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Case Report

Localized naviculocuneiform arthrodesis combined with osteosynthesis of fracture nonunion of the tarsal navicular bone using a locked plating system

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ABSTRACT

Aims: Navicular fracture is still challenging disorder to treat because there is a risk of nonunion, avascular necrosis and symptomatic osteoarthritis.

Patients (Methods and results): A 40-year-old woman with an ununited fracture of the tarsal navicular bone was treated with localized naviculocuneiform arthrodesis (arthrodesis of the navicular, the middle cuneiform, and the lateral cuneiform). Fusion with the navicular, the middle cuneiform, and the lateral cuneiform as well as union of fracture of the navicular was confirmed on the radiographs.

Conclusion: Localized naviculocuneiform arthrodesis using a locked plating system is one of the options to treat nonunion of the navicular bone.

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1. Introduction

Navicular fracture is still challenging disorder to treat because there is a risk of nonunion and avascular necrosis due to tenuous blood supply of the navicular and nonunion and avascular necrosis of the navicular bone result in symptomatic osteoarthritis.¹ In the present report, we successfully treated nonunion of the body of the navicular bone with localized naviculocuneiform arthrodesis (the arthrodesis of the navicular, the middle cuneiform, and the lateral

cuneiform), combined with osteosynthesis of fracture nonunion of the navicular using a locked plating system. The patient and the family were informed that data from the case would be submitted for publication and gave their consent.

2. Case presentation

A 40-year-old woman fell from a motorcycle and felt pain in the left foot, however, she did not consult any physicians.

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Fig. 1 – Radiographs of the left foot at first visit. Six months after injury, the anteroposterior (A), the lateral (B), and the oblique (C) views revealed an ununited fracture of the tarsal navicular bone with displacement of the bone fragment (arrow).

Six months later, she visited us. Tenderness and swelling with less local heat was detected over the dorsal midfoot and the active range of motion of the ankle was not limited. The radiographs of the foot revealed an ununited fracture of the tarsal navicular bone with an upward displacement of the dorsal bone fragment (Fig. 1). Computed tomographic (CT) scan revealed that the fracture site was located at the middle to lateral portion of the navicular with an upward displacement of the dorsal bone fragment (Fig. 2). We diagnosed the patient with nonunion of the tarsal navicular

bone and treated the patient surgically with internal fixation with two headless screws. However, the fracture did not unite.

Therefore, we planned the localized arthrodesis of the midfoot (the arthrodesis of the navicular, the middle cuneiform, and the lateral cuneiform) combined with osteosynthesis of fracture nonunion of the navicular as a salvage surgery, one year and six months after the initial injury (Fig. 3).

Through a curved longitudinal skin incision on the foot over the navicular, abnormal movement between the two

Fig. 2 – CT scan of the left foot before surgery. Fracture nonunion with an upward displacement of the dorsal fracture fragment was confirmed on the axial (A) and the coronal (B) plane of the CT scan.

Fig. 3 – Scheme of localized naviculocuneiform arthrodesis combined with osteosynthesis of fracture nonunion of the navicular. Free cancellous bone was grafted to the fracture nonunion site of the navicular, the naviculo-middle cuneiform joint, and the naviculo-lateral cuneiform joint. The fracture fragments of the navicular, the middle cuneiform, and the lateral cuneiform were fixed with the locked plating system.

navicular fragments was observed and the gap at the nonunion site of the navicular was filled with fibrous tissue. The articular cartilage of the navicular, the middle cuneiform, and the lateral cuneiform was damaged and partially eburnated. By contrast, the articular cartilage of the talonavicular joint and the naviculo-medial cuneiform joint was preserved. The remainder of the articular cartilage of the navicular, the middle cuneiform, and the lateral cuneiform as well as the fibrous tissue at the nonunion site was removed. Cancellous bone taken from the iliac bone was grafted to the fracture nonunion site of the navicular, the naviculo-middle cuneiform joint, and the naviculo-lateral cuneiform joint. The

navicular, the middle cuneiform, and the lateral cuneiform were fixed with the locked plating system for reconstructive rearfoot surgery (DARCO UPS 3.5 plate™, Wright Medical, Japan).

A short leg cast was applied for eight weeks without weight-bearing and progressive weight-bearing was allowed after removal of the cast. Two years and 6 months after the localized naviculocuneiform arthrodesis (the arthrodesis of the navicular, the middle cuneiform, and the lateral cuneiform) combined with osteosynthesis of fracture nonunion of the navicular, the patient could walk without any pain using an arch support orthosis. The range of motion of the ankle joint was not disturbed. Fusion with the navicular, the middle cuneiform, and the lateral cuneiform as well as union of fracture of the navicular was confirmed on the radiographs (Fig. 4).

3. Discussion

In the present case, we have treated the patient with the localized naviculocuneiform arthrodesis (the arthrodesis of the navicular, the middle cuneiform, and the lateral cuneiform) combined with osteosynthesis of fracture nonunion of the navicular as the salvage surgery.

The reconstruction of the midfoot and hindfoot is important in treating osteoarthritis after mid tarsal injuries and triple arthrodesis has been reported to be effective for persistent symptoms.^{2–6} Arthrodesis around the talus articulations including the talonavicular joint is recommended for treating navicular nonunion, avascular necrosis of the navicular bone, inflammatory arthritis, and adult acquired flat foot because the talonavicular joint is multi-axial bearing multidirectional forces.^{2–6}

By contrast, the naviculocuneiform joint has little mobility because of its characteristic bony and ligamentous structures although the naviculocuneiform joint bears multidirectional forces as well as the talonavicular joint. Therefore, in the reconstruction of the midfoot and hindfoot, isolated naviculocuneiform arthrodesis is not common and it has been

Fig. 4 – Radiographs after the localized naviculocuneiform arthrodesis. Two years and 6 months after the localized naviculocuneiform arthrodesis combined with osteosynthesis of navicular fracture, fusion with the navicular, the middle cuneiform, and the lateral cuneiform as well as union of fracture of the navicular was confirmed on the radiographs (A, B).

considered as less reliable surgical technique than talonavicular arthrodesis. Ajis and Geary reported that naviculocuneiform fusion (the arthrodesis of the navicular, the medial cuneiform, the middle cuneiform, and the lateral cuneiform) in treating flexible planovalgus foot deformity was a safe and predictable procedure with a similar fusion rate compared to other joint fusions in the foot.⁷ Moreover, they suggested the possibility of increasing the union rate and the stability in naviculocuneiform fusion by using a recent locked plating system.

Low profile locked plating system has been applied in correction metatarsal osteotomy to correct moderate to severe hallux valgus deformity and first metatarsophalangeal joint arthrodesis, and acceptable results have been obtained.^{8,9} We have applied the locked plating system to localized naviculocuneiform arthrodesis (the arthrodesis of the navicular, the middle cuneiform, and the lateral cuneiform) combined with osteosynthesis of fracture nonunion of the navicular, as a salvage surgery for nonunion of the body of the navicular bone associated with symptomatic osteoarthritis. Two years and 6 months after the salvage surgery, fusion of the arthrodesis of the navicular, the middle cuneiform, and the lateral cuneiform including nonunion of navicular fracture was confirmed on the radiographs. The patient could walk without any pain using an arch support orthosis, which was recommended to the patient in order to prevent talonavicular osteoarthritis progression.

Localized naviculocuneiform arthrodesis (the arthrodesis of the navicular, the middle cuneiform, and the lateral cuneiform) combined with osteosynthesis of fracture nonunion of the navicular, using a locked plating system, is one of the useful surgical treatment options for nonunion of the body of the navicular bone associated with symptomatic osteoarthritis.

Conflicts of interest

All authors have none to declare.

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