

Femoral Stress Fracture in a Collegiate Male Basketball Player: A Case Report

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Objective: We present a case of a femoral stress fracture in a male Division I basketball player. **Background:** During post-season conditioning, the athlete (21 years, 200 cm, 102.3 kg) presented to the team physician with anterior mid-thigh pain. He reported intense pain that had progressively increased a month before he sought medical advice. The athlete indicated that the pain had spread from his upper thigh to his knee and lower leg and reported no numbness or tingling. Upon evaluation, the team physician ordered diagnostic testing to rule out the presence of a femoral stress fracture. **Differential Diagnosis:** Results of the thigh radiograph were negative for hip dislocation, femoral neck fracture or arthritis, but a bone scan revealed a posterior medial femoral stress fracture. **Treatment:** Sports restrictions were specified for the first 3 weeks to discontinue jumping and running. At the initiation of pre-season conditioning, four months after his initial evaluation, the athlete was given full clearance to participate in team practices. **Uniqueness:** Documentation of femoral stress fractures in the general population is commonly observed secondary to predisposing pathologies or in the elderly population; however, it has only been documented among females and marathon runners in the athletic or military population. **Conclusion:** Athletic Trainers must be aware of factors that place athletes at an increased risk of stress fractures and able to recognize the signs and symptoms in order to rule out a femoral stress fracture.

Stress fractures are micro-fractures within the bone matrix¹ and are most commonly caused by repetitive stress.¹⁻⁴ Competitive athletes are often predisposed to stress fractures due to repetitive sport-specific motions, lengthened seasons, and continuous years of participation.^{1,3} Stress fractures are well documented in the military setting and in collegiate athletics^{1,3-6} and have been reported in every major sport¹⁻³ as well as almost every bone.¹ Stress fractures are more prevalent in the lower extremity, occurring most in the tibia and bones of the foot; however, femoral stress fractures occur less frequently.^{1,3,6} Femoral stress fractures are overuse injuries caused by repetitive stresses, with two major possible etiological pathophysiologies.¹ First, during periods of high-intensity training without rest, bone formation as a result of stressful demands is unable to keep up with bone resorption.¹⁻² Further, muscle attaches to bone and repetitive muscle contractions may cause pulling forces at the attachment sites, initiating uncompensable stress.¹

Several factors may lead to the development of stress fractures. First, hormonal imbalances may predispose athletes to weakened bone structure.^{1,4,5} Research has indicated a decrease in estrogen levels in women, often caused by menstrual irregularities, is a risk factor for stress fractures.⁵ Additionally, low levels of male sex hormones are a predisposing factor for stress fractures as testosterone encourages a reduction of osteoclast formation.¹ Low testosterone levels are often found in male long-distance endurance runners.¹ Additionally, irregular gait patterns or leg-length discrepancy may lead to stress fractures as abnormal and asymmetrical forces are imposed upon the bone.⁴ Finally, most importantly, stress fractures are often found as

a result of overtraining and a lack of cross-training.² High-intensity workouts, performed without sufficient rest periods, are a considerable factor in uncompensable bone reformation.² These risk factors are often indicators for the development of stress fractures in marathon runners or females (specifically characterized by the female athlete triad: eating disorder, amenorrhea, and osteoporosis).¹⁻⁵

A paucity of data exists on femoral stress fractures in young, physically active male athletes. Femoral stress fractures have been closely associated as sequelae related to primary pathologies⁴ or in elderly populations.⁷ We found only one case reporting a stress fracture in a healthy, active male athlete, also a basketball player.⁸ The purpose of this investigation was to describe a unique case of a femoral stress fracture in a male collegiate basketball player.

Case Report

Patient History

A 21-year old male collegiate basketball player (21 yr, 200 cm, 102.3 kg) reported to the team physician complaining of medial thigh pain during his fourth year of Division I basketball. The athlete started playing basketball at 12 years of age. Between his sophomore and junior years of high school, he began to play intensely during his summer breaks including participating in summer camps, Amateur Athletic Union leagues, and city leagues. After beginning college basketball, he spent his summers working coach's camps, weight lifting, and playing pick-up basketball nearly every day. The athlete reported an approximate 2-week break from basketball each summer when he would go home. Throughout the athlete's college career, he sustained numerous injuries in his lower extremities including sprains, strains, bursitis, and tendonitis; he additionally underwent surgeries on both shoulders and experienced anteriorly herniated lumbar discs. The athlete had red-shirted the previous year due to shoulder surgery and had one remaining year to play. The team's basketball season had ended in early March after play-offs and after two weeks of rest, the team began intensive post-season workouts. The athlete reported the training was more rigorous than previous years and included weight lifting, individual basketball workouts, and vigorous conditioning sessions. Because the team was in their off-season at the end of April, the athlete chose not to see an athletic trainer and instead took it upon himself to go directly to the team physician. Upon evaluation by the team physician, the athlete reported intense pain along his thigh. The athlete reported that the pain began approximately 2 weeks after the beginning of post-season conditioning, and over the course of a month, the pain in his thigh had increased in intensity and spread out over a larger area including his knee and lower leg. The athlete denied previous leg injury, radiating pain, numbness, and tingling. To rule out a stress fracture as a differential diagnosis, the physician ordered diagnostic testing. No record indicating the athlete's diet, mineral intake, or supplement consumption was found. At this point in time, two other severe overuse injuries occurred on the basketball team: debilitating shin splints and compartment syndrome that eventually required surgery.

Differential Diagnosis

The differential diagnosis was hip dislocation, fracture of the femoral neck, degenerative arthritis, quadriceps contusion, quadriceps strain, myositis ossificans, leg length discrepancy, coxa vera, or a femoral stress fracture. Plain film radiographs ruled out hip dislocation, femoral neck fracture, and degenerative arthritis. Spin echo axial, coronal, and sagittal magnetic resonance imaging was performed to rule out muscle injury and demonstrated no significant findings in the thigh. Since radiographs are not sensitive for stress fracture, a bone scan was indicated. A technetium-99m bone scan revealed a focal area radiotracer uptake indicating

increased cortical activity within the posteromedial aspect of the distal metaphyseal-diaphyseal junction of the right femur consistent with a stress injury.

Treatment and Denouement

The team physician instructed the athlete to limit activity by restricting running and jumping for three weeks. He was permitted to do seated calf raises and knee extension and flexion strengthening. The athlete completed bike and pool workouts on a daily basis to maintain cardiovascular endurance. Three weeks after the initial evaluation, the athlete returned to the team physician for a follow up appointment. The athlete reported an increase in thigh pain from the first visit. He now also reported night pain and pain with ambulation. Upon physical examination, a fulcrum test was positive, a Thomas test was positive, and a straight leg raise was negative. The athlete demonstrated a hamstring lag of 30°. The athlete was put on crutches and instructed to take 1500 mg of calcium per day. The athlete continued bike and pool workouts until he returned to the team physician for his second follow up appointment. Five weeks after the initial evaluation the athlete was still reporting thigh pain and had pain simply sitting on the examining table with his leg dangling off. He was still exhibiting a positive fulcrum test, and now had a positive hop test. He was instructed to continue restraining from running or jumping but was allowed to continue to do pool and bike workouts, which he completed five days a week.

Two months after being diagnosed, the athlete returned for evaluation by the team physician, and the athlete was cleared to jog and participate in shooting drills. He was instructed to progress slowly and to back off with pain. The physician also stressed the need for continued off-season strengthening. By the time the team began pre-season conditioning, four months after the initial diagnosis, the athlete reported his thigh was only sometimes painful. The athlete was cleared for sports and was told to stretch aggressively. New bone scans indicated fracture healing.

Discussion

Identifying Femoral Stress Fractures

Although femoral stress fractures occur less frequently than stress fractures in other lower extremity bones, some femoral stress fractures have been identified in athletes participating in unsuspecting sports.¹⁻⁴ Therefore, athletic trainers need to be aware of and rule out stress fractures as a differential diagnosis for thigh pain.² Since the femur is located deep to muscle, symptoms do not necessarily include the normal fracture characteristic of palpable point tenderness. Instead, athletes with a femoral stress fracture may experience pain with weight-loading and pain with range of motion.¹ Deep stress fracture pain can be described as deep, burning, or lingering.² Although symptoms overlap with and may indicate several pathologies, a stress fracture or other fracture should be ruled out via diagnostic tests.^{2,3}

Femoral Stress Fracture as a Result of Over-training

We suggest that playing basketball year-round may predispose basketball athletes to femoral stress fractures. As previously established, stress fractures are the result of repetitive stress to bone.¹⁻⁴ In addition to providing structural support, one of bone's primary functions is to help absorb forces. Jumping is one of the distinguishing characteristics of basketball. Thus, jumping everyday in practice and games causes repetitive, heavy force stress through the weight-bearing bones, including the seldom-injured femur.

We also suggest that in addition, over-training and years of playing competitive basketball with very little rest increase the chances of a stress injury in a stronger, less frequently injured bone, such as the femur. Further compounding any predisposing factors, many

basketball players do not participate in cross-training, which is conditioning with other sporting options such as swimming, biking, or rowing. Two decades ago, many athletes often played two to four sports every year in both high school and college. While this does not provide for overall rest, playing different sports allows for a time of cross-training and periods of decreased jumping intensity. At the collegiate level, and now often at the high school level, athletes focus on and play only one sport. Also, in the summer and off-season months, athletes often participate in competitive camps, leagues, or play pickup games every day. Many serious basketball players now play basketball year-round from high school through college. Jumping year round for continuous years may increase the risk of basketball players obtaining overuse injuries, such as femoral stress fractures.

Prevention of Stress Fractures with Cross-Training

Periodization is a year plan designed to emphasize and develop sport-specific exercises enabling the athlete to come to his or her physical peak during their competitive season.⁹ The phases of periodization include preparatory, competitive, and transition.⁹ Due to the competitive nature of athletics, many athletes have shortened their transition stage or fail to give their bodies appropriate rest during the transition stage. Collegiate basketball players are recommended to have a transition period between the months of May and June, before starting again in July with sport-specific conditioning.⁹ During the transition months, basketball players could maintain their level of conditioning by swimming, biking, or elliptical machine training. Activities such as sprint workouts, track workouts, and plyometrics should be avoided during this period.⁹ While athletic trainers are well aware of the dangers of over-training, many coaches and athletes may not understand the concepts and importance of transition phases and cross-training in over-use injury prevention. The athletic trainer should educate coaches, emphasizing the need for cross-training, and recommend appropriate periodization schedules for athletes participating in competitive summer camps or leagues. Also, the athletic trainer should warn the athlete against playing pick-up games on a consistent basis as a training method and emphasize the importance of cross-training.

Uniqueness of This Case

It is not disputed that femoral stress fractures are not a rare injury. In fact, a plethora of evidence is found in the literature on femoral stress fractures in the general population, specifically in the elderly.⁷ Also, femoral stress fractures are well documented as a secondary problem or in concomitant to existing pathologies such as leg length discrepancy, coxa vera, or knee arthroplasties.⁴ Femoral stress fractures are well documented in the athletic¹⁻⁴ and military populations;⁵ however published case studies are typically found reporting the injury in females or in long distances runners. There is only one other published case of a femoral stress fracture diagnosed in a male participating in a sport other than long-distance running.⁸ Previous case reports indicated the rarity of a stress fracture in a male who is not a long-distance runner.² In a ten-year study of a Division I athletic program, only seven femoral stress fractures were recorded.² Of the seven femoral stress fractures reported, five occurred in females and two were sustained by male athletes.² Both of the male athletes diagnosed with femoral stress fractures were distance runners.²

Clinical Implications

Athletic trainers are responsible for the prevention, treatment, and rehabilitation of athletes as well as educating athletes about healthy behaviors. Part of the responsibility of recognizing injuries is to determine the cause of pain and pathology in order provide the correct treatment for the athlete. Athletic trainers may need to consider unlikely or improbable causes of

injuries when assessing an athlete's injury. Understanding and considering possible exceptions to normal predisposing factors to a variety of injuries can aid in the evaluation and assessment of stress fractures. In this case, the exceptions were an uncommon femoral stress fracture in an unlikely athletic population. Further, athletic trainers should stress to athletes, especially basketball players, the importance of cross-training in the prevention of over-use injuries.

References

1. Boden BP, Osbahr DC, Jimenez C. Low-risk stress fractures. *Am J Sports Med.* 2001;29:100-111.
2. Edwards PH, Wright ML, Hartman JF. A practical approach for the differential diagnosis of chronic leg pain in the athlete. *Am J Sports Med.* 2005;33:1241-1259.
3. Arendt E, Agel J, Heikes C, Griffiths H. Stress injuries to bone in college athletes. *Am J Sports Med.* 2003;31:959-968.
4. Korpelainen R, Orava S, Karpakka J, Siira P, Hulkko A. Risk factors for recurrent stress fractures in athletes. *Am J Sports Med.* 2001;29:304-310.
5. Shaffer RA, Mitchell JR, Brodine SK, Trone DW, Macera CA. Predictors of stress fracture susceptibility in young female recruits. *Am J Sports Med.* 2005;34:1-8.
6. Mathenson GO, Clement DB, McKenzie DC, Taunton JE, Lloyd-Smith DR, MacIntyre JG. Stress fractures in athletes: A study of 320 cases. *Am J Sports Med.* 1987;15:46-58.
7. Williams M, Laredo JD, Setbon S, Belange G, Timsit MA, Karneff A, Pertuiset E. Unusual longitudinal stress fractures of the femoral diaphysis: A report of five cases. *Skeletal Radiol.* 1999;27:81-89.
8. Willeford SK. Stress fracture of the femoral shaft in collegiate basketball player: A case report. *NATA News.* 2005;40:58-60.
9. Bompa TO. T. *Periodization training for sports.* Champaign, IL: Human Kinetics; 1999.