Medial and Plantar Dislocation of the Navicular Bone Associated With a Calcaneocuboid Fracture-subluxation. Case Report

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ABSTRACT
Isolated navicular dislocations are unusual. They are frequently associated with navicular fractures or diverse patterns of lateral column injuries. We report a case of a patient with medial and plantar navicular dislocation with a comminuted intra-articular fracture of the anterior process of the calcaneus and associated subluxation at the calcaneocuboid joint. The patient underwent closed reduction and Kirschner wire stabilization in the Emergency Service. As part of the deferred treatment, talonavicular-cuneiform and calcaneocuboid 2.0 mm bridge plates were temporarily placed and osteosynthesis material was removed 5 months later. The AOFAS score was excellent in the one-year follow-up. **Conclusion:** An accurate diagnosis, ruling out lateral column injuries, should be done in the Emergency Service. Bridge plate stabilization is a valid option to prevent loss of reduction, which is observed when removing Kirschner wires, allowing early weight-bearing.
Keywords: Chopart injuries, navicular bone, calcaneal fractures
Level of Evidence: IV

Luxación medial y plantar del hueso navicular asociada a fractura-subluxación calcaneocuboidea. Presentación de un caso

RESUMEN
Las luxaciones del escafoides aisladas y sin fractura son poco frecuentes. Por lo general, se presentan asociadas a fracturas del escafoides o a diversos patrones de lesión de la columna lateral. Presentamos el caso de un paciente con luxación medial y plantar del hueso navicular y fractura conminuta del proceso anterior del calcáneo y subluxación calcaneocuboidea. En el Servicio de Urgencia, se procedió a la reducción cerrada y la estabilización con agujas de Kirschner y, como tratamiento diferido, se colocaron placas en puente astragalonavicular-cuneiforme y calcaneocuboidea de 2,0 mm, en forma transitoria, y el material de osteosíntesis se retiró a los 5 meses. El puntaje de la escala de la AOFAS fue excelente al año de seguimiento. **Conclusión:** Es necesario llegar a un diagnóstico adecuado descartando lesiones de la columna lateral y reducir esta lesión en la atención de urgencia. La estabilización con placas en puente es una opción válida que podría evitar la pérdida de la reducción que se observa al retirar los clavos de Kirschner y permite una carga precoz.
Palabras clave: Lesión de Chopart; luxación; hueso navicular; fractura de calcáneo.
Nivel de Evidencia: IV

INTRODUCTION

Dislocations of the navicular bone without fracture are rare.[1,2] Similar injuries have been published, but, in general, they occur in association with fractures of the navicular bone or other bones of the midfoot.[1-13] This is due to the stability conferred by the anatomy of the tarsal bones in the midfoot which are held firmly by strong dorsal and plantar ligaments.[14] In a review of published studies, we found 17 cases between 1924 and 2016, the latter being the last reference found. It has been claimed that dislocation of the navicular bone without fracture is anatomically impossible.[7] The concept of interdependence between the medial and lateral columns has also been proposed, where the dislocation of one column is accompanied by a ligament or bone lesion of the other.[4] The

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How to cite this article: Seletti M, Parma J. Medial and Plantar Dislocation of the Navicular Bone Associated With a Calcaneocuboid Fracture-subluxation. Case Report. *Rev Asoc Argent Ortop Traumatol 2023;88(1):*97a106. https://doi.org/10.15417/issn.1852-7434.2023.88.1.1551

various treatments already reported for these injuries have included closed reduction and casting, closed reduction with percutaneous pinning, open reduction and Kirschner wire fixation, open reduction with internal fixation, and osteodesis combined with external fixation.

We present the case of a patient with dislocation of the navicular bone associated with a comminuted fracture of the anterior process of the calcaneus with calcaneocuboid subluxation and treated with bridge plating through the calcaneocuboid and talonavicular-cuneiform joints.

The objective of this study is to present a rare case and a review of the literature.

CLINICAL CASE

A 39-year-old patient, with no relevant medical history, suffered a blunt crushing injury to his right foot (a pickup truck ran over his foot) while doing rural work. He was admitted to the emergency service due to pain in the right midfoot and marked deformity in the medial longitudinal arch, as well as moderate edema. He had no sensory-motor deficit and capillary nail refill was preserved. No associated lesions were observed on the rest of the body.

Anteroposterior, lateral, and oblique foot radiographs were taken (Figure 1) and a CT scan was performed (Figure 2). A dislocation of the navicular bone associated with a comminuted fracture of the anterior process of the calcaneus and cuboid with calcaneocuboid subluxation was observed.

Figure 1. Anteroposterior, lateral, and oblique radiographs of the foot. Dislocation of the medial plantar navicular bone and comminuted fracture of the anterior process of the calcaneus with calcaneocuboid subluxation.

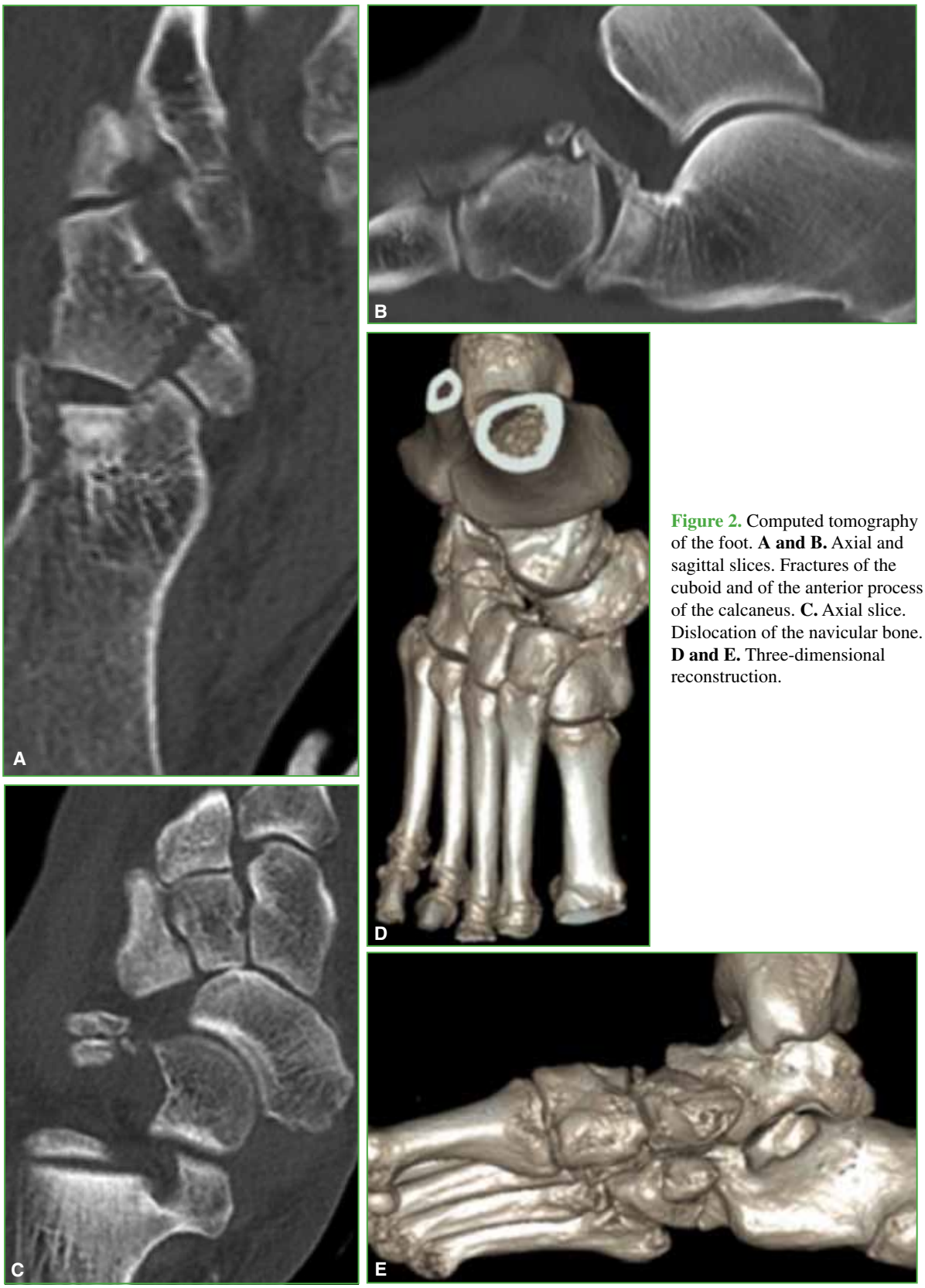

Figure 2. Computed tomography of the foot. **A and B.** Axial and sagittal slices. Fractures of the cuboid and of the anterior process of the calcaneus. **C.** Axial slice. Dislocation of the navicular bone. **D and E.** Three-dimensional reconstruction.

Three hours after admission and after carrying out the corresponding complementary studies, the patient was transferred to the operating room where closed reduction and stabilization maneuvers were performed using a Kirschner pin taking the first cuneiform, navicular and cuboid. All procedures were performed with radioscopic assistance. The extremity was immobilized with a posterior ankle splint and postoperative radiographs were taken, which showed an acceptable joint reduction; the definitive fixation was scheduled (Figure 3).

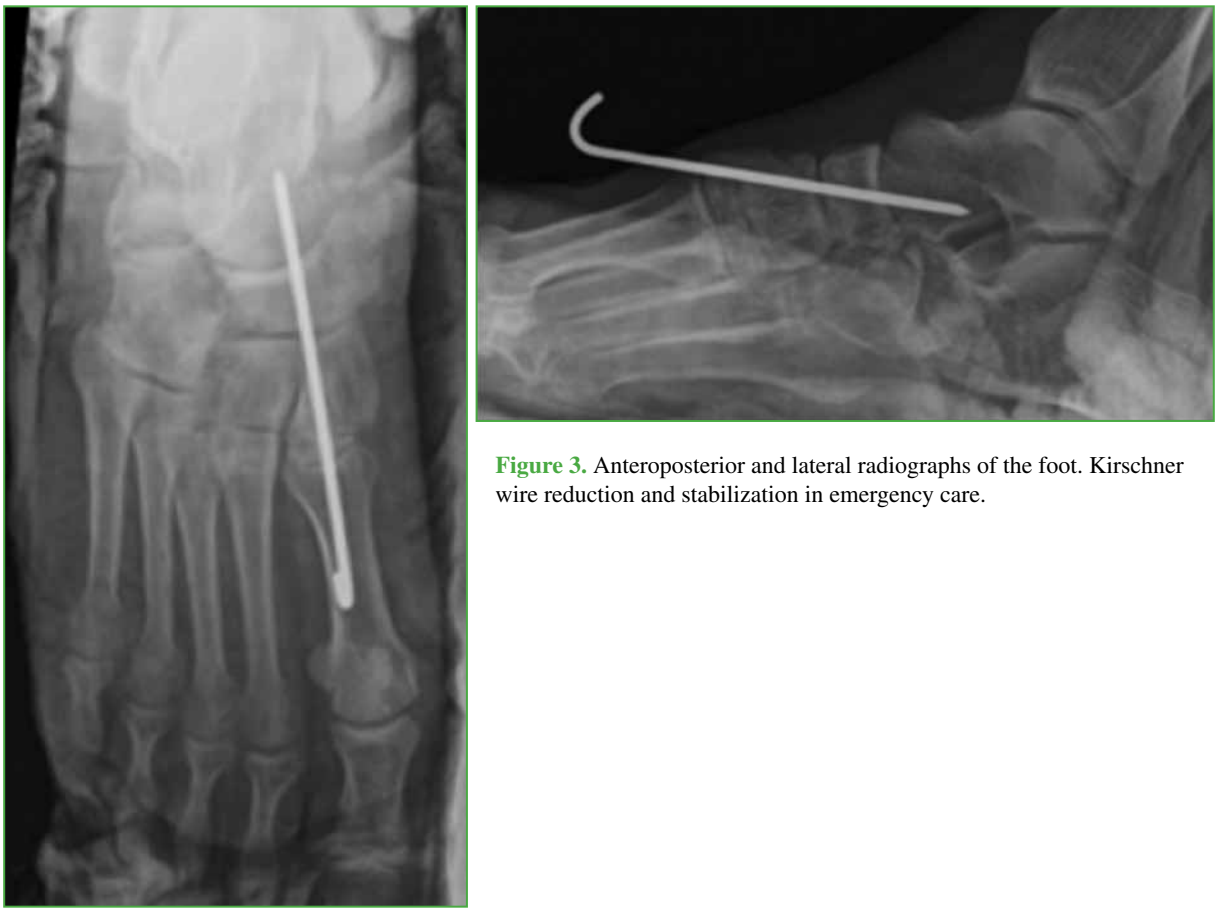

Figure 3. Anteroposterior and lateral radiographs of the foot. Kirschner wire reduction and stabilization in emergency care.

After a week of follow-up and after verifying the correct evolution of the soft tissues (Figure 4), definitive fixation was carried out. In the operating room, the patient was placed in the dorsal decubitus position and a tourniquet was placed on the thigh. Initially, a dorsomedial incision was made, centered at the talonavicular-cuneiform level, where it was possible to visualize the unrestrained dislocation of the navicular bone once the Kirschner pin was removed (Figure 5). It was decided to perform open reduction by applying axial traction and lateral compression, with temporary stabilization using a Kirschner pin and then, with a 2.0 mm locking T-plate (Figure 6), to perform the definitive talonavicular-cuneiform fixation. A dorsolateral approach was made at the level of the calcaneocuboid joint where an articular subsidence fracture was visualized at the level of the calcaneus with a calcaneocuboid plantar subluxation. A bone impactor was used to elevate the articular surface to its normal position, an autologous cancellous graft from the posterior calcaneal tuberosity was placed, joint congruence was restored and fixated with a 2.0 mm T-type locking calcaneocuboid bridging plate. (Figures 7 and 8).

Figure 4. Favorable soft tissue evolution after reduction in emergency care.

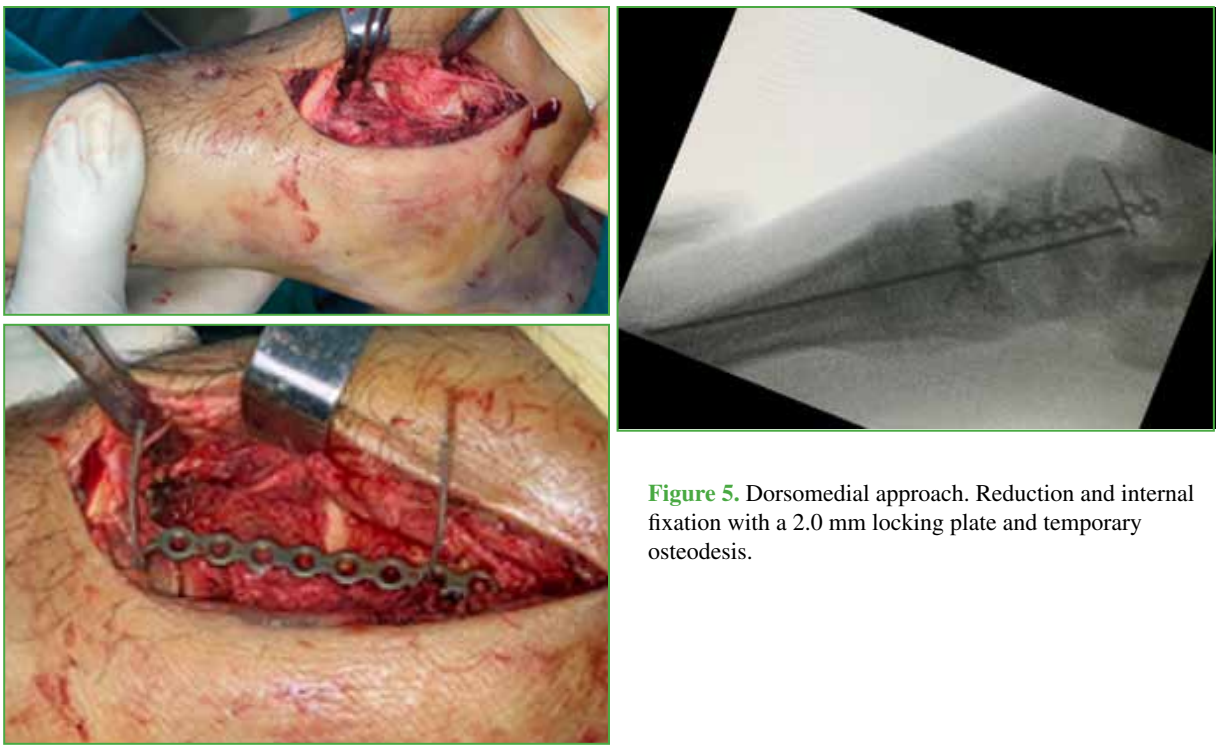

Figure 5. Dorsomedial approach. Reduction and internal fixation with a 2.0 mm locking plate and temporary osteodesis.

Figure 6. Anteroposterior and lateral control of the foot with fluoroscopy. Stabilization with talonavicular-cuneiform plate.

Figure 7. Calcaneocuboid lateral approach. The articular subsidence of the anterior process of the calcaneus and the reconstruction is observed.

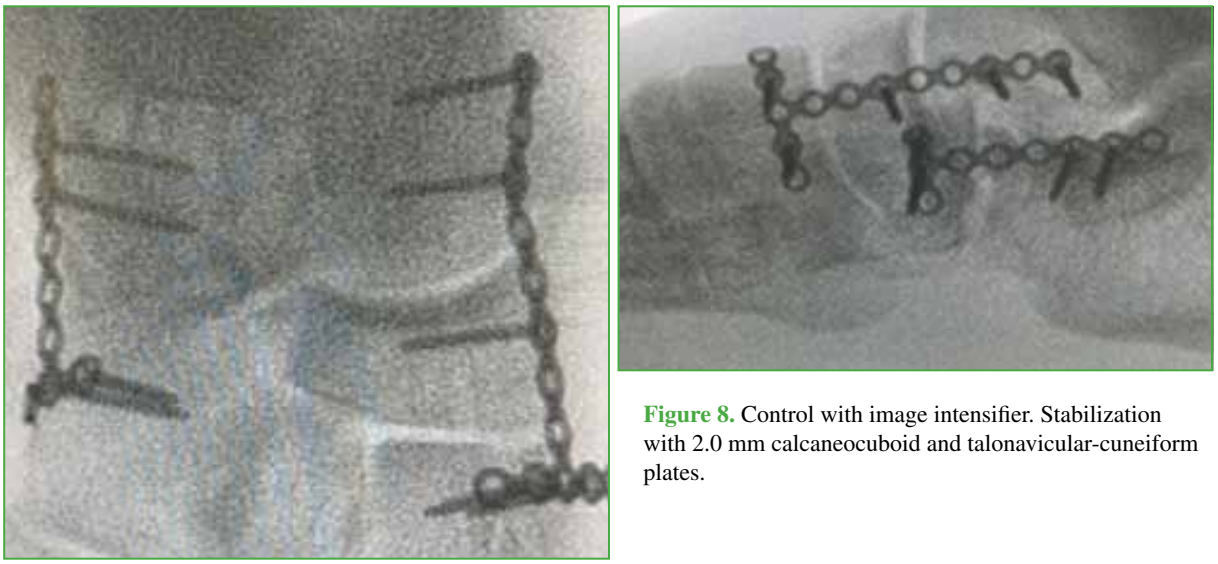

Figure 8. Control with image intensifier. Stabilization with 2.0 mm calcaneocuboid and talonavicular-cuneiform plates.

First of all, the medial column was stabilized, since it did not have any fractures and this allowed it to recover the adequate length once the joints were reduced. Secondly, the lateral column, which did present comminuted fractures, was fixated. The wounds were closed by planes and the extremity was immobilized with a posterior ankle splint. Non-weight-bearing anteroposterior and lateral radiographs of the foot were taken in the immediate postoperative period. In the third, sixth, and twelfth months of follow-up, they were repeated, with weight-bearing (Figure 9).

Figure 9. Anteroposterior and lateral radiographs of the foot, three months after the operation.

In the postoperative period, flexion-extension movements of the ankle began in the second week and of the subtalar joint in the fourth week, guided by the Kinesiology team. From the fourth week to the eighth week, partial weight-bearing was allowed with a Walker boot; then, full weight-bearing was allowed.

The suture was removed after 15 days, the wounds had a good evolution and removal of the osteosynthesis material was planned after five months, because the implants were placed as a bridge through the calcaneocuboid and talonavicular-cuneiform joints until ligaments had healed. No signs of necrosis of the navicular bone were observed. The presence of osteoarthritis in the calcaneocuboid, talonavicular-cuneiform and subtalar joints was evaluated after one year of follow-up, which did not correlate with the patient's symptoms (Figure 10). Grade 1 osteoarthritis was detected in the different joints.[15]

The AOFAS scale score was 92, an excellent result. The level of patient satisfaction with the procedure was high and, at present, he carries out his usual tasks normally.

Figure 10. Anteroposterior and lateral radiographs of the foot, 12 months after surgery.

DISCUSSION

The isolated and complete dislocation of the navicular bone can present various patterns of injury in the lateral column with calcaneocuboid fracture-subluxation,[4] cuboid fracture,[12] fifth metatarsal base fracture,[10] third and fourth metatarsal fracture with calcaneocuboid fracture-dislocation,[9] and fracture of the second to fourth metatarsal, cuboid and intermediate cuneiform.[15,16] This is consistent with Dhillon and Nagi's all-or-nothing concept,[4] whereby injury to one of the columns can affect the other.

The mechanism of the injury is unknown. Dhillon and Nagi postulate that a violent pronation/abduction movement generates a cuneonavicular disruption leading to a 'nutcracker' mechanism in the lateral column. The forefoot can dislocate in a dorsolateral or inferolateral direction depending on whether the deforming force is plantar or dorsal. Pathria et al.,[9] and Dixon[10] have proposed other mechanisms.

The proper treatment of these injuries requires a correct diagnosis in emergency care, achieving reduction and stabilization through Kirschner nails or external fixators. Subsequently, it should be evaluated if there are associated fractures in the lateral column that require osteosynthesis. It is essential to preserve, as much as possible, the length of both medial and lateral columns, maintaining the best range of motion in the talonavicular and cuboid-metatarsal joints.

In our case, we performed reduction during emergency care and stabilization with Kirschner pins; then, when the soft tissues were ready, we performed internal fixation of the fracture of the anterior process of the calcaneus with a calcaneocuboid bridging plate. This type of stabilization was carried out because there was great comminution that made distal fixation in the calcaneus impossible and also because of the instability in said joint. In the medial

column, internal fixation was performed by fixating the navicular to the talus and cuneiform bones with a bridge plate. This type of treatment is similar to the concept of plates in Lisfranc injuries.[17] In most published cases, definitive Kirschner wire stabilization of unstable joints is performed, causing complications such as pin intolerance and loss of reduction after nail removal. The excellent result on the AOFAS scale and the Chopart and subtalar osteoarthritis signs are similar to those reported in other publications.[3,4,6]

One of the limitations of this study is the follow-up period, which should be longer in order to control the appearance of complications. It would also be appropriate to evaluate our patient with others who suffer the same symptoms in order to increase the casuistry and, thus, be able to reach a more appropriate conclusion.

CONCLUSIONS

Isolated navicular dislocations are rare and are usually associated with lateral column injuries. They must be properly diagnosed and reduced in emergency care, and definitive treatment will depend on the associated lateral column injuries. Bridge plate stabilization is a valid option that could prevent the loss of reduction seen in the removal of the Kirschner pins and also allow early weight-bearing.

Conflict of interest: The authors declare no conflicts of interest.

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