

## Arthrodesis with Intramedullary Fixation in Posttraumatic Arthrosis of the Midfoot: A Case Report

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### Abstract

We present two middle-aged men with posttraumatic arthrosis of the midfoot. Both patients suffered from severe pain and their foot was unable to bear weight. Both were operated using new fusion bolt 6.5 mm and additional screws. In their case, arthrodesis was mandatory and effective intervention. After surgical treatment both patients were pain free and able to walk without crutches and return to daily work.

**Keywords:** Bolt; Arthrodesis; Midfoot; Intramedullary fixation; Case report

### Introduction

Midfoot arthrosis is a common cause of significant pain and disability [1]. The general aims of treatment are to eliminate/reduce pain and restore the patient's everyday activity [2,3]. The treatment approach is individualized according to the severity and degree of disability considering arthrosis, patient's age and general condition. It can be conservative or surgical. Conservative includes physical therapy which offers a variety of treatment options for foot arthrosis: specific exercises, Achilles tendon stretch, joint mobilizations, massage, whirlpool and paraffin baths, electrical stimulation, laser and ultrasound therapy. All these treatments are widely used, but research supporting their efficacy and effectiveness is lacking. A recent review found limited evidence of the short-term effect of manual therapy on metatarsalgia [4]. For pain control, analgesics and anti-inflammatory drugs may be used [5]. The surgical option is arthrodesis. Midfoot arthrodesis traditionally have been done to treat deformities resulting from posttraumatic arthrosis. Arthrodesis of the affected joints is indicated when uncontrolled severe pain or loss of function is present. Surgery restores mechanical alignment and foot stabilization [3]. There are standard options arthrodesis with plates, screws and a new option arthrodesis with intramedullary screws. In this article we want to present a case of a patient in which we have made arthrodesis with bolt screws.

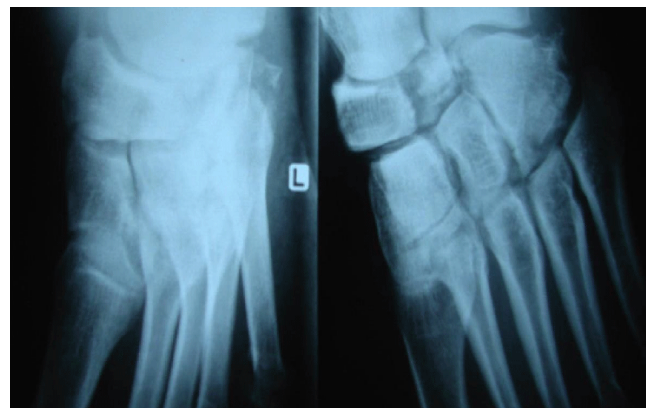
The midfoot fusion bolt is a recently developed implant designed to withstand the extensive forces occurring in these areas. The bolt is a 6.5 mm, titanium or stainless steel, solid-core, headless screw used to create a beam along the longitudinal columns of the foot. This acts to accept both compressive and tensile loads in these areas, analogous to the action of steel rebars used to reinforce concrete [6]. Although the concept of beaming the longitudinal columns of the foot is not new [7-11], this was previously described with cannulated screws, which are, by design, inherently weaker than solid-core screws and thus subject to failure at lesser loads. As such, the midfoot fusion bolt offers a technical advantage compared with other forms of fixation in challenging cases. Midfoot fusion bolt is usually used in surgical

treatment of Charcot foot. Considering applicability of the midfoot fusion bolt system we decided to use them also in two patients with severe posttraumatic midfoot osteoarthritis. Our article describes preoperative condition of patients; surgical treatment and long term follow up.

### Case Reports

#### Patient 1

29-year-old man suffered a fracture of the cuboid, navicular bone and bases of the III and IV metatarsal bone in 2010 and was operated in another institution (Figure 1). He was treated with external fixator and K wires, which were later removed after 6 weeks (Figure 2). Treatment was estimated to be completed after 4 months.



**Figure 1:** X-ray immediately after injury of patient 1 where fractures of the navicular, cuboid and bases of the III and IV metatarsal bones were seen.



Figure 2: Control X-ray after first operation in patient 1.



Figure 3: CT scan of the patient 1 on admission to our department - six months after injury and first operation. Osteosynthetic material was removed. CT shows collapse of the navicular bone, arthrosis in Chopart and Lisfranc joints.

Two months later (six months after the injury) he came as an outpatient in orthopaedic trauma department complaining of severe pain (10 according to VAS scale) and swelling occurring for the last month and disability to weight bear. He was using crutches. He denied to have injured his leg after first operation. CT showed the collapse of navicular bone, arthrosis in Chopart and Lisfranc joints (Figure 3). Considering clinical status and CT results arthrodesis of the Chopart and Lisfranc joints was indicated using midfoot fusion bolt system and additionally solitary 3.5 mm cannulated cancellous screws.



Figure 4: Articular debridement was performed using two approaches, dorsal approach extending from the second webspace (»Hannover incision«) and small lateral approach over calcaneocuboid joint (patient 1).



Figure 5: Retrograde introduction of the intramedullary nail through small incision over first metatarsophalangeal joint in patient 1.

The operation was performed under spinal anesthesia and local ischemia. Preventive antibiotics were used. Articular debridement was performed using two approaches; dorsal approach extending from the second webspace (»Hannover incision«) and small lateral approach over calcaneocuboid joint (Figure 4). Additionally we made minimal invasive approach dorsally over first MTP joint for retrograde introduction of bolt intramedullary nail for arthrodesis of the medial column of the foot (metatarso-tarso-naviculo-talar fusion) (Figure 5). Additionally cancellous bone graft was taken from anterior iliac crest to fulfill completely collapsed navicular bone. Calcaneo-cuboid fusion was made percutaneously with anterograde approach, also using bolt system. Bolt nails were inserted under the control of x-ray. Lisfranc joint was additionally fused with 3.5 mm cannulated cancellous screws. Drainage was used for two days. Day after the surgery control

x-ray was made (Figure 6), a patient was mobilised with crutches without weight bearing and two days later released from the hospital. Two weeks after operation we removed the stitches and he was sent to the physiotherapy (FTH). After 6 weeks he started to walk with crutches with partial weight bearing and after 12 weeks he started with full weight bearing. The patient was able to return to daily work as a truck driver after 4 months. After three years of follow up the patient was still without pain and able to work normally (Figure 7)



Figure 7: X-ray of patient 1 three years after the operation.

### Patient 2

44-year-old man was checked in 2011 as outpatient in orthopaedic trauma department complaining of severe pain and swelling of the left foot and two months of disability of weight bearing therefore he was using crutches. The same leg was injured by a mine 15 years ago during war. Pain measured by VAS scale was assessed to be 10 out of 10. Radiographs (X-ray) revealed a small metal particle in the left ankle, metal particle at the base of the fourth metatarsal joint and posttraumatic changes between the metatarsals and cuneiform bones. CT revealed severe arthrosis in Chopart's and Lisfranc's joints and mild arthrosis in subtalar joint. On plantar side were non-union fragments of a size up to one centimeter, cuneiform bones were fragmented. There was also arthrosis of tarsometatarsal joints present and visible metal particles between cuboid and the base of fourth metatarsal bone.

Considering severe arthrosis and pain we decided for total arthrodesis of the Lisfranc and Chopart joints with midfoot fusion bolt system and additional 3.5 mm cannulated cancellous screws.

Operative procedure was performed as described in patient 1 with the difference that in this patient there was no need for cancellous bone graft (Figure 8). Postoperative treatment also took the same steps, but at the start of full weight bearing at 12 weeks he described mild pain on the lateral side over base of the fifth metatarsal bone therefore one of the cannulated cancellous screws was removed and the pain disappeared.



Figure 8: X-ray of the midfoot fusion in patient 2 one day after the operation.

He was checked as an outpatient every 2 weeks where x-ray control was done. Four months after operation he walked without crutches and was without pain. After 6 months he returned to daily activities and work as a construction worker. After three years of follow up the patient was still without pain and able to work normally (Figure 9).



Figure 9: Patient 2 X-ray control three years after operation.

### Discussion

Midfoot fusion bolt-a solid core intramedullary nail was originally developed for treatment for gross collapse of the mid/hindfoot associated with Charcot foot, neuropathic disease and deformities with gross misalignment [12,13]. With intramedullary nailing we can achieve permanent fusion of medial and lateral column in patients suffering from gross instability with or without collapse of the midfoot. It provides stabilization and alignment enhancing the possibility of a functional foot.

Comparing to conventional methods of midfoot arthrodesis using plates and screws, intramedullary nailing offers sufficient stabilization, blood supply preservation and lower the risk of infections [14]. The

key advantage of these implants is the short incision needed with less soft tissue damage compared with any bulky implant. Anyhow, cannulated screws are inherently weaker than solid-core screws and thus subject to failure at progressive weight-bearing and high loads. Up to 36% of breakage rates in fixation for midtarsal arthrodesis in Charcot arthropathy were reported [15].

These advantages are expected to be beneficial also in posttraumatic cases where midfoot arthrodesis is indicated. To our knowledge there are no publications describing total midfoot arthrodesis in posttraumatic arthrosis using solid intramedullary fusion bolt system. In our two cases arthrodesis was performed successfully. The goal of our treatment was to relieve patient of severe pain and enabled them to return to work and other daily activities. Both of the patients postoperatively described pain according the VAS 11 scale to be 0, compared to 10 prior the surgery.

Considering our cases, midfoot fusion bolt system can be a good alternative also in posttraumatic cases since both patients had excellent long term results.

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