# Chapter 13
# Navicular Fractures

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## Case Presentation #1

A 45-year-old male unrestrained driver in a motor vehicle collision sustained a closed fracture-dislocation of the right navicular. Associated injuries included a posterior ipsilateral hip dislocation. His medical history included prior knee surgery and chronic back pain and anxiety. He was using Klonopin and oxycodone prior to this injury.

## Injury Films

AP, lateral, and oblique radiographs of the foot and a CT scan were obtained (Figs. 13.1 and 13.2).

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FIGURE 13.1 AP and lateral radiographs showing a fracture-dislocation of the right navicular

FIGURE 13.2 Axial CT cut illustrating large displaced dorsomedial fragment of the navicular

## Treatment and Timing of Surgery

Following examination and radiographic analysis of the injury, the hip dislocation was reduced. It was noted that the navicular dislocation was unable to be maintained in a

reduced position. The patient was taken urgently to the operating room for open reduction internal fixation due to tenting of the skin and concern for skin necrosis.

## Surgical Tact

### *Position*

The patient was placed on the operating table in the supine position, with a thigh tourniquet. Once draped to the level of the tourniquet, the knee was flexed over a radiolucent triangle and the foot slightly elevated with respect to the opposite lower extremity, allowing for unimpeded lateral fluoroscopic views.

### *Approach*

The tourniquet was not inflated. A dorsomedial incision was made extending from the distal talus to the distal medial cuneiform. Deep exposure involved retraction of the dorsalis pedis artery and deep peroneal nerve.

### *Fracture Reduction and Fixation*

Bone fragments were identified, cleaned, and reduced using plantar pressure and manual distraction. Two main fragments across the central aspect of the navicular were held using a bone reduction forceps. This was then secured using a smooth Kirschner wire and two partially threaded cannulated 4.0-mm cancellous screws were placed from medial to lateral, one dorsal and the other plantar. These navicular screws were placed through two small medial stab incisions. The navicular was then pinned from the medial and intermediate cuneiform, through the navicular, into the talus with two smooth 2.0-mm Kirschner wires to provide additional stability to the medial column (Fig. 13.3). The wound was closed, after tourniquet release and saline irrigation, in layers with 2-0 Vicryl and 3-0 nylon sutures.

FIGURE 13.3 Postoperative radiographs showing fixation of the navicular and medial column

## Postoperative Plan

An AO splint was applied. Antibiotics were maintained for 24 h perioperatively. The patient was instructed to maintain foot-flat touchdown weight bearing for 10 weeks. Elevation to heart level was instructed. The sutures were removed at 2 weeks, and the patient was placed into a removable cam-walker boot. Ankle and toe range-of-motion exercises

FIGURE 13.4 Final X-rays, 1 year post-injury

were initiated. Pins were removed at 4 weeks without re-subluxation.

## Outcome

The patient had multifocal post-injury pain, although his midfoot pain was mild. His primary complaint regarding his foot was swelling. He had diminished sensation in his saphenous nerve distribution that slowly improved. He returned to work 6 months post-injury. He was discharged from care 1 year post-injury. Final X-rays are shown (Fig. 13.4).

## Case Presentation #2

A 34-year-old male involved in a motorcycle collision presented complaining of right-foot pain. No other complaints were noted. He was stable hemodynamically, and ATLS-based assessment revealed no other sites of injury. Skin was intact, with mild swelling over the midfoot. No neurovascular compromise was seen.

## Injury Films

Radiographs and a CT were obtained (Figs. 13.5 and 13.6). 3D reconstruction images were created from CT data showing a comminuted navicular (Fig. 13.7).

Figure 13.5 AP, oblique, and lateral radiographs showing a comminuted navicular fracture

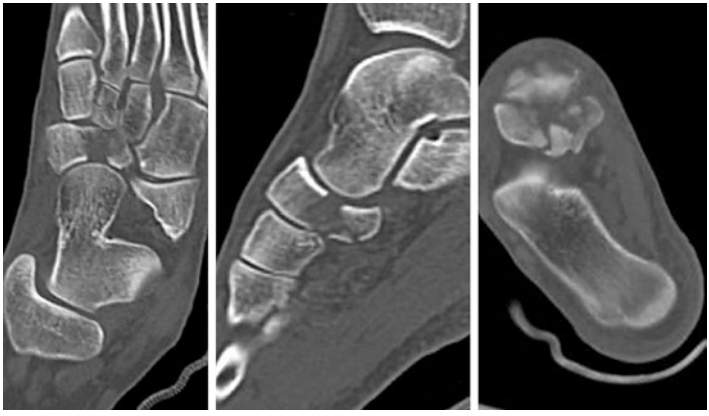

Figure 13.6 Axial, sagittal, and coronal CT cuts

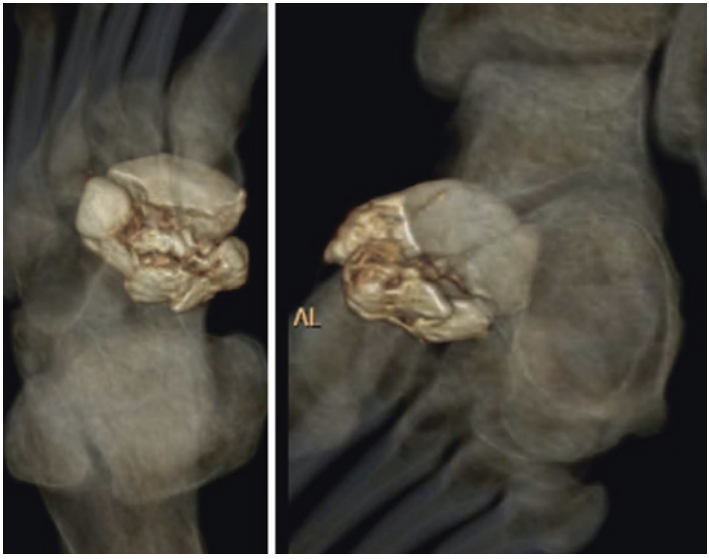


Figure 13.7 3D reconstruction of the navicular illustrating extensive plantar comminution

## Treatment and Timing of Surgery

The patient was indicated for surgery and consent obtained. While surgery was not deemed urgent or emergent, the foot was suitable for surgery the same day and swelling was mild. The dedicated orthopedic trauma operating room schedule allowed for his surgical care to be completed that day. He was brought to the operating room within 4 h of presentation.

## Surgical Tact

### *Position and Approach*

Position was supine with the radiolucent triangle. Tourniquet was loosely applied but not inflated. Dual incisions, dorsal and medial, were used to approach the fracture. The dorsal incision was in line with the third ray, centered over the navicular. Exposure required mobilization of a superficial

peroneal nerve branch. Two main fragments, one large dorsal medial fragment and a lateral fragment, were identified after tendons were retracted medially and the retinaculum and capsule incised. The second (medial) incision extended from the talonavicular joint to the medial cuneiform. The tibialis anterior tendon was identified and retracted anteriorly. A small distractor was placed on the medial side of the foot to assist with exposure. This was done by placing a 3-mm Schanz pin into the first metatarsal base and a second pin into the talar neck. The navicular was secondarily distracted using a lamina spreader to allow fragment mobilization and visualization of the plantar surface of the navicular.

### *Fracture Reduction and Fixation*

Both windows were exploited simultaneously. The fracture was reduced from lateral to medial using the talar head as a template to reduce the articular surface. Temporary Kirschner wires were replaced with fragment-specific 2.4-mm plates and screws. Adjacent joint instability was addressed with trans-articular screws and spanning plates (Fig. 13.8).

## Postoperative Plan

An AO splint was applied. Antibiotics were maintained for 24 h perioperatively. The patient was instructed to maintain foot-flat touchdown weight bearing for 10 weeks. Elevation to heart level was instructed. The sutures were removed at 2 weeks, and the patient was placed into a removable cam-walker boot. Ankle and toe range-of-motion exercises were initiated.

## Outcome

While there was minimal complaint of pain, stiffness and swelling were reported. It was recommended that trans-articular plates be electively removed 6 months postoperatively; however, the patient declined any further surgery. Final X-rays are shown at 6 months (Fig. 13.9).

FIGURE 13.8 Postoperative radiographs. Fixation of the navicular is achieved using a 2.4-mm cannulated screw and a 2.4-mm T-plate. Another 2.4-mm T-plate spans the naviculocuneiform joint to provide additional stability to the medial column, and a 3.5-mm screw is used to fixate the medial, middle, and lateral cuneiforms. Lastly, an additional 2.4-mm T-plate spans the naviculocuneiform-second metatarsal joints

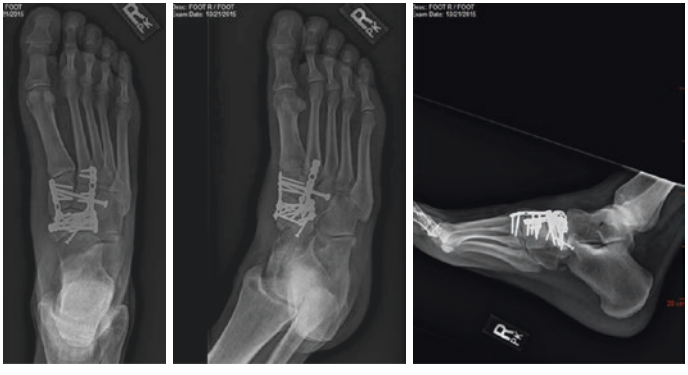

FIGURE 13.9 X-rays at 6 months postoperatively

## Salient Points/Pearls

- A high index of suspicion for concomitant injury to the ipsilateral midfoot and hindfoot must be maintained. Associated injury to the cuboid or intercuneiform ligaments must be ruled out.
- The talar articular surface of the navicular has a concave shape. Screws at this location must be angled distally into the navicular to avoid joint penetration [1].
- The talonavicular joint is the most mobile midfoot joint and fusion results in degeneration of the subtalar and calcaneocuboid joints [1–4].
- The central area of the navicular is a watershed area that makes it more susceptible to avascular necrosis, nonunion, and stress fractures [5, 6].
- A 2-incision approach, utilizing both dorsal and medial intervals, can be used in more complex fracture patterns with comminution. Caution should be taken to protect the superficial peroneal nerve as well as the deep peroneal nerve with the more lateral window.
- Use of medially applied external fixator to the first metatarsal and medial talar neck can assist with exposure of the navicular as well as in restoring the length of the medial column [2].
- In fractures with comminution, strong consideration should be given to plate and screw constructs [1, 7, 8].
- Alternative or supplemental treatment options such as primary arthrodesis of the naviculocuneiform joints, primary talonavicular/medial column arthrodesis, application of a spanning external fixator, delayed reconstruction, and temporary medial column bridge plating should be considered in cases with severe comminution not amenable to open reduction internal fixation [2, 4, 9].

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