



The American Orthopaedic  
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## SPORTS TIP

# Stress Fractures

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### What is a stress fracture?

Each day, the body produces new bone to replace the bone that is broken down by the stress of everyday living. Usually, this process is balanced, with the body replacing the amount of bone lost. However, this balance may become upset with excessive physical training. The body, due to several factors, may not produce sufficient bone. As a result, microcracks, called “stress fractures,” can occur in the bone.

The most common cause of stress fractures is an abrupt increase in the duration, intensity, or frequency of physical activity without adequate periods of rest. In addition to mechanical influences, systemic factors (such as hormonal imbalances), nutritional deficiencies, sleep deprivation, and metabolic bone disorders may contribute to the development of stress fractures. Furthermore, some female athletes who train competitively develop eating disorders and/or amenorrhea (infrequent menstrual periods). Both conditions may lead to a low estrogen state with resultant decreased bone mineral density and an increased risk of stress fractures.

Stress fractures are frequently seen in military recruits and athletes, especially runners. Although stress fractures have been described in nearly every bone of the human body, they are more common in the lower extremity weight-bearing bones. Stress fractures may be associated with a specific sport such as the humerus in throwing sports, the ribs in golfing and rowing, the spine in gymnastics, the



Dark regions on the above bone scan indicate stress fracture of the first rib.

lower extremity in running activities, and the foot in gymnastics and basketball.

### How will I know if I have a stress fracture?

Stress fractures produce pain in a limited area directly over the point of the bone where the fracture has occurred. The pain is exacerbated by activity and is relieved with rest. Bone tenderness is the most obvious finding on physical examination. Hopping or jumping on a leg with a stress fracture will cause increased pain.

X-rays may not be helpful in diagnosing an early stress fracture because the bone often appears normal and the microcracks are not visible. After several weeks of rest, the bone begins to repair itself and often demonstrates a healing reaction or callus on X-ray.

The diagnosis of an early stress fracture can usually be confirmed by a bone scan or magnetic resonance imaging (MRI). In a bone scan, a radioactive substance

called a “tracer,” normally used by the bone for repair, is injected into the patient’s bloodstream. All of the bones will absorb some of the tracer, but if a bone is repairing a stress fracture, it will absorb more of the tracer at the fracture site and will appear darker than uninjured bones (see figure). In many cases an MRI is preferable since there is no radiation exposure, the test takes less time, and MRIs are better than bone scans at specifying different types of bone or soft tissue abnormalities.

### How is a stress fracture treated?

Stress fractures may be broadly classified as either low-risk injuries (less likely to become more serious fractures) or high-risk injuries (more likely to become serious fractures). Low-risk stress fractures infrequently require expensive imaging modalities such as bone scans or MR imaging. Most cases can be diagnosed on the basis of a thorough history, physical examination, and radiographs. A rest period of one to six weeks of limited weight bearing progressing to full weight bearing may be necessary (see box). Return to activity should be a gradual process. Low-impact activities, such as swimming or biking, can be performed to maintain cardiovascular conditioning once the pain subsides. When the patient can comfortably perform low-impact activities for prolonged periods without pain, high-impact exercises may be initiated. Typically, the athlete gradually increases jogging mileage and eventually returns to sport-specific activities.



## Stress Fractures

High-risk stress fractures, involving areas such as the hip, have a predilection for progressing to complete fracture; therefore, they require a more aggressive approach. In athletes who have chronic pain and normal findings on initial X-rays, a bone scan or MRI is recommended. Because of the high complication rate, high-risk stress fractures should be treated like traumatic fractures—often with a cast and occasionally with surgery when necessary.

### How are stress fractures prevented?

Stress fractures are best managed by prevention. Training errors, such as an excessive increase in intensity, are the most frequent culprits and should be corrected. New activities, such as hill running or running on a hard surface, may be contributing factors. Athletes, coaches, military personnel, and parents should be educated about the deleterious effects of overtraining and the importance of periodic rest days. In addition, female athletes and their coaches need to be alerted to the adverse effects of eating disorders and hormonal abnormalities.

### Treating Lower Extremity Stress Fractures

#### Activity Progression

1. Non-weightbearing, non-impact activities like swimming or biking.
2. Weightbearing, non-impact activities like a stair machine or a treadmill.
3. Weightbearing, impact activities like jogging.

#### Intensity Progression

1. Low intensity, short duration.
2. Low intensity, increased duration.
3. Higher intensity, short duration.
4. Higher intensity, increased duration.
5. Advance to next activity level.