MRI Monitoring of Tarsal Navicular Stress Fracture Healing — A Case Report —

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Summary: Stress fractures of the tarsal navicular bone are rare injury and assessing its healing is difficult. Tenderness over the tarsal navicular on physical examination is the most reliable sign for assessing fracture healing. However, it is desirable to assess fracture healing with some imaging method. We used serial magnetic resonance imaging (MRI) to assess healing in a patient with a tarsal navicular stress fracture. MRI was useful for the assessment of fracture healing of tarsal navicular stress fracture in our case.

Key words stress fracture, tarsal navicular, magnetic resonance imaging (MRI)

INTRODUCTION

Stress fractures of the tarsal navicular bone are rare [1-10]. The prognosis is usually good with appropriate treatment, but assessing fracture healing is difficult. Khan et al. [11] has shown that tenderness over the tarsal navicular on physical examination is the most reliable sign for assessing fracture healing, and that neither computed tomography (CT) nor bone scintigraphy is sufficiently accurate. However, it is desirable to assess fracture healing with some imaging method. We used serial magnetic resonance imaging (MRI) to assess healing in a patient with a tarsal navicular stress fracture, and describe the MRI findings in conjunction with the findings on physical examination.

CASE REPORT

A 17-year-old male high school baseball player presented with pain in the dorsomedial aspect of the right foot. He had been training 3-4 hours daily for about 5 years. The pain had been present for 6 months and prevented him from participating in baseball training. He denied direct trauma. Physical

examination revealed no swelling or redness of the right foot or ankle and ankle motion was normal. Dorsiflexion of the great toe against resistance reproduced the pain on the dorsal aspect of the right foot. Radiographic evaluation revealed a radiolucent fissure line in the central one-third of the right tarsal navicular involving the proximal articular border of the talo-navicular joint but not the distal. MRI was performed 7 days after the initial radiographs. T1-weighted axial images revealed a diffuse low intensity area in the tarsal navicular bone (Fig.1, row a, left), and T2-weighted axial images (fast spin echo) revealed a linear high signal intensity area surrounded by a larger diffuse low intensity area (Fig.1, row a, right). We advised the patient to discontinue sports activity and prescribed non-weight bearing on the right foot and followed the patient with physical examinations, plain radiographs, and MRI. The fracture line on the plain radiographs was no longer observed 4 weeks after treatment onset, but the linear high intensity area on T1-weighted images and the thicker linear high intensity area on T2-weighted images were still observed. Tenderness over the right tarsal navicular persisted until 16 weeks, at this time the linear high intensity areas on both T1- and T2-

Fig. 1. Serial magnetic resonance examinations of the tarsal navicular in a 17-year-old athlete with a stress fracture. Each row of images includes a T1-weighted axial image, and a fast spin echo T2-weighted axial image. Images in row a were obtained at the initial presentation; those in rows b, c, d, and e were obtained at 4, 8, 16, and 24 weeks later, respectively.

weighted images had disappeared. The diffuse low intensity areas on T1- and T2-weighted images were still present. These low signal intensity areas had been shrinking gradually and observed on MRI until 24 weeks after presentation.

DISCUSSION

Stress fracture of the tarsal navicular bone, first reported by Towne et al. [1], is uncommon [4]. Because of intensive athletic training and excellent diagnostic methods, this stress fracture has recently been found more frequently [3-5,8,11]. In patients with suspected stress fracture of the tarsal navicular bone and normal radiographs, the diagnosis can be made using CT or scintigraphic bone imaging with technetium-99. However, these imaging modalities have been shown to be inaccurate for the evaluation of fracture healing [11]. CT does not necessarily show complete obliteration of the fracture even though the patient is symptom-free [11]. For these reasons, Khan et al. [11] recommended that tenderness of the tarsal navicular should be used to monitor fracture healing. This, however, is a subjective clinical evaluation. Our case illustrates the potential usefulness of MRI in assessing fracture healing. The linear high signal intensity area on T1-weighted images may represent hemorrhage and was no longer seen on MRI at 8 weeks. The thick linear area of high signal intensity on T2-weighted images was no longer seen on MRI at 16 weeks, and the diffuse low signal intensity areas observed on both T1 and T2-weighted images showed gradual shrinkage consistent with clinical union. Concurrently, tenderness over the tarsal navicular bone resolved. We conclude that MRI was useful for the assessment of fracture healing of the tarsal navicular stress

fracture in our patient.

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