Case 23: Gunshot Tibia Fracture

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Contents

Abstract

Firearm injuries are increasingly encountered, especially in countries with political instability and uprisings (e.g., Arab spring uprisings). This is in part due to increased availability of weapons to the public. Near-distance and high-velocity missiles are expected to leave extensive soft tissue damage, contamination, and bone comminution. Secondary missiles are generated when the primary bullet or missile impacts objects, such as cortical bone, and cause more damage than the primary missile by taking erratic courses and spreading the energy over a wider area. Open tibial fractures due to gunshots are more apt to be followed by complications even with the universally accepted lines of treatment. The usually confronted complications are bone and soft tissue loss, infection, and nonunion. Judicious staged reconstruction using external skeletal fixation is expected to yield good functional and radiological outcomes.

1 Brief Clinical History

The case is of a 25 year old male who suffered accidental gunshot injury of his right leg while passing near a street fight. Primary treatment included minimal debridement, irrigation with normal saline, and application of a monolateral external fixator in a local hospital. Several weeks later, he was referred to our department for further management. On presentation, there was an area of skin loss on the anteromedial aspect of the leg at the site of bullet entry with exposed tibial bone and deep infection.

Clinical photos and radiographs of this case have been provided by courtesy of Dr. Wael A. Azzam, Lecturer of Orthopaedic Surgery, Faculty of Medicine, Tanta University, Tanta, Egypt

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Fig. 1 (**a**) Clinical photo at the time of presentation showed exposed tibial bone through a skin loss on the anteromedial aspect of the middle third of the leg at the site of bullet entry. The fracture was fixed by a monolateral external fixator. (**b** and **c**) Radiographs at the time of presentation demonstrate a comminuted fracture of the middle third of tibia. Secondary missiles are dispersed in the soft tissues

2 Preoperative Clinical Photos and Radiographs

See Fig. 1.

3 Preoperative Problem List

- Open comminuted fracture middle third of the tibia with extensive soft tissue damage (indicated by the retained secondary missiles and near-distance injury by a high-velocity gunshot)
- Delayed presentation
- Deep infection
- Exposed tibial bone
- Soft tissue loss over middle third of leg

4 Treatment Strategy

The goal of surgery was to eradicate infection (by aggressive debridement of all infected and dead tissues), to bridge the bone and soft tissue loss (by distraction histogenesis using Ilizarov external fixator), and to preserve limb function.

5 Basic Principles

The mainstay in the treatment of open, infected, and comminuted fractures of the tibia is the debridement of all devitalized tissues back to healthy bone with early soft tissue coverage. Using the bifocal bone transport, the wound was left open and packed with gauze soaked with povidone iodine, which was changed every few days. With gradual

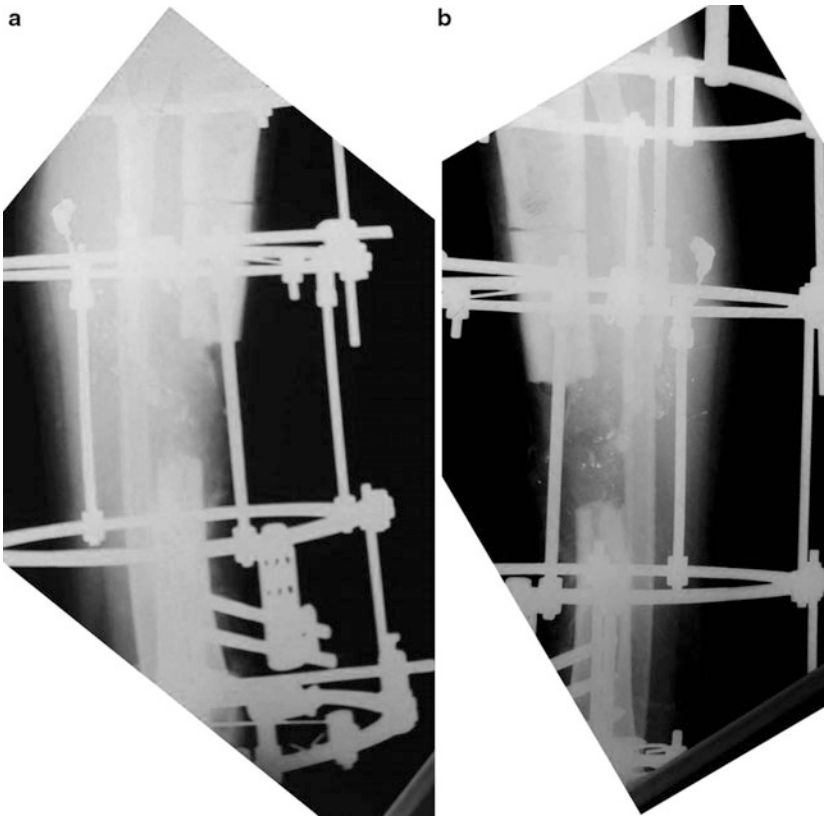

Fig. 2 (**a** and **b**): Immediate post-operative radiographs after resection of comminuted and devitalized bones (square osteotomy of bone ends) and application of Ilizarov external fixator and proximal tibial Gigli saw osteotomy for bone transport

transport, the transported segment descended with its soft tissue cover, and the soft tissue defect was eventually closed by the time of docking.

6 Images During Treatment

Figs. 2, 3, and 4.

7 Technical Pearl

- Resection of all devitalized tissues to ensure eradication of infection.
- Square osteotomy of bone ends to get the maximum bone contact and an inherently stable bone geometry.
- Autogenous ICBG is the gold standard in the management of fractures with impaired local biological environment.
- Fibular osteotomy facilitates reposition of translated bone ends and allows axial compression of the fracture site.

8 Outcome Clinical Photos and Radiographs

Fig. 5.

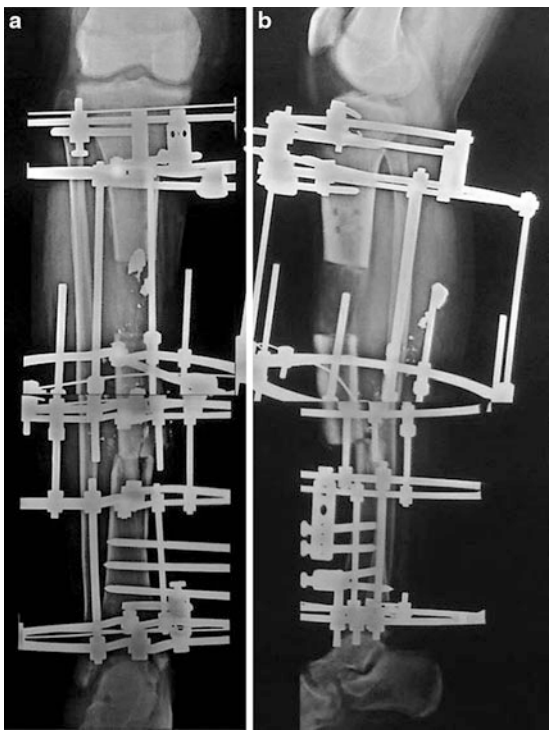

Fig. 3 (**a** and **b**): Radiographs after completion of bone transport show early regenerate formation in the distraction gap (new bones are arranged longitudinally along lines of distraction). Docking of the transported segment needs revision due to anterior translation of the middle segment relative to the distal segment (seen in the lateral view)

Fig. 4 (**a**, **b**) Radiographs after revision of the docking site: trimming of bone ends, excision of interposed fibrous tissue, fibular osteotomy (junction of middle and lower thirds) to facilitate reposition of the distal segment in line with the proximal segment, and insertion of autogenous iliac crest bone graft (ICBG) around the docking site were performed. Progressive consolidation of the regenerate is also seen. Lengthening through the proximal osteotomy was continued until the limb length was restored. (**c**, **d**) Clinical photos during treatment show weight bearing as tolerated while the fixator on the patient's leg

Fig. 5 Follow up, (**a**) radiograph and (**b**, **c**, **d** & **e**) clinical; photos show consolidation of the regenerate and fracture site with good limb alignment and motion of the knee and ankle

9 Avoiding and Managing Problems

- The infected fracture site is left open (after meticulous debridement) for free drainage and is closed gradually during transport.
- A stable osteotomy, good bone contact, and stable fixator construction are essential to allow good bone formation, healing, and early rehabilitation of the patient.
- A history of deep infection and high-velocity gunshot injury implies a compromised local biological environment; hence, the use of autogenous ICBG would improve the healing potential of such fractures.

10 Cross-References

- ▶ Case 11: Bone Transport Over a Nail for Infected Tibial Nonunion and Bone Defect
- ▶ Case 12: Open IIIB Tibia Fracture, Severely Contaminated, Treated with Ilizarov
- ▶ Case 35: Periarticular Distal Tibial Infected Nonunion, Ankle Salvage with Bone Transport

References and Suggested Reading

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