

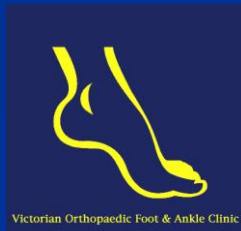


# Diabetic Foot:an Orthopaedic Perspective: Ulceration & Deformity

Chris Birks

# Summary

- Introduction
- Ulceration
- Deformity (Charcot)
  - Cause
  - Assessment
  - Orthopaedic Surgical Treatment
- Amputation



# Introduction: (USA Stats 2005)

17 million (6.2%) with Diabetes

5.9 million Undiagnosed

20 % of population over 65 have Diabetes

20% Diabetic admissions with foot ulcers

5-15% Diabetic require LL amputation

25% Adult diabetics with plantar insensitivity

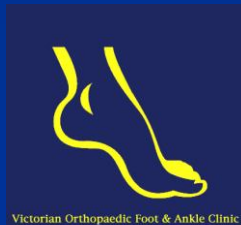
0.5-1% Diabetics may develop charcot

Up to 30% Charcot have vascular insufficiency



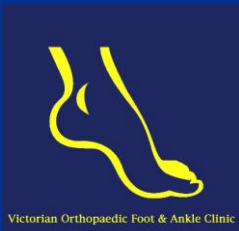
# Epidemiology

- 60% of non traumatic amputations are a consequence of diabetes
- Mortality in these patients is between 50 - 80% at 5 years. (especially ischaemic ulcers)
- 50% patients will have an amputation of the contralateral limb within 5 years.
- Cost US\$ 11 Billion/year.



# Co-morbidities:

- Cardio-respiratory
- Renal
- Vascular
- Neuropathic
- Eyes
- ? Smoking
- Obesity



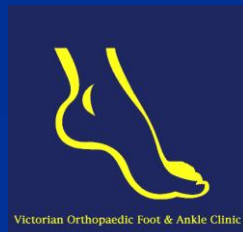
# Etiology: Pressure vs Healing

## Pressure

- Peripheral Neuropathy
  - Sensory
  - Autonomic (scaly/cracked skin)
  - Motor (Claw toes/MTP Dislocation)
- Contractures
- Deformity/Charcot
- Poor foot care

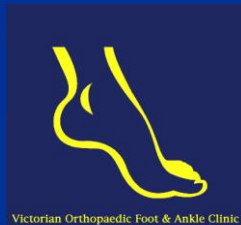
## Healing

- Aging process
- Vascular supply
- Nutritional state
- Poor foot care



# The Team Members

- Endocrinologist/Diabetic Nurse Educator
- Podiatrist/Orthotist/Plaster Technician
- Wound care specialist
- Vascular Lab / Surgeon
- Orthopaedic specialist



A photograph of a person from behind, performing a wheelie on a motorcycle. The person is wearing a dark, long-sleeved shirt and dark pants. The motorcycle is blue and black. The background is a blurred outdoor setting with green foliage and a white structure. The text "Mechanical Failure" is overlaid in the upper center of the image.

# Mechanical Failure

Contractures  
Boney prominences  
Malalignment  
Instability



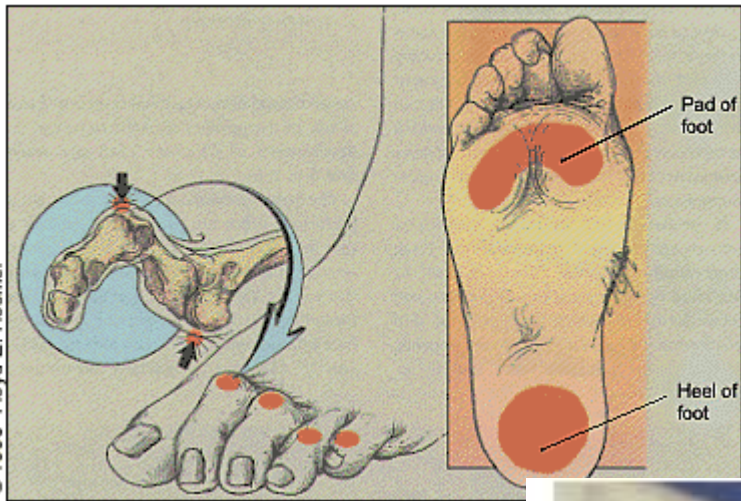
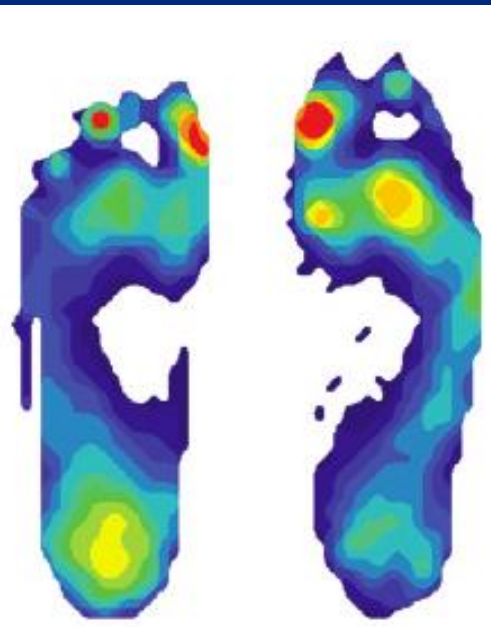


Figure 2

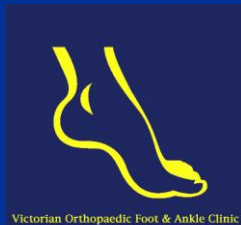


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# Factors in ulcer treatment

- Inpatient vs Outpatient
  - Chronicity
  - Size/depth
  - Infection
  - Compliance/Support
  - Vascular
  - Facilities
  - Co-morbidities
  - Debridement
  - Off loading
  - Footwear
  - Education
  - Diabetes control
  - Nutrition
  - Revascularization
  - Orthopaedic Surgery
  - Amputation

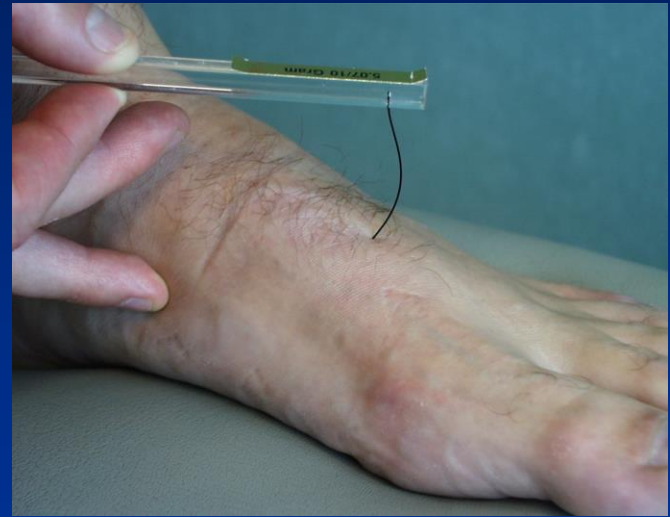


# Take Home Messages

- No skin break, infection very unlikely
- Probe goes to bone over 85% deep OM
- More than grade 1 ulcer, not suitable for TCC
- Deep infection and unstable joints need frame or amputation

# Assessment of the Diabetic Foot Ulcer

- Ulcer Classification
  - u Probe ulcer if you touch bone = osteomyelitis
    - F Grayson, JAMA, 1995
- Foot Biomechanics
  - u Bony deformity, Instability
  - u Joint contracture / stiffness
- Sensory Examination
  - u (5.07 Semmes-Weinstein)
- Vascular Evaluation
  - u Pedal Pulses
  - u Note that Charcot feet are often highly vascular
- Look at both feet



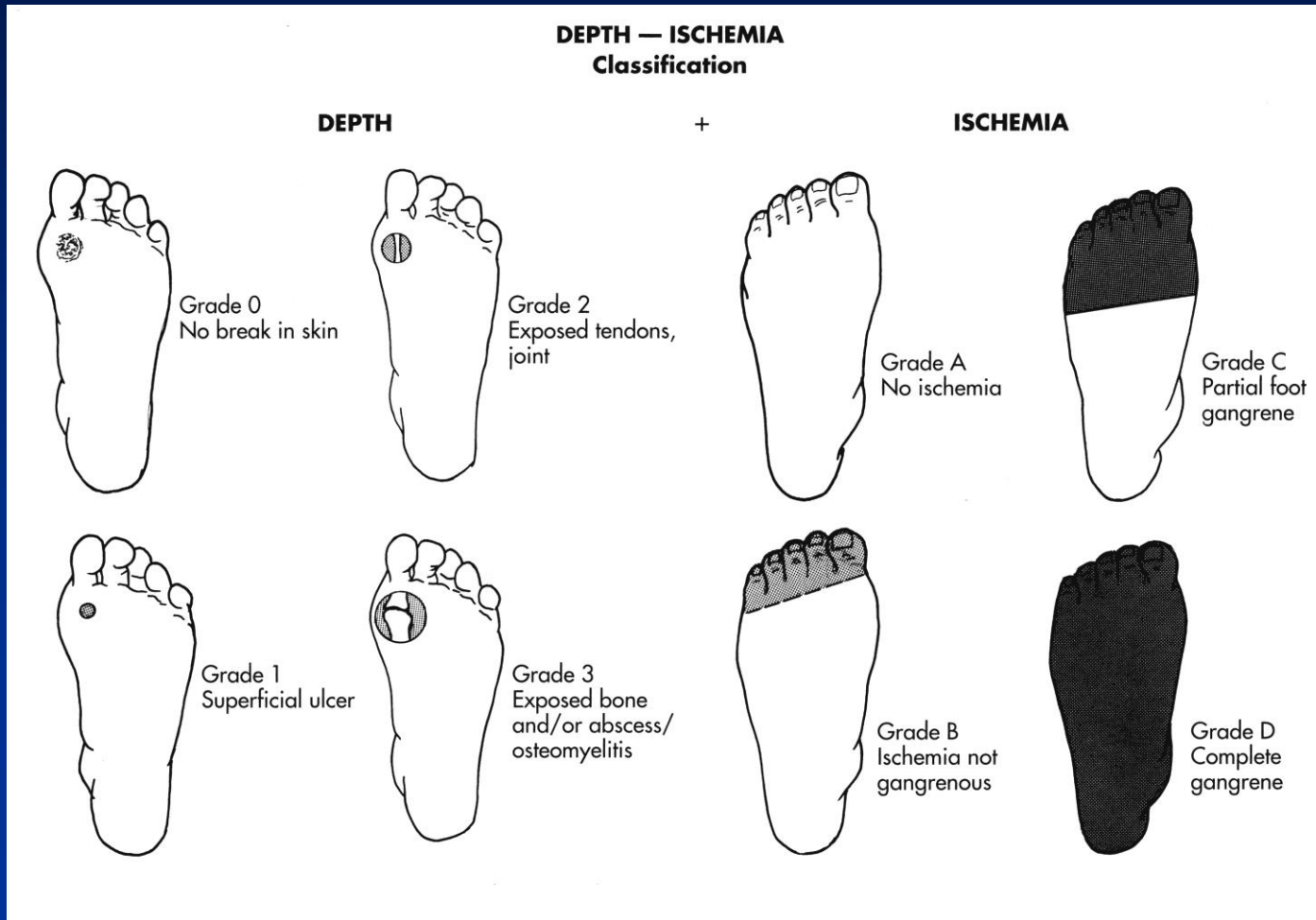
# Investigation of the Diabetic Foot Ulcer

- Weight bearing AP, Lateral, Oblique foot radiographs
- CRP, Se albumin, HBalc
- +/- Vascular studies
- +/- MRI



# Diabetic Ulcer Classification

## Brodsky: Depth-Ischaemia



# Management of a grade 0A Lesion (Foot at risk)





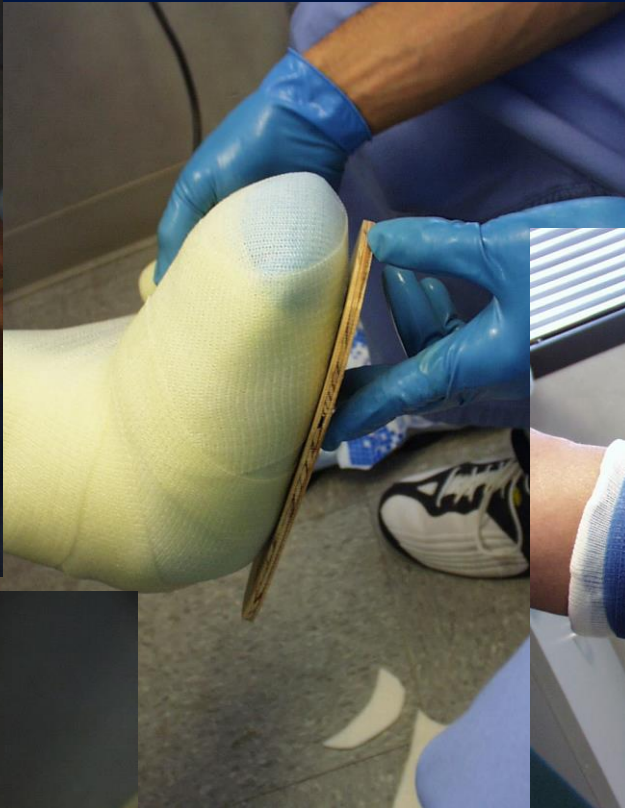
**Foot wear options**



# Management of a grade 1A Ulcer (Superficial ulcer)



# Total Contact Cast



Myerson JBJS 1992, Average ulcer size 3.5 cm  
64/71 ulcers (90%) healed at a mean 5.5 weeks.



## 2A Ulcer

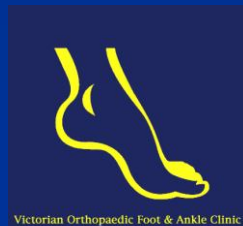


## 3A Ulcer

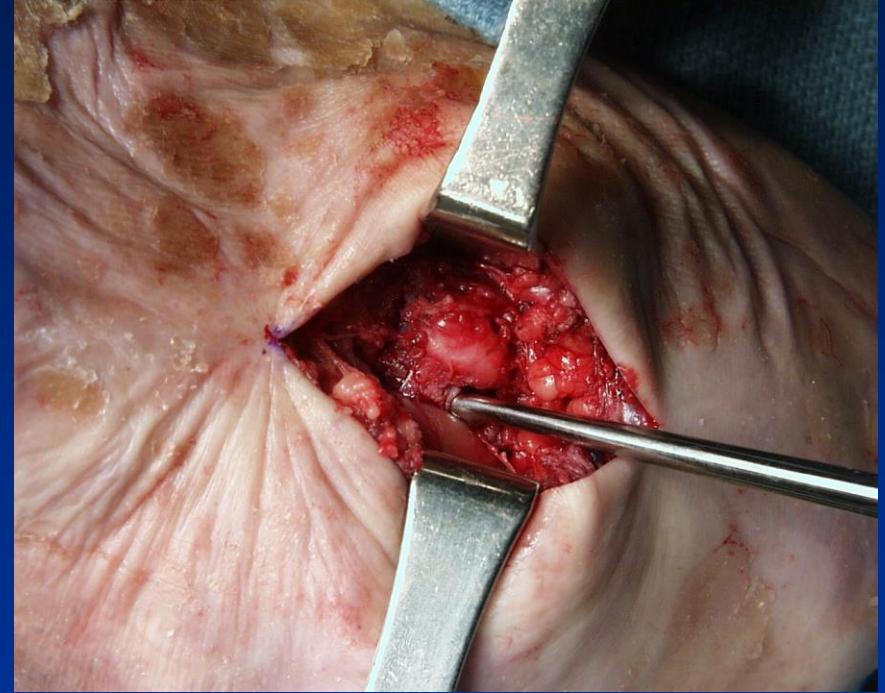


# Surgical Management Ulcers: Options

- Debridement / VAC/ TCC
- Debridement + Osteotomy
- Amputation
- Debridement + Reconstruction  
(acute /delayed)



# Ostectomy





# Ostectomy

# Charcot Foot; Definition

- Chronic & progressive disease of joints and bones... .. painful or painless bone and joint destruction in limbs that have lost sensory innervation
- Joints exhibit synovitis, instability, subluxation & destruction

# Peripheral Neuropathy

- Causes (DINTMINI)
  - Diabetes
  - Alcoholism
  - Congenital insensitivity to pain
  - Renal disease
  - Leprosy
  - Syphilis
- Diabetic feet
  - Up to 5% of all diabetic patients
  - Up to 29% of patients with PN
  - Average duration of DM 15 years
  - Bilateral in 6 - 39%



# Charcot Foot & Ankle; Pathogenesis

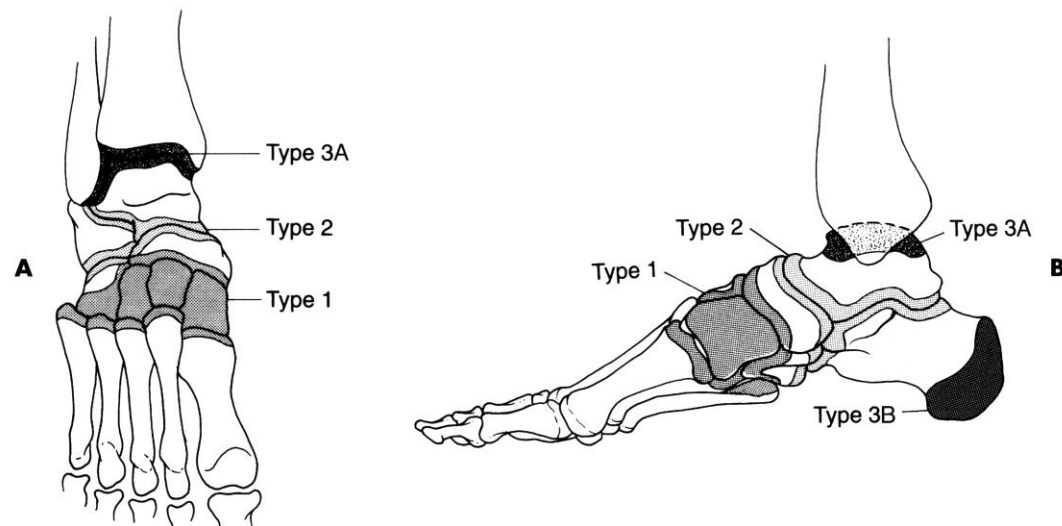
## Peripheral Neuropathy

- Loss of protective sensation
- Motor neuropathy
  - Equinus contracture/ Claw Toes →
- Autonomic neuropathy
  - Decreased sympathetic tone
  - Arterial vasodilatation
  - Hypervascularity
  - Osteopenia
  - Loss of trophic factors

- Renal disease
- Steroids
- Renal Transplantation
- Ligamentous failure
  - Altered collagen cross linking
- Trauma
  - **Cumulative stress**
  - Acute traumatic event

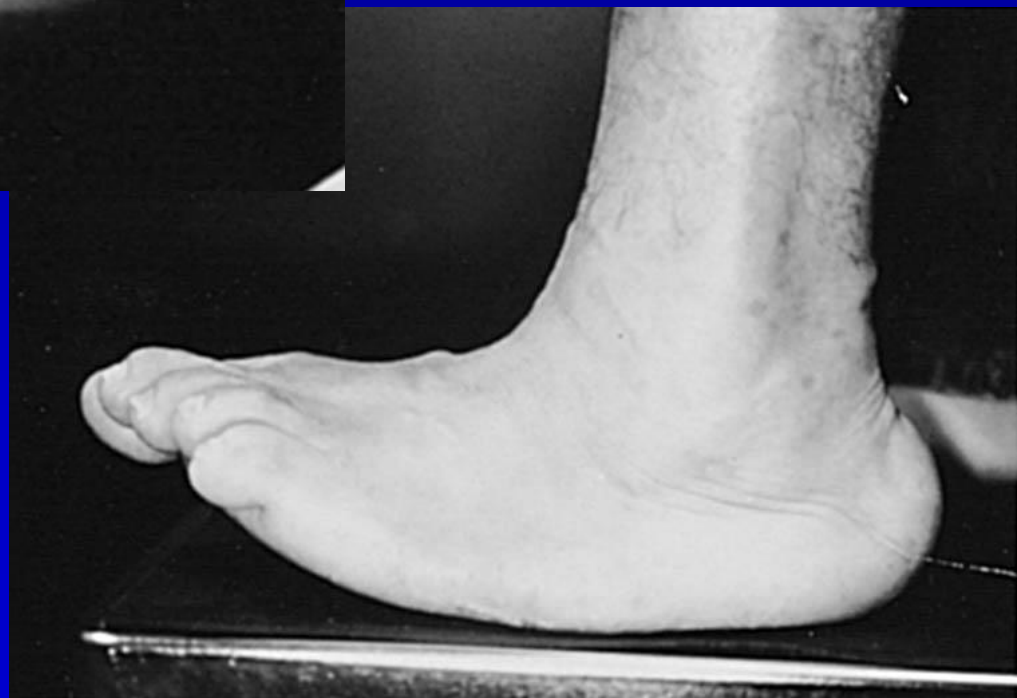
# Charcot Foot & Ankle: Classification

- Eichenholtz; Temporal
  - Stage of Development
  - Stage of Coalescence
  - Stage of Reconstruction.
- Brodsky; Anatomic
  - Type 1 60%
  - Type 2 30%
  - Type 3 10%



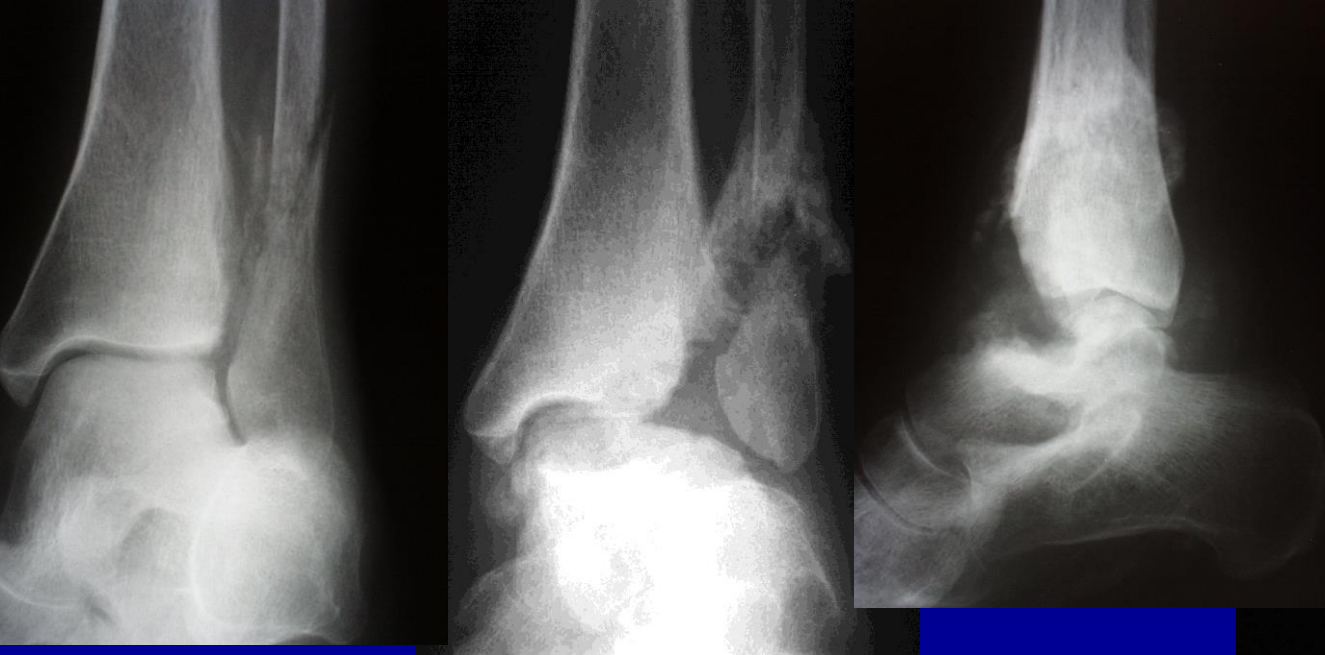


Type 1



# Type 2



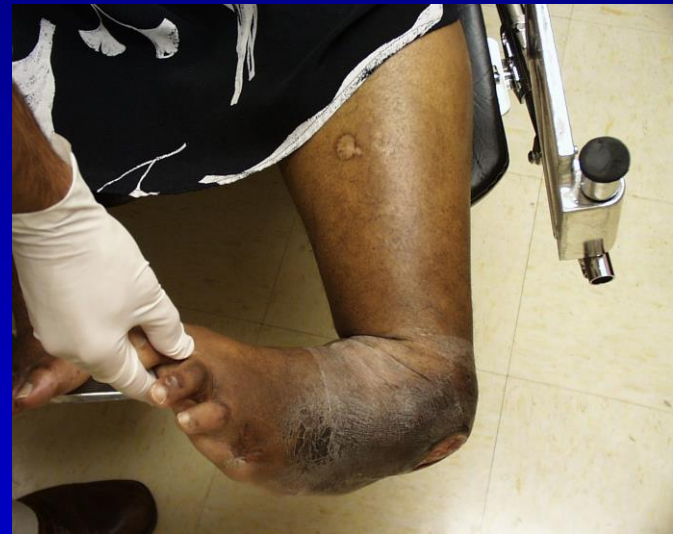


• Type 3A



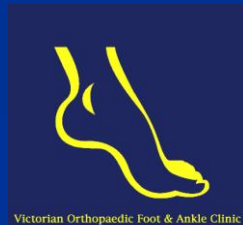
# Type 3A (Ankle) Charcot Arthropathy

- Require immobilisation for 1-2 years
- Malleolar ulceration
- Deep sepsis
- Amputation



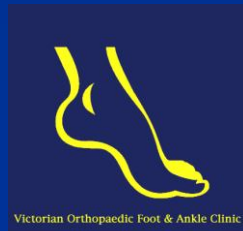
# Charcot Foot; Treatment Goals

- Recognition 'not an episode of cellulitis'
  - No fever/ normal BSL/CRP/ elevation test
- Heal ulcers
- Stable, braceable, plantargrade, (painless) foot that can fit a shoe / brace without a tendency to recurrent ulceration
- Maintain patient as normally ambulatory as possible
- Prevent contralateral problems
- All predicated on Adequate Perfusion



# NON -Operative treatment

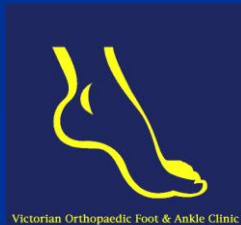
- TCC total contact cast
- CROW Charcot restraint orthotic walker
- BAFO Bivalved Ankle foot orthosis
- CFLO custom full length orthosis
- ? Medical Management





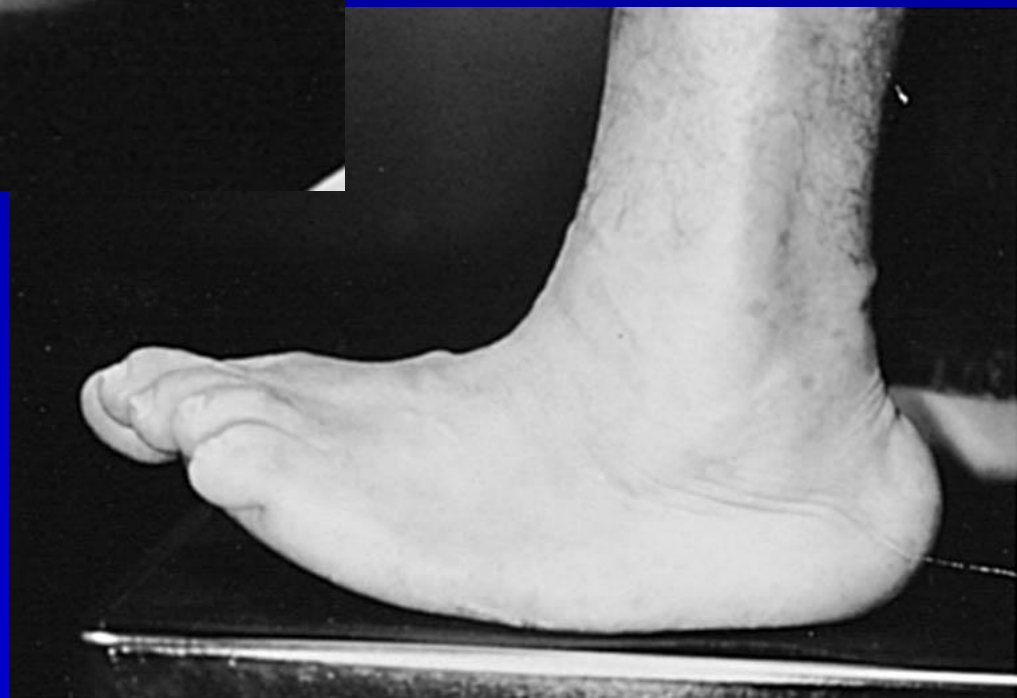
# Operative

- Re-vascularisation
- Ulcer treatment
- Osteotomy
- Reconstruction
  - Fuse short, Instrument long
  - Two forms of fixation
- Amputation



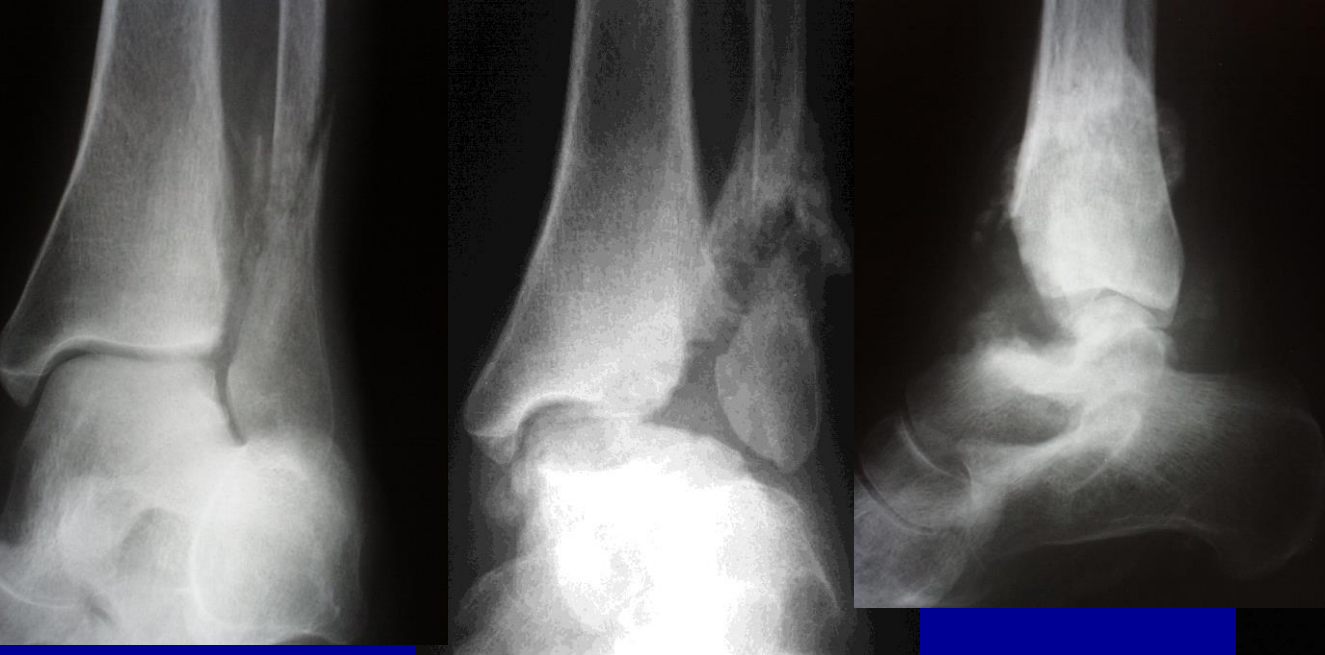


Type 1



# Type 2

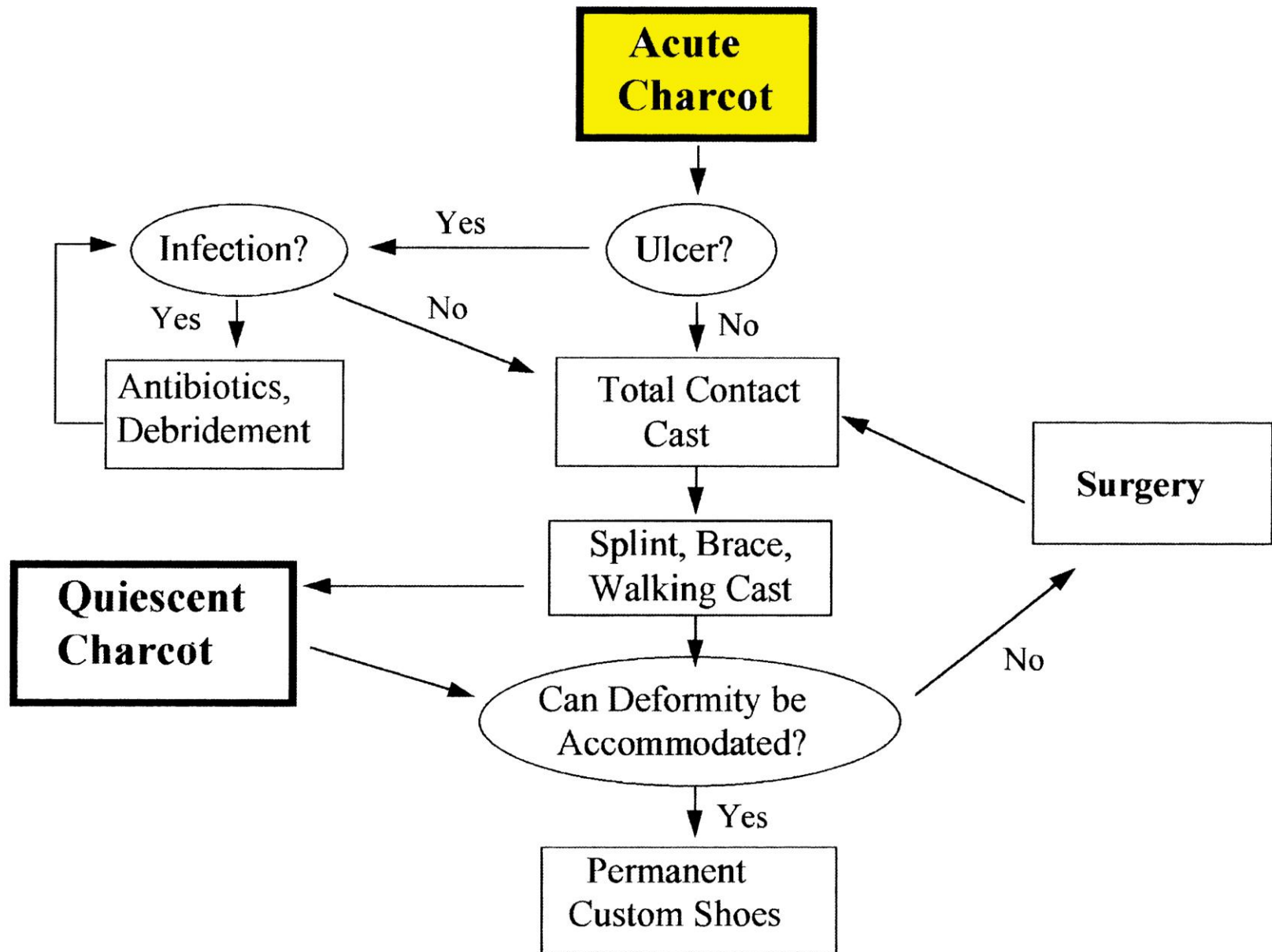




• Type 3A

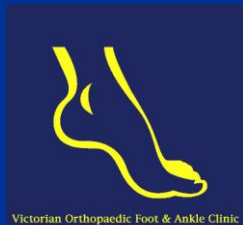


# Summary Treatment Algorithm

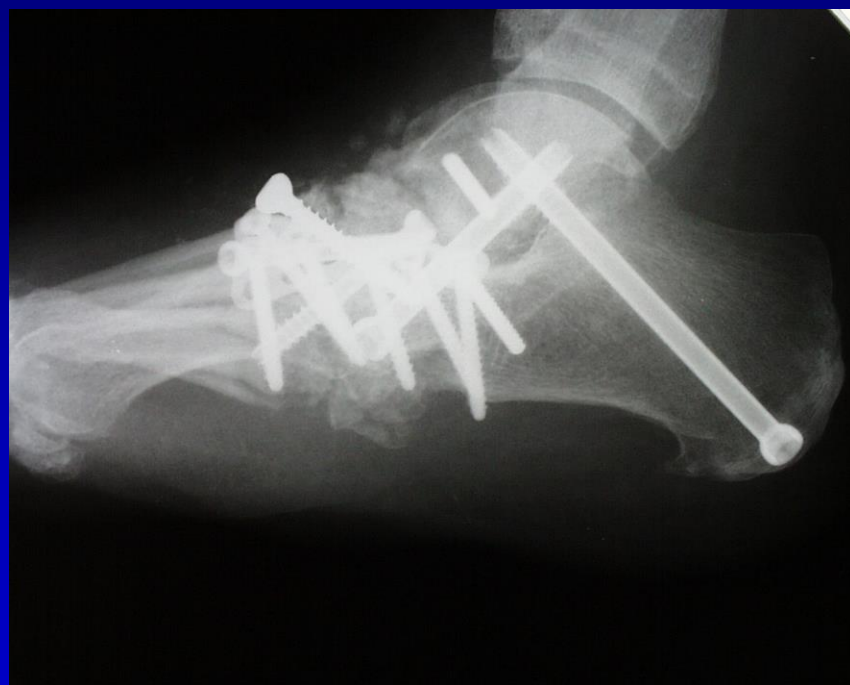


# Issues With Surgery

- Technically challenging
- Multi disciplinary team approach
- Risks of failure of internal fixation
- Wound healing problems
- Deep infections
- Amputation
- Loss of Mobility/Independence



# Arthrodesis



# Arthrodesis





# Complications

- Infection
- Poor wound healing
- Psuedoarthrosis
- Mal-union



# Infected Type 2 (Hind foot)

- Stage 1
  - Initial Debridement ( $\pm$  repeated)
  - IV Antibiotics



# Infected Type 2 (Hind foot)

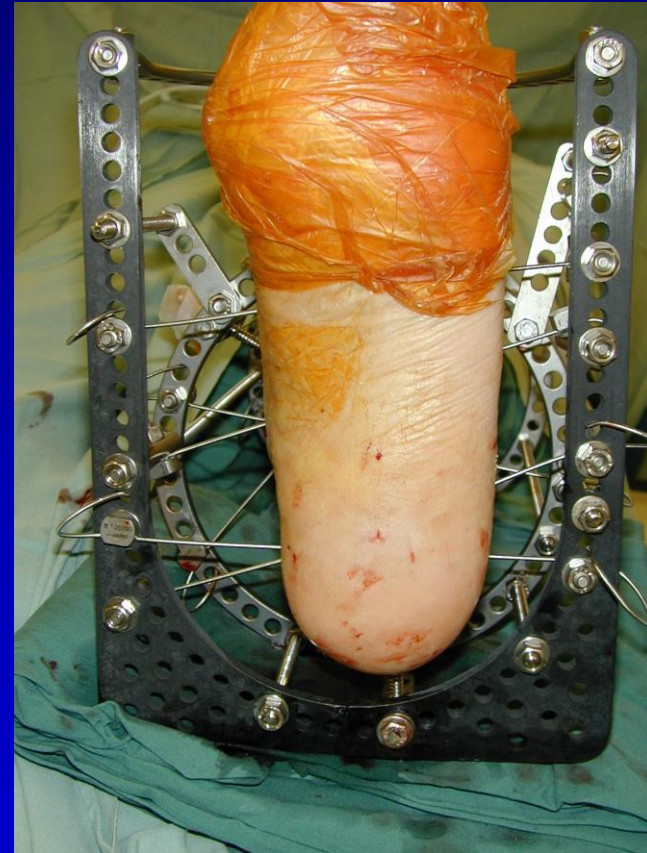


Wedge excision and Ace Fisher frame

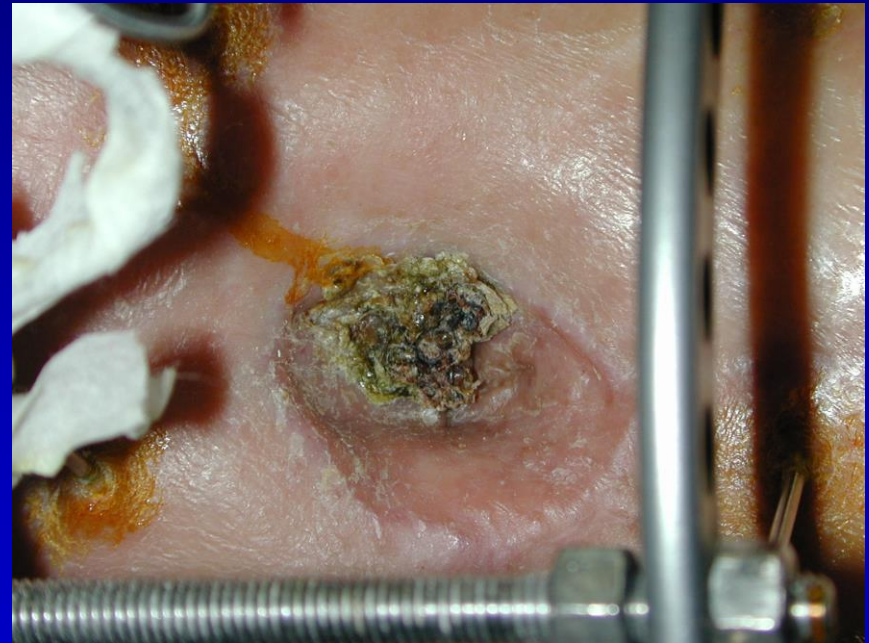
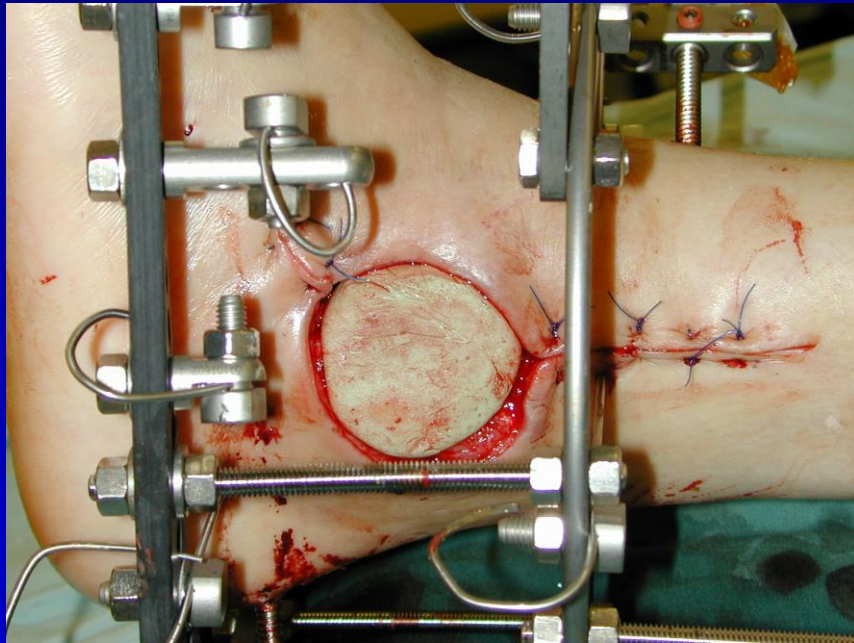
# Infected Type 3A



# Infected Type 3A

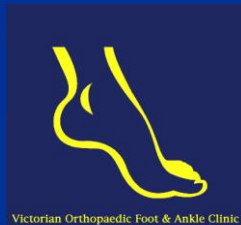


# Infected Type 3A



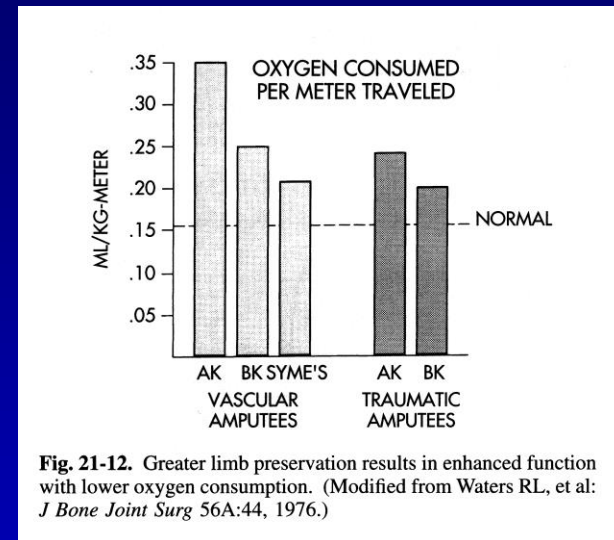
# Role of Amputation

- Potentially good option especially with deep infection
- More rapid rehab (elderly population)
- ? More reliable healing
- ? Mid / Hind foot versus BKA
- ? Contralateral side



# Amputation

- Partial Foot
  - Chopart
  - Symes/Boyd



- BKA





# Below Knee Amputation



# Conclusion: Ulcers

- Common Problem
- Surgical and Orthotic Management is Becoming More Sophisticated
- Off-loading pressure is the Key
- Multi-disciplinary Approach Required
- Ulcers Need Appropriate Investigation and Staging

# Conclusion : Charcot

- Hot swollen foot think Charcot as well as infection  
(Do an x-ray)
- Early treatment is usually non-operative (midfoot)
- Early surgery for Ulcers / Deformity (ankle)
- Surgery: Recurrent ulceration (Midfoot)  
Uncontrolled deformity (hindfoot)
- Don't forget Amputation as an option