



Poster #70: Low Flow Ankle Arthroscopy for Gunshot Wounds with Retained Intra-Articular Ballistics

**Kevin D. Martin, DO, FAAOS, FAANA, Paul M. Alvarez, MD,
Christian Curatolo, MD, James Gallagher, MD**

The Ohio State University Wexner Medical Center

Disclosure Information

- Kevin D. Martin, DO, FAAOS, FAANA is an Arthrex consultant.
- The remaining authors have nothing to disclose.



Objectives

- Describe the technique for low flow arthroscopy for gun shot wounds to the foot and ankle with retained intra-articular ballistics.
- Describe the utility of arthroscopy for GSWs to the foot and ankle, specifically advantages of targeted irrigation and debridement along the ballistic missiles path.
- Describe the adaptability of low flow arthroscopy for GSWs when treating concomitant fractures.
- Describe early results of management of low velocity GSWs to the foot and ankle using low flow arthroscopy.



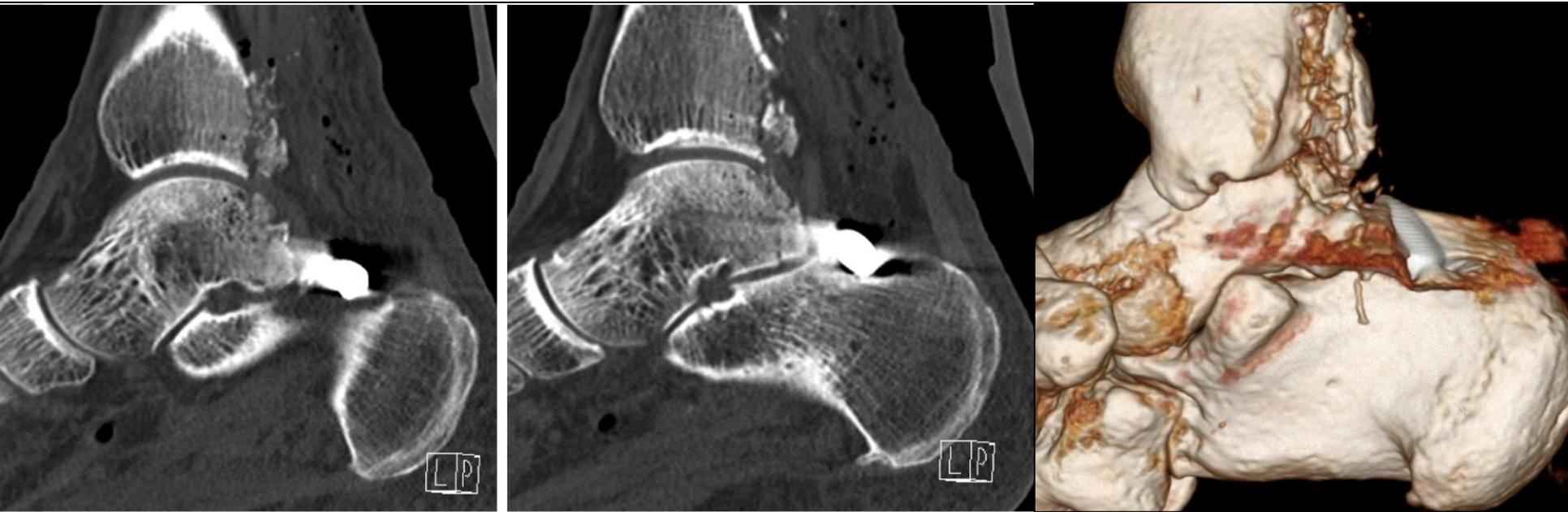
Introduction

- There is limited soft tissue coverage and highly congruent joint spaces which often leads to substantial soft tissue loss and development of an underlying fracture after GSW to the foot or ankle.
- Remnants of the footwear and clothing are often pulled into the path of the projectile leading to higher infection rates.
- Intra-articular foreign bodies should be retrieved due to the the risk of repeated mechanical trauma against the cartilage or risk of lead toxicity over time secondary to lead being soluble in synovial fluid.



Pre-operative Planning

- Plain radiographs should be obtained after GSW to the lower extremity to evaluate for the presence of fracture and retained ballistic fragment.
- Advanced imaging in the form of Computed Tomography (CT) is then obtained to confirm the location and path of the ballistic fragments within the joint space and for further characterization of underlying fracture if present.



Operative Setup

- Procedure can be performed in the supine or prone position depending on the location of the retained fragments within the ankle joint.
- A tourniquet is applied to the proximal thigh.
- Gel foam is positioned to protect pressure areas.
- Feet are positioned off the end of the bed in neutral position with room to plantar and dorsiflex the ankle freely to accommodate reduction maneuvers.
- Position arthroscopic and fluoroscopic screen on the contralateral side.



Operative Setup

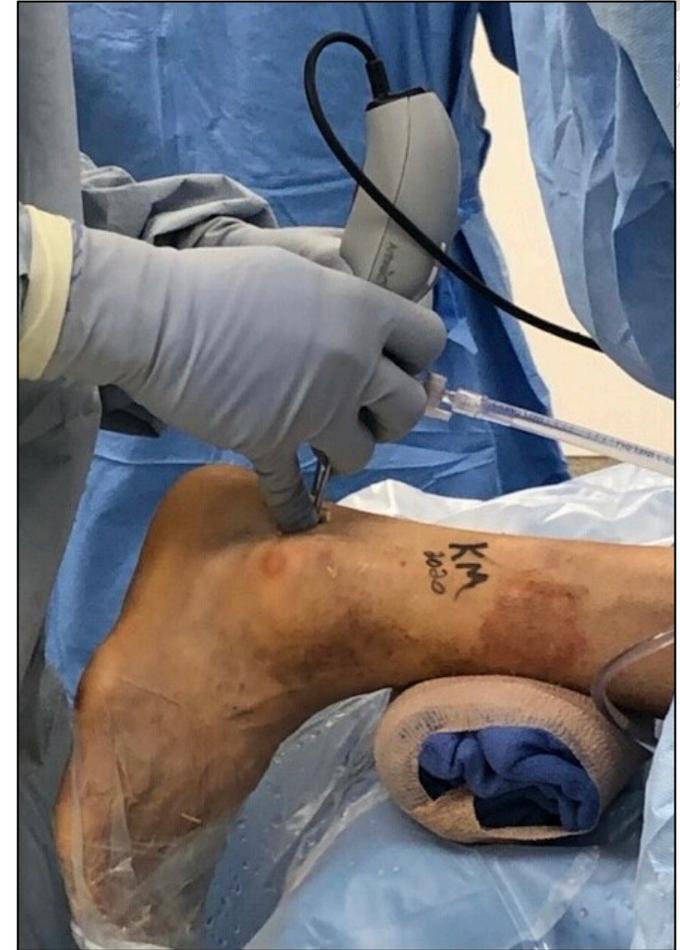
Patient's pertinent structures are marked with a surgical skin marker.

- Borders of the medial and lateral malleolus are marked.
- Edges of the calcaneal tuberosity.
- Medial and lateral edge of the Achilles tendon.

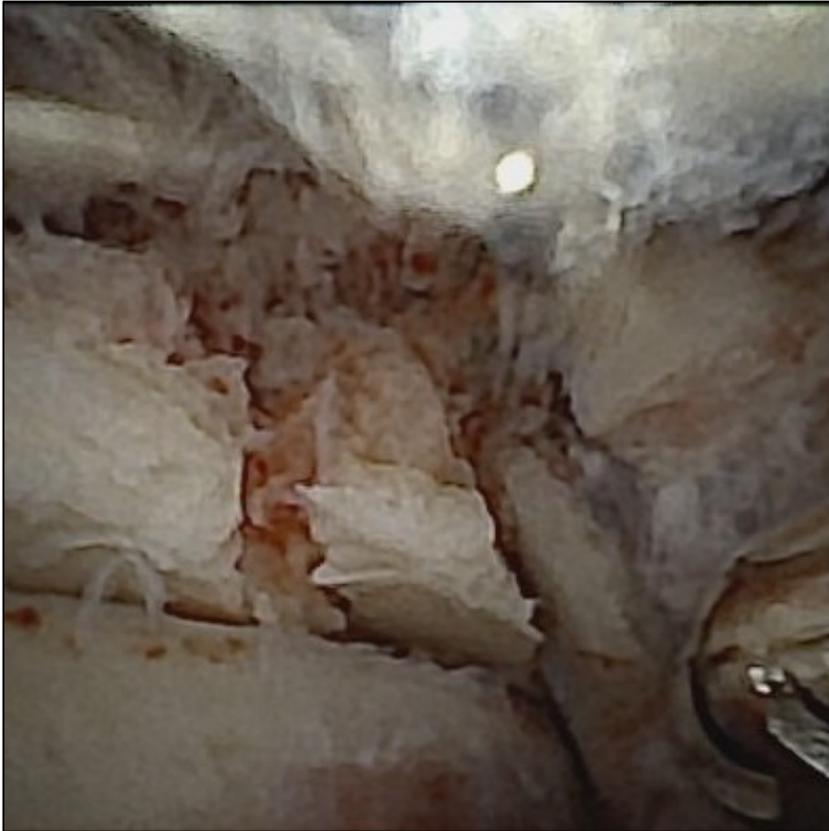


Portal Creation and Scope Entry

- Small incisions are used to allow for passage of the low flow 1.9 mm arthroscope (NanoScope, Arthrex Inc, Naples FL), while a 20-gauge needle is used to verify the position of the working portal.
- The joint may be hemorrhagic with damaged soft tissues, establishing clear visualization is paramount prior to debridement as landmarks will be difficult to appreciate.
- Low flow arthroscopy allows for reduced fluid extravasation into damaged tissue as well as mitigation of any potential compartment pressurization.

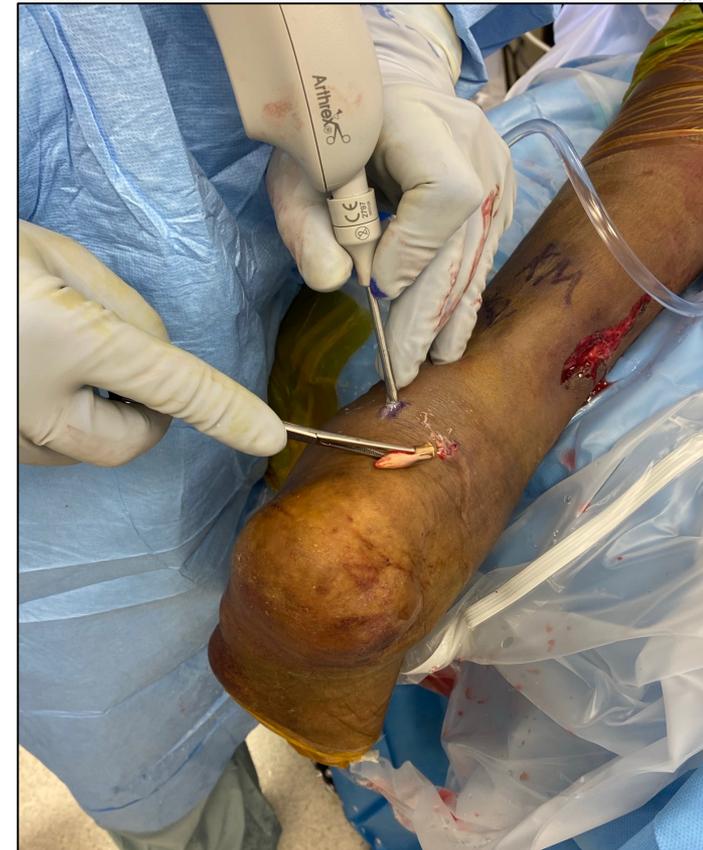


Hemorrhagic Joint Space with Underlying Fracture and Intra-Articular Ballistic Missile



Initial Debridement and Foreign Body Retrieval

- A 3.5 mm shaver is introduced and damaged tissue along with hematoma is evacuated. Graspers are used to retrieve foreign body material such as footwear as it can quickly clog the shaver.
- Prior to retrieving objects, the inflow valve is turned to the off position to prevent hydro-jetting over the dome of the talus to opposing gutters.
- For missile shaped rounds, the round is rotated such that the tip points out of the portal to reduce soft-tissue impingement.
- Following retrieval, aggressive debridement of any loose osteochondral fragments is performed to prevent any loose bodies in the future.



Retrieved Ballistic Missile



Debridement of Ballistic Path and Addressing Concomitant Pathology

- Following retrieval of the ballistic missile, the bullet path or cavitation is directly evaluated using endoscopic visualization.
- A shaver or grasper is then placed in the exit wound or accessory portal and an aggressive debridement of any residual foreign material or devitalized bone is performed to prevent sequestration and infection.
- Fractures secondary to low velocity GSWs are amenable to fixation at the time of the index procedure.
- Any residual bone loss is addressed acutely using primary grafting via arthroscopically injectable puddy versus larger talar auto-grafting from the iliac crest if further structural support is needed.



Final Images and Closing

- Final fluoroscopic images are taken utilizing the miniature C-arm to confirm successful removal of all retained intra-articular missiles.
- Patient's weight bearing status is dependent on degree of soft tissue pathology and presence of any underlying fracture and method of fixation.



Early Results

- Total patients: 3
- The mean age of our cohort was 37.3 years (range 24-58), including all males, with 66.7% reporting a history of tobacco use.
- The average follow-up for the patients within our cohort was 260 days.
- 2 patients sustained an underlying fracture requiring open reduction internal fixation (ORIF) at the time of the index procedure which was completed using an all-arthroscopic technique.
- All patient's reported improvement in function post-operatively with ability to return to work full time. No patients experienced evidence of infection requiring treatment with oral antibiotics nor return to the operating room for any reason.



Conclusions and Significance of Findings

- Technique describing the use of low flow arthroscopy/endoscopy for management of GSWs with retained intra-articular ballistics within the foot and ankle.
- Our low flow arthroscopic technique allows for direct visualized debridement of the tract of the bullet which can decrease the risk of infection and retained intra-articular foreign bodies.
- Our short-term results indicate that low-flow arthroscopy for treatment of lower extremity gunshot wounds to the foot and ankle is a safe and effective treatment method for completion of foreign body removal, irrigation and debridement, as well as treatment of underlying fracture if present.

