Tibial Pilon Fractures

They Can't All be Fixed
Amputation anyone?

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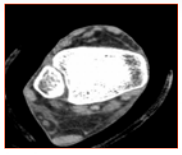
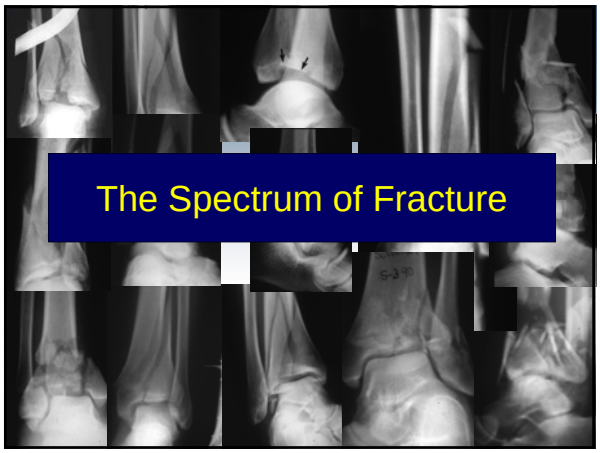
HUGHSTON CLINIC

Defining the Injury

- Delicate soft-tissue envelope
- Fragile skin
- Little underlying muscle
- Scant extra tissue
- Obstructions for surgical approaches





Tibial Plafond Fractures - Results

General Comments

- Terrible Injuries
- “Excellent Results” are rarely achieved
- Fair-Good results are the norm
- Outcomes are impossible to predict
- Treatment complications must be avoided

Planning Treatment

- Consider the entire patient
- NOT all patients get treated the same way

Compliance?

Funky toes sign?

Unfortunately these techniques led to the Dark Ages of Soft Tissue Management

Ill-Advised

- Extensive surgical approaches
- Fracture stripping
- Prolonged tourniquet times
- Bulky implants

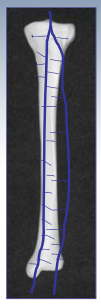
Increased soft tissue injury

A recipe for disaster

Blood Supply and MIPPO: Distal Tibia

Dye injection study
- 9 matched cadaver legs
- Open plating vs. MIPPO distal tibia

Dye injection study
- Avg. identifiable A's preserved
  - Open plating 1.2
  - MIPPO 7.4 ($p<0.05$)



Borrelli et al. J Ortho Trauma, 2002

If Treated "Poorly"….

- Teeny and Wiss. ORIF of tibial plafond fractures: Variables that affect complications and outcomes, Clin Orthop, 1993
- Treated with *Early* ORIF
- 50% major complications
  - Deep infection
  - Would breakdown
  - Free flap vs. BKA
- Notably:
- Many C2/ C3 injuries from highway (high energy)

If Treated "Poorly"….


Non-union


Implant Failure


Wound Infection

Cases Treated 1980's Early 1990's

McFerran et al JOT 1992

21pts (40%) with major complications

require 77 additional operations

Wyrsch et al JBJS 1996

3/18 amputations in closed fractures

Teeney and Wiss CORR 1993

37% infection and 26% fusion in Type 3's

We Have Learned From Our Errors!

Current Techniques Emphasize the Soft Tissue Injury

- Delays until surgery
- Spanning ex-fix part of most protocols
- Percutaneous and limited approaches

Complications With Current Techniques

Overall 0-10%

- Spanning ex fx
  - Marsh et al JBJS 1995 – 43 cases 0%
  - Wyrsch et al JBJS 1996 – 20 cases 0%
- External fixation same side
  - Court Brown et al JOT 1999 – 4 cases 4%
  - Tornetta et al JOT 1993– 26 cases 7%
- Delayed plating
  - Patterson and Cole JOT 2000 – 22 cases 0%
  - Sands et al CORR 1998– 64 cases 6 %
  - Sanders et al CORR 2002 - 28 cases 14%

0-10%

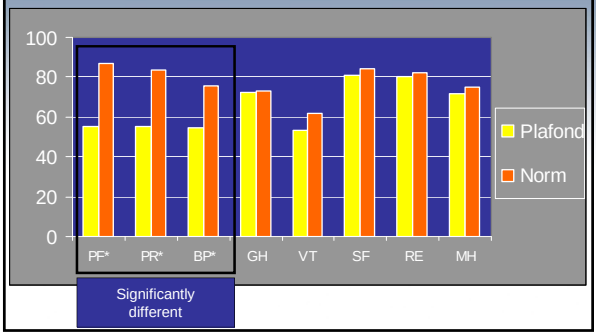
Measurable Effect on Health and Quality of Life regardless of treatment technique

Decreased General Health Status

- Sands et al CORR 1998 - 2-4 years after injury
  - Delayed plating
- Pollak et al JBJS 2003 – average 3.2 years after injury
  - Plating and external fixation
- Marsh et al JBJS Feb 2003 – 5-11 years after injury
  - Spanning external fixation

SF-36: Plafond vs Aged Matched Norms

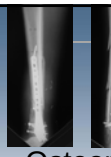
5-11 years after injury (Marsh et al JBJS Feb 03)



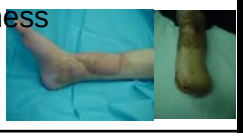
Outcomes

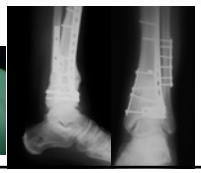
- Pollack et al. Outcomes after high-energy plafond fractures, JBJS-Am, 2003
- C-types Rx'ed with staged ORIF
- SF-36 >2 SD below norms in 4/8 categories
- Lots of persistent problems
  - 35% ankle stiff
  - 29% chronic swelling
  - 33% ankle pain
  - 43% unemployed (86% due to plafond)
- Complications had worst outcomes

Late Complications




- Osteomyelitis
- Arthosis
- Malunion
- Nonunion
- Stiffness
- BKA



Trauma

- Acute Amputations Treated Like Infection
- Maintain Length
- Early Amputation Better
- Modern Prosthesis Better than Salvaged Limbs

Leg (Transtibial) Amputations

- 85% of Amputations
- Ischemic vs. Non-Ischemic
- Length Determination
  - Ideal: 12.5 cm to 17.5 cm
  - 2.5 cm of bone length for each 30 cm of body height
- Short Below the Knee Amputation

Level of Amputation

- Local factors
  - Bone
  - Soft tissue
- Lowest functional level
- Systemic factors
  - Co-morbidities
  - Nutrition

Function

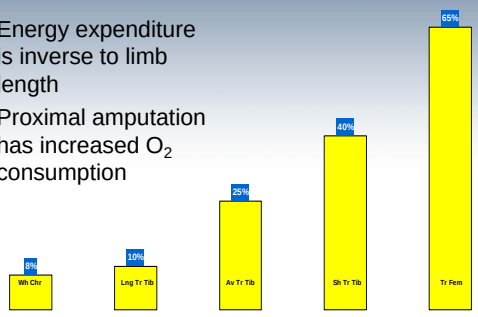
- Early amputation
- Reduced morbidity
- Early prosthetic fitting
- Unlimited activity

Principles

- Amputation surgery is reconstructive surgery
- Create a functioning motor and sensory end organ
- Achieve healing for maximum recovery of function
- Treatment and rehabilitation are team efforts

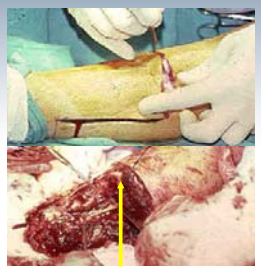
Metabolic Cost of Amputation

- Energy expenditure is inverse to limb length
- Proximal amputation has increased O_2 consumption



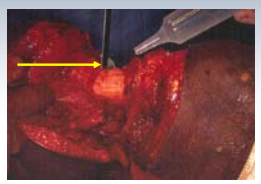
Transtibial Amputation

- Anterior incision 1cm proximal to bone cut
- Any skin flap in trauma
- Two thirds circum.
- Remove soleus



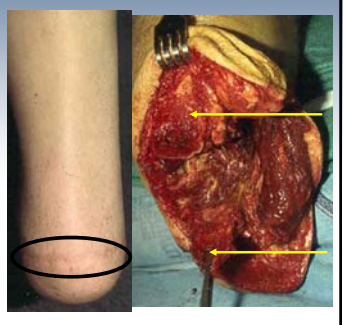
Bone

- Cut with power saw
- Avoid periosteal stripping
- Bevel bone ends
- Heterotopic bone in trauma



Transtibial Amputation

- Gastrocnemius myodesis
- Cylindrical shape



Ankle Disarticulation

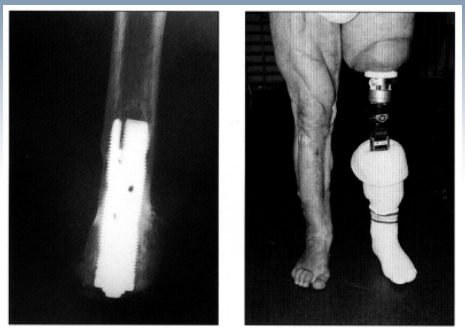
- Heel pad for weight bearing
- Patent posterior tibial artery
- Remove malleoli

Ertl Procedure

Leg (Transtibial) Amputations

- Prosthesis
  - Foot
    - SACH
    - Single Axial
    - Multi-Axial
    - Energy Storing
  - Pilon
  - Socket

Osseointigration



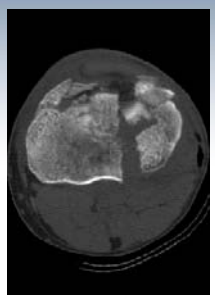
LW

- 46 YO AAM
- I/O Boat motor explosion
- Open injuries
- Pulled from lake by other boaters
- PMH-HTN
- SH-Smokes, ETOH

Left Leg

Left Leg

Knee CT



Treatment Options

- I and D
- Ex-fix/Delayed ORIF
- Amputate
- Other options

Left LE

Right Leg

Right Leg

Right LE

Left LE

Thank You