

# Bullet Hole Sinus Tarsi: Functional and Radiographic Outcomes Following A Self-inflicted Gunshot Wound to the Talus with Vascular Injury

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## Statement of Purpose

Gunshot wounds (GSW) to the foot and ankle make up a low percentage of the lower extremity trauma seen by foot and ankle surgeons. This present study examines the functional and radiographic outcomes of a patient who sustained a self-inflicted GSW to the foot and ankle resulting in comminuted fractures of the distal tibia, posterior talus, and severance of the posterior tibial artery.

## Literature Review

The literature shows that GSWs to the foot and ankle make up approximately 5% percent of all GSWs. An even lower percentage of these GSWs affect the hindfoot and the talus specifically<sup>3</sup>. These injuries pose a challenge to foot and ankle surgeons due to the damage that GSWs cause to the soft tissue, bone, nerves and vascular supply.

Violation of the vascular supply can lead to non union and avascular necrosis(AVN). Durkin and Coughlin showed in their study of 120 lower extremity GSW's over a 10-year period that there documented nonunion rate after was 3.3%<sup>2</sup>. There is minimal literature looking at the rate of nonunion or AVN specifically in the foot and ankle after GSW's. The talar blood supply has been documented to be fragile with injuries commonly leading to AVN. The blood supply of the talus is made up from the 3 major arteries of the lower extremity; the posterior tibial, anterior tibial and deep peroneal arteries. The branches of the posterior tibial artery that supply blood to the talus are the artery to the tarsal canal and deltoid branches which provide the dominant blood supply to the talar body. Injuries to the posterior tibial artery or its branches can then lead to avascular necrosis. These arterial injuries also have a tendency to end in poorer outcomes and secondary surgeries due to the high rate of malunion and nonunion post operatively<sup>1-2</sup>.

## Case Study

A 43-year-old male presented to our facilities emergency room with a chief complaint of an accidental self-inflicted gunshot wound to the posterior medial aspect of the left lower leg. No pertinent medical history was noted upon interviewing the patient.

On examination a entrance wound was noted to the posterior medial aspect of the leg with no active bleeding. Exposed subcutaneous tissue was noted with tunneling down towards the posterior ankle with no exit wound. Neurovascular status was intact to the left leg and foot with exception of the posterior tibial pulse being weakly palpable at +1/4. Range of motion and muscle strength testing was deferred due to pain and guarding.

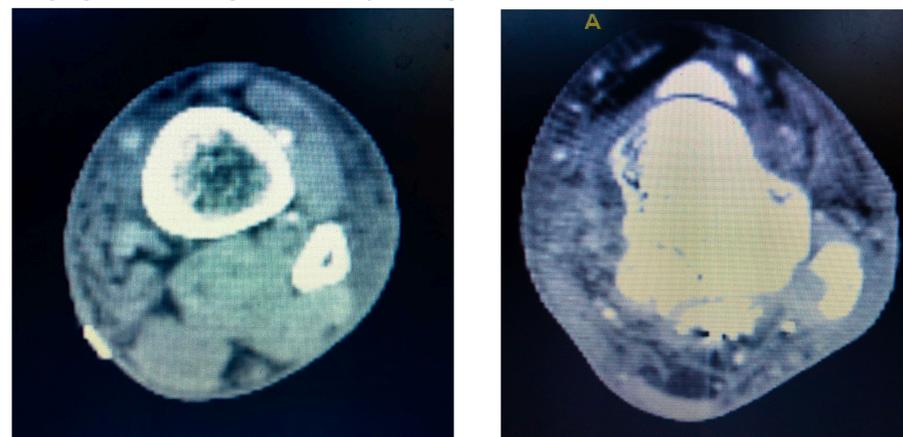
## Case Study Cont'd



Radiographic plain films and CT imaging were obtained preop showing: Multiple punctate fragments seen in the posterior soft tissues of the ankle with the bullet fragment located in the talocalcaneal joint with fractures comminuted fractures of the talus and tibia. The patient was taken to the OR for: Removal of foreign body with debridement of gunshot wound and talus, ORIF of fractures to the posterior malleolus, talar neck and dome with placement of antibiotic impregnated beads and application of multiplanar external fixator.



Intraoperatively it was found that the bullet had fully transected the posterior tibial artery. Even though the posterior tibial artery was fully transected the foot remained perfused. This was also confirmed with a post-operative CT angiogram showing flow distally through the collaterals.



## Follow-up & Outcomes

The patient underwent removal of the external fixator 2.5 weeks post op. The patient was then kept non-weightbearing for the remainder of the 6-week period and gradually progressed from weightbearing in a cam walker boot to a web ankle braced with supportive tennis shoes. The patient progressed well with ambulation and range of motion post operatively. At the 1-year mark the patient was ambulating without incidence in tennis shoes, with adequate range of motion and no pain. Plain film Radiographs were taken at the 1-year mark and are shown below.



## Analysis & Discussion

Gunshot injuries to the foot and ankle can be particularly damaging when there is articular involvement and/or neurovascular insult. Sequelae include deep infection, avascular necrosis, post-traumatic arthritis, and chronic pain. Despite the injury of the posterior tibial artery, the patient's limb was perfused and with our treatment approach, the patient was able to avoid talar avascular necrosis at 1-year post-injury.

There is minimal literature analyzing the outcomes after treatment of GSW's to the foot and ankle. We believe that with further studies, treatment protocols can be developed like the one we implemented which can further benefit patient outcomes.

## References

1. Abghari, Michelle, et al. "Outcomes following low-energy civilian gunshot wound trauma to the lower extremities: Results of a standard protocol at an urban trauma center." *The Iowa orthopaedic journal* 35 (2015): 65.
2. Durkin, Robert C., and R. Richard Coughlin. "Management of gunshot wounds of the foot." *Injury* 28 (1997): C6-C11.
3. Husain, Zeeshan S., Stephen Schmid, and Nicholas Lombardo. "Functional outcomes after gunshot wounds to the foot and ankle." *The Journal of Foot and Ankle Surgery* 55.6 (2016): 1234-1240.