Management of Infected Intramedullary Nails in Foot and Ankle Surgery

Jason St. John, DPM, MS
Conflict of Interest

- No conflicts of interest
Objectives

- Overview of uses/applications of intramedullary nails in limb salvage
- Complications associated with use of intramedullary nails in foot and ankle surgery
- Review techniques for managing infected intramedullary nails
- Discuss non-foot and ankle outcomes/trauma outcomes of antibiotic intramedullary nails for infection management
- Review foot and ankle specific literature regarding use of antibiotic intramedullary nails for infection management
Tibiotalocalcaneal Arthrodesis

- Multiple constructs to treat complex lower extremity deformities

- Retrograde intramedullary nails (IMN) with tibiotalar and subtalar arthrodesis has been described for management of many of these problems

- TTC with intramedullary fixation not a new concept:
  - Lexer 1906
    - Boiled cadaver bone as intramedullary device for TTCA
  - Adams, JBJS, 1948
    - Described using intramedullary nails for TTCA
    - Primarily evaluating transfibular ankle arthrodesis
Tibiotalocalcaneal Arthrodesis

- Variety of nails used historically
  - Foot and ankle specific nails now available
  - Others utilized with good success

- Tibiototalocalcaneal arthrodesis (TTCA) results in significant limitations of foot/ankle motion
  - Often limited to salvage procedures
  - Goal to achieve stable construct/union with plantargrade foot
TTC Complications

• Reasonably successful limb salvage has been reported with use of IMN for TTC, but not without significant complication rates
  – Persistent pain, tibial fracture, nonunion, malunion, hardware failure, osteomyelitis, limb loss

• Jehan, Acta Orthopaedica Belgica, 2011
  – Systematic review of 613 patients, 641 procedures
  – Union rate of 86.7% at average of 4.5 months
  – 55.7% complication rate, 22% re-operation rate, 1.5% amputation rate

• Mendicino, JFAS, 2004
  – 19 pts, 20 feet with 95% fusion rate at 4.1 months
  – 70% complication rate

• Rammelt, FAI, 2013
  – Overall union rate of 84% in 38 patients
  – 23.7% complication rate
TTC Complications

- **Pinzur, FAI, 2005**
  - 9 consecutive Charcot patients
  - All fused at an average of 10.5 weeks

- **Dalla Paola, FAI, 2007**
  - 18 patients, no history of wounds
  - 77% fusion rate, 22% complication rate

- **Wukich, JFAS, 2015**
  - 61 pts with DM, 56 pts without DM
  - 96.8% limb salvage, 79% fusion rate
  - Overall complication rate 45.2%; no difference between DM and no DM
    - Higher rate of superficial infection in diabetics
Acceptable limb salvage rates given pathology
  - Otherwise often major amputation

Must be able to manage complications, particularly infection...

Removal of IM fixation, I&D, and placement of antibiotic cement beads an option, no mechanical support
  - High concentrations of local antibiotic
  - Not stabilizing bone and soft tissue

Use of antibiotic cement nails or antibiotic cement coated nails in tibia and femur fractures with good success
  - Better stabilization than antibiotic beads
  - High local antibiotic concentrations
Infected IMN

• Salvage with antibiotic coated wire and antibiotic coated IMN have been reported for both femur and tibia infections after nailing

• Qiang, Arch Orthoepadic Trauma Surg, 2007
  – 19 patients (14 tibia, 5 femur): removal of the nails, excision of sinus tracts, canal debridement, antibiotic cement rod insertion
  – 1 patient with recurrent infection, 11 with union, 6 partial union, 1 major amputation

• Reilly, Injury, 2016
  – 41 pts with infected tibial IMN 2/2 fracture treatment
  – 76% union rate after treatment with antibiotic nails at 6 months
  – Remaining 10 with continued infection, 3 patients with above knee amputation
Infected IMN

• Paley, JOT, 2002
  – 9 patients, 6 femur, 2 tibia, 1 humerus
  – Antibiotic cement rod
  – No recurrent infections

• Sancineto, 2008, Trauma
  – 18 patients, 19 bones with antibiotic cement rod
  – 4 femur, 15 tibia
  – None of the 17 available for follow up had recurrent infection at 12-54 months follow up

• Thonse, JOT, 2007
  – 20 patients with antibiotic cement coated nail
    • Rather then temporary rod
  – 17 with union (85%), 3 stable nonunion, 1 AKA
  – 3 patients with repeat antibiotic cement coated nail

• Limited reports regarding its use in the foot and ankle for management of infection
Surgical Approach

- All initially underwent TTCA for limb salvage/reconstruction

- Infection post operatively

- All hardware removed, specimens sent for pathology and microbiology
  - Curettage from canal or from nail

- Non-viable tissue removed, any wounds debrided; canal reamed

- Irrigation: femoral irrigator with 3-6L saline
Surgical Approach

- Antibiotic coated ball tip guidewire or block spacer
  - Polymethylmethacrylate with vancomycin and gentamycin
Surgical Approach

- Ball tip wire or flexible titanium nail placed retrograde, end bent to prevent ulceration/migration

- Antibiotic spacer placed at tibiotalar joint level
  - If spacer utilized, multiplanar ring external fixator applied in addition for stabilization

- PICC line and culture guided antibiotics for 6 weeks
Foot and Ankle Infected IMN

• Few studies previously with management of infected TTCA with intramedullary nail

• Bibbo, FAI, 2003
  – 5 patients, infected TTCA with intramedullary nail
  – Treatment as limb salvage in place of BKA/AKA with antibiotic cement rod
  – 2 with stable pseudarthrosis, 1 with re-implantation of metal IMN, 1 in process of re-implantation, 1 scheduled for re-implantation
  – No limb loss at time of publication

• Pawar, FAI, 2013
  – 5 patients, all Charcot with infected ankles, avg f/u 18 months (12-24m)
  – Treated with antibiotic coated IMN, 3 after failing ex-fix, 2 primarily
  – Average time to radiographic fusion 4.1 months
  – No recurrent infections at follow up
Foot and Ankle Infected IMN

- Woods, Diabetic Foot and Ankle, 2012
  - Technique for inserting antibiotic coated IMN

- Wukich, JFAS, 2015
  - 17% deep infection rate
  - Review of 979 patients with infection rate of 13% overall, 22% in the 342 patients with Charcot
Conclusion

• Literature with good results from use of retrograde nail for TTCA, but not without high reported complication rates

• Limited literature on management and/or outcomes of patients with infection following TTCA with retrograde intramedullary nailing
  – Borrow from trauma literature

• Foot and ankle specific literature with reported success for management