Ankle Fracture: Options for Early Mal-reduction

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Disclosure

- Consultant speaker:
- Wright Medical, INC/Stryker
- Bespa Global
- Paragon 28
- Kinos
- Integra

Introduction

- Ankle malunions result from
  - Failure to restore joint congruity and
  - Failure to restore stability
Introduction

- Malunions occur more commonly after closed treatment

Malunions after surgery still occur

- Fracture severity not appreciated
- Operative reductions inadequate
- Surgical fixation fails

Clinical

- Pts mainly complain of pain
- Typically diffuse
- When weight bearing or at night
Exam

- Swelling
- Loss of ankle motion
- Abnormal heel alignment
- Antalgic gait
- Assistive devices used

Two distinct groups of malunions

- Based on radiographs
  - Overt malunion
    - Talus is displaced
  - Occult malunion
    - Talus remains reduced

Importance

- 1mm shift of the talus → 42% reduction in the tibiotalar contact area → increase stress on the articular cartilage
- Serious and persistent dysfunction
Overt malunion – easily identified

- Fibula is shortened, rotated
- Ankle mortised is widened
- Talus is shifted

Yablon and Leach
JBJS, 71A, 1989

Occult malunions

- Talus is in anatomical position

Yablon and Leach
JBJS, 71A, 1989

The “sprung mortise”

- Three radiographic characteristics
- 1) joint space is no longer equidistant or parallel

Weber B.G.
Clin Orthop, 1981
The “sprung mortise”

• 2) Shenton’s line is broken

Weber B.G.
Clin Orthop, 1981

The “sprung mortise”

• 3) The curve between the lateral part of the talus and the recess of the distal fibula is interrupted

Weber B.G.
Clin Orthop, 1981

Other x-ray parameters

• Increased tibiofibular interval
• Normally less than 6 mm
• Measure 1 cm above joint line
Other x-ray parameters

• Talocrural angle
  • Normally is within several degrees of the opposite ankle

CT scan is definitive

Disruption of the syndesmosis clearly seen

Stress radiographs

• Has been very helpful to sort out the tricky ones
Decision making

- Reconstruction candidates have
  - Pain
  - Limited function
  - Identifiable malunion
  - *Limited arthritis!*

Decision making

- Fusion/total ankle replacement candidates have
  - Ankylosis
  - Loss of bone stock
  - Complete loss of joint space

Decision making

- Non-operative candidates have
  - Profound peripheral vascular disease
  - Poor soft tissues
  - Medical conditions that prohibit surgery
Relative contra-indications

Medial conditions
• Diabetes
• ESRD
• Neuropathy
• Dermal issues
• Nicotine use

Operative procedure

• Goal: restore normal anatomy
  • Address all components of malunion
  • Strict attention to details of modern fracture management
  • Careful soft tissue technique

Surgical plan

• Approach bone
• Osteotomy
• Mobilize bone
• Fixation
**Surgical approach**

**Osteotomies**
- Fibular
- Tibial
- Supramalleolar

**Fixation**
- Ex-fix, Internal fixation, Combo
- Bone grafts (auto and allografts) and orthobiologics

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**Operative technique**

**Fibular exposure**

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**Fibular osteotomy**
**Fibular mobilization**

Imperative to remove all scar tissue to obtain reduction

**Posterior malleolar takedown**

Revise posterior malleolus when significant portion involved

**Remove medial obstacles**

- Anteromedial incision often needed to debride scar tissue
- Straight medial approach when revising medial malleolus

Sometimes a portion of deep deltoid is removed
Seating the fibula

- Place bone block
- Check position with fluoro
- If out to length, then seat into incisura fibularis
- Temporary K-wire

Plating the fibula

When greater fibular length needed
AO articulating tension device

- Bone graft fibular defect
- Most common error is to underestimate fibular length

Stress test of syndesmosis

- Cotton test: application of lateral force to the fibula
- Search for any lateral translation
- Usually positive in these cases

Syndesmosis reduction
Syndesmosis reduction

• Dealer’s choice
  • Three or four cortices
  • Recommend 4
  • 3.5 or 4.5 mm cortical screw
  • Remove?

Fixation of the syndesmosis
Case 1

• 43 year old
• Fell off bicycle
• Presents to you at 6 weeks, having just moved to area
• No complaints

Healing malunion
Staples still in!!???
Talofibular incongruity

Intra-operative x-rays
Post op x-ray

- Take down of original fracture
- Syndesmosis was stable after plate fixation

Results: ankle malunion surgery

- Good results range between 74% and 91%
- Pain is lessened considerably in most
- Many note improvements in ROM and ability to walk

Hughes, JBJS, 1976  
Marti et al., JBJS, 1990  
Offierske et al., Clin. Orthop. 1982  
Ward et al., JBJS, 1990  

Results: ankle malunion surgery

- Time since accident
- Patient’s age
- Type of initial treatment
- Do not adversely affect results

Fogel and Sim, Orthopedics, 1982  
Hughes, JBJS, 1976  
Marti et al., JBJS 1990  
Results: syndesmosis

- Mal-reductions range from 29 to 39%
- Mal-reductions less with tight rope in some studies
- The clinical and functional consequence of mal-reductions remains controversial


Results: ankle malunion surgery

- Poor results can be expected
- If talar subluxation is not reduced
- If preexisting osteochondral defects not identified and treated
- Arthritis may not progress

Marti et al, JBJS, 1990
Ward et al, JBJS, 1990
Yablon et al, JBJS, 1979

Case 2

- 36 year old female
- 6 months from ORIF ankle fracture
- Ankle never felt right
Case 2

- Daily pain across ankle joint
- Swelling
- No fevers, chills, or night sweats
- She wants to know what’s wrong?

Pre-operative planning
6 month visit

- Did well initially
- Now with fibular sided pain
- Broken screws

6 month visit

Repair nonunion fibula

- Autogenous graft
Case 3

- 80 year old female
  - ORIF ankle fx 2 weeks ago in Italy
  - Back from vacation
  - Here for routine follow-up
  - NMB x-ray at visit

Surgical wounds benign
Thoughts?

- I removed her sutures
- Placed into short leg NWB cast
- Return in one month

6 week office visit

- No complaints
- Minimal pain
- Has been compliant

6 week radiographs
Surgical wound

- No fevers, chills, or night sweats

Thoughts now?

- I scheduled revision surgery
- Planned to remove hardware
- However, at surgery, the fracture was not healed
- I re-plated fibula and repair the syndesmosis

More problems

- Intra-op cultures grew MRSA
- Picc line placed, ID consulted
- Started on 6 week course of Vancomycin and rifampin
2nd surgery: 2 week visit

• Doing well
• No fevers, chills, night sweats
• Surgical wound benign

2nd surgery: 2 week visit

• Pt feels fine
• Afebrile
• Normal WBC, c-reactive protein, and west. sed rate
• Removed sutures
• Placed into cast brace
• Close follow-up

2nd surgery: 6 week visit
2nd surgery: 6 week visit

- Surgical wound

And now?

- Continue suppressive antibiotics
- Schedule hardware removal
Final visit: 6 weeks after metal out

Case 4

- 40 y/o female
- Previously fractured ankle 16 years ago
- Now with acute twisting injury during volleyball

Case 4
Repair of the syndesmosis

3 month visit

• Very prominent painful screws
3 month visit

Decision was made to remove screws

8 month visit

• Pain across entire ankle joint
• Some swelling
• Never felt right
• Ankle feels weak

8 month visit

• Now what?
CT scan

Stress radiograph
- For completeness
- Helped patient understand her problem

Repair fibula and syndesmosis
Repair fibula and syndesmosis

• At 6 months, pt doing better
• Still has some ankle pain posterior
• Large osteophyte present

At one year from repair

• Ankle twisted hard at work
• Broken syndesmosis screws
• Fibula might be healed

Thoughts?
2 months after hardware out

- Continued posterior ankle pain
- Posterior ankle impingement
- Wants additional surgery to remove osteophyte

Case 5 - Introduction

- 31 year old
- Drunk, unknown injury
- Taken to hospital next day by friends
Introduction

- Underwent ORIF the next day by community doc
- Discharged to home
- Syndesmosis fixation failed at first post-op visit
- Operating surgeon wanted to wait and see

2 weeks post-op

2 months, comes to you

10/10 sharp pain, daily
Moved in with mommy
Quit the booze, but smokes
Syndesmosis repair
Reduces with Manual stress

Plate and syndesmosis screws
What now?  
Redo everything, and tibial osteotomy  
Screws placed
1.5 years

Case 6
- 45 year old
- Victim of assault
- Closed injury
- Obvious deformity

Injury films
CT scans

Surgery done elsewhere

3 months later…
Fibula fixation

Syndesmosis reduction, fixation

3 months post op
4 years post op

Thank You