Case 40: Acute Shortening and Arthrodesis Technique in Severe Irreparable Tibial Pilon Fracture

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Contents

Abstract

Severe soft tissue and bony injuries around the ankle present limb salvage challenges to the orthopedic trauma surgeon. Infection and soft tissue loss often lead to amputation. Reconstruction with external fixation helps prevent deep infection and allows for acute limb shortening as a means of managing the soft tissue loss without free flap coverage. Even significant limb shortening can be remedied with relative ease, utilizing the Ilizarov method of distraction osteogenesis. The following case highlights these principles with the additional use of an integrated fixation technique where a fusion lengthening performed with external fixation is converted during consolidation to internal fixation to decrease time in the frame.

1 Brief Clinical History

A 48 year old male was involved in a traffic accident and sustained a IIIC open tibial pilon fracture, loss of skin coverage, and exposure of the neurovascular bundle and tendons. Miraculously, his neurovascular structures were still functional.

2 Preoperative Clinical Photos and Radiographs

See Figs. 1, 2, 3, 4, and 5.

3 Preoperative Problem List

- Severe trauma to soft tissue
- Massive contamination and delayed transfer to the hospital
- Ankle joint destruction
- Bone loss and limb shortening

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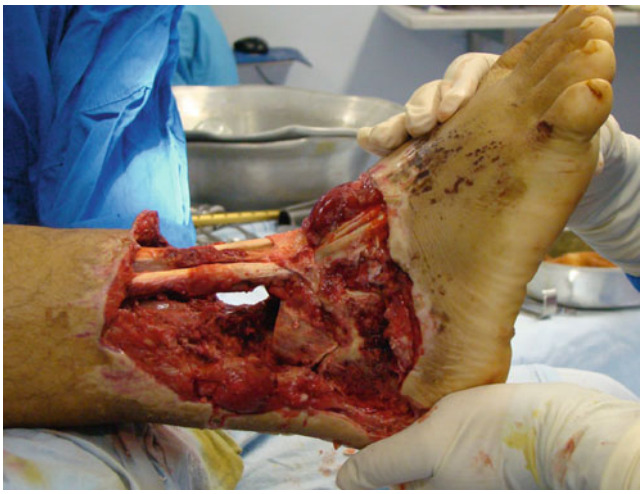

Fig. 1 Sensate and well-perfused foot

Fig. 3 Bone and soft tissues instability

Fig. 2 Palpable dorsalis pedis pulse

Fig. 4 AP radiograph showing bone loss and comminution

4 Treatment Strategy

- Transfer to a third-level multidisciplinary center.
- Immediate damage control with limb stabilization and soft tissue management.
- Acute shortening techniques.
- Ankle fusion.
- Combination of proximal tibial lengthening and internal and external fixation techniques.

Fig. 5 Lateral X-ray showing bone and joint damage

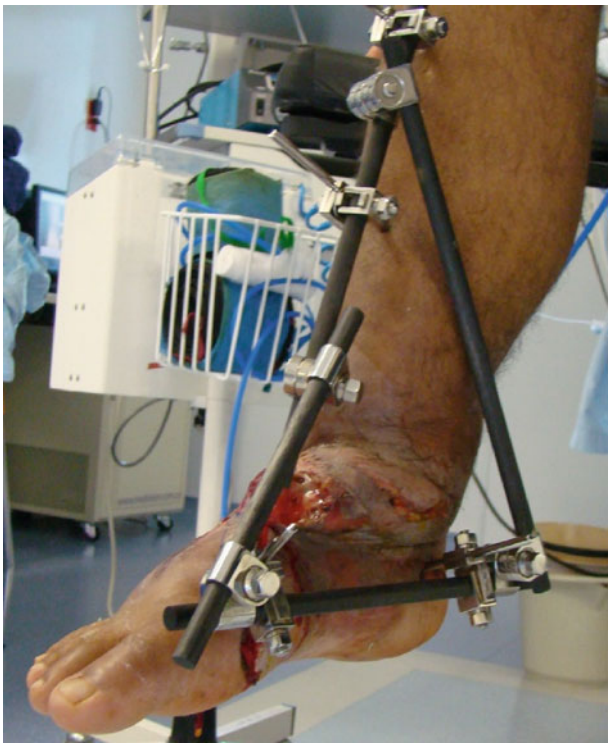

Fig. 6 Soft tissues stability

5 Basic Principles

- Stabilization of bone and soft tissues
- Immediate antibiotic IV
- Rational use of the Ilizarov method

6 Images During Treatment

See Figs. 6, 7, 8, 9, 10, 11, and 12.

7 Technical Pearls

- Early stabilization with pin-to-bar fixation makes soft tissue management easier than stabilization with a circular fixator. The plan was to convert to the definitive Ilizarov frame once the acute damage was well controlled.
- Removal of all contaminated tissues is important to avoid infection. Multiple debridements are often necessary to clean the area adequately. Little regard should be given to removing questionable bone as length defects can always be restored with bone transport.
- Early skin coverage is helpful in preventing deep infection. Limb stability is very important in obtaining skin healing and reducing the risk of infection. Acute shortening of the bone defect reduces dead space and allows for improved soft tissue management. In this case a free soft tissue transfer with microvascular

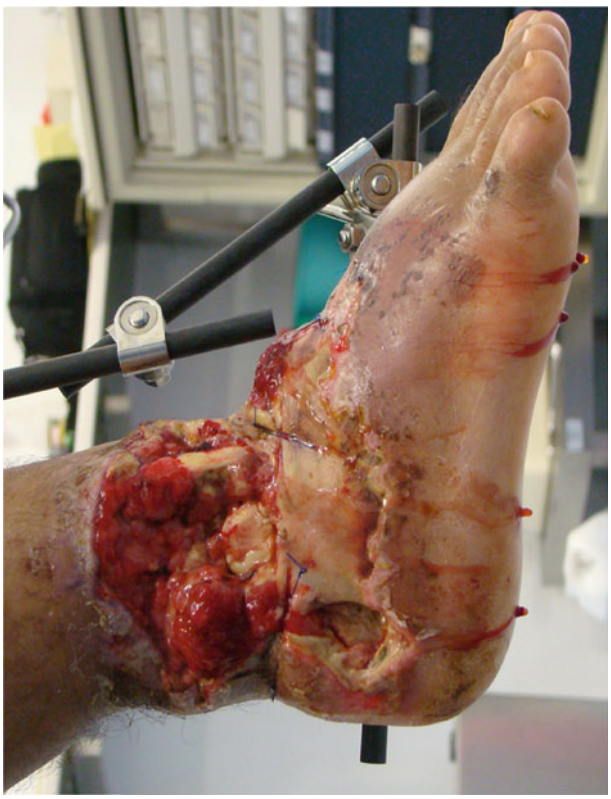

Fig. 7 After shortening and provisional stabilization with pin-to-bar fixation

Fig. 8 Lateral radiograph demonstrates bone loss after thorough debridement including resection of the distal tibia

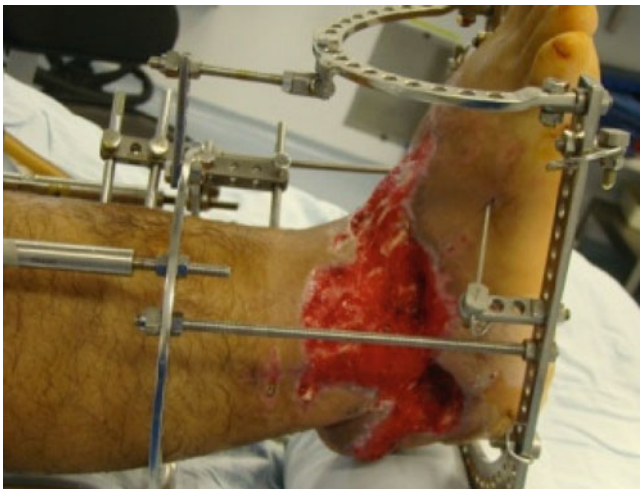

Fig. 11 Granulation tissue thrives with limb stability, shortening of the soft tissue defect, and use of the matrix cover

Fig. 9 Ilizarov method. A minimally invasive technique was used to convert to a circular external fixator

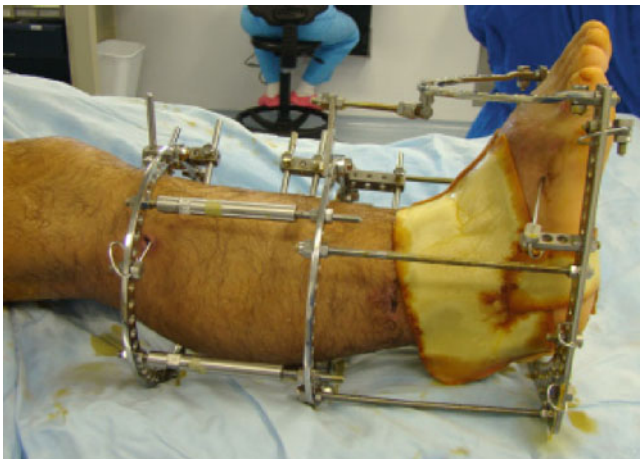

Fig. 10 The skin loss was treated with a hydrophilic matrix cover

Fig. 12 A long, standing X-ray demonstrates severe limb shortening and bone stabilization with the Ilizarov device

Fig. 13 A free skin graft was used to cover the granulation tissue

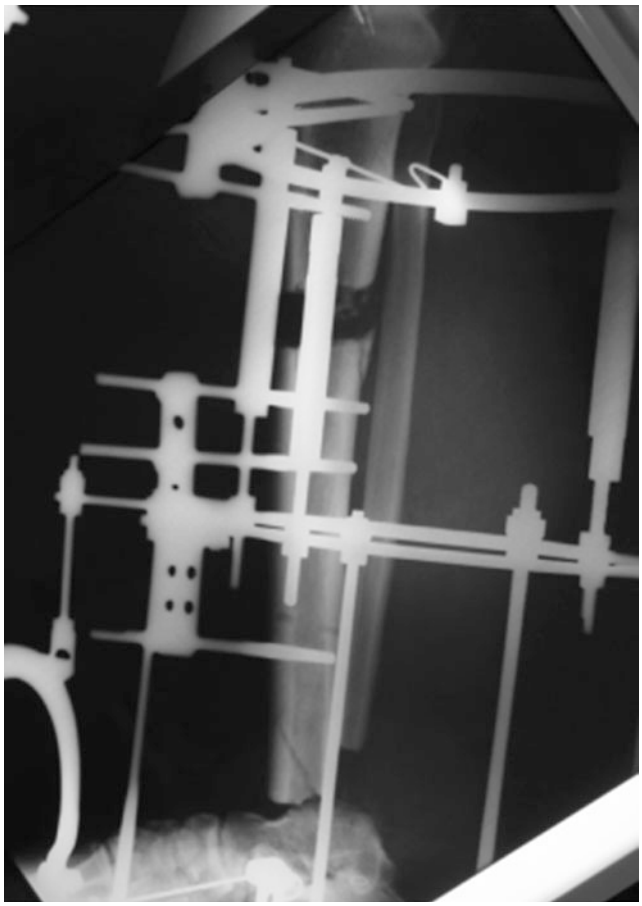

Fig. 14 Tibiotalar arthrodesis is seen at the docking site and proximal tibial osteotomy with gradual lengthening is seen occurring simultaneously

Fig. 15 AP radiograph showing internal stabilization of the regenerate bone and ankle fusion site

anastomosis was avoided by utilizing the acute shortening principle.

- External fixation with the Ilizarov techniques of both acute ankle fusion and gradual bone lengthening of the proximal tibia has revolutionized limb salvage. The external fixator is dynamic, can be adjusted, prevents contamination of the zone of injury, requires no additional vascular and soft tissue insult (minimally invasive), and allows for early mobilization out of bed.
- Consolidation of the ankle fusion and tibial lengthening site can be a lengthy process, complicated by pin infection and pain. In this case the patient was converted to internal fixation during the consolidation process. The external fixator was removed and a LCP plate was inserted submuscularly onto the lateral tibial cortex. Note that the majority of the external fixation was inserted from the medial side in anticipation of later

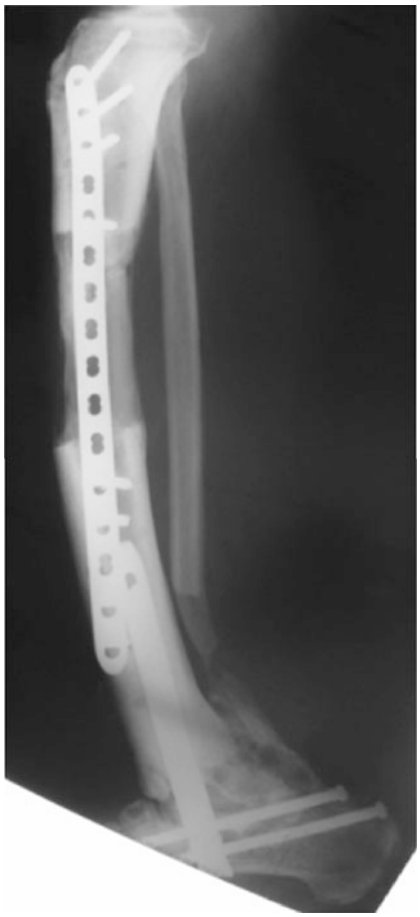

Fig. 16 A lateral X-ray shows the LCP plate spanning the lengthening site

Fig. 17 A closer view of the ankle demonstrates intramedullary ankle arthrodesis to improve docking site union

conversion to a lateral plate to avoid deep infection. The ankle fusion was converted from external fixation to an IM ankle arthrodesis nail with bone grafting to achieve union at the docking site.

8 Outcome Clinical Photos and Radiographs

See Figs. 13, 14, 15, 16, 17, 18, and 19.

9 Avoiding and Managing Problems

- Identify structures at risk early.
- Immediate arthrodesis in severely damaged articular surfaces.
- Multidisciplinary team – reconstruction team.
- Early total bone and soft tissues stability.

Fig. 18 Front view of the leg after reconstruction

Fig. 19 Functional reconstruction, walking without assistive device

10 Cross-References

- ▶ Case 41: Ankle Arthrodesis with Tibial Lengthening for Failed Pilon Fracture
- ▶ Case 42: Traumatic Loss of the Talus. Tibial Calcaneal Arthrodesis with Proximal Tibia Lengthening
- ▶ Case 45: Ankle Fusion and Tibial Lengthening (LATN Technique) for Failed Ankle Replacement

References and Suggested Reading

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