Extraarticular Distal Tibia Fractures
OTA 43.A

R. Bruce Simpson
Hughston Trauma
Ft Walton Beach FL

Disclosure(s)

• Speaker/family has no contractual relationships with any manufacturer, commercial organization, or for-profit retail organization

• Speaker has received no financial gifts from any manufacturer, commercial organization, or for-profit retail organization, and has no bank accounts in Zurich or the Caymans

• Speaker is for sale, and with the economy in the tank, I think we can work something out cheaply

• Does anyone actually read the disclosures?

Objectives

• Review relevant anatomy
• Discuss difficulties in managing these fractures
• Define options for management
• Tricks and traps
The Problem: Distal 1/4\textsuperscript{th} fractures

- Achieve/maintain reduction
- Control distal fragment (short)
- Avoid soft tissue injury
- Consider subtle fracture extensions
  - INTO THE JOINT
- Need to fix the fibula?
Goals

- Obtain/maintain alignment and length
- Encourage healing
- Allow early motion of adjacent joints
- Avoid complications:
  - Skin
  - Nonunion
  - Infection
  - Stiffness

The Problem
Getting Reduction

- Spiral oblique fractures:
  - Rotational displacement
  - Short (through rotation)
- Both deformities must be corrected for an anatomic fracture reduction
- Barriers:
  - Interposed material
  - Persistent loss of length (lateral column)

Anatomic Features

Distal tibia
- Transition from diaphysis to articular surface
- Orientation of articular surface determines joint position
- Congruence of joint surface critical to longevity
The Problem
Getting Reduction (cont’d)

• Anatomical consideration:
• Transition from diaphysis to metaphysis
• Lack of supportive structures
  – Fibula-
    • Length
    • Rotation

The Problem
Avoiding Additional Soft Tissue Injury

• Thin envelope
• High energy transfer to surrounding tissues
• Poor tissue vascularity
  – Diabetes
  – PVD
  – Burns
  – Abrasions
  – Traumatic laceration

The Problem
Fracture Extensions

• Linear cracks
• Nondisplaced
• Multiplanar

• Does this represent a risk:
  – Malreduction
  – Loss of alignment
The Problem
Fix the Fibula?

- Reduction barrier?
  - Reduction aid
- Stability problem?
  - Stability solution
- Occult syndesmotic ankle injury?
  - Obligated to test the syndesmosis

Evolution of Treatment
No Good Deed Goes Unpunished

Treatment
- Closed reduction/LLC
- External fixator
  - Joint spanning
- Hybrid fixators
  - Juxtaarticular
- Plate osteosynthesis
- IM nails
- MIPPO

Problem
- Stiffness
- Infection, stiffness
- Pin tract infections, septic arthritis, stiffness
- Infections
- Malunions, nonunions
- Infections, nonunions

Closed Reduction
Long Leg Cast

- Difficult to obtain/maintain reduction
- OR/ER?
- Frequent Xray checks
- Re-reductions
- Residual length/rotation deformities
- Ankle/subtalar stiffness
- DVT

Giving birth to a reduction
Pins and Plaster

- K wires transfixing proximal and distal segments
- PTB applied, closed reduction while cast wet
- Problems: pin tract infections, compartment syndromes

Hoffman-Vidal Frame

- Transfixion Shantz pins
- Rigid frame:
  - Ability to distract, compress
  - Allow for early partial weight-bearing

Hoffman-Vidal Frame

Clinical Problems

- Pin tract infections:
  - Cellulitis
  - Ring sequestra
- Soft tissue tethering / contractures
- Delayed / nonunions

Hammer Acta 1985
Modern Joint Spanning Ex Fix

- Provisional
- Keep pins away from the potential incisions
- Limit construct design
- Allow for soft tissue care

Small Wire Fixation

- Advantages:
  - Rigid control of fragments
  - Indirect reduction using olive wires
- Indications:
  - Segmental fractures
  - Intraarticular extension
  - Poor skin
- Disadvantages:
  - Pin tract infections
  - Septic arthritis
  - Joint stiffness

Closed Reduction/IM Nail

- Anatomic/mechanical challenges
- Assistive devices:
  - Triangle
  - Distractor
  - Blocking screws
  - ORIF Fibula
Historic AO Principles

Surgical Strategy

• Open extensile approach
  – Anteromedial
• Anatomic reduction with resolution of fracture lines
  – Primary bone healing
• Dynamic compression plates and screws
  – Compression at fracture site
• Interfragmentary compression
  – Lag screws

Early US Experience

Open Fixation Distal Tibia Fractures

Teeny et al

• Distal tibia fractures
• AO principles:
  – Early operative management
  – Rigid internal fixation
• Significant infection rate (11-30%)
• Wound breakdown

Open Reduction

Modern Fixation Strategies

• AO Teaching  (Problems)
• Early US Experiences  (Problems)

• Second generation plating
  – MIPPO
  – Anatomically contoured plates
  – Alternative surgical approaches
  – Facilitative adjuncts to reduction
ORIF Current Philosophy

- Avoid large incisions
- Relative stability
  - Locked plates
  - Internal Ex Fix
- Adjunctive reduction
- Advantages:
  - Early motion
  - Rigid fixation
  - Anatomic reduction

Minimally Invasive Technique

Small medial incisions
  - For insertion and positioning
- Non-destructive plating
  - Leave periosteum intact
  - Cautious skin handling / closure
- Indirect reduction
  - Plate will not reduce the fracture

Percutaneous Plating

Early Experiences

- Initial implants
  - ½ tubular plates
    - Pounded flat
  - 4.5mm screws
  - Indirect reduction
  - Small incisions
- Problems:
  - 20% superficial infection rate
  - Prominent hardware
  - Focus on implant rather than reduction
MIPPO

• Minimally invasive
• Small incisions
• Relative stability
• Requires facilitated reduction:
  – Push-pull
  – Distractor
• Disadvantages:
  – REDUCTION
  – Avoid OIF

Example:
Open Comminuted Tibia and Fibula Fx

Minimally Invasive Plating
Definitive Fixation
Anterolateral Distal Tibial Plate

- Distal 1/3 and Pilon Fx
- Lateral incision
- Spares medial skin
  - Earlier ORIF?
- Can fix fibula through same incision
  - Ex fix
  - Delayed ORIF

Anterolateral Incision

- Grose JOT 2007
- Anterolateral incision
- 44 pts
- 93% anatomic reduction
- 2 infections (4.5%)

Example
Fibula

Fix or don’t?

• Aid in reduction:
  – Length
  – Coronal plane
  – Rotation
• Aid in stability
• Offers an excuse to do simultaneous fasciotomy
• Test for syndesmotic stability

Suggestions:

• Become familiar with means of facilitated reduction
  – Femoral distractor
  – Blocking screws
  – Mini ORIF
  – Fixing the fibula
• Modern surgical approaches, implants

Summary

• Methods evolving
• Goals unchanged
  – Anatomic alignment
  – Stable reduction
  – Allow early ankle motion
  – Minimize skin/soft tissue complications

The device is not designed to replace the surgeon. You still have to reduce the fracture.