Mid-Third Femoral Stress Fracture With Hip Pain

John W. O'Kane, MD, and Laura Jane Matsen

Stress fractures are relatively common in runners, accounting for 10% to 15% of total running injuries.[1] Bennell et al[2] observed 111 track and field athletes for 12 months and noted a 21% incidence of stress fractures. Matheson et al[3] reported that 7% of all stress injuries to bone involved the femur. One review and one prospective analysis of stress fractures in athletes have shown a 3.5% incidence of femoral shaft involvement,[4] although Johnson et al[5] found that 20% of all stress fractures in a study of collegiate athletes involved the femoral shaft. This case of a midshaft femoral stress fracture illustrates the often vague and confusing symptoms of these injuries and reinforces the need for physicians to be alert to the possibility of a femoral stress fracture when evaluating a runner with hip or leg pain.

Case Report

A 17-year-old female student came to the clinic with the complaint of 4 weeks of intermittent left anterior hip pain that was beginning to radiate to her proximal medial thigh. She was a high school cross-country runner and was nearing the end of her season. She described the pain initially as an acute spasm in her groin after a 400-meter training run at sprint pace. The pain improved during the evening, and a couple of days later she was seen by her regular physician. She was also complaining of congestion, cough, fatigue, and a possible low-grade fever during the preceding week. Her history was notable for allergies treated with an oral antihistamine and exercise-induced asthma treated with inhaled albuterol before exercise. She denied any history of stress fracture, and she had no previous major orthopedic injuries. On examination she had tender left inguinal lymph nodes, and cephalexin was prescribed for a week for presumed lymphadenitis. During the next week she continued to train, complaining of proximal thigh and groin pain with foot strike, especially running downhill. Her lymphadenopathy improved, but her pain was gradually worsening with activity, although still improving with rest. Because she began to experience worsening hip and proximal thigh pain and spasm after races, she was referred to a sports medicine clinic.

At that time she had a normal gait and was able to hop without pain. She had no point tenderness over her anterior hip, but she did have pain with hip flexion and adduction against resistance. She had no back pain and no lower extremity numbness, tingling, or weakness during a neurologic examination. Findings on radiographs of her hip and proximal thigh were normal. Findings on a magnetic resonance imaging (MRI) scan of her left hip were also normal, and there was no evidence of fracture or soft tissue abnormalities. At that time she was 2 weeks from the state championship competition. She was instructed to stop running and work on adductor and hip flexor flexibility and strength while conditioning in a pool.

After 1 week she was free of pain, so she attempted a moderate training run, which again resulted in considerable pain and spasm, although her symptoms were more in the region of her proximal to midthigh. The pain lasted for about 6 hours, during which time she was limping for a couple of hours. Again the pain improved. At that time, a bone scan was obtained looking for a femoral shaft stress fracture beyond the field evaluated in the MRI. The bone scan showed a focal area of increased uptake on the medial cortex of the middle third of the femur consistent with a stress fracture (Figure 1). At that point the patient was removed from competition and restricted to non–weight-bearing pain-free exercise. She did not require crutches.

At a follow-up visit the patient acknowledged that she had not had a menstrual period during the

Submitted, revised, 20 April 2000.

From the Department of Orthopaedics, University of Washington School of Medicine, Seattle. Address reprint requests to John W. O'Kane, MD, Sports Medicine Clinic, Department of Orthopaedics, Box 354060, University of Washington, Seattle, WA 98195.

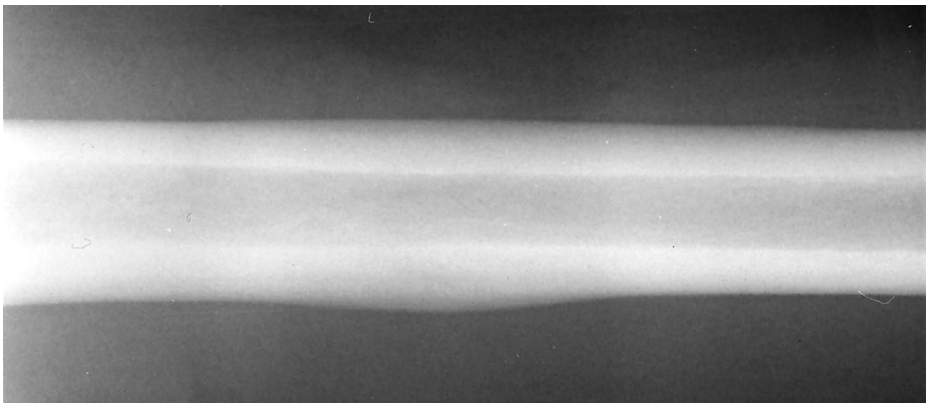

Figure 1. Bone scan showing local area of increased uptake on the medial cortex of the middle third of the femur consistent with a stress fracture.

last 6 months and that her training regimen was more aggressive this year than in years past. She did not feel she was restricting her diet, and she denied purging behavior. She had not increased her caloric intake to accommodate her increased training. She believed that her amenorrhea was a normal response to training.

At a 6 week follow-up visit she continued to note a dull ache occasionally in her mid to proximal thigh, which was improving. For the most part, however, she was ambulating without pain. Radiographs of her femur revealed an area with mature periosteal reaction in the medial midshaft consistent with a healing stress fracture (Figure 2). She was given permission to increase her strengthening program and begin a gradual progression to weight-bearing exercise with no running until after her 12-week follow-up examination. At 12 weeks she was skiing with no pain, and she was able to resume running after a gradual training progression.

Discussion

This case illustrates a number of important points in the evaluation of an athlete who is a runner. Thigh and hip pain from a femoral stress fracture is generally vague, and the location of the pain might not correlate with the location of the fracture. Clinical findings are also variable. Hip range of motion generally is not affected except in intracapsular fractures involving the femoral neck. Clement et al[6] in a case-control study of 71 athletes with femoral stress fractures reported a limp in only 22% of their cases, but they did note reproduction of pain with hopping in 70% of the cases. Johnson et al[5] reported a positive fulcrum test in 7 of 7 femoral shaft stress fractures. The examiner performs the fulcrum test by placing an arm under the symptomatic thigh of the seated patient then pushing down on the knee. Midthigh pain with the maneuver is a positive test. In this case, the hop test was negative and the fulcrum test was not performed.

Plain radiographs should be obtained early in the evaluation of recreational or competitive runners with thigh or hip pain, but as illustrated in this case, initial radiograph findings are often normal.

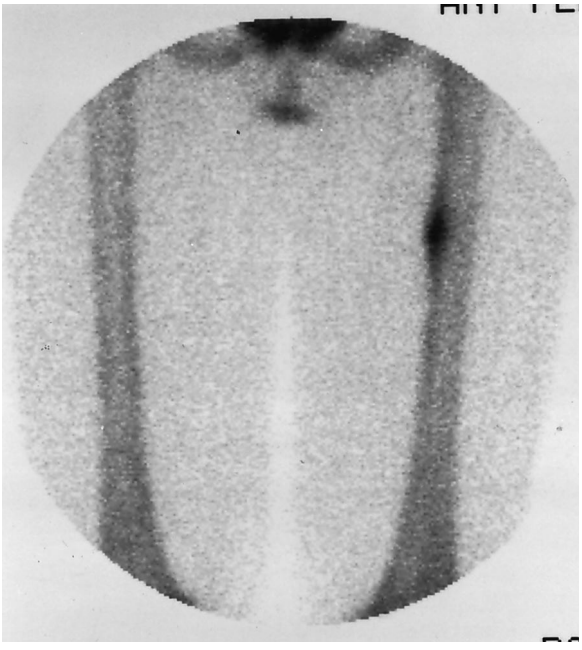

Figure 2. Radiograph of femur with mature periosteal reaction in the medial midshaft consistent with a healing stress fracture.

Clement et al[6] found plain radiographs diagnostic only 24% of the time. Because of the high morbidity of an untreated femoral stress fracture, if radiograph findings are normal, an MRI or a radionucleotide bone scan should be obtained. There are advantages and disadvantages with both imaging techniques. MRI is advantageous because the athlete is not exposed to radiation, and any pathologic abnormalities of soft tissue can be found, which will assist in rehabilitation. Early stress changes in bone can also be detected by MRI, with similar sensitivity and improved specificity compared with bone scan.[7] One disadvantage of MRI is that a standard examination evaluates a narrower field than bone scan, and as this case illustrates, pathologic changes in the femur beyond the field of a standard hip MRI can radiate pain to the hip. Consequently, if a stress fracture is suspected and hip pain persists despite normal hip MRI findings, a bone scan is indicated. In most institutions, MRI is also more expensive. If the primary purpose of the evaluation is to exclude a stress fracture by the most cost-effective means possible, a bone scan is the best initial screening test in runners with hip or thigh pain.

A second point is the importance of specific questioning regarding stress fracture risk factors when evaluating runners. Athletes who are runners should be asked about previous stress fractures, increases in training volume, medications such as corticosteroids that alter bone metabolism, a dietary history specifically addressing restrictive eating patterns, and a history of oligomenorrhea or amenorrhea. Clement et al[6] found that in their study the recreational runners with femoral stress fractures ran more than 56 km (35 miles) per week. Marathon runners exceeded 73 km (45 miles) and competitive runners were training more than 114 km (70 miles) each week. Bennell et al,[2] in a prospective study of track and field athletes, found that major stress fracture risk factors in women included a history of menstrual irregularity, including late menarche, lower bone density, a lower fat diet, and lower lean mass in the lower limb. Eliciting a history of amenorrhea earlier in the course of this case might have increased suspicion of a stress fracture and resulted in an earlier diagnosis.

About one half of all femoral stress fractures occur in the femoral shaft, with the medial aspect of the proximal third of the femur being by far the most common location. Biomechanical studies have shown that the medial shaft of the femur undergoes a compression strain with weight bearing, with the greatest strain occurring proximally.[8] This excessive compression in weight bearing, compounded by additional compressive loads from the adductors and vastus medialis, predisposes the medial aspect of the proximal femur to stress injury. Midshaft involvement, as in this case, is much less common in runners, and the factors contributing to a stress fracture in this location are less clear.

Rehabilitation and return to play after a femoral shaft stress fracture are guided by tolerance of pain-free activity. Conservative therapy is uniformly successful provided the patient gets adequate rest, and factors promoting the initial injury are addressed. Crutches are used initially, if necessary, to allow pain-free ambulation, and their use is withdrawn, as tolerated. Aerobic conditioning is maintained by pool workouts then cycling, as tolerated. Weight-bearing training, as tolerated, comes next with impact loading avoided for 6 to 8 weeks. Clement et al[6] in their review noted a mean time to return to preinjury exercise level of 10.4 weeks. Return to play in a review by Hershman et al[4] averaged 11.5 weeks. Follow-up radiographs are helpful at 6 to 12 weeks to document bony changes that might occur during the healing process. Return to play is guided, however, by the absence of clinical symptoms, and a follow-up MRI or bone scan is not necessary provided the athlete follows the expected course of improvement.

In conclusion, stress fractures are relatively common in runners and must be ruled out early to prevent serious potential complications. Findings on plain radiographs are frequently initially normal. Because the symptoms can be vague and poorly localized relative to the location of the injury, further imaging studies to rule out stress fracture should include the entire femur. If the injury is detected before progressing to a displaced fracture, conservative treatment is generally successful. Training errors and other risk factors should be evaluated to help prevent recurrence.

References

1. Brubaker C, James SL. Injuries to runners. J Sports Med 1974;2:189–98.
2. Bennell KL, Malcolm SA, Thomas SA, et al. Risk factors for stress fractures in track and field athletes. A twelve-month prospective study. Am J Sports Med 1996;24:810–8.
3. Matheson GO, Clement DB, McKenzie DC, Taun-

ton JE, Lloyd-Smith DR, MacIntyre JG. Stress fractures in athletes. A study of 320 cases. Am J Sports Med 1987;15:46–58.
4. Hershman EB, Lombardo J, Bergfeld JA. Femoral shaft fractures in athletes. Clin Sports Med 1990;9: 111–9.
5. Johnson AW, Weiss CB Jr, Wheeler DL. Stress fractures of the femoral shaft in athletes—more common then expected. A new clinical test. Am J Sports Med 1994;22:248–56.
6. Clement DB, Ammann W, Taunton JE, et al. Exercise-induced stress injuries to the femur. Int J Sports Med 1993;14:347–52.
7. Shin AY, Morin WD, Gorman JD, Jones SB, Lapinsky AS. The superiority of magnetic resonance imaging in differentiating the cause of hip pain in endurance athletes. Am J Sports Med 1996;24: 168–76.
8. Oh L, Harris W. Proximal strain distribution in the loaded femur. J Bone Joint Surg Am 1978;60:75–85.