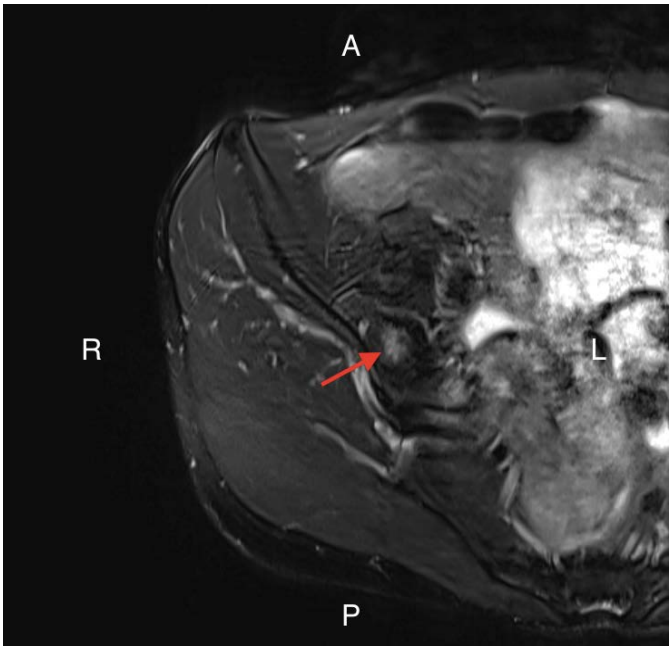

Figure 2: MR of the pelvis axial view T2 weighted fat suppression. Red arrow points to a stress fracture of the right sacral ala.

Discussion

There are many risk factors that have been implicated to contribute in the development of a stress fracture. These include intrinsic and extrinsic factors such as gender, anatomic and biochemical variations, as well as nutritional deficits and sudden changes in training volume and intensity.

Gender and Female Athlete Triad

Females are at higher risk for developing a stress fracture compared to males.[1] Part of this increase in risk can be attributed to the female athlete triad: disordered eating, amenorrhea/oligomenorrhea, and decreased bone mineral density. The combination of inadequate caloric intake coupled with increased energy expenditure from exercise can lead to a negative energy balance. This in turn can result in amenorrhea, estrogen deficiency, and deficiency of other hormones important in overall bone health.[2] Amenorrhea and menstrual irregularities are well established risk factors for stress fractures.[3,4] A study of 1630 female US Army recruits, found those with a history of amenorrhea lasting more than 6 months were more likely to develop one or more stress fractures.[5] The increased risk of stress fractures in the female athlete triad may in part be due to a hypoestrogenic state. Estrogen has the effect of protecting bone from resportion. Interestingly, estrogen receptors are found on osteoblasts and can stimulate their activity.[6]

Repeated stress on bone can push the balance toward bone resorption from increased osteoclastic activity and lead to the development of microfractures. The low energy state from inadequate caloric intake in relation to excess exercise can hinder repair of microfractures. Over time, these microfractures accumulate due to the inability of osteoblastic activity to keep up with the bone remodeling, leading to the development of stress fractures.

Muscle Fatigue and Other Extrinsic Factors

Muscle fatigue may also play a role by subjecting bone to higher forces.[7,8] During exercise, muscles can act to absorb, counteract, and redirect forces experienced by the bone. Muscle fatigue in running can cause a change in gait, leading to increased shear forces experienced by a section of bone that is not accustomed to this higher level of force. This can predispose it to microdamage. Other factors have been shown to increase the risk of stress fractures, including changing footwear without a proper break-in period, changing running surfaces, and sudden change or increase in intensity of the training regimen.[9-11] In our case report, the patient may have developed muscle fatigue from running on the uneven surface of the cobblestone streets. This added stress in context of the female athlete triad likely led to the development of her stress fracture of the sacral ala.

General Diagnostic and Treatment Guidelines

Pelvic radiographs are of limited utility due to the presence of bowel gas, stool, and calcified vessels that may obscure the view of the sacrum. MRI remains the imaging modality of choice in diagnosing stress fractures. It is both highly sensitive and specific in detecting stress fractures, reaching nearly 100%.[8,12-14] Sensitivity of radionuclide bone scintigraphy has been reported to reach nearly 100% sensitivity as well.[13] However, MRI remains the gold standard for detecting stress fractures as it does not expose the patient to radiation and has the added benefit of imaging soft tissue structures such as ligaments, muscles, and tendons that may be the source of the patient's pain.

Treatment plans should be individually tailored to each patient. The first steps are to achieve adequate pain control, which can generally be achieved with analgesics such as acetaminophen or NSAIDs, addressing weight bearing status, and activity modification. Some studies have shown the risk of delayed union or nonunion in fractures with NSAID use.[15-16] However, a meta-analysis in 2010 did not find any significant risk of nonunion with NSAID use when only the high quality studies were considered.[17] Generally speaking, NSAID should not be excluded in treatment of stress fractures. Non-weight bearing status of the affected side should be maintained until there is no pain with walking. Physical therapy should be initiated as soon as possible when there is no significant pain. A graduated return to activities protocol can be initiated once the patient is pain free with normal daily activities. In general, total time to recovery to usual activities can take 4-8 weeks.

Conclusion

Stress fractures of the pelvis are relatively rare events and account for only 1-7% of all stress fractures.[18] Sacral stress fractures are often misdiagnosed, as the history and physical can be suggestive of more common etiologies such as lumbago, lumbar radiculitis, sacroiliac joint dysfunction, or gluteal strain/tendinitis. Stress fractures of the sacrum should be considered in patients with insidious onset of asymmetric low back pain or buttock pain.

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