

Case Study:

The Use of Intramedullary Fixation for Neck Fractures of the 2nd, 3rd, and 4th Metatarsals



Joel Virkler, DO
Lafayette Orthopaedic Clinic
Lafayette, IN

Pre-op



Intra-op



Case Presentation

Patient was a 36-year-old male who suffered a closed crush injury from his motorcycle falling on his left foot, just prior to arrival to the emergency department. X-ray and CT imaging demonstrated left 2nd, 3rd, and 4th metatarsal neck fractures, as well as a first metatarsal base fracture-dislocation. There were no other associated injuries and his foot compartments were soft and neurovascularly intact distally (NVID). Due to multiple fractures with displacement in an active individual, surgical fixation was indicated. He was placed in a splint and scheduled for surgery the following day.

Pre-op Plan

Dr. Virkler considered both K-wire fixation and intramedullary screw fixation of the metatarsal fractures. He also considered closed versus open reduction techniques. Due to the anatomic location of the fractures in the metatarsal necks, K-wires would not likely provide as rigid fixation as intramedullary nails, in addition to infection and secondary procedure risks. Therefore, intramedullary nail fixation was selected to treat the metatarsal neck fractures. Of note, both internal fixation versus primary fusion options were considered for the first metatarsal base fracture. Due to the intra-articular nature of the fracture leading to post-traumatic arthrosis and improved outcomes in the literature with fusion, primary fusion was selected to treat the first metatarsal base fracture-dislocation.

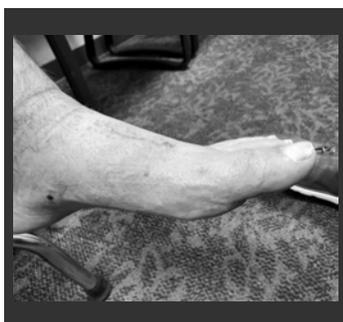
Operative Findings and Approach

Dr. Virkler addressed the 2nd, 3rd, and 4th metatarsal neck fractures, first. Utilizing longitudinal traction and hyperextending the toe for reduction and approach, he first placed percutaneous guidewires retrograde through each metatarsal under multi-planar fluoroscopy. The guidewire was placed into the plantar third of the metatarsal head.

Intra-op



Post-op



Once reduction and guidewire placement was achieved, Dr. Virkler performed a 4mm longitudinal vertical split around the guidewire, through the flexor tendon and capsule. The length of each metatarsal was measured, the canal was opened with the cannulated drill retrograde over the guidewire, and 4.5mm diameter INnate nails of appropriate length (65mm for the 2nd and 55mm for the 3rd and 4th) were placed under multi-planar fluoroscopy. The INnate nail heads were placed beneath the articular cartilage on the lateral side to avoid joint impingement. Proximal fixation was achieved at the isthmus. Rotational and longitudinal alignment were assessed on multiple occasions throughout the case both radiographically and clinically. The first metatarsal base was treated with a primary fusion technique utilizing dorsal plating and staple construction for compression. Dr. Virkler felt the patient could have begun weight bearing through the heel after 2 weeks and full weight bearing at 4 weeks regarding the metatarsal fracture fixation; however, due to the primary fusion weight bearing limitation of 8 weeks, his return to activity was limited by his first tarsometatarsal fusion.

Follow-up

The patient was seen in clinic at 2, 8, and 12 weeks after surgery. He experienced very little pain or swelling after surgery. Dr. Virkler did limit his weight bearing for 8 weeks in the boot due to the fusion, although the patient could have begun weight bearing sooner on the metatarsals, he was limited by the post-op restrictions of the fusion. At 8 weeks he began full weight bearing as tolerated in a regular shoe. At final follow-up at 12 weeks, the patient had full range of motion of all toes and ankle, and was back to full regular activities. He reported working through the harvest season as a farmer without limitation to his ability to work. There were no complications and he was extremely satisfied with the outcome. Final follow-up radiographs demonstrated excellent reduction and healing of his multiple fractures.

Post-op



12-Week Post-op



Discussion

The INnate nail allowed Dr. Virkler to treat this patient with an intramedullary nail that allowed for good maintenance of reduction and control of rotation without secondary procedures or infection risk, all advantages of the INnate nail over K-wires. In general, the INnate nail is also a load-sharing device placed percutaneously; great advantages over plate and screw fixation for these fractures. Large open dissection for plate and screw placement results in more stiffness and prolonged recovery with longer restrictions. INnate nail placement is also an expeditious technique which reduces operative time and complications.