



ORIGINAL RESEARCH PAPER

Radiology

RADIOLOGICAL VALUATION OF STRESS FRACTURES OF THE LOWER LIMB

KEY WORDS: Stress fractures, knee pain, Diagnostic measure.

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ABSTRACT

The purpose of this study is to diagnose stress fractures early to prevent bone remodelling, non-union injuries and loss of function by using various modalities. Plain Radiograph, CT scan and MRI of 50 patients imaged with history of of localized pain related to change in their physical activity or followed by an effort/activity to which they were not accustomed were retrospectively reviewed for stress fractures. Lesions with both bone injuries and pathological findings on the adjacent soft tissues were taken into consideration and evaluated further. The age of the study population ranged from 16 to 75 years. Of the 50 patients studied, 25 were men and 25 were women. We found 5 mild stress reaction, 10 insufficiency fractures and 35 stress fractures. The use of CT and MRI is of a great importance for early diagnosis and thus was essential to exclude other causes of bone lesions that may create confusion in the differential diagnosis of a patient with pain and non-specific abnormalities on plain radiography. In the absence of a clear co-relation between repeated stress and pain in an active individual the clinical diagnosis of a stress related bone injury may be troublesome and a possible delay may cause worsening of this condition and further impairment to a professional athlete.

INTRODUCTION:

Stress fracture should be suspected in persons with a drastic recent increase in physical activity or repeated excessive activity with limited rest. Pain is a common presenting symptom that can vary by location, such as knee pain with a proximal tibial injury, hip pain with a femoral neck injury, or groin pain with a pelvic fracture. Specifically, pain with ambulation is common. On examination, patients usually demonstrate focal tenderness and edema at the site of injury.

Although the hop test (i.e., single leg hopping that produces severe localized pain) is often used and cited in texts as a diagnostic test for lower extremity fractures, no recent literature was found to validate its accuracy. In some studies, a positive hop test was an inclusion criterion⁴ or a common finding in patients with presumed stress fractures, but was also noted in nearly one-half of patients with suspected medial tibial stress syndrome (shin splints). Another diagnostic measure used often, but with little supporting evidence, is the tuning fork test (i.e., applying a tuning fork to the fracture site to produce focal pain).

Stress fractures are a result of accelerated physiologic change from excessive loading applied to a normal bone. (1) Chronic repetitive stress injury of bone involve a myriad of bone lesions extending from mild stress reactions with pain, soft tissue and periosteal oedema to complete and displaced stress or insufficiency fractures (2). Stress fractures are common in professional or recreational athletes, military personnel and also seen in any individual who starts a new activity or carries out normal activity in excess. The most frequent patients with stress related bone injuries are Runners and athletes. Stress fractures of the calcaneus, metatarsals, tibia, distal end of the fibula and sesamoid bones. (3) Insufficiency fractures usually occur in elderly patients with abnormal mineral content or with diminished elasticity of bone and are frequent in osteoporosis. These fractures are becoming increasingly important by the progressive aging of the population with a higher prevalence of osteoporosis. The most frequent locations for insufficiency fractures are the pelvic girdle, femur, tibia, and foot bones. Hence, in this study we intend to use multi-modality imaging and sensitivity of modalities to diagnose the stress fractures at earliest.

Our study aim is to Assess the sensitivity of Plain radiograph, Computed tomography and MRI in early and correct diagnosis of Stress Fractures.

Material and Methods:

The age of the study population ranged from 16 to 75 years. Of the 50 patients studied, 25 were men and 25 were women. We found 5 mild stress reaction, 10 insufficiency fractures and 35 stress fractures.

Inclusion Criteria:

Patients were clinically evaluated for history of localized pain related to change in their physical activity or followed by an effort/activity to which they were not accustomed. Lesions with both bone injuries and pathological findings on the adjacent soft tissues were taken into consideration and evaluated further.

Exclusion Criteria:

Diagnosed case of fracture on clinical examination and plain radiograph.

Observation:

Location is an important factor in the diagnosis of stress fractures. Different sports activities lead to location specific injuries. This information was useful to draw inference and classify the fractures in the high or low risk categories. Treatment is specific to type of fractures where high-risk fractures required prompt treatment.

Plain Radiography:

Initial Radiography in most of the cases is negative. The first imaging test on the majority of the studied cases was plain radiography. Its initial sensitivity is lower than 10 percent but it increases reaching 30 to 70 percent after three weeks. Common described features of stress fractures on plain radiography are as follows.

Subtle lucency: Faint sclerosis showing obvious signs appearing over the weeks.

Sclerosis with periosteal thickening and callus formation. Subtle loss of cortical density has been described as the grey cortex sign of early-stage stress injury. Sign known as the dreaded black line occurs in the anterior cortical bone of the tibia and suggests the presence of a fracture with poor prognosis and a high probability of evolution to a complete fracture because of its location in a region of bone tension and poor vascularization.

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• Subtle lucency. • Faint sclerosis showing obvious signs appearing over the weeks. • Sclerosis with periosteal thickening and callus formation. • Subtle loss of cortical density has been described as the grey cortex sign of early-stage stress injury. Sign known as the dreaded black line occurs in the anterior cortical bone of the tibia and suggests the presence of a fracture with poor prognosis and a high probability of evolution to a complete fracture because of its location in a region of bone tension and poor vascularization (4-5).

Computed Tomography:

CT Computed tomography was very useful in studying the bone in detail and to diagnose difficult cases mainly for fractures of the pelvic girdle or the foot and for demonstrating linear stress fractures following the long axis of the tibia.

Chronic and quiescent lesions were observed to be more evident on CT Scan. Following were the findings that was observed on CT scan:- • Sclerosis, • New Bone Formation, • Periosteal reaction • Fracture lines in long bones. It was also essential in differentiating stress fractures from bone tumour or osteomyelitis if the plain radiographs are negative and bone scans are positive. Hence, superior to other modalities in such cases.

Magnetic Resonance Imaging:

MRI is recognised as the most sensitive and specific imaging technique for the diagnosis of stress related bone injuries and most preferred examination in the absence of radiographic alterations. MRI is essential and makes it possible to differentiate medullary damage from cortical, endosteal and periosteal damage and thus allows gradation of the lesions regarding their severity and prognosis. A multimodality approach to these conditions allows the radiologist to correctly diagnose most of these complex cases. Sometimes however final diagnosis is made after biopsy. It is finally important to take note that the signal changes. Intramedullary endosteal edema is one of the first signs of bone remodelling. It is important to take note that the signal changes in stress fractures may persist during 5 to 6 months after the onset of the symptoms on the follow-up.

RESULTS:

The age of the study population ranged from 14 to 73 years. Of the sixty-three patients studied, 33 were men and 30 were women. We found 10 mild stress reaction, 19 insufficiency fractures and 34 stress fractures.

DISCUSSION AND CONCLUSION:

Radiologist is needed to obtain a high index of suspicion for this easily overlooked entity. Radiographs are not reliable for detection of stress fractures and radiologist should not falsely be comforted by them, which could result in delayed diagnosis and possibly permanent consequences for the patient. Although radiographs are mandatory to rule out differentials, they should be followed through when negative, preferably by magnetic resonance imaging (MRI), as this technique has proven to be superior to bone scintigraphy. CT can be beneficial in a limited number of patients, but should not be used routinely (6-8).

The use of CT and MRI is of a great importance for early diagnosis and thus was essential to exclude other causes of

bone lesions that may create confusion in the differential diagnosis of a patient with pain and non-specific abnormalities on plain radiography. In the absence of a clear co-relation between repeated stress and pain in an active individual the clinical diagnosis of a stress-related bone injury may be troublesome and a possible delay may cause worsening of this condition and further impairment to a professional athlete. Imaging plays an important role in the specific diagnosis of stress related bone injuries and helps in classifying them into high and low risk fractures. Also in some patients there are indeterminate findings that may suggest stress related bone injury but subsequent imaging techniques or biopsy provide a final diagnosis of inflammation or tumour. In cases where stress fractures are secondary to any systemic lesion, diagnosing the condition promptly had helped in further treatment and better prognosis of a patient.

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