

Management of a High Velocity Gunshot Wound Pilon Fracture: A Case Report

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Statement of Purpose

Gunshot wounds (GSW) to the lower extremities exhibit significant variety in soft tissue damage and fracture pattern characteristics. The majority of current literature focuses on low velocity injuries due to its relative frequency compared to civilian high velocity gunshot wounds. Literature defining management of these cases is incomplete, this case report reviews the management of initial injury and eventual complications following a high velocity gunshot wound to the ankle.

Literature Review

Civilian GSW have been decreasing steadily since 1990; however, there still exists approximately 500,000 gunshot injuries within the United States annually¹. Gunshot fractures have been historically categorized and treated as type 3 Gustilo-Anderson open fractures, although there is significant variance in treatment protocols today². Several authors have called into question the need for prophylactic antibiotics and deep debridements for low velocity gunshots^{1,3}. There exists significant variability in soft tissue injury, fracture pattern, and degree of contamination due to bullet mechanics and the structures encountered during passage. Literature review yields an approximate infection rate of 2-5% for low velocity GSW versus 30% for high velocity GSWs⁴. High velocity gunshots, classified as projectiles greater than 600 meters/second, are often associated with more significant soft tissue injury and vascular damage necessitating standardized treatment protocols³.

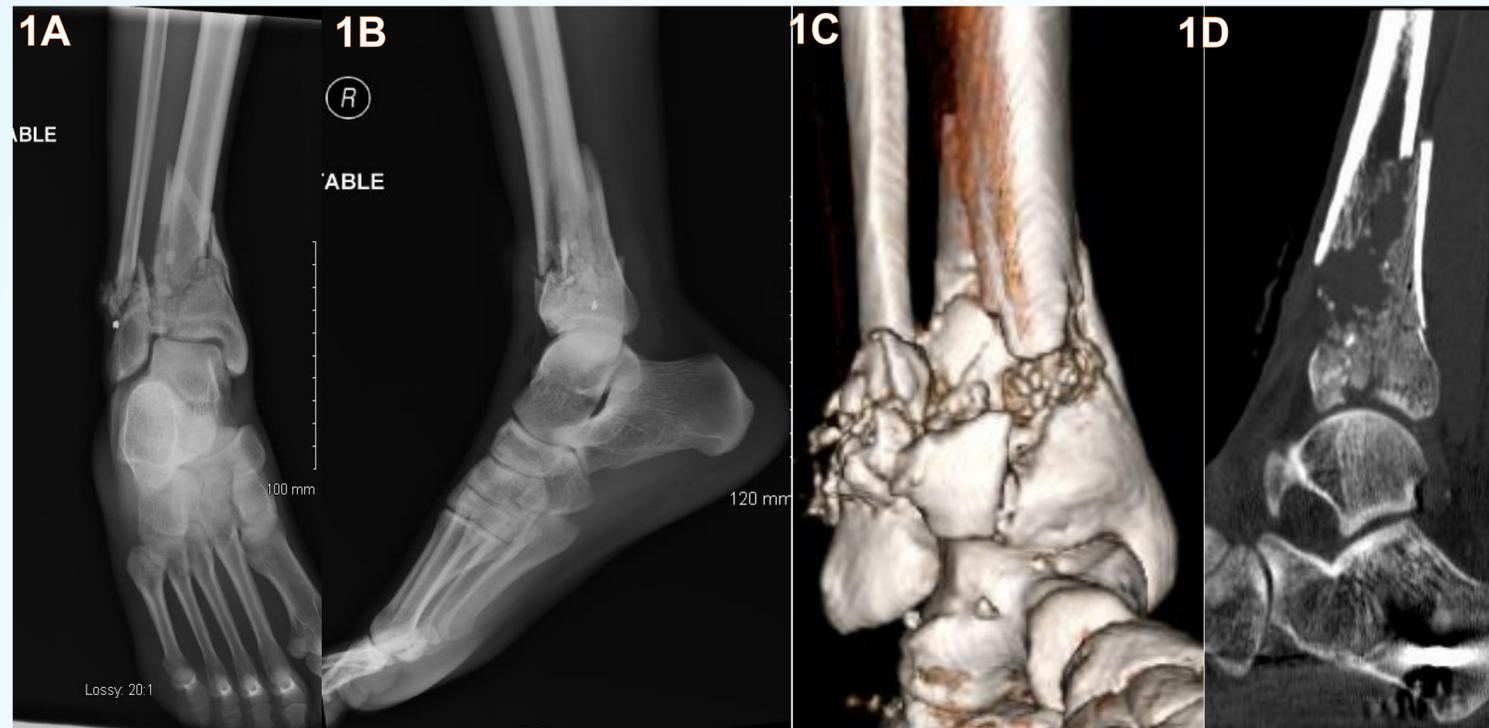


Figure 1: AB) Initial post GSW radiographs, CD) Initial post GSW CT scans

Case Report

29 year old male transferred to our facilities ER after sustaining a GSW to his right ankle. X-rays revealed a comminuted Pilon and fibula fracture with retained bullet. Physical exam revealed entrance/exit wounds to lateral and anterior right ankle. ROM was intact to right foot/ankle. Past medical history unremarkable, social history positive for alcohol and smoking. 2g of Ancef, weight based gentamicin and tetanus administered in the ER. He was taken to the operating room same day for washout/application of external fixator/removal of foreign body. After finishing course of antibiotics per open fracture protocol he was discharged home and came back 9 days later for ORIF of pilon fracture and bilayer membrane application over GSW. Approximately 20cc of autogenous bone graft was utilized along with a minimally invasive plating system. 10 days after ORIF he returned to ER where silicone layer was removed from graft. No signs of infection were noted and graft was incorporating. He was again seen in the ER 8 days later after not following up for wound inspection in the office. It was noted that the anterior aspect of graft was not incorporating. It was decided that a free flap would be in his best interest. Multiple washouts were performed until all cultures showed no growth. He then had a free flap performed by plastics department.

Results

Patient showed complete radiographic and clinical signs of fracture union 6 months after definitive fixation. Free flap incorporated without incident. Patient returned to work without any limitations to his activity.

Discussion

Today, gunshot injuries are amenable to modern reconstructive techniques that can preserve limb function but only after adequate primary and emergency care. Prompt administration of antibiotics per open fracture protocol, deep irrigation/debridement, and temporary stabilization of unstable fractures prior to definitive fixation are needed to improve outcomes. Although unlikely, removal of retained bullets that extend into the joint should be performed to reduce systemic lead uptake⁵. Attention was taken during the perioperative period to monitor for signs of compartment syndrome which have been shown occur even in the presence of an exit wound in high velocity GSWs⁵. It is important to note that gunshots result in “developing wounds” and the degree of soft tissue damage usually cannot be fully determined until after the initial evaluation and treatment.

References

1. Nguyen et al. "Infection Rates and Treatment of Low-Velocity Extremity Gunshot Injuries." *Journal of Orthopaedic Trauma* 2017, 31 (6): 326-329
2. Paul et al. "Gustilo Anderson Classification updates." *Clin Orthop Relat Res*. 2012 Nov; 470(11): 3270-3274.
3. Bluman EM et al. "War wounds of the foot and ankle: causes, characteristics, and initial management." *Foot Ankle Clin* 2010; 15: 1-21
4. Thakore et al. "Gunshot-induced fractures of the extremities: a review of antibiotic and debridement practices." *Curr Rev Musculoskelet Med*. 2015 Sep; 8(3): 276-289.
5. Leffers et al. "Tibial fractures associated with civilian gunshot injuries." *J Trauma*. 1985;25(11):1059-84.
6. Jorgenson et al. "Advances in the treatment of lower extremity wounds applied to military casualties." *Ann Plast Surg*. 1995;34(3):298-301

Figure 2: A) Anterior ankle wound following failed bilayer graft. B) Healed free flap.

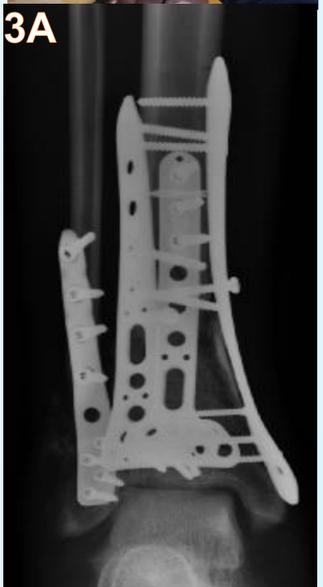


Figure 3: AB) Post definitive fixation and bone grafting