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Case Reports and Series

Failure of Internal Fixation for Painful Bipartite Navicular in Two Adolescent Soccer Players: A Report of Two Cases

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ABSTRACT

Bipartite navicular bone is an uncommon condition that can cause midfoot pain in children and adolescents. No treatment methods, other than conservative management, have been reported. We report the cases of 2 adolescent soccer players who underwent internal fixation of the painful bipartite fragments, resulting in nonunion. After failure of conservative management, the patients underwent surgery. Curettage of the junction between the 2 bone fragments was performed, and autologous cancellous bone was grafted. Next, the fragments were fixed with variable-threaded screws. Bone union of the bipartite fragments was once achieved on computed tomography in both cases at 3 and 5 months after surgery, respectively. However, separation of the fragment occurred in both cases after the patients had returned to sports. Although the patients were able to return to sports activities, they still had mild midfoot pain 3 and 2 years after surgery, respectively. Internal fixation using screws and an autologous bone graft for painful bipartite navicular bone in adolescent athletes is not recommended, and other surgeries should be considered to achieve bony union.

Bipartite navicular bone is a relatively uncommon condition (1–4). The definition and etiology of the condition is somewhat confusing. Mueller-Weiss disease (5), osteochondritis (6), osteochondrosis (7) , and osteonecrosis of the navicular bone have been used to report similar conditions (8). Bipartite navicular bone is regarded as a consequence of ≥2 ossification centers of the navicular that failed to fuse and can cause pain in children and adolescents. Mueller-Weiss disease is a different entity from bipartite navicular bone. It is usually defined as a syndrome that causes midfoot pain in middle-age adults with a deformity of the navicular bone and osteoarthritis in the adjacent joints (9). Bipartite navicular bone is believed to be one of the causes of Mueller-Weiss disease (1). A case of Mueller-Weiss disease in adolescents has been reported (10); however, painful bipartite navicular bone, rather than Mueller-Weiss disease, might be more appropriate to describe the condition. For Mueller-Weiss disease in which patients have advanced osteoarthritis, arthrodesis of the involved joints has been reported to have satisfactory clinical results (2,9,10). However, other than conservative management (1,6,7,10), no other treatment methods have been reported for painful bipartite navicular bone in children and adolescents. We report the cases of 2 adolescent soccer players who underwent internal fixation of the painful bipartite fragments, resulting in nonunion.

Case Report

Patient 1

A 14-year-old male soccer player was referred to our hospital after being diagnosed with a navicular stress fracture of the right foot. He had been experiencing pain for the previous 6 months while playing soccer. He had no systemic musculoskeletal disease or other significant medical history. His height, weight, and body mass index were 1.7 m, 75 kg, and 26 kg/m^2, respectively. The Japanese Society for Surgery of the Foot (JSSF) midfoot scale (11), which assigns 40 points for pain, 45 points for function, and 15 points for alignment, yielded a score of 80 points. On the weightbearing dorsoplantar radiograph (Fig. 1*A*), the navicular appeared comma-shaped owing to the flattened lateral half of the bone. The weightbearing lateral radiograph showed fragmentation of the navicular bones (Fig. 1*B*). The dorsolateral fragment was slightly displaced dorsally. The coronal computed tomography (CT) image clearly depicted the dorsolateral and plantar-medial fragments with sclerotic margins and osteophytes on the dorsal edge (Fig. 2*A*). In the sagittal plane (Fig. 2*B*), the 2

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Fig. 1. Weightbearing radiographs of patient 1. Dorsoplantar (*A*) and lateral (*B*) views. In the dorsoplantar view, the navicular appeared comma-shaped owing to the flattened lateral half of the bone. The lateral radiograph showed fragmentation of the navicular bone. The dorsolateral fragment was slightly displaced dorsally.

portions of the navicular bone appeared wedge shaped, with the narrow tapering margins in apposition. From the clinical and radiographic findings, the lesion was diagnosed as bipartite navicular bone.

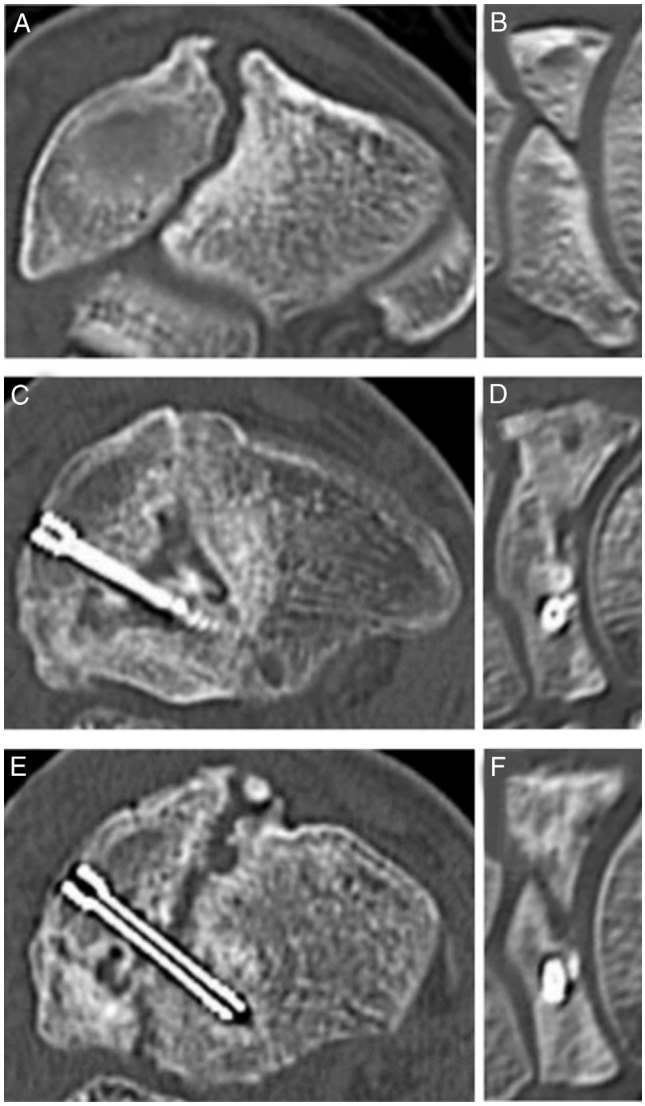

Fig. 2. Computed tomography images of patient 1 before surgery (*A* and *B*), 3 months after surgery (*C* and *D*), and 8 months after surgery (*E* and *F*). In the preoperative images, the 2 portions of the navicular appeared wedge-shaped, with narrow tapering margins. The images taken 3 months after surgery appeared to show bony union of the fragments. However, they had separated at 8 months after surgery.

The patient received conservative treatment, including rest and shoe orthosis. However, the pain persisted during sports activities, including cutting and sprinting, and he was not able to return to full activity. After a discussion with the patient and family, operative treatment was planned. We performed internal fixation of the 2 fragments to preserve the motion of the talonavicular and naviculocuneiform joints in this young and athletic patient.

The patient was placed in a supine position. A tourniquet was applied on the ipsilateral thigh. A 3-cm longitudinal skin incision was made on the dorsal aspect of the navicular bone. The subcutaneous tissue was dissected bluntly, and the overlying tendons and neurovascular bundle were retracted. Meticulous curettage of the junction between the fragments was performed from the medial and lateral sides of the junction using chisels and curettes. Autologous cancellous bone from the iliac crest was grafted into the defect. Next, the fragments were fixed using a variable threaded screw (double-threaded Japan screw; Meira, Gifu, Japan) and an autologous bone pin, with fluoroscopic assistance. Postoperatively, the patient was not allowed to bear any weight on the affected limb for 8 weeks. Low-intensity pulsed ultrasound was also used to promote bone healing. CT images taken 3 months after surgery appeared to show union of the fragments, with continuity of the cortex and cancellous bones (Fig. 2*C* and *D*). The patient was allowed full weightbearing and gradually returned to sports activity with minimal pain. However, the CT scan at the 8-month follow-up visit showed separation of the fragments (Fig. 2*E* and *F*). At 3 years after surgery, the patient still had midfoot pain during sports activities. The JSSF midfoot scale score was 80 points. The CT images showed persistent nonunion; however, the osteoarthritic change in the adjacent joints did not progress.

Patient 2

A 14-year-old male soccer player presented with a right midfoot pain and swelling during running and jumping. He had no systemic musculoskeletal disease or other significant medical history. His height, weight, and body mass index were 1.6 m, 72 kg, and 28 kg/m^2, respectively. The JSSF midfoot scale score was 72 points. The radiographs and CT images showed findings similar to those of patient 1, and the navicular bone was separated from the wedge-shaped dorsomedial and plantar-lateral fragments. The weightbearing dorsoplantar radiograph showed that the displaced dorsolateral fragment was superimposed over the lateral cuneiform bone (Fig. 3*A*). On the weightbearing lateral radiograph (Fig. 3*B*), a small osteophyte in the dorsal edge of the middle cuneiform was noted, suggesting an early osteoarthritic change and the chronic nature of the condition. On the CT images (Fig. 4*A* and *B*), the lateral edges of both fragments were smooth and round, which was distinct from a fatigue fracture. Also, a fracture line was present in the center of the dorsolateral fragment