5th Metatarsal Fractures

When is intervention necessary?

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Differentials

**Apophysitis** of the 5\(^{th}\) met tuberosity known as Iselin's Disease is a self-limiting disorder of active children (*overuse disease*)

- Inflammation of growth cartilage
- Child may complain of pain that improves with rest
- PE reveals tenderness at the base
- Rarely, associated ecchymosis and edema
- Seen most commonly between ages 8-13
- Radiographic findings include irregular apophyseal density and shape
- Treatment is primary rest, and ice.\(^4\)

**Accessory ossicles**
- May also be confused with avulsion fractures
- Os vesalianum is rare and may be found next to the peroneus brevis insertion
- More common os peroneum can be located at the lateral border of the cuboid within the substance of the peroneus longus tendon

**Insertional Peroneal Tendinitis** – Tertius, or Brevis.
- Pain with active ROM.
- Radiographs negative for frx
Classifying the Types of Fractures

• Traditional classification – Stewart system
  - **Type I**: Supra-articular fracture occurring at the meta-diaphyseal jnx (true Jones frx)
  - **Type II**: Intra-articular avulsion frx with 1 or 2 fracture lines
  - **Type III**: Extra-articular avulsion fracture in which PB tears a small fragment from the styloid
  - **Type IV**: Intra-articular, comminuted frx assoc. with a crush injury
  - **Type V**: Extra-articular avulsion frx of the epiphysis in children (SH type 1)
Simpler is better

ZONE 1
Chip, avulsion fracture possibly involving PB tendon at tuber

ZONE 2
Jones Fracture at met-diaphyseal junction

ZONE 3
Distal, proximal shaft frx
Anatomy and Force

- Adduction of the FF
- Rearfoot inversion
- Repetitive microtrauma

**Photo courtesy of orthobullets**
Non-unions uncommon at Zone 1 according to literature
- Most likely due to more robust blood supply that exists at tuberosity area via metaphyseal arterial perfusion

Treatment recommendations
- Protect WB in stiff soled shoe, ie post op shoe, or even boot
- Let pain determine return to activity
- Return early to work/activity but may be sore for up to 6 months

See reference 8 for image citation
• The force imposed on the bone via tendinous insertion has also been hypothesized to effect the ability of union to occur after fracture

• Farrow - Morris study demonstrated the notion that a mechanical component may contribute to the poor healing potential of Jones fractures secondary to deformation exerted by the PB tendon. They hypothesized the PB tendon helped stabilized the more proximal fracture. And the more distal fracture was inherently unstable due to the lack of PB bracing. This would help explain why screw fixation is often recommended to address Jones fractures. “Further research is needed to evaluate the biomechanics of these fractures.”

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What Zones do we operate in?

• Literature shows a non/delayed-union rate as high as 33% for non-operative tx plans for Jones fractures with
• Mologne, et al, study in AJSM showed a rate of 44% failure after cast treatment of acute Jones fractures. They concluded, early screw fixation results in quicker times to union and return to sports compared with cast treatment. ¹

“The nutrient artery terminates in the proximal diaphysis, and the metaphyseal vessels supply the tuberosity. The region where these blood vessels converge corresponds to the region of poor fracture healing clinically.” ⁸
Study by Roche & Calder

- Lit review from 1980 to 2012
- 26 studies reviewed
- Return to sports following IM screw fixation for acute fractures ranged from 4 - 18 wks.
- Acute fractures treated non-operatively had union rate of 76 % (pooled), vs fractures treated w/ screw; 96 % (pooled).
- Delayed unions treated non-operatively union rate: 44% vs treated operatively: 97% union.
- Non-unions treated with screw fixation healed in 97 % of cases.
- Conclusion: “IM screw fixation is more likely to lead to successful union of all types of Jones fractures compared to non-operative treatments. **Early return to play in athletes prior to full radiological union is not advised in case of re-fracture.”
A Zone for debate…

ZONE 3

Distal, proximal shaft fractures (stress)

• Stress reactions at the 5th met are caused by repetitive forces – perfusion & oxygenation to bone is interrupted w/ continual loading of the bone which causes an increase in bone remodeling. During this weakened state the bone is susceptible to fracture.

• Not typically evident on plain film until at least 2 weeks – will see “linear lucencies or fluffy periosteal reactions”.

• Literature shows marked rates of re-fracture and continued pathology even after surgical intervention in elite athletes.
• Multiple studies have investigated trends with 5th metatarsal stress fractures in an attempt to establish possible causative factors
• 2011 study titled “Radiographic Evaluation of Foot Structure following Fifth Metatarsal Stress Fracture” by Lee, Kim, et al, showed cavus foot structure as being a risk factor combined with repetitive physical activity
• However, in another, larger, 2013 Korean retrospective comparative series study by authors Lee and Park, they concluded after analyzing 168 stress fracture cases that there was a correlation between greater BMI, increased IM 4-5 angle, and increased 5th met lateral deviation angle. They did not conclude that cavus foot type was a predisposition to stress events at the 5th metatarsal.
Summarizing the Zones

• Zone 1
  • Overwhelming evidence based medicine shows Zone 1, 5\textsuperscript{th} met fractures do not typically need intervention

• Zone 2
  • Quality, evidence based medicine shows higher rates of bony union following surgical intervention vs conservative care

• Zone 3
  • Evidence to support both operative and non-operative tx exists
  • Stress frx tx plans should be based on patients activity levels, and pmhx.
  • If re-fracture occurs following conservative tx, consider screw fixation
Case Study

- 60 y/o male presents w/ left 5th metatarsal frx following misstep at home. Pt self-reported feeling “pop”, followed by significant pain in spite of neuropathy.
- Height: 5’9 weight: 272lbs
- Pmhx: DM-II w/ neuropathy, OA, glaucoma, HTN, gout, hypothyroidism, hx of DFU’s (resolved at time of index sx), & history of a stroke.
- Pshx: TKA, left 2nd HT sx, Cardiac ablation, rotator cuff repair
- Social hx: denies smoking & drinking
- Allergies: adhesive tape
- Fam hx: Non-contributory
- PE: Pulses 2/4, CFT <3 sec x 10. Semmes and vibratory diminished. Tenderness at 5th met at base. Pain w/ eversion and plantarflexion. Pain during propulsion and loading of Mid/FF
3.5 x 40mm screw, partially threaded, headless compression screw

Arrow adjacent to screw is approx. 55mm

What’s missing?
Case Radiographs
Follow up

- Pt returns to clinic 4 months post-op w/ ulceration present laterally near 5\textsuperscript{th} met base and signs of local infection including erythema, minor purulence, and edema
- Attending physician utilizes local wound care – places pt on PO antibiotics, take radiographs, cultures, and schedules pt for sx
- Pt presents 5/22/16 for surgical removal of hardware due to presumed colonization and HW failure
- Surgical plan consists of peroneal tendon tenodesis, aside from hardware removal, cultures, pulse lavage, and bone fragment excision
Follow Up

5/22/15

4.5mm screw or >
Post op
References


Questions