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Stress fracture in metatarsals: concerning two cases

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Summary

Stress fractures occur when a bone with normal elastic strength is subjected to higher loads than its mechanical strength. Although they may occur in any location they are more frequent in the metatarsals, these being the areas subject to greatest load. The clinical presentation for stress fractures is highly non-specific, which means that a detailed history is key to a suspected diagnosis. X-rays may be normal in the first stages, with gammagraphy and magnetic resonance being the gold standards for diagnosis in the initial stages. It is recommended that a study of possible underlying causes which may have contributed to the fracture is carried out. Generally the treatment is conservative, although in some cases, such as those occurring in the 5th metatarsal, surgical treatment may be necessary.

Key words: *fracture, stress, metatarsals.*

Introduction

Stress fractures occur when a bone with a normal elastic strength is subject to repeated force by tension or compression. We need to differentiate between stress fractures and fractures due to insufficiency, which are those which are produced by physiological tensions on a bone with reduced bone strength.

Stress fractures may appear in any location, being more common in the metatarsals (MTT), mainly in the neck of the 2nd and 3rd MTT. The clinical presentation and physical examination permit a suspected diagnosis, confirmed with an X-ray. However, in the initial stages the X-ray may be normal or inconclusive, which means that the carrying out of a CT, NMR or bone gammagraphy is necessary. Below, we describe two cases of stress fractures.

Case 1

We describe the case of a female patient of 47 years of age being monitored due to psoriatic spondyloarthritis and fibromyalgia, in treatment with leflunomide, celecoxib and gabapentin, without history of interest and who maintained a regular menstrual cycle. She reported no toxic habits and her body mass index (BMI) was normal. In a routine examination she reported pain in her feet and ankles, with no history of trauma, with a mechanical rhythm, which had increased progressively until claudication occurred, with

Figure 1. NMR image of right foot which shows fracture callus in the 3rd and 4th MTT (Case 1)



modification of the foot statics due to the pain. The examination highlighted the inflammation of the ankles and feet with pain from the pressure and bilateral fovea. An echography was carried out at the surgery which showed up a very marked inflammation of the subcutaneous cell tissue (SCT) with no signs of synovitis or Doppler signal. An X-ray was requested of the feet, which showed no pathological signs. Due to the significant SCT oedema, the patient was referred to angiology for assessment. From this service a lymphography was requested which confirmed severe bilateral lymphatic insufficiency. With the persistence of the symptoms of intense pain with claudication, the carrying out of an NMR of the feet was initiated, which showed in the right foot a fracture callus in the 3rd and 4th MTT and oedema in the 2nd MTT (Figure 1); and in the left foot a fracture line in the 1st MTT, and oedema in the 3rd and 4th MTT and in the surrounding tissue (Figure 2). Given the findings of the NMR, the patient was assessed by the traumatology service which indicated conservative treatment with non-weight-bearing and rehabilitation (magnet therapy). Due to the finding of multiple stress fractures, the study proceeded in our clinics, with analysis of renal function, calcium in blood and urine, ionic calcium, magnesium and PTH being carried out, which were normal. Only vitamin D was confirmed to be 19.5 ng/ml, for which treatment for supplements was indicated.

Assessing the case of this patient as a whole, we suggested, as a predisposing factor to the appearance of stress fractures, the significant antalgic alterations in foot statics which had developed due to the pain produced by the severe lymphatic insufficiency the patient had suffered.

Case 2

We describe the case of a 58 year old female patient. Her history includes a hysterectomy at 42 years of age due to metrorrhagia secondary to myoma. Two years before, she had been assessed by the gynaecology department due to densitometric lumbar osteoporosis (T-score in L1-L4 of -3, with normal figures in the femoral neck), treated with denosumab and vitamin D supplements. No toxic habits or personal or family history of fracture were reported, and her BMI was normal. She attended the clinic due to mechanical pain in the left foot, acute onset, without inflammation or triggering cause, which had increased in intensity until it became refractory to NSAIDs. In the examination there were no notable findings, except pain on the movement of the left forefoot. No alterations in the foot statics were observed. The patient was given an X-ray of the feet with showed no pathological signs. An NMR of the left foot was requested, which revealed a stress fracture in the 2nd MTT with periosteal callus and soft tissue oedema (Figure 3). An analytic study was carried out, which highlighted an increase in levels of PTH and vitamin D. (103.7 pg/ml and 272 ng/ml, respectively), attributed to an excess in the sup-

plementation of vitamin D. Renal function and calcium in blood and urine were normal. Treatment with vitamin D supplements and denosumab were stopped. Assessed by the traumatology service, conservative treatment was indicated, with non-weight-bearing, relative rest, NSAIDs and magnet therapy, with progressive improvement. Due to the age of the patient, 58 years, and the predominance of osteoporosis in the lumbar region, the patient was considered an appropriate candidate for treatment with SERMs (bazedoxifene), associated with supplements of calcium with vitamin D. One year later, in the same month in which the pain started in the earlier episode, the patient again reported the same symptoms in the left foot, without a triggering cause. An X-ray was requested which showed a callus from an old fracture in the 2nd MTT due to an earlier stress fracture, with no other findings. An NMR was carried out of the left foot to complete the study, which showed oedema in the 1st and 3rd MTT, cuneiform, scaphoid and astragalus bones, and posterior tibial tenosynovitis. A new bone densitometry was requested which showed a T-score in the lumbar spine of -3.5. The patient had not been taking bazedoxifene and vitamin D continuously, so the importance of resuming them was emphasised given that the levels of bone mineral density had worsened. The fractures were treated with rehabilitation and non-weight-bearing with progressive improvement.

Assessing the case overall, we suggest osteoporosis as the predisposing factor, since the patient was not obese, nor had she presented trauma or other risk factors. The fact that the two episodes of pain started in the same month (coinciding with a change of season) with a year's difference, appears to us striking. The patient reported no change in her habits or in her state of physical activity (sedentary) at these times, which is why we consider that the change in type of footwear may have put an overload on the left foot causing the appearance of new stress fractures.

Discussion

The first description of stress fractures are attributable to Dr Briethaupt, who studied pain in the feet of recruits which worsened with standing and training. Stress fractures are located in the MTTs in 25% of cases, this being the area of greatest load¹. Those located in the 2nd, 3rd or 4th MTT are considered to be low risk because they usually respond to conservative treatment, while those in the 5th MTT are of high risk^{2,3} since they may require more aggressive treatment^{4,5}. Although different causes have been suggested risk factors are considered to be^{6,7,8}: anatomical anomalies (flat feet, dorsiflexion or plantar flexion of MTT, contracted gastrocnemius, excessively long 2nd MTT); physical anomalies, obesity, osteoporosis and related diseases, lack of exercise, muscular insufficiency and external factors (footwear, changes in the intensity or amount of training, change in the training surface).

Figure 2. NMR image of the left foot with fracture line in the 1st MTT, bone oedema in 2nd, 3rd and 4th MTT, and in surrounding tissues (Case 1)

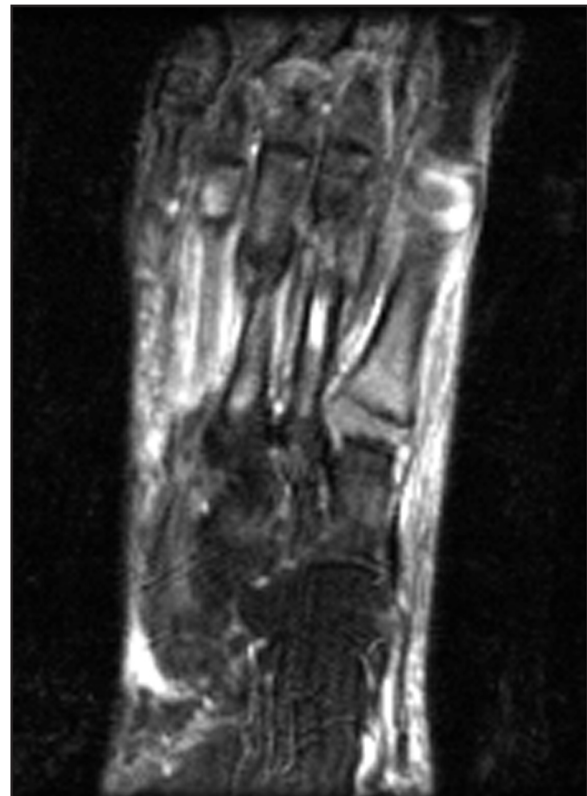


Figure 3. NMR image of left foot with fracture of 2nd MTT with periosteal callus and soft tissue oedema (Case 2)



Table 1. Radiological gradation of stress fractures

	X-ray	Gammagraphy	NMR	Treatment
Grade I	Normal	Poorly defined hypercaptant areas	STIR positive T1 and T2 negative	3 weeks rest
Grade II	Normal	More intense capture but not defined	STIR and T2 positive T2 negative	Rest of 3-6 weeks
Grade III	Barely perceptible lines. Incipient periosteal reaction	Well defined areas of capture with well contrasted margins	T1 and T2 positives without cortical rupture	Rest for 12-16 weeks
Grade IV	Fracture or periosteal reaction	Intense transcortical capture	T1 and T2 positive with fracture line	More than 16 weeks rest

The diagnosis is based on a detailed clinical history which includes data on working and sporting habits. A stress fracture should be suspected in a case of foot pain which is poorly located and worsens gradually after the start of a new activity or very hard training weeks before the start of the pain. The radiological evidence does not usually appear before 2-6 weeks, cortical stretching and periosteal thickening and hypertrophy being the initial radiological signs. The degree of bone lesion may be of different intensity: bone contusion, cortical microfracture, extended periosteal microfracture and macroscopic transcortical fracture⁹. Gammagraphy and NMR are the “gold standards” for the initial diagnosis of cases, those in which X-ray tests may show normal findings. The classification of Arendt¹⁰ correlates the histopathological studies with the imaging tests and treatment (Table 1). Grades I and II correspond to the stage of medullar oedema, grade III corresponds to periosteal changes and bone stress, and grade IV to clear cortical fracture.

The treatment is initially conservative, although in some cases, especially in fractures in the 5th MTT, surgical treatment may be necessary¹¹.

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