

Case Report

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Complex Foot Injury With Grade III B Compound Fracture Involving Lisfranc And Chopart Fracture Dislocation With Bone Loss Of Middle And Lateral Cuneiform Bones Treated With A Novel Technique Of Tricortical Iliac Bone Graft: A Case Report.

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ABSTRACT

Background:

Open fractures of the foot with combined Chopart and Lisfranc fracture-dislocations are rare, limb-threatening injuries that are difficult to manage because of severe contamination, osseous instability, and associated soft-tissue loss. Segmental loss of two cuneiform bones in this setting is exceptionally uncommon, and successful reconstruction with tricortical iliac crest bone grafting has rarely been described. We report the management and short-term outcome of a young man with Grade IIIB open complex foot trauma involving combined Chopart and Lisfranc fracture-dislocations, loss of the middle and lateral cuneiforms, and extensive soft-tissue damage.

Case Report:

A 22-year-old man sustained a road traffic injury to the right foot and presented with a Grade IIIB open injury characterized by combined Chopart and Lisfranc fracture-dislocations, severe contamination with grass particles, extensive soft-tissue injury, loss of the middle and lateral cuneiform bones, and loss of the extensor digitorum tendon. Emergency management included thorough debridement, broad-spectrum intravenous antibiotics, and temporary stabilization with multiple Kirschner wires. The soft-tissue defect was addressed with staged wound care and coverage using a reverse sural artery fasciocutaneous flap, supplemented with skin grafting. In a subsequent stage, osseous reconstruction of the cuneiform defects was performed using a tricortical iliac crest bone graft.

Conclusion:

At 6 months, all fractures had united, the iliac crest graft had fully incorporated, and the fasciocutaneous flap had survived completely. Functional outcome was satisfactory, with an American Orthopaedic Foot and Ankle Society score of 80/100. This case highlights that urgent debridement, early stable fixation, staged biological reconstruction with a tricortical iliac crest graft, and timely flap coverage can preserve the limb, restore midfoot stability, reduce the risk of amputation, and provide good functional recovery in severe open complex foot trauma with cuneiform bone loss.

Keywords: Bone Transplantation, Dislocations, Fractures, Foot Injuries, Wounds And Injuries

INTRODUCTION

The foot is a complex structure consisting of 26 bones and multiple intrinsic and extrinsic muscles attached by ligaments and arranged into medial, lateral, and transverse arches.^{1,4} The incidence of compound fracture of the foot is 12.1 to 25.88 per 100,000 per year. The incidence of Lisfranc fracture-dislocation is 0.2% of all fractures.⁵ The incidence of Chopart fracture-dislocation is 2.2 per 100,000 per annum, and the incidence of combined Chopart and Lisfranc fracture-dislocation is 20% of these injuries (Main's classification). The incidence of isolated navicular bone fracture is 5% of all foot fractures and 35% of all midfoot fractures, while the incidence of cuboid fracture is 1.8 per 100,000 per annum.^{6,7} Management of compound fractures of the foot is always challenging for the orthopedic surgeon, as amputation may be an easier option, but it has long-term psychological effects on the patient and adversely affects rehabilitation.^{8,9} The reconstruction of the foot is a complex procedure, and if not treated properly, chronic pain and disability can lead to long-term patient dissatisfaction. Complex foot trauma with compound fractures associated with bone loss is a rare condition, and only a negligible number of successfully treated cases using tricortical iliac crest bone grafting have been documented in the literature. Hence, we present a case report of a young patient who sustained a complex open foot injury with combined Chopart and Lisfranc fracture-dislocations, along with bone loss of the middle and lateral cuneiform bones, successfully treated with a tricortical iliac crest bone graft and reverse sural artery fasciocutaneous flap. The case was admitted and treated at KIMS General Hospital, Amalapurum, Andhra Pradesh.

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CASE REPORT

A 23-year-old male patient was hit head-on by a four-wheeler and dragged toward the side divider of the road, where his right foot became trapped between the divider and the foot bar of the bike, causing severe injury. The patient was taken to a nearby hospital, where resuscitation was carried out according to ATLS protocol. After hemodynamic stabilization, the patient was transferred to the casualty department of our hospital.

On examination, the patient's right foot showed a massive injury with exposed bone and extensor digitorum longus tendon. There was a fracture of the navicular bone with talonavicular joint dislocation; the middle and lateral cuneiform bones were missing; and there was a fracture of the cuboid with calcaneocuboid dislocation (Chopart fracture-dislocation). There was fracture-dislocation of the 2nd, 3rd, 4th, and 5th metatarsal bases (Lisfranc fracture-dislocation). The extensor digitorum tendon was exposed and ruptured distally. Skin coverage was possible. Capillary refill was good, and the dorsalis pedis artery was well felt. The wound was severely contaminated with grass particles, dust, and roadside sand. The dislocations of the above-mentioned joints were reducible but unstable. Copious wound wash with 0.9% NaCl was given, and intravenous infusions of third-generation cephalosporins, amikacin, and metronidazole were administered. Two units of whole blood and two units of fresh frozen plasma were transfused concurrently.

A below-knee plaster slab was applied, and limb elevation was advised. X-rays of the right foot in AP, lateral, and oblique views were taken, and all findings were confirmed. Urgent debridement and multiple K-wire fixation of all fractures and involved joints were performed, with the Lisfranc and Chopart joints stabilized by transarticular K-wire fixation, followed by wound closure under spinal anesthesia within 6 hours of injury. After 3 days, a second wound debridement was performed, and as the wound appeared healthy, tricortical iliac crest bone grafting was done in the space created by the loss of the middle and lateral cuneiform bones and stabilized with K-wire transfixation.

On the 7th postoperative day, the dorsal skin became necrotic, and therefore debridement of the necrosed skin and skin grafting were performed. At the end of 10 days, only 40%–50% of the skin graft had survived; hence, the plastic surgery team performed a reverse sural artery fasciocutaneous flap. The flap survived completely, and all other wounds healed completely. Wire removal was done at 6 weeks, and the graft K-wire was removed at 8 weeks.

The patient was allowed weight bearing at the end of 12 weeks after confirmation of healing of all fractures and incorporation of the tricortical iliac crest bone graft on X-ray. At 6 months after injury, the patient was evaluated for pain on walking and range of movement according to the AOFAS scoring system. At the 6-month follow-up, the tricortical graft had incorporated well, and all wounds and fractures were found to have healed satisfactorily. The patient was able to walk with full weight bearing and had satisfactory ankle and subtalar joint range of movement (AOFAS score: 80/100). The patient resumed work with full satisfaction. He was advised not to participate in any recreational, athletic, or strenuous activities. Due to the extensor digitorum longus tendon rupture, he had some clawing of the toes. He was provided with special footwear to protect and support the foot.

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FIGURE 1: Images (from left to right) showing clinical photograph of severe open right foot injury with exposed bone and soft tissue loss; preoperative X-ray demonstrating combined Chopart and Lisfranc fracture-dislocations with midfoot instability; intraoperative C-arm image showing multiple transarticular K-wire fixation; and postoperative X-ray showing stabilized midfoot architecture with K-wire fixation and reconstruction following tricortical iliac crest bone grafting.



FIGURE 2: Images (from left to right) showing harvested tricortical iliac crest bone graft; intraoperative placement of tricortical graft at the site of cuneiform bone loss; postoperative appearance following skin grafting, partially healed skin graft with granulation tissue; and reverse sural artery fasciocutaneous flap used for definitive soft-tissue coverage of the defect.



FIGURE 3: Images (from left to right) showing clinical photographs of the dorsum of the foot with well-healed soft tissue and flap coverage; lateral view demonstrating contour and integrity of the reconstructed foot; follow-up X-ray showing union of fractures and incorporation of the tricortical iliac crest bone graft with maintained midfoot alignment; and functional outcome with the patient ambulating with support.

DISCUSSION

Structures of foot (Bones and soft tissues) have complex vascularity, nerve innervation, ligamentous support, and capsular anatomy. Compound fractures of the foot are therefore challenging to treat. The incidence of compound fractures is 52% in multiple trauma patients.⁹ The rate of amputation of the foot in complex trauma is 17% for hindfoot injuries and 30% for midfoot injuries.¹⁰ It is common in the young age group (30–40 years), with a male-to-female ratio of 4:1, and bike accidents, war injuries, workplace injuries, and falls from height are common mechanisms of injury. Forefoot injury is classified as a Level I injury. Multiple forefoot injuries constitute Level II injuries, while midfoot and hindfoot injuries are Level III injuries with a very high rate of amputation. Neither amputation nor salvage of the foot has proved to be a clearly superior option for the patient.

Each foot consists of 5 zones—pilon, talus, calcaneum, Chopart, and Lisfranc—plus soft-tissue injury. Each zone carries 1 point; if the total score is more than 5, it is classified as complex foot trauma (Zwipp classification).¹¹ Detailed radiological evaluation is important, as 10% of foot fractures are missed at the time of admission and 41% of Chopart fractures are missed at the first visit. Therefore, a 3D reconstruction CT scan is essential for evaluation of complex foot trauma.

The most common complication in a salvaged foot is osteomyelitis. A 0%–9% incidence of superficial surgical scar infection has been reported in the literature. The Gustilo-Anderson classification is the most commonly accepted classification for compound fractures.¹² It is simple to use and considers wound size, level of contamination, skin coverage, and distal vascularity. Prophylactic antibiotics are indicated for better results. Debridement should be performed within 24 hours. If compartment syndrome, gross contamination, or vascular deficit is present, debridement should be performed within 6 hours for better results. Debridement should be performed by a senior surgeon, preferably in collaboration with a plastic surgeon.

A copious amount of NaCl is sufficient, and there is no significant difference between normal saline and antibiotic solution lavage in the final outcome.^{13,14} Generally, the 4 “Cs” should be followed during debridement: color of muscle, contractility of muscle, consistency, and capacity to bleed after cutting.¹⁵ Loose bone fragments that are not useful for union and are devoid of soft tissue should be removed. Negative suction drainage (vacuum-assisted closure) is helpful.^{16,17} It prevents desiccation of cortical bone. It should be continued until a decision regarding wound coverage is made.

Primary management of foot fractures involves multiple K-wires, especially for lateral column fractures, or intra-articular screws; stabilization of the fracture and wound coverage with a skin graft or flap (fix-and-flap technique) gives better results and helps in salvage of the foot in complex trauma. K-wires are easy to insert and remove. There is a 32% incidence of secondary displacement or suboptimal reduction with K-wires. Restoration of the correct foot axis and maintenance of column length are the main goals of surgical treatment. Antibiotic cement beads give better results.

A synchronous soleus and reverse sural artery flap is a one-time surgical procedure that helps in early recovery and reduces hospital stay.¹⁸ It has a 70% 5-year survival rate in nonsmokers. Return to work after reconstructive surgery and amputation is 30% and 63%, respectively.¹⁹ Salvaged patients are more satisfied with their bodies and more content with the aesthetic outcome after treatment. Functional rehabilitation and psychological support programs are essential for a good outcome in complex foot trauma. Early debridement and staged reconstruction give optimum functional results.²⁰ Amputation of the foot can cause psychological problems such as depression and delay rehabilitation; therefore, it should not be considered a suitable option in all cases.

Tricortical bone grafting is a novel technique, is biologically favorable, offers mechanical support, promotes early bone healing, reduces pain, and improves functional recovery and patient satisfaction.²¹ Very few cases in the literature have reported the use of the iliac crest bone grafting technique in bone loss due to complex foot trauma. The results are promising, but more research on this technique and long-term follow-up are needed. Cuneiform fracture, dislocation, or bone loss is a rare entity and should be included in the classification of complex foot injuries.²²

The AOFAS scoring system is a standard tool used to evaluate the functional outcome of foot injuries. An AOFAS score of 58/100 has been reported in the literature for combined injuries (Lisfranc and Chopart fracture-dislocations).²³ Arthritis of the foot has been reported in 33% of cases of combined fracture-dislocation in the literature. Talonavicular joint arthrodesis decreases 50% of the mobility of the Chopart joint and hence should be avoided.²⁴ In our case, we meticulously followed all the above guidelines and obtained a good functional outcome (AOFAS score: 80/100).

Conclusion:

Complex foot injury with Grade IIIB compound fracture-dislocation and bone loss can be managed with early debridement, antibiotics, and minimal but stable fixation. Bone loss can be managed by the novel and scientifically sound technique of tricortical iliac crest bone grafting, which

is biologically favorable, stable, and result-oriented. When augmented early with a fasciocutaneous flap for wound coverage, it can reduce the chances of amputation, provide stability, and yield optimum functional results, offering psychological satisfaction to the patient and facilitating early return to work-related activities. However, a more detailed classification of complex foot trauma, modification of treatment guidelines, and long-term follow-up are essential for better functional outcomes.

Conflict Of Interest-None

Source Of Funding- None

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Complex Lisfranc–Chopart Injury with Cuneiform Bone Loss Reconstruction

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Author Contribution :

KK - contributed to patient management, data collection, and initial manuscript drafting, **NG** - participated in data compilation, literature review, and manuscript editing, **JM** - performed data interpretation and contributed to critical revision of the manuscript, **AV** - assisted in data analysis and manuscript revision, **YR** - supervised the study and approved the final manuscript.

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