Compartment Syndrome

Andrew Taylor
OTC Nice 2008
The Message

• Compartment Syndrome is Important
• Open Fractures
• Distal Ischaemia Rare
• Salvage of Missed Compartment Syndrome Dissapointing
• Do something about it
The Foot at Risk
Learning Outcomes

• Epidemiology
• Pathophysiology
• Anatomy
• Clinical Presentation
• Management
Pathophysiology

• Elevated intracompartmental pressure
• Decreased Capillary Perfusion

• LOCAL Moneural Ischaemia
Anatomy
5 Clinically Relevant

- Medial
- Lateral
- Central
- Intraosseous
- Calcaneal
Symptoms

Pain
Signs

• Pain on Passive Toe Dorsiflexion
• Swollen
• +/- Pulse
• Warm
• Pink
• Paraesthesia
Investigations

• 40 mm Hg or within 30 mm diastolic b.p.
• Base 1st Metatarsal  
  – Medial then Central Compartment
• Interosseous
• Calcaneal  
  – 2 cm inf. and 5 cm distal to medial mall
Management

• Fasciotomy
  – Dorsal
  – Medial
  – Combined

• Temporary Stabilisation
Dorsal Fasciotomies
Medial Fasciotomy
Fasciotomies
Fasciotomies
Temporary Fixation
Post - Operative

- Splint
- AV Pump
- Elevate
- CT
  - Definitive Fixation
- DPS @ 5 - 7 Days
  - Avoid Skin Graft
Complications

• Late Presentation
  ➢ 8 hours
  ➢ 24 hours

• RSD and Neuropathic Pain

• Contractures and Soft Tissue Atrophy
  – Claw
  – Flexion Contracture
Compartment Syndrome

- Underdiagnosed
- High Index of Suspicion
  - High Energy Injuries
  - Open Fractures
- Prompt treatment improves outcomes
Salvaging and Reconstructing The Severe Ankle and Hindfoot Injury

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The Message

• Preserve Function
• Minimise Loss of function
Outcomes

• Anatomy and Biomechanics

• Indications
  – Patient
  – Problems
  – Techniques
  – Literature
Foot & ankle (& knee) act as either a
- **BRAKE** (shock-absorber)
- or a
- **MOTOR**
- at various stages of the walking cycle
Axes of rotation
- ANKLE

- Axis of rotation is not parallel to the floor
- TILTED and ROTATED
- Line between tips of malleoli approximates to axis
- Lateral malleolus is both posterior and distal to the medial malleolus
- Foot deviates laterally in ankle dorsiflexion
- Foot deviates medially in ankle plantarflexion
Axes of rotation
- ANKLE
Axes of rotation
- SUBTALAR JOINT

- Single helical axis between talus and calcaneum
- Oblique axis of rotation - very variable
- Postero-lateral to antero-medial
- Postero-inferior to antero-superior
- Allows heel inversion and eversion to take place
- Forefoot pronation and supination are secondary consequences
Axes of rotation
- SUBTALAR JOINT
Axes of rotation
- TRANSVERSE TARSAL ARTICULATION

• a.k.a Chopart’s joint / mid-tarsal joint
• Talo-navicular and calcaneo-cuboid joints
• Axes parallel when calcaneus is everted - TTA flexible (e.g. at heel strike) allowing longitudinal arch to collapse
• Axes non-parallel when calcaneus is inverted - TTA locked (e.g. at toe off) providing support to longitudinal arch
• Arthrodesis of one joint prevents movement in the other
Axes of rotation
- TRANSVERSE TARSAL ARTICULATION

Heel EVERTED
Joints PARALLEL
T.T.A. FLEXIBLE

Heel INVERTED
Joints NON-PARALLEL
T.T.A. RIGID
Salvage of the Foot and Ankle
Salvage of the Foot and Ankle
Salvage of the Foot and Ankle
Questions

- Can it be salvaged?
- Should it be salvaged?
- How to do it?
  - Joint preservation
  - Joint sacrificing
- Am I the surgeon for the job?
Goals of Surgery

- Painfree
- Stable
- Plantigrade
- Balanced
- Sensate Foot

- Maximise Function
Indications

• Pain
  – Arthritis
  – Instability
  – Malunion v. Deformity
  – Nonunion
  – Infection
  – Bone Loss
Can you salvage the joint?

- Instability
- Malunion
- Early Arthritis
Do you remove the screw?
Mortise Instability
• Transverse Osteotomy
• Restore Length
• Rotation
• Stable Fixation
What are the results?

• 7 patients
• 3-16 months
• 11 month follow up
• AOFAS 82 – Good

Sinha et al. Foot Ankle Int. 2008
Malunion

- Symptomatic
- Good Joint
Joint Preservation

• 35 patients
• Tibial osteotomy
• 5 year follow up
• 70% survivorship

Pagenstert et al 2007
26 year old
Calcaneal Fracture
Stiff midfoot
Pain lateral border of foot
Varus Heel
Normal Subtalar
and Transverse Tarsal Joints
Multi-Level Deformity
The literature

Who knows?
Distraction:

- Van Tulberg 1994
- Small series
- 6 months distraction
- 50% good results
Distraction/Arthroscopy
Distraction/Arthroscopy

- 14 patients
- 2 failures
- 8 avoided arthrodesis
- Favourable features – no deformity
  - dorsiflexion to 90
Bone Loss
Bone Loss
Bone Loss
Bone Loss
Soft Tissue Reconstruction
Bone Loss
Distraction Osteogenesis
Bone Loss
Allograft v. Osteogenesis
Allograft v. Osteogenesis

- 87% union with allograft
- 81% with Ilizarov Technique
Joint Sacrificing

- Arthrodesis
  - Which joint
- Arthrodesis + Osteotomy
- Amputation
Total Ankle Replacement
Arthrodesis

- Choose your joint
- Fuse in functional position
- Select technique
Arthrodesis v. Arthroplasty

- No RCT
- Outcomes data sparse
- Comparable in the medium term

Haddad et al JBJS 2007
Arthritis with Deformity
Arthritis Ankle
Subtalar Arthritis
In situ fusion v. distraction arthrodesis

- 17 patients
- In situ fusion
- Lateral wall exostectomy
- Comparable results to bone block arthrodesis

Savva and Saxby JBJS 2007
Tibio-Talar-Calcaneal Fusion
Which implant?

- Blade Plate: 100% Union
- Nail: 65% Radiological Union
  - Locked
  - Angle Stable
  - Compression
Triple Arthrodesis
Keep on Going
Summary

• Treat Infection and bone loss

• Treat Malunion

• Preserve Movement and Function

• Do what works for you