Management of Fifth Metatarsal Fractures

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Proximal Fifth Metatarsal Fractures

- Tuberosity fractures
- Jones fractures
- Diaphyseal stress fractures
Fifth Metatarsal Fractures
Presentation

• Similar mechanism as an ankle sprain

• Often too painful to bear weight
Tuberosity Fractures

• Most common, 90% of 5th mt fxns

• Mechanism is lateral band of P. fascia, usually NOT P. brevis depending on size of the fragment

• Displacement is rare
Fifth Metatarsal Fractures
Avulsion Fracture

- Fracture usually extra-articular.
- Presents with pain, swelling on lateral border of foot.
Fifth Metatarsal Fractures

Tuberosity Fracture

- **Treatment**
  - Walking boot x4 weeks, wb as tolerated
  - Healing can be prolonged, return to activity is based on clinical recovery
Avulsion Fracture

- 85% of patients expected to return to preinjury functional level at 6 months after injury
- Symptomatic nonunion treated with excision of fragment vs. late orif

Egol et al. FAI 2007
Avulsion Fractures

- Large, displaced, or intra-articular fractures require orif with a bicortical screw vs tension band

Sarimo et al. AmJSM 2006
Cases

- 45 y/o with 5th mt prox avulsion/fracture
Cases

- Peroneal brevis attachment pulled off
- Fragment large enough for fixation
Jones Fracture: Defined

- Best defined as a fracture of the metaphyseal-diaphyseal junction at or distal to the 4/5 intermetatarsal articulation.
5th Metatarsal: Blood Supply

- Metaphyseal, nutrient and periosteal vessels
- Avascular zone at metaphyseal-diaphyseal junction
Jones Fracture: Epidemiology

- Multiple etiologies proposed
- Raikin:
  - Lateral overload from cavovarus foot posture
  - Metatarsus adductus
  - Skew foot

Raikin et al: AJSM 36(7), 2008
Jones Fracture: Tx Options

• Treat non-weight-bearing in short-leg cast for 6 weeks

• Operative treatment for delayed union, non-union or acutely in high performance athlete
Jones Fracture: Screw favored

- Non op tx failure rate 44% with median healing rate 15 weeks.
- Early screw fixation had 5% failure rate with mean fracture union 8 weeks.
- Level 1 study

Mologne et al. AJSM 2005
Case

- 25 y/o male
- High-performance athlete
- Acute lateral foot pain
Case

- Percutaneous axial screw fixation
- Returned to full activity in 9 weeks
Jones Fractures- things to consider

• Technique
• Biomechanical Issues
• Fixation choices:
  – Type of screw (solid or cannulated)
  – Metallurgy (titanium or stainless steel)
• Return to sport timelines
Selection of screw?

What type of screw?

- Cannulated vs. solid
- Diameter?
- Headless?
Cannulated Screws Easier but ...

- Hardware failure?
Screw Selection - literature

• Pietropoali, FAI ’99
  – No difference in cannulated vs. non-cannulated 4.5 mm

• Reese, AJSM ’04
  – Larger solid better (cycles to failure)
  – Avoid < 4 mm

• Devries JFAS 2011
  – No difference between cannulated 4.5 mm titanium or stainless steel
Screw Selection: Headless?

• Unpredictable compression
• Not easy to remove
• Sides, FAI ’06
  – Headless tapered = headed screws for resistance to bending but not to pull-out
Screw Selection: My Preference

• Chose the largest screw that fits the canal
• Solid screw
  • 4.5/5.5/6.5 mm options
  • Low profile head
Technical Issues: High and Inside

Not LOW and OUTSIDE
High and Inside

• Failure to start “high and inside”
  – Prominent screw head laterally
  – Perforation of medial cortex → stress riser
Technique Tip: Drilling

• Use cannulated drill only for entry into the canal

• Beware of cannulated drilling past insertion point
  – Straight drill in a curved bone
  – Guide wire failure
Technique Tip: Drilling

• Drill “free-hand”
  – Let *solid* drill “find” the canal
  • Advance on reverse
  • Acts as a reamer
  • Acts as bone graft
Technique Tip: Screw Length

• Proper screw length
  – Usually 40-50 mm
  – Threads just past the fracture site
  – Avoid “straightening” the curved bone
Technique Tip: Confirm Position

- Check multiple planes
- Consider an injectable graft
When to start weightbearing?

• Larson, AJSM ’02
  – Wait till radiographic union prior to RTP
  – 4-6.5mm cannulated screws

• Portland, FAI ’03
  – 100% union of type I/II despite WB at 2 weeks
  • 4.5-5mm cannulated
More aggressive in athletes...

- NWB x 2 weeks
- WBTT in boot x 2-4 weeks
- Pool therapy/bike
- Bone stimulator
Rehab Protocols

More aggressive in athletes…

• Begin running in modified shoewear at 4-6 weeks (if clinically nontender)
• Orthotics
• Avg. RTP 8-10 weeks
Rehab Protocols

- RTP based on clinical exam
  - Radiographic union may not be evident for 12-16 weeks
Screw Removal?

- Leave screw forever!
- Custom orthosis
  - Lateral heel wedge if hindfoot varus
- Rankin, AJSM ‘08
Outcomes: Good even if delayed treatment

Habbu et al:
• 14 patients
• Mean duration from symptoms to surgery = 28 weeks
• Single intramedullary screw
• 100 % union at an average of 13.3 weeks

Habbu et al: FAI 32(6), June 2011
Fracture after ORIF

- Wright, AJSM ’00
  - Case report: 6 refractures
  - 3 required repeat surgery
- Larsen, AJSM, ’02
  - 6/15 cases failed screw fixation
Complications: Recurrent Fracture

- 5-8% incidence
- Hardware fatigue a sign of trouble
Recurrent Fracture- now what?

- Adequate fixation?
- Deformity?
  - Achilles contracture?
OFAC Study-Jones Fx

• 149 patients retrospectively reviewed
• 7.3% (4) refracture rate
• Avg time to refracture 8 months

Granata, Philbin et al.
• Primary fixation was cann screw 4.0 - 5.0
• 3 revised to larger screw, 1 required a 2\textsuperscript{nd} revision for nonunion
Nonunion / Refracture in Athletes

- 21 elite athletes
  - with non union or refracture
- Retrospective clinical and radiographic review
- Results:
  - Average rtp = 12.3 weeks
  - All fractures showed healing - one refracture
- Recommendation: solid screw ≥ 5.5 mm + grafting

Hunt, Anderson AJSM 2011
Case

- 20 y/o division 1 football player with foot pain
- Had orif 5th mt 6 months ago
Case

- Required redo ORIF
- Bonestim
- Don’t forget about hindfoot varus!
- Went onto heal with return to sports
Growth Factor Expression and Healing Time After Pulsed Electromagnetic Field Stimulation of 5th Metatarsal Nonunions: A Prospective, Randomized, Double-Blind Trial

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Purpose

• Quantify the effect of PEMF on:
  – Growth factor expression and
  – Healing time
    • In 5th metatarsal nonunions.
Methods

• IRB approved prospective, randomized study
  – Inclusion criteria
    • Between ages of 18 and 75
    • Incompletely healed 5th metatarsal fracture after 3 months of conservative treatment
  – Exclusion criteria
    • Fracture gap greater than 5mm on CT scan
    • History of autoimmune or connective tissue disease, history of cancer, current or previous infection of the 5th metatarsal, and pregnancy
Methods

Procedure:
- The initial procedure was a standardized biopsy of the nonunion site
  - Sample sent for laboratory analysis, including evaluation for infection and growth factor assay
- Patients were then subject to the randomization protocol and separate treatment groups
Methods

• Procedure:
  – All patients were brought back to the OR at 3 weeks (+/- 1 week) following randomization
    • Intramedullary screw fixation
    • Repeat biopsy

Patients were followed at regular time intervals postoperatively with routine radiographic evaluation
Results

• Eight patients met the selection criteria
  – Computer randomized into one of two treatment groups:
    • Group 1, inactive PEMF and surgery
    • Group 2, active PEMF and surgery
• The postoperative protocol was standardized for both groups
• Antibody arrays were used to determine the growth factor levels in the biopsy samples before and after treatment
• Determination of healing time
  – Bridging callous across 4 cortices on postoperative radiographs
Results

- All fractures healed in both treatment groups
  - Average healing time
    - Group 1: 12.5 weeks (range 6 to 20 weeks)
    - Group 2: 8.5 weeks (range 6 to 16 weeks)

- Growth Factor Expression
- A significant increase in PIGF level was found after active PEMF treatment (p=0.043)
- Trend towards increased expression after PEMF
  - Brain-Derived Neurotrophic Factor (BDNF), Bone Morphogenetic Protein (BMP) -7, and BMP-5
- No significant differences were found in the inactive PEMF treatment group
Conclusions

• The results of this study are consistent with previous reports of increased growth factor expression after the use of PEMF in fracture healing

• A trend towards faster healing time was also noted in the active PEMF group

• Additional studies with larger treatment groups are needed to clarify the role of PEMF in delayed fracture healing and nonunions
Summary: Jones Fracture

- Jones fracture can still be a challenge
- Always consider biomechanical issues in recurrent situations and with revision surgery
- Be critical of your technique, fixation selection and rehab protocol
Go Irish!!
Case A.K.

Bone stimulator

Healed in 10 weeks

Returned to full activity at 16 weeks

Remains asymptomatic
Case A.K.

- Recurrent lateral foot pain four months postop
- Worsened by activity
Case A.K.

- CT imaging: consistent with nonunion of 5\textsuperscript{th} metatarsal
Case A.K.

- Revision surgery
- ORIF with bone graft and 6.5 mm screw
Complications: Recurrent Fracture

• Evaluation:
  • If asymptomatic
  • “good” screw

consider observation with shoewear protection

• Shoewear:
  • Rigid sole/turf toe plate
  • Pressure relieving orthosis
Complications: Recurrent Fracture

- Resorption plantar and lateral common
- If uncertain obtain CT