Stress fractures occur as a result of bone tissue overload. The development of micro-fractures is part of the normal fatigue process that leads to strengthening of bone tissue. When this fatigue process occurs continuously without an adequate amount of time for tissue remodeling to take place, however, a stress fracture can develop.

A common causative factor for development of stress fractures in runners is rapid increase in training volume, particularly when there has been an insufficient amount of time for bone tissue adaptations to occur. Female runners may have elevated risk, due to lower quadriceps strength per body mass unit than male runners. Poor quadriceps strength can lead to a diminished ability to dissipate forces acting on the femur during the stance phase of running.

The purpose of this case review is to present a systematic approach to the differential diagnosis and clinical management of a female recreational runner who developed a stress fracture of the femoral shaft.

**Patient History**

The patient was a thirty-two year old female who was not employed outside of the home and who had not previously participated in recreational or competitive running. Her training program consisted of running 3–5 days per week for a total distance of 15–20 miles per week. She recalled that the onset of her symptoms occurred at approximately one month after the initiation of her running program. She described her primary symptom as a dull ache in the right proximal lateral thigh and buttock region. She reported that she associated her symptoms with “normal muscle soreness” and continued her running program.

Approximately one week after the onset of her symptoms, she completed an eight-mile run, which she described as being significantly longer than her normal running distance. There were no other changes in her normal routine. Immediately following the eight-mile run, she experienced severe pain in the mid-thigh area that radiated both distally and laterally, and she experienced difficulty with normal ambulation.

**Clinical Examination**

The patient was diagnosed as having trochanteric bursitis by her primary care physician, and she was referred to physical therapy several days after the onset of severe pain. At the time of the initial physical therapy evaluation, she reported her pain as deep aching in the right lateral mid-thigh region, with a radiating ache that extended distally to the...
lateral side of the knee. She reported her pain as being 8/10 when attempting to run and 5/10 during normal ambulation. Her gait was antalgic, with a moderate decrease in weight bearing on the right lower extremity.

The clinical examination was consistent with a published recommendation for evaluation of the hip. Examination for the lumbar spine included assessment of active range of motion, and it was negative for provocation of the patient’s symptoms. Passive range of motion testing into hip extension provoked mild lateral thigh pain, with an empty end-feel as a result of muscle guarding. Passive hip flexion produced trace discomfort in the same region, without any limitation in normal range of motion. Passive hip external rotation and hip adduction provoked trace discomfort, with no limitation in normal range of motion. Manually resisted knee extension elicited mild lateral thigh pain, and manually resisted hip flexion elicited trace discomfort.

Passive range of motion and manually resisted hip and knee motions elicited vague and poorly-localized symptoms. The fulcrum test, described by Johnson et al., elicited severe lateral thigh pain, and the patient reported a sensation of nausea during performance of the test. The fulcrum test is performed with the patient sitting on the side of an examination table, the examiner places one arm beneath the thigh (proximal or distal), and the examiner exerts a downward manual force on the distal femur.

**Diagnosis**

Based on the patient’s history of a rapid increase in training volume, her relative brief experience as a runner, and the severe pain provocation associated with performance of the fulcrum test, a femoral shaft stress fracture was suspected.

Immediately following the examination, the patient was instructed to limit weight bearing through the use of crutches. She was instructed to return to her primary care physician, who was advised that the evaluation findings suggested the existence of a stress fracture. The primary care physician subsequently ordered radiographs, which were negative, and a bone scan, which revealed a mid-shaft femoral stress fracture (an example of such a bone scan result for a different patient is presented in Figure 1).

The patient was limited to toe-touch weight bearing with crutches for a period of four weeks. She gradually increased weight bearing and discontinued the use of crutches over the subsequent two-week period. The patient returned to physical therapy at ten weeks after her initial physical therapy examination. Treatment included open-chain and closed-chain quadriceps strengthening and gradual progression to slow jogging over a four-week period. Treatment was discontinued after six weeks, when she returned to running and initiated a home exercise program. At discharge from the therapy program, both running and the fulcrum test were pain-free. A pain-free fulcrum test was used as a criterion for functional progression of runners in a case series reported by Ivkovic et al.

**Discussion**

Stress fractures are a common cause of lower extremity pain in runners. Bennell et al. reported a 20% incidence of stress fractures among 111 track and field athletes over a 12-month period. The most common site of stress fracture among runners is the tibia. Occurrence of stress fracture in the shaft of the femur is relatively uncommon but must be considered when assessing lower extremity pain in a runner, especially if the history includes possible causative factors. One of the key factors in this case was the patient’s lack of prior recreational or competitive running. Gardner
et al. reported a 24 times greater incidence of stress fracture in previously inactive individuals than among very active individuals. The patient’s abrupt increase in volume may have also played a role. According to Wen, high training volume is associated with increased risk for development of overuse injuries in runners. No studies to date, however, have quantified the level of risk imposed by specific training variables such as training surface, running pace, or rate of progression in training volume. Age of running shoes has been identified as a factor in the development stress fractures in runners. In this case, the patient reported having worn new running shoes.

Early diagnosis of stress fracture is critical due to the potential for progression to a complete fracture. The fulcrum test proved to be an important examination component that helped to identify the source of the patient’s discomfort. The patient was able to resume running at approximately sixteen weeks after the initial physical therapy examination. The time frame for return to running is consistent with cases presented by Hershman et al. and Johnson et al.

**Summary**

The amount of time that passed between the onset of symptoms and acquisition of the bone scan that confirmed the existence of a femoral shaft stress fracture was approximately two weeks. Physicians, athletic trainers, and physical therapists who are familiar with running injuries can expedite the diagnostic process (see Table 1). This case illustrates the importance of early evaluation, careful consideration of the patient’s history, and performance of a thorough clinical examination.

**References**


**Table 1. Femoral Shaft Stress Fracture**

<table>
<thead>
<tr>
<th>Clinical Presentation</th>
<th>Differential Diagnosis</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased pain with weight bearing</td>
<td>Hip arthrosis</td>
<td>Acute (2-4 weeks): Rest and limited weight bearing</td>
</tr>
<tr>
<td>Decreased pain with rest</td>
<td>Labral lesion</td>
<td>Sub-Acute (4-8 weeks): Progressive increase in weight-bearing, aquatic, and upper extremity activities.</td>
</tr>
<tr>
<td>Positive Fulcrum Test</td>
<td>Muscle strain</td>
<td>Functional Restoration (8-12 weeks): Open and closed kinetic chained strengthening activities and progressive return to all prior activities.</td>
</tr>
<tr>
<td>Positive bone scan</td>
<td>Trochanteric bursitis</td>
<td></td>
</tr>
</tbody>
</table>


Chris Owens is an assistant professor with the Physical Therapy Department at Hampton University in Hampton Virginia.

William Humphries is a graduate student in Human Movement at A.T. Still University in Mesa, AZ.