Sports Medicine and Rehabilitation Journal

Case Report
Published: 29 Aug, 2017

Atypical Presentation of a Pubic Ramus Stress Fracture in an Avid Runner

*Emily N Gray[1], Nadia Zaman[1] and Russell Camhi[2]**

[1]Department of Physical Medicine and Rehabilitation; Hofstra Northwell School of Medicine, Manhasset, USA

[2]Department of Sports Medicine, Northwell Health Orthopaedic Institute, USA

Abstract

Stress fracture is a common pathology affecting the athletic population, which is especially prevalent in runners, females and army recruits. Primary care and sports medicine physicians require a sound knowledge base of the epidemiology, risk factors, and symptomatology of stress fractures in order to appropriately screen at-risk athletes and facilitate early diagnosis for appropriate management and prevention of complications. Post-menopausal female athletes with increased likelihood of osteoporosis are at especially high risk for stress fractures. We discuss a case of a female athlete with an atypical presentation of stress fracture, emphasizing the necessity of high clinical suspicion for fracture in this population.

Keywords: Pubic ramus stress fracture; Stress fracture; Osteoporosis; Female runner

Introduction

A stress fracture is a fatigue related fracture caused by repetitive overloading with submaximal stress resulting in micro-fractures accumulating over time to cause a stress fracture. Stress fractures account for up to 10% of sports injuries presenting to outpatient sports medicine clinics, of which 31% are noted in runners [1]. Risk factors for stress fracture include intrinsic and extrinsic factors such as female gender, age greater than 50, sudden increase in exercise intensity, year-round and recreational running greater than 25 miles/week, training on concrete, leg length discrepancy, prior stress fracture and alcohol or tobacco use. Some metabolic risk factors include low bone mineral density, glucocorticoid use, hyperparathyroidism and calcium/vitamin D deficiency [1,2].

Women have a 1.5-3.5 times higher risk for stress fracture than men [1]. Anatomically, women have wider pelvic breadth which causes a tilt on the hips and knees and thus increased stress on these joints [3]. A hypoestrogemenic state is observed in younger athletes caused by hypothalamic amenorrhea, whereas menopause is often the cause in older athletes. The decreased estrogen state leads to impaired bone remodeling due increased bone resorption and suppressed bone formation causing osteopenia or osteoporosis. Menstrual irregularities, regardless of etiology, results in a 2-4 times increased risk of fracture [4]. Additionally, failure to achieve peak bone mass in youth increases predisposition to stress fracture [3].

Stress reaction and fracture are often the result of an "unhappy triad" of new/increased, strenuous and repetitive activity [5]. Presenting complaints of stress fractures generally include pain during exercise which abates with rest. Over time, as stress on the bone increases, pain begins to appear earlier in the exercise program, takes longer to resolve and may persist at rest. The diagnosis of a stress fracture is often clinical and supported by imaging modalities. Radiographs are commonly used as the initial imaging modality, and are important to rule out other pathologies (i.e., tumor), but have only 10% sensitivity for detecting stress fractures. MRI is both sensitive (86% to 100%), specific (100%) and able to detect the extent of bone injury and surrounding tissue damage [5]. The Fredericson and Arendt scales are employed for stress fracture grading which help guide recovery time by correlating the extent of bone involvement and clinical symptoms [6]. CT scans are less sensitive than MRI, but may be useful in imaging of the pelvis and sacrum. Bone scintigraphy is not often employed due to the high rate of false positives. Finally, ultrasound has been studied for the diagnosis of metatarsal stress fractures with 83% sensitivity and 76% specificity but not commonly used for other fracture locations [5].

Stress fractures most commonly occur in the tibia, tarsal navicular, fibula and metatarsals bones. The location of the fracture determines its classification as a high versus low risk fracture which

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Correspondence:
Russell Camhi, Department of Sports Medicine, Northwell Health Orthopaedic Institute, 611 Northern Blvd, #200, Great Neck, New York, 11021, USA, Tel: (516) 325-7197; E-mail: RCamhi@northwell.edu

Received Date: *14 Jul 2017*
Accepted Date: *22 Aug 2017*
Published Date: *29 Aug 2017*

Citation:
Gray EN, Zaman N, Camhi R. Atypical Presentation of a Pubic Ramus Stress Fracture in an Avid Runner. Sports Med Rehabil J. 2017; 2(3): 1021.

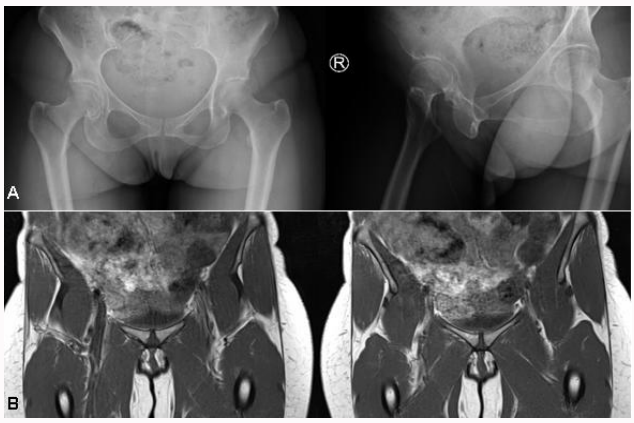

Figure 1: A) Initial plain radiographs of the right hip (AP and lateral) showed no osseous abnormality: no fracture, dislocation, malalignment or degenerative changes. **B)** Follow-up MRI of the bony pelvis (coronal view depicted) showed a stress fracture through the midportion of the right inferior pubic ramus with associated bone marrow and soft tissue edema.

in turn predicts the risk of non-union (Table 1) [1]. Based on the radiologic imaging scales, higher grade stress fractures are more likely detected in amenorrheic than eumenorrheic females [6]. Here, we present a case of an avid female runner with an atypical presentation of a stress fracture.

Case Presentation

A 57-year-old avid female runner who typically ran 4-6 miles four times per week with no significant past medical history presented to an outpatient sports medicine clinic one week after developing significant posterior right thigh pain after completing her usual run. The pain was described as constant soreness with intermittent sharp pain, worse with walking and sit-to-stand transfers; relieved temporarily with non-steroidal anti-inflammatories, rest and ice. The pain prevented her from completing her usual running routine. She denied any numbness/tingling, radiating pain or focal weakness. She had no history of prior injuries, trauma or surgeries; family history includes osteoporosis. She denied a history of smoking, alcohol or illicit drug use.

On physical examination, the patient exhibited tenderness to palpation at the right proximal hamstring and ischial tuberosity. There was no other right-sided localized tenderness including at the pubic symphysis, greater trochanter or tensor fascia lata. The patient also had pain-limited lumbar flexion, hip flexion and hip extension on the right, as well as notable pain in the proximal hamstrings with resisted hip extension and knee flexion. However, there was no pain with resisted internal or external rotation, abduction or adduction of the hips bilaterally. The left gluteal, ischium/proximal hamstring and hip flexor regions were not tender to palpation.

During the first office visit, hip radiographs (Figure 1A) were obtained with anterior-posterior and lateral views which were negative for fracture or dislocation, showed no degenerative changes, malalignment, or obvious osseous abnormality. At that time, a hamstring tendon strain was suspected, and the patient was prescribed physical therapy, with proper activity modification. A collaborative plan was formulated which consisted of gradually increasing exercise intensity beginning with walking and progressing to stationary bike, elliptical, gradual interval running and finally return to full activity.

On follow-up visit, approximately three weeks later, the patient continued to complain of pain, which radiated to the proximal groin towards the pubic symphysis. Despite initiating physical therapy, the pain progressively worsened and the patient was unable to perform any pain-free activity including light walking. Physical exam was positive for new tenderness to palpation at the adductor origin on the pubic ramus and pain in the groin region with resisted hip adduction. It was also noted that prior DEXA scan was positive for osteoporosis. Subsequently, a non-contrast MRI of the pelvis (Figure 1B) was ordered which showed a mildly angulated, non-displaced fracture through the mid-portion of the right inferior pubic ramus, consistent with a stress fracture and soft tissue edema extending into the right-sided abductor musculature. The patient was instructed to stop physical therapy and avoid light or strenuous physical activity involving the right lower extremity until she was pain free. The patient agreed to follow-up with endocrinology for further evaluation and treatment for osteoporosis, as she was only taking calcium and vitamin D supplements. Approximately 3 months after the initial injury, mild discomfort was still present in the pelvic and pubic area with extended walking. At 6 months the patient was pain free with walking, able to swim and ride a bicycle without pain, but had not yet returned to running.

Table 1: Stress fractures are more common in the lower than the upper limb. Certain fracture sites are at greater risk for propagation, displacement or delayed non-union. Modified from Behrens et al. [1].

High-Risk	Low-Risk
Lateral femoral neck and Femoral head	Sacrum
Patella	Pubic rami
Anterior tibial diaphysis	Medial femoral neck
Medial malleolus	Femoral shaft
Talar neck	Posteromedial tibia
Tarsal navicular	Fibula
Great toe sesamoids	Calcaneus
Base of 5th metatarsal	Cuneiform
Neck of 2nd-4th metatarsal	Cuboid

Discussion

Overall, pelvic stress fractures are rare, compromising only 1.6% to 7.1% of all stress fractures [1]. Common presenting complaints are pain in the inguinal, perineal and adductor regions; however this patient presented with posterior thigh pain. Pubic rami fractures are often difficult to detect on standard radiographs which are accepted as the initial imaging modality. Therefore, close follow-up and MRI should be employed early in the clinical course [5]. Trabecular bone including the femoral neck, pubic bones and sacrum are associated with longer recovery and longer time to return to sport as compared with cortical bones [6], which accounts for the prolonged recovery observed in this patient. With this knowledge, it is crucial to manage expectations to avoid premature return to activity which may hinder recovery and worsen outcomes.

Management of stress fractures include discontinuation of any offending activity until pain free, which suggests a healed fracture (generally 6-8 weeks), followed by a slow return to exercise. During this time, fitness maintenance can include swimming, water running, cycling and upper extremity weight-lifting [7]. Identification of contributing factors is paramount to provide patient education and prevent recurrence. In this case, we have multiple risk factors including female gender over age 50, active diagnosis of osteoporosis,

participation in a repetitive high impact activity, and year-round activity. Low bone mineral density may be secondary to insufficient accumulation of density in adolescence and/or accelerated bone loss in adulthood. Screening at yearly physical exams or as part of the pre-participation physical exam (PPE) may include yearly DEXA scan for patients with a history of hypoestrogenism, disordered eating ≥ 6 months, and/or history of stress fracture or fracture from minimal trauma [4]. Additional screening for vitamin deficiencies may be performed prior to treating with recommended Vitamin D 800 IU/day to 1,000 IU/day and Calcium 1,200 mg/day [2]. Endocrinology referral may be necessary for appropriate further specialized care and follow-up.

Post-menopausal women likely fit some, if not all, of the criteria for the Female Athlete Triad defined in 2007 by the American College of Sports Medicine as a spectrum of dysfunction related to energy availability, menstrual function and bone mineral density [4]. Primary care and sports medicine practitioners should have a high clinical suspicion for stress fracture in a female athlete over the age of 50 and therefore at risk for osteoporosis and the sequela of stress fractures. Post-menopausal women who participate in regular weight-bearing exercise should be screened for risk factors to avoid a low energy state and be provided education to promote safe exercise. With adequate screening and appropriate exercise prescription, adverse outcomes including stress fractures can be prevented or diagnosed earlier.

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