Multiple Foot Fractures Treated With Multiple Minirail External Fixation: A Case Report

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INTRODUCTION

Patients with multiple foot fractures can be challenging when performing surgical correction. Fracture reduction can be accomplished by closed or open methods by the means of an external fixator, screws, plating, Kirschner wire (K-wire), Steinmann pins, and tension band wiring. The difficulty is in the size of the bone in the foot and attempting to realign the small fragments of bone. In order to achieve adequate results, the bone needs to be placed in the correct alignment and held in place with stable fixation (1). The use of external fixation helps with adding stability across the fracture sites (2). Other challenges such as soft tissue quality after a traumatic injury can benefit from minimal incisions and the use of percutaneous wiring or external fixation to minimize further damage of the soft tissue (3).

Fractures of the navicular body are associated with other mid tarsal injuries and rarely occur alone (4). The navicular is important to fix due to the fact that it plays an essential role of the talonavicular joint in the the stability, alignment, and accommodative motion of the foot during gait (5,6). The important points on fixing a navicular fracture are to restore the length in relationship to the medial column, maintain a proper insertion of the posterior tibial tendon, and preserve the stability and alignment of the navicular-cuneiform joint (6). This article presents a case study that introduces a method for fixating a patient with multiple acute foot fractures.

CASE PRESENTATION

The patient was a 19-year-old Haitian man brought to the emergency room after an accident. He was crossing the street and was hit by a motor vehicle from the side injuring his left lower extremity. The patient was healthy with no significant past medical history. On physical examination, severe edema of the left foot and ankle was noted, with no open wounds. The patient also had severe pain in the left foot and ankle.

Radiographs were obtained and showed a nondisplaced fracture of the medical malleolus, highly comminuted compressed fracture of the navicular bone, fracture of the second through fifth metatarsal bones, and complete lateral dislocation of the fifth metatarsal bone (Figure 1). Jones compression with a posterior splint was applied to the left lower extremity and the patient was scheduled for surgery the following morning.

SURGICAL APPROACH

The surgical approach started with percutaneous fixation of the medical malleolus. A K-wire was driven from distal-medial to proximal-lateral in order to capture the fracture fragment. This procedure was done under fluoroscopy. Then via the cannulated system, a drill was used to overdrill the wire, and the fracture fragment was secured with 2 partially-threaded screws as close as possible to the correct anatomic alignment (Figure 2).

The next procedure was an open reduction of the navicular with application of mini-rail external fixation. A linear incision was made along the medial aspect of the foot over the navicular bone, and blunt dissection was carried down to bone. The lucinate ligament and all soft tissue structures were reflected from the navicular until it could be properly identified. It was determined at that time that the severity and comminution of the navicular fracture did not warrant screw fixation. However, the decrease in talo-navicular joint space and comminution of the navicular prompted the use of a mini-rail external fixator for diastasis of the talo-navicular joint and navicular-cuneiform joint. The spanning fixation provided decompression of the aforementioned joints and utilized ligamentotaxis to reduce and stabilize the navicular fracture. The mini-rail external fixation device was applied under fluoroscopic guidance with 2 pins proximal into the talar body and 2 pins distal into the medial cuneiform in order to distract the joint (Figure 3).

Next, attention was directed to the lateral aspect of the foot along the area of the fifth metatarsal, where a linear incision was made. Blunt dissection was carried down to the bone and the fifth metatarsal was identified and found to be comminuted and in multiple shards. Two shards of bone were removed in order for successful anatomic reduction to

Figure 1A. Radiograph of left foot showing fracture of the second through fifth metatarsals with lateral displacement of fifth metatarsal bone and comminuted fracture of the navicular.

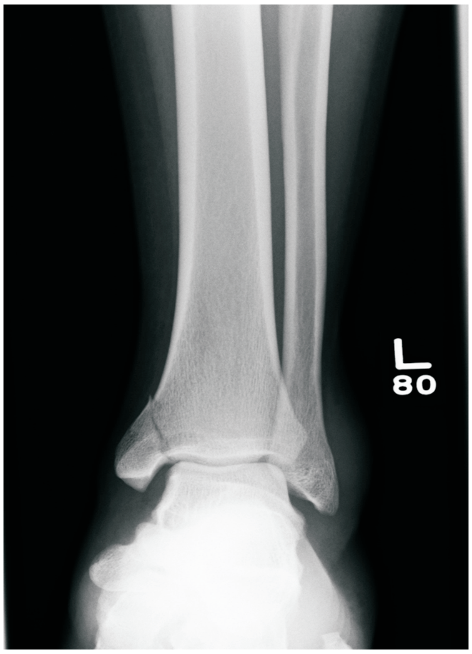

Figure 1B. Anterior-posterior radiograph showing non-displaced fracture of medial malleolus.

Figure 1C. Lateral view showing lateral and plantar displacement of the fifth metatarsal.

occur. Three 0.062 K-wires were inserted along the base of the fifth metatarsal in order to hold the remaining fracture fragment in place. Once successful reduction had been achieved, a mini-rail external fixation device was applied to the lateral aspect foot with 2 pins proximally just distal to the calcaneocuboid joint and 2 pins proximally into the neck and shaft of fifth metatarsal (Figure 4).

Fluoroscopic imaging was once again used to identify the remaining metatarsal fractures. The fourth metatarsal was deemed to be slightly displaced. A 0.062 K-wire was carried in anti-grade, followed by retrograde direction in order to fixate the fourth metatarsal head onto its shaft. Placement was confirmed by fluoroscopic imaging (Figure 5). Good radiographic alignment was confirmed (Figure 6).

Postoperative Care

The patient was kept completely nonweight-bearing on the left leg by use of a posterior splint and crutches. He was evaluated in the office on a weekly basis (Figure 7). Evidence of fracture site coalescence was noted on radiographs as the weeks progressed. Radiographs were also used to confirm that the hardware was intact. No pin site infections or hardware malfunctions were noted. The hardware was removed in 3 months, after radiographs showed complete closure of the fractures. The ankle hardware was not removed because it was not causing any pain. Physical therapy was recommended in order to gain range of motion and strength. At the 6-month follow up, the patient had regained most of his strength and mobility, and reported no pain. Radiographs at the 6-month followup demonstrated good alignment, and no nonunions (Figures 8-12).

Figure 2A. Radiograph of left ankle.

Figure 2B. Anterior-posterior radiograph of left ankle, fixation of medial malleolus fragment with 2 partially threated screws.

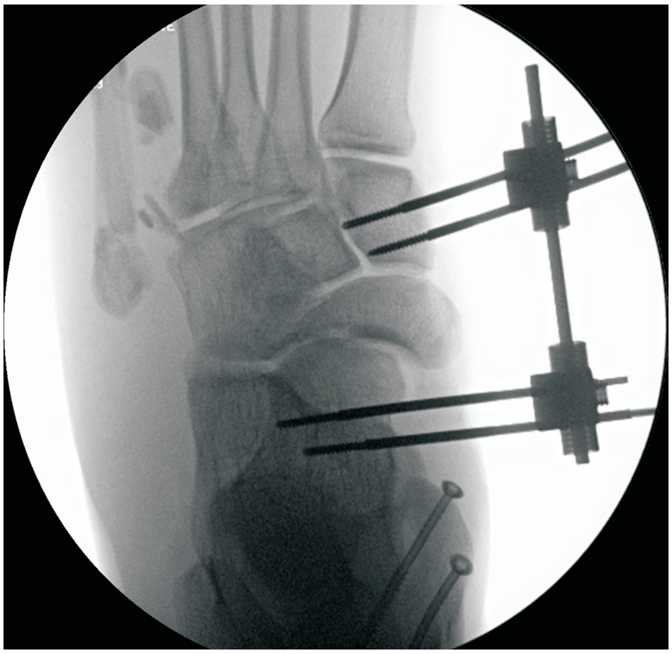

Figure 3A. Anterior-posterior radiograph showing application of mini-rail application in the medial cuneiform and talar bone for distraction.

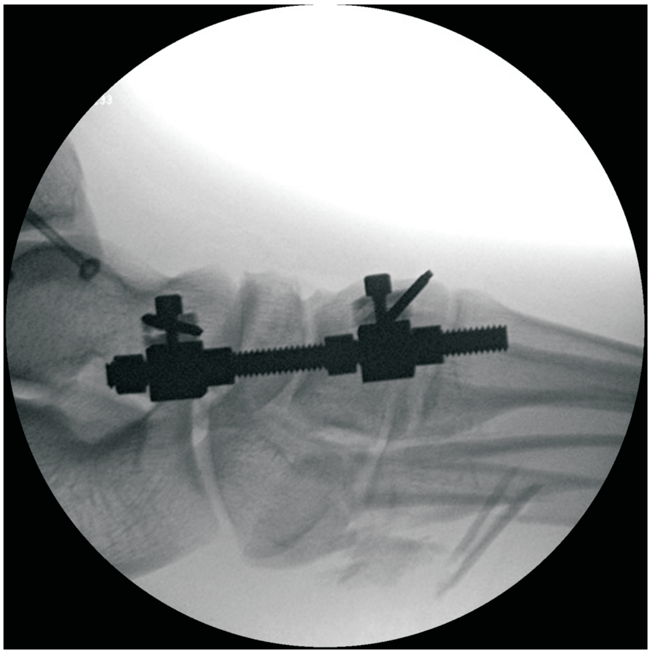

Figure 3B. Lateral view of mini-rail fixation.

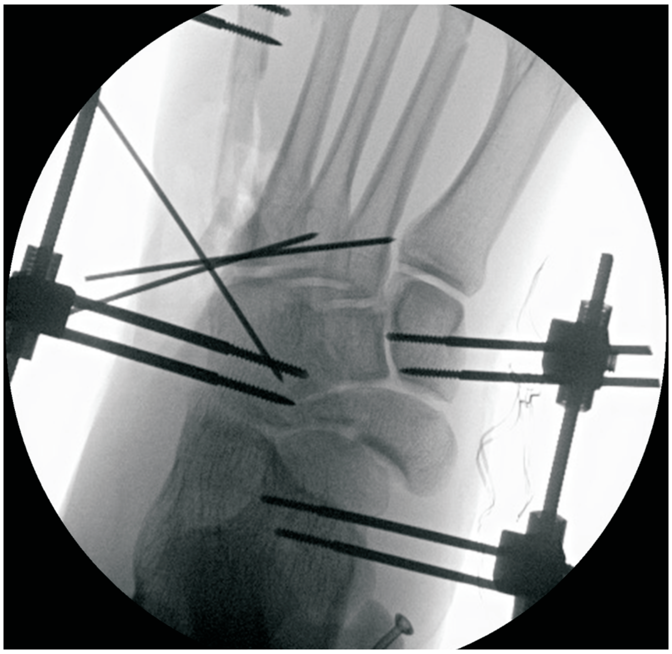

Figure 4A. Application of 3 Kirschner wires and mini-rail external fixator to hold the fifth metatarsal fragments in position.

Figure 4B. Lateral view.

Figure 5A. Fixation of fourth-metatarsal head fracture using Kirschner wire.

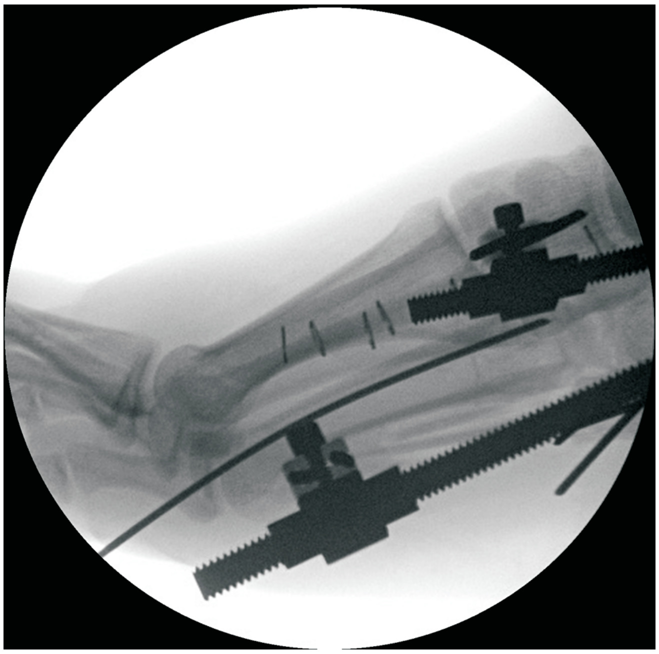

Figure 5B. Lateral view.

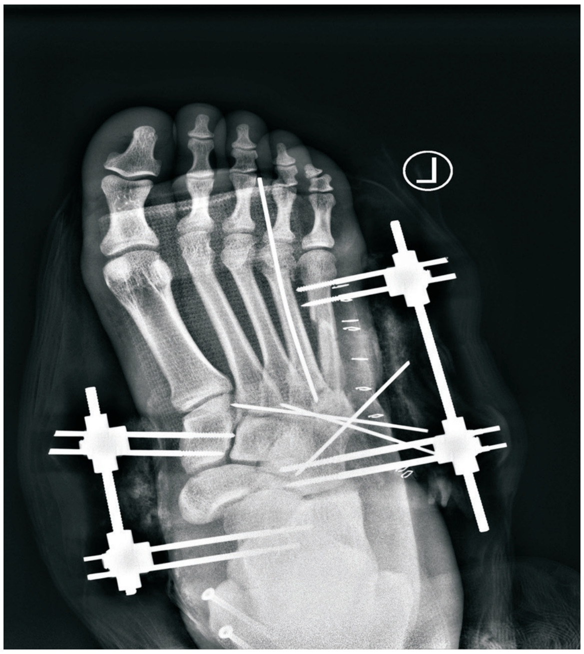

Figure 6A. Immediate postoperative radiograph showing good anatomic alignment.

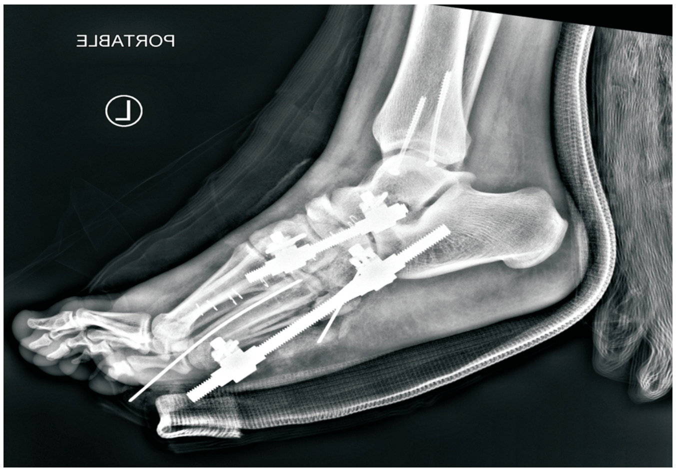

Figure 6B. Lateral view.

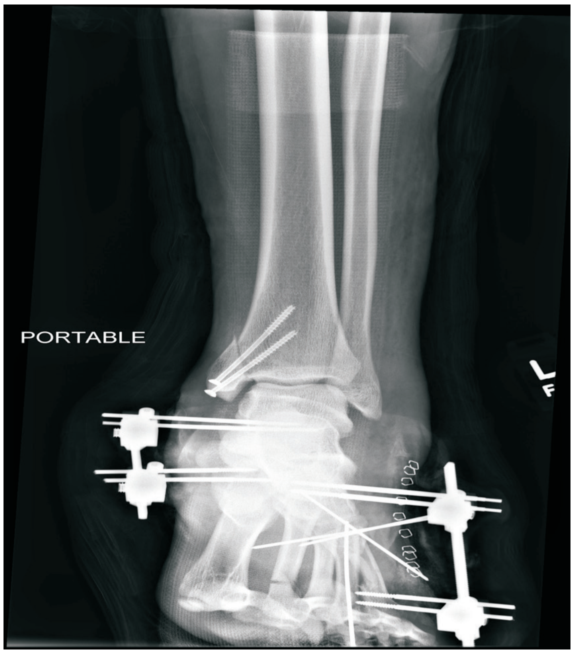

Figure 6C. Immediate postoperative view.

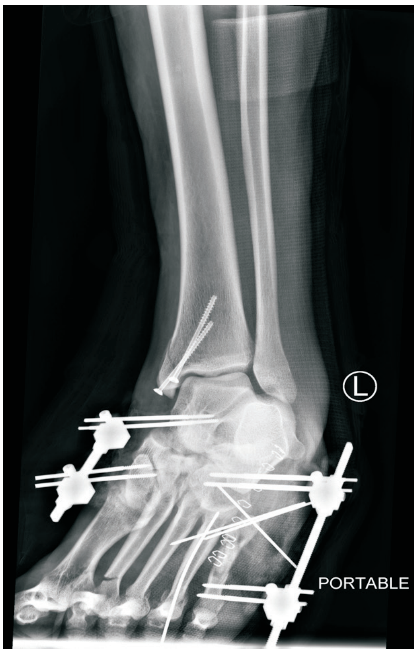

Figure 6D. Immediate postoperative alignment.

Figure 7A. Clinical view at 2 weeks postoperative.

Figure 7B. View at 2 weeks postoperative showing intact mini-rail external fixation.

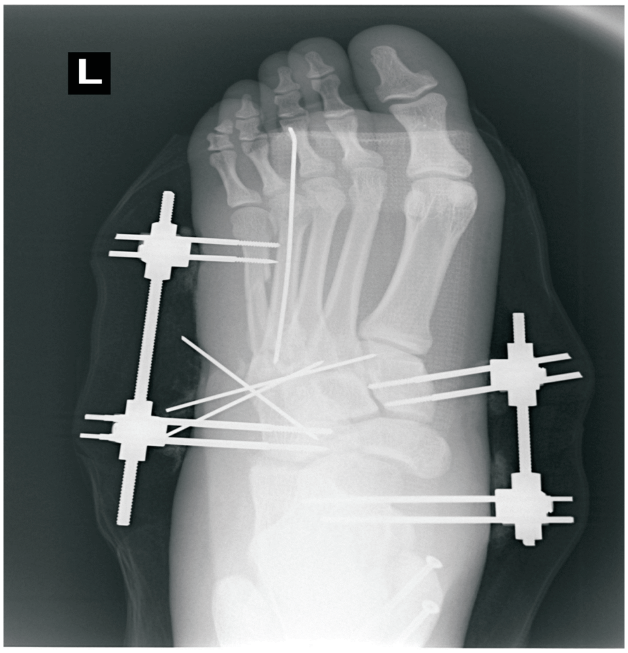

Figure 8A. Radiographic view at 2 weeks postoperative showing callus formation and good alignment.

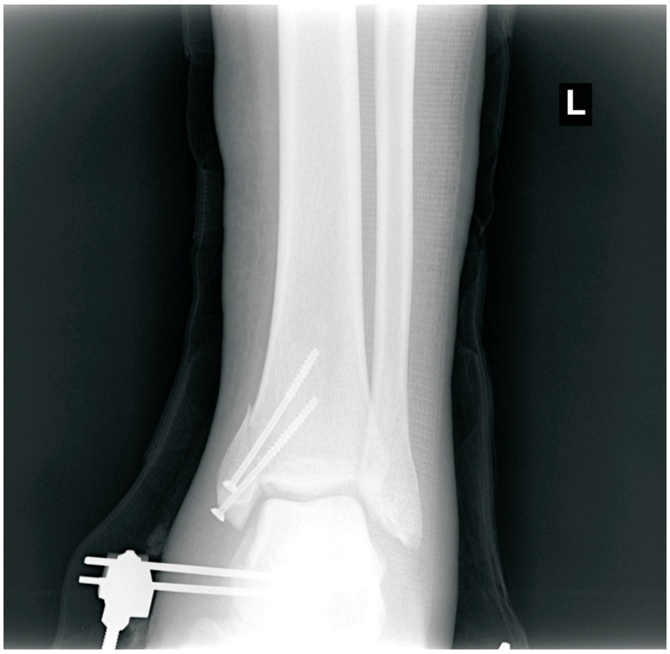

Figure 8B. Radiographic view of the ankle at 2 weeks postoperative.

Figure 9A. Postoperative radiograph at 4 weeks.

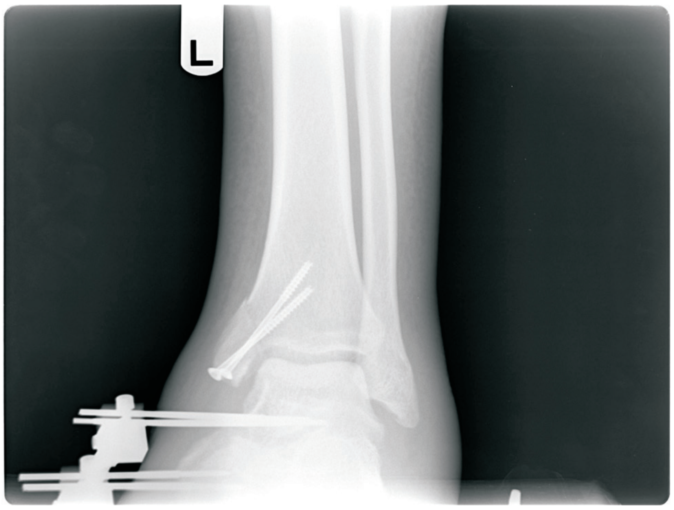

Figure 9B. Four weeks postoperative radiograph.

Figure 10A. Radiograph at 8 weeks postoperative.

Figure 10B. Lateral view at 8 weeks postoperative.

Figure 11A. View at 3 months postoperative after removal of mini rail external fixation and pins.

Figure 11B. Lateral view at 3 months postoperative.

Figure 12A. Radiographic view at 4 months postoperative.

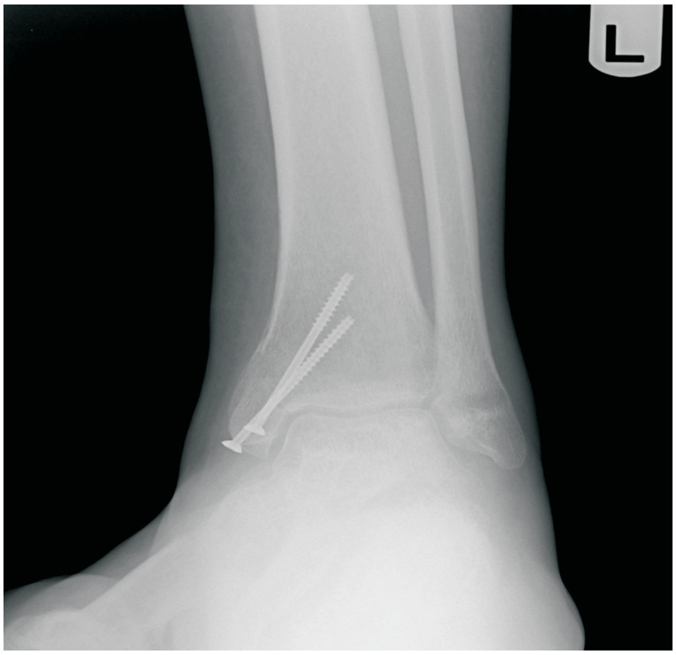

Figure 12B. View of the ankle at 4 months postoperative.

Figure 13A. View at 6 months, demonstrating complete recovery.

Figure 13B. Radiograph at 6 months postoperative.

Figure 13C. Ankle at 6 months postoperative.

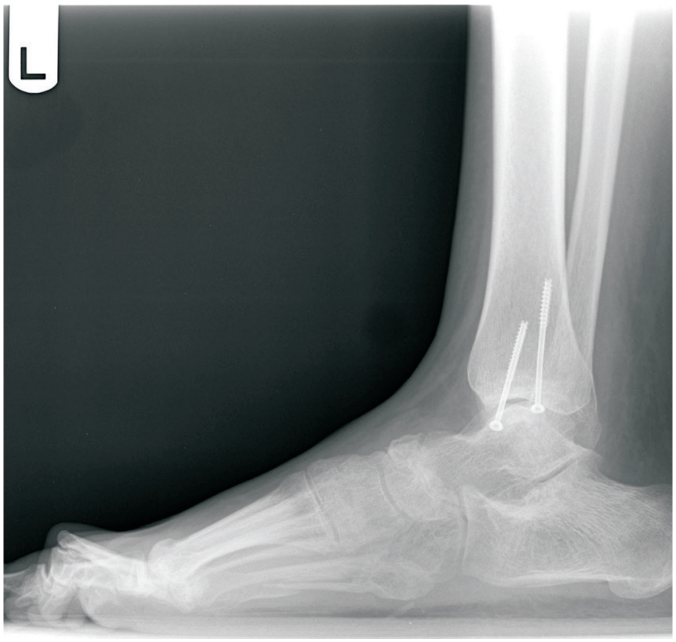

Figure 13D. Lateral view at 6 months postoperative.

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