CASE REPORT

Bilateral distal tibial stress fractures in a healthy field-hockey goalkeeper

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SUMMARY

Stress fractures occurring within the lower limbs are relatively common in athletes and military personnel. The specific bones affected are often predictable when the patient's activities are considered. We present an unusual case of bilateral distal tibial stress fractures sustained while playing as a goalkeeper in field hockey, in an otherwise healthy 46-year-old woman.

INVESTIGATIONS

Initial anteroposterior and lateral X-rays of both ankles appeared and were reported as normal (figure 1). The patient was referred to a musculo-skeletal physiotherapist for strengthening exercises, and an MRI of both ankles was arranged. The MRI was performed 4 weeks after the onset of symptoms and revealed bilateral distal tibial fractures through the metaphyseal regions, just proximal to the physal scars (figure 2).

BACKGROUND

Athletes participating in high-level sport are at risk of developing stress fractures, due to the volume and intensity of training and the repetitive stresses placed on specific anatomical regions.¹ The regions or bones affected may be particular to the athlete's individual sport or position.¹ We present an unusual case of bilateral distal tibial stress fractures sustained while playing as a goalkeeper in field hockey, in an otherwise healthy 46-year-old woman. Reports of this specific injury are rare, and to the best of our knowledge it has not previously been associated with field-hockey goalkeepers.

CASE PRESENTATION

A healthy 46-year-old woman developed pain in both ankles after playing as a goalkeeper in a field-hockey match. She first noticed the pain 1 day after she played in the first match of a new season in the Irish National League. The patient had completed approximately 3 months of preseason training prior to the start of the season. She could recall no specific traumatic or initiating event during the match, and there was no direct blow or other such injury to her ankles. The pain was deep-seated and throbbing and was aggravated by exertion. Despite her discomfort, she continued to work as an anaesthetic nurse in an orthopaedic teaching hospital. Simple analgesia was ineffective, so 2 weeks after the onset of symptoms she sought an opinion from an orthopaedic consultant with an interest in foot and ankle surgery. Initial examination revealed a bilateral antalgic gait with some tenderness over the anterior aspect of both ankle joints. There was no swelling or bruising evident at either ankle. The patient retained a full range of motion in both ankles and both feet, but complained of anterior ankle pain in full dorsiflexion and full plantarflexion of her ankles. A neurovascular examination of both feet and ankles was entirely normal. The patient reported no significant medical history and was not taking any medication.

DIFFERENTIAL DIAGNOSIS

With no history of trauma in an otherwise healthy 46-year-old hockey player, the primary diagnosis of bilateral stress fractures was made. We also considered the possibility that this woman may have osteoporosis, and that she may have lower limb alignment anomalies that may have contributed to increased stress concentration through her distal tibiae.

TREATMENT

Stress fractures are routinely treated with rest and offloading of the affected limb in order to break the strain cycle. In cases where the patient is unable to offload the limb, supportive splintage may provide pain relief. At the time of diagnosis of bilateral distal tibial stress fractures (4 weeks post onset of symptoms), the patient reported a decrease in her pain levels and an improvement in her gait. She had not been immobilised during this period and had continued to work. After discussion with the patient, it was agreed that immobilisation at this stage would result in stiffness of her ankle, and was unnecessary. Her symptoms and function were improving without the use of any form of splintage, and it was agreed that immobilisation at this stage would be counterproductive. She was advised to contact the orthopaedic team directly if she experienced any increase in pain or decrease in function.

OUTCOME AND FOLLOW-UP

Over a period of 12 weeks, the patient's symptoms gradually resolved. Radiographs were repeated 6 weeks after the initial radiographs and these confirmed the presence of healing stress fractures (figure 3). Lower limb alignment X-rays (figure 4) demonstrated normal alignment, and a dual-emission X-ray absorptiometry (DEXA) scan was normal, ruling out osteoporosis or osteopaenia (figure 4). At the most recent review, the patient's symptoms have resolved and function has returned to normal. She continues to work as an anaesthetic

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Figure 1 Anteroposterior and lateral radiographs of the right ankle (A) and left ankle (B) at initial presentation with apparent normal appearance.

nurse in an orthopaedic hospital, but has decided to retire from field hockey.

DISCUSSION

The incidence of stress fracture occurring in athletes is reported to be around 2%.²⁻³ The tibia has been shown to be the most common site for lower limb stress fracture in this group, but most tibial stress fractures occur within the diaphysis.² Reports of true stress fracture through the distal tibial metaphysis are rare.⁴⁻⁹ Reports of bilateral distal tibial stress fractures are even

less common.¹⁰⁻¹³ Associated aetiological factors include military exercises,¹⁰ chronic liver disease,¹¹ prolonged heavy lifting on stairs¹² and heavy smoking.¹³ Our patient did not report any of these risk factors, and we could find no reports in the literature regarding distal tibial stress fractures related to field hockey or goalkeeping.

Risk factors for stress fracture include repetitive activity and abnormal biomechanical forces across the bone.¹⁴ Field-hockey goalkeepers protect their goal by externally rotating their lower limbs to block the progress of the ball with the insteps of their

Figure 2 Sagittal and coronal T1-weighted MRI scan of the right (A) and left (B) ankles. Sagittal and coronal STIR sequence MRIs of the right (C) and left (D) ankles.

Figure 3 Repeat anteroposterior and lateral radiographs of the right (A) and left (B) ankles taken 6 weeks after initial presentation, demonstrating healing stress fractures not evident on initial radiographs.

feet. Padding is worn to protect the ankle and lower leg from direct blows from the ball, but the repeated torsional movement of the tibia may result in concentration of stress in the distal aspect of the bone, especially if the foot is fixed on the ground and the tibia placed under valgus stress to resist the impact of the ball. This may lead to excessive strain in the tibia, which can result in pathological bone modelling, remodelling or micro-damage leading to stress fracture.^{15 16}

Mal-alignment of the lower limbs can lead to abnormal stress concentrations within the bony structures and may predispose to stress fracture.¹⁴ The alignment X-rays in [figure 4](#) demonstrate normal lower limb alignment, making this an unlikely aetiological factor. Low bone mineral density can also predispose to development of stress fractures, but the normal DEXA

scan seen in [figure 4](#) excludes osteoporosis and osteopaenia as a contributory factor. The patient is a healthy 46-year-old woman who is a non-smoker and reports no other known medical comorbidities. In the absence of any other detectable risk factors, we propose abnormal stress patterns within the distal tibia as the aetiological factor most likely to have precipitated the patient's injuries. These stress patterns appear to be specific but not unique to goalkeepers in field hockey.

This woman's fractures healed without any period of immobilisation. This management strategy was influenced by her late presentation, and by the fact that her symptoms had started to resolve when the diagnosis was made. Had we reviewed the woman and established the diagnosis earlier, immobilisation in some form of cast or splint would have been initiated to allow

Figure 4 Normal lower limb alignment radiographs and normal dual-emission X-ray absorptiometry scan.

the bones to heal and prevent the development of a deformity. It was felt that both fractures were sufficiently stable so that immobilisation was not necessary, as evidenced by both fractures being undisplaced despite the patient fully-weight-bearing on them for 4 weeks. Splinting would also have helped to alleviate pain, but her symptoms were resolving at first presentation, and it was felt that immobilisation would result in ankle stiffness with no real contribution to pain control. The management strategy was discussed with the patient, and all parties agreed that immobilisation would be counterproductive. This strategy proved to be successful, and the patient has an excellent outcome with no complications.

Learning points

- ▶ Bilateral stress fractures of the distal tibial metaphysis are uncommon, but can occur in susceptible individuals.
- ▶ Patients who complain of sudden onset and prolonged ankle pain with normal radiographs should have an MRI performed to exclude stress fracture.
- ▶ Abnormal lower limb alignment, whether structural or postural, may not only result in abnormal stress concentration within the tibia, but may also predispose to stress fracture.
- ▶ Stress fractures should be treated with offloading of the affected limb, and short-term immobilisation can be used to provide analgesia.
- ▶ MRIs are useful in cases where the pathology is unclear, but are not indicated in clear cases of stress fracture seen on appropriate X-rays.

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Contributors BJON identified the case as unusual and prepared the case report. KR arranged imaging studies, follow-up and coedited the case report. NGB prepared the figures and coedited the case report. PJM was involved in the editing of the manuscript.

Competing interests None.

Patient consent Obtained.

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REFERENCES

- 1 Robinson M, Fulcher M. Delayed healing of a navicular stress fracture, following limited weight-bearing activity. *BMJ Case Rep* 2014;2014:pil: bcr2013203216.
- 2 Iwamoto J, Takeda T. Stress fractures in athletes: review of 196 cases. *J Orthop Sci* 2003;8:273–8.
- 3 Sherbondy PS, Sebastianelli WJ. Stress fractures of the medial malleolus and distal fibula. *Clin Sports Med* 2006;25:129–37.
- 4 Bernholt DL, Garzon-Muvdi J, Chhabra A, et al. Fracture of the distal tibial physis in an adolescent recreational dancer. *Am J Sports Med* 2013;41:1649–52.
- 5 Van Demark RE Illrd, Allard B, Van Demark RE Jr. Nonunion of a distal tibial stress fracture associated with vitamin D deficiency: a case report. *S D Med* 2010;63:87–91.
- 6 Jensen A, Dahl S. Stress fracture of the distal tibia and fibula through heavy lifting. *Am J Ind Med* 2005;47:181–3.
- 7 Gwyn DT, Olney BW. Stress fracture of the distal tibial physis following subtalar arthrodesis: a case report. *Am J Orthop (Belle Mead NJ)* 2004;33:295–7.
- 8 Miyakoshi N, Sato K, Murai H, et al. Insufficiency fractures of the distal tibiae. *J Orthop Sci* 2000;5:71–4.
- 9 Mulligan ME, Shanley DJ. Supramalleolar fatigue fractures of the tibia. *Skeletal Radiol* 1996;25:325–8.
- 10 Sciberras N, Taylor C, Trimble K. Bilateral distal tibial stress fractures in a military recruit. *BMJ Case Rep* 2012;2012:pil: bcr0120125563.
- 11 Tsuchie H, Miyakoshi N, Hongo M, et al. Insufficiency fractures of bilateral distal tibiae associated with chronic liver disease. *J Orthop Sci* 2010;15:678–81.
- 12 Sobczyk K, Močko K, Sonecki L, et al. Bilateral stress fracture of distal fibula and tibia—case report. *Ortop Traumatol Rehabil* 2008;10:183–90.
- 13 Mpofu S, Moots RJ, Thompson RN. Bilateral distal fibular and tibial stress fractures associated with heavy smoking. *Ann Rheum Dis* 2003;62:273–4.
- 14 Tey IK, Chong K, Singh I. Stress fracture of the distal tibia secondary to severe knee osteoarthritis: a case report. *J Orthop Surg (Hong Kong)* 2006;14:212–15.
- 15 Frost HM. Perspectives: bone's mechanical usage windows. *Bone Miner* 1992;19:257–71.
- 16 Burr DB, Milgrom C, Fyhrie D, et al. In vivo measurement of human tibial strains during vigorous activity. *Bone* 1996;18:405–10.

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