Circular Fixator-Assisted Foot Reconstruction of a Severe Bone and Soft Tissue Land mine Injury

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Abstract

Land mine injuries often devastate the lower extremities leading to open fractures, high tissue contamination, bone and soft tissue defects, and amputation. Fine-wire, circular, external fixation has revolutionized the treatment of these injuries. External fixators provide bone and soft tissue stability, avoid further tissue stripping, can be manipulated for additional surgeries, and allow for gradual shortening and lengthening of the extremity. We present such a case where amputation was narrowly avoided through the use of circular fixation.

1 Brief Clinical History

A 22 year old soldier was wounded by a land mine in a jungle area. He sustained a major blood loss and a severe soft tissue injury and was delayed medical care more than 12 h due to his remote location.

2 Preoperative Clinical Photos and Radiographs

See Figs. 1, 2, and 3.

3 Preoperative Problem List

- Severe trauma to soft tissue and bone loss
- Massive contamination and delayed transfer to the hospital
- Short bone fragments and comminution

4 Treatment Strategy

- Damage control and prevention of infection through thorough debridement of the bone and soft tissue, provisional bony reduction, and stabilization with K-wires and external fixation (Fig. 4). A simple external fixator is used at first to allow for repeat open debridements. The wound is closed primarily after all the damaged tissue has been removed from the zone of injury (Fig. 5).
- A combination treatment with the integration of internal and external fixation techniques is applied. The circular fixator is utilized to provide superior stability and comfortable patient mobilization

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Fig. 1  The plantar aspect of the foot is seen with soft tissues and bone loss as well as massive wound contamination

Fig. 2  The talus is visible in the wound. The surrounding muscle and soft tissue are vascularized. There is bone and soft tissue instability
Fig. 3  The entire foot has been split in half and dislocated around the talus

Fig. 4  Soft tissue stability – monofilament sutures without tension
The frame is extended proximally to control the diaphyseal tibial fracture. Percutaneous hindfoot fusion with internal fixation is implemented for definitive fixation (Fig. 7). These cannulated screws also prevent subtalar separation during correction of the equinus ankle position (Fig. 8). The tibia fracture was further stabilized with an IM nail. The use of the fixator was limited to the control of the foot fractures and the ankle joint position.

5 Basic Principles

- Stabilization of bone and soft tissues.
- Immediate antibiotic IV.
- Rational use of Ilizarov method.
- Integrated fixation: the surgeon must be careful to avoid contact between internal and external fixation to prevent infection.
6 Images During Treatment

See Figs. 4, 5, 6, and 7.

7 Technical Pearls

- The stability of all fractures and soft tissue injuries is important to avoid infection, reduce swelling and pain, and allow for early mobilization.
- Early skin coverage plan.
- Early MIO (minimally invasive osteosynthesis) associated to external fixation with Ilizarov techniques.

Fig. 6 Ilizarov method. Minimally invasive external fixation and dynamic stability
Fig. 7  Subtalar arthrodesis and minimally invasive osteosynthesis

Fig. 8  Combination of external and internal fixation

8 Outcome Clinical Photos and Radiographs

See Figs. 8, 9, 10, 11, and 12.
9 Avoiding and Managing Problems

- An acute joint arthrodesis is best in severely damaged articular surfaces.
- A multidisciplinary reconstruction team approach provides the best care for the patient.
- Early bone and soft tissue stability is very important.

Fig. 9 The patient is able to resume unassisted ambulation
**Fig. 10** The tibiotalar joint is subluxed but is painless and stable. The subtalar fusion is healed. Disuse osteopenia is common after prolonged nonweight bearing.

**Fig. 11** Functional reconstruction of soft tissue and bone alignment.
Fig. 12 The side view of the foot and ankle shows excellent tissue healing

10 Cross-References

▶ Acute Shortening and Arthrodesis Technique in Severe Irreparable Tibial Pilon Fracture
▶ IIIB Segmental Open Tibial Plafond Fracture Treated with Ankle Joint Salvage and Bone Transport

References and Suggested Reading