### Challenges of Managing Heel Ulceration

- Morbidity and mortality associated with heel ulcers
- Increased risk - up to 5 fold in PAD population
- Diabetics - Increased risk due to neuropathy and microvascular disease
- Management
  - difficulties with off-loading, nutrition, limitations of bony coverage at this location
  - Economic burden

### Heel Anatomy

- Bony prominence (calcaneus)
  - Well adapted to withstand pressure - tightly packed adipose compartments which provide shock absorption during gait initiation with limited blood supply in the normal state
- Blood supply
  - lateral aspect of supplied by perforating branches peroneal artery
  - heel pad supplied via medial calcaneal branch of posterior tibial artery

### Heel Gangrene

- Intolerant of ischemia
  - lack of subcutaneous tissue
  - presence of an end-arterial plexus
  - pressure, friction and shear forces
- Neuropathic patients especially at risk
- Dorsal aspect of the posterior heel
  - lacks abundant fat compartments
  - poorly vascularized thin subcutaneous fat layer
  - skin tightly bound to underlying deep fascia

### Algorithm for Management of an Ischemic Heel Ulcer

- Assess depth of the ulceration
  - probe bone, x-ray and MRI/ CT Scan
- Determine the presence of infection
  - Drain and debride
- Broad spectrum antibiotics until culture specific abx determined
- Assess the degree of vascular disease (ABI, TBI, PVR, TcPO2)
- Immediate pressure relief
Algorithm for Management of an Ischemic Heel Ulcer

- Angiography
- Revascularization (endovascular vs. open)
  - co-morbid factors
  - availability of conduit
  - goal is in line flow to the foot
- Direct revascularization preferred over indirect (angiosome concept)

Calcanectomy

- Angiosome boundaries can guide incisions and tissue exposure
- Surgical incision can include excision of the ulcer, linear posterior or posteromedial approach
- Other incisions - extensile hockey-stick, postero-lateral
- Hurricane incision
  - serpentine plantar-based incision
  - when process is mostly plantar

Adjuncts for Management of an Ischemic Heel Ulcer

- Vacuum assisted closure
- Hyperbaric oxygen therapy
- Nutrition - protein calorie malnutrition
- Total off loading (critical)

Advanced Wound Care

- Bone/tendon coverage with bilayer wound matrix
- Skin grafting vs bi-layered living cell therapy

- Dressings/Antimicrobials, Alginites
- Biologics: Growth Factors, Becapararin, Autologous Platelet Gels, Gene / Stem Cell
- Ultrasound Mist Shock Therapy
- Electrostimulation
- Magnets

Case: 81 y o with osteomyelitis heel ulceration and exposed tendon, severe PAD, DM

left ABI 0.58
Toe pressure 10 mmHg
TBI 0.09
**Post-intervention indirect revascularization**

Cross total occlusion AT artery and BA of DP and AT artery
Stenting origin of the AT artery drug-eluting stent

TBI improved to 0.61

**CASE**

- 69 y/o male with ESRD, DM, Neuropathy and PAD
- Optimized medically – failed to heal
- Revascularization
- Became infected
- To OR for debridement / partial calcaneectomy, partial closure

July

October

Infected

December – healing

- Infected

- Developed abscess posteriorly requiring debridement of Achilles tendon and further bone resection

- 4 mos later

- tendon

- Granulation over resected tendon

- healed

**Conclusions**

- Management of an ischemic heel ulcer can be challenging
  - Combination of marginal blood supply, thin skin and lack of muscle or adipose tissue over bony prominences
  - Difficulty with off loading
  - Malnutrition
  - Neuropathy
  - Arterial insufficiency
- Partial or total calcaneectomy is option with or without Achilles tendon resection in presence of osteomyelitis
Conclusions

• Early consideration for revascularization
• Consideration of distal target preferentially in respective angiosome supplied by the peroneal or posterior tibial arteries
• Healing and walking ability can be maintained with resection of the Achilles tendon and partial resection of the os calcis