Accessory Ossicles vs. Avulsion Fractures vs. Stress Fractures: How can you tell?

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Stress Fractures

• Definition
  • Repetitive microtrauma
  • Forces exceed the ultimate stress of bone, cortical and cancellous
  • Failure of tensile vs. compression side
  • High risk of nonunion tension side
  • Fatigue (repetitive approach of stress to normal bone vs. insufficient application of stress to abnormal bone)
Stress Fractures

- **Foot morphology**
  - Pes cavus more bone problem
    - i.e., stress fractures
    - More peroneal tendon problems

- **Pes planus**
  - More posterior tibial tendon problems
Fig. 31. Hallux valgus. The "L" in valgus refers to the lateral deviation of the phalanx.
Fig. 37. The os calcis in valgus and in pes planus.
Fig. 4-2. “Too-many-toes” sign signifying lateral forefoot rotation. Two and one-half toes seen on the left foot, four toes on the abnormal right foot.
Physical Exam of the Foot and Ankle
Claw Toes Flexed PIPJ/DIPJ: Think Neurologic Involvement

Hammer Toes: Extended DIPJ Think Shoe Wear
Freiberg’s Infraction
Stress Fractures

- Specific risk factors
  - Sport – repetitive microtrauma
  - Hormonal imbalance
  - Malalignment
  - Foot development – rigid high arch
  - Less muscle mass
  - Nutritional deficiencies
  - Surfaces: hard, uneven
  - Training intensity
Stress Fractures

• Risk Factors – Gender Related
  • Menstrual disturbances
  • Caloric restriction
  • Lower bone density
  • Muscle weakness
  • Leg length differences
  • Lower fact diet


<table>
<thead>
<tr>
<th>Location</th>
<th>Rough Incidence</th>
<th>Ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metatarsals</td>
<td>50%</td>
<td>40-60%</td>
</tr>
<tr>
<td>1st</td>
<td>2%</td>
<td>1-3%</td>
</tr>
<tr>
<td>2nd</td>
<td>24%</td>
<td>20-30%</td>
</tr>
<tr>
<td>3rd</td>
<td>19%</td>
<td>15-25%</td>
</tr>
<tr>
<td>4th</td>
<td>1%</td>
<td>1-4%</td>
</tr>
<tr>
<td>5th</td>
<td>5%</td>
<td>1-10%</td>
</tr>
<tr>
<td>Lateral malleolus</td>
<td></td>
<td>20-30%</td>
</tr>
<tr>
<td>Medial malleolus</td>
<td></td>
<td>1-5%</td>
</tr>
<tr>
<td>Os calcis</td>
<td>10%</td>
<td>5-10%</td>
</tr>
<tr>
<td>Navicular</td>
<td>3%</td>
<td>1-5%</td>
</tr>
<tr>
<td>Sesamoid</td>
<td>5%</td>
<td>1-5%</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td>1-5%</td>
</tr>
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</table>
High Risk Tensile Side
Low Risk Compression Side
Body Locations and Level of Concern

CRITICAL
(at risk, may require surgical intervention)

- Anterior tibial cortex
- Medial malleolus
- Navicular
- Proximal 5th MT diaphysis (Jones Fracture)
Body Locations and Level of Concern

NON-CRITICAL (will heal)

- Metatarsals distal 1, 2, 3, 4
- Fibula
- Os calcis
- Talus
Fibular Stress Fracture
Initial
Femoral neck stress fracture
Compression side treated nonoperatively.
Healed 60 mo. later.
Patella Stress Fracture
18 YO Freshman Div. I basketball athlete

• C/O mid-foot pain, L > R
• Started when she was running, playing in shoes mandated by her school
• History of “normal” periods
Navicular view
30º ER
Torg described

Typical orientation of navicular stress fracture
# Stress Fractures

## 5th metatarsal base fractures

<table>
<thead>
<tr>
<th>TYPE</th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>I.</td>
<td>Acute</td>
</tr>
<tr>
<td></td>
<td>Nondisplaced</td>
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<tr>
<td></td>
<td>Displaced</td>
</tr>
<tr>
<td>II.</td>
<td>Previous injury abnormal</td>
</tr>
<tr>
<td></td>
<td>Previous radiographs</td>
</tr>
<tr>
<td>III.</td>
<td>Styloid Process</td>
</tr>
<tr>
<td></td>
<td>No 5th MT – cuboid involvement</td>
</tr>
<tr>
<td></td>
<td>5th MT – cuboid involvement</td>
</tr>
</tbody>
</table>
9 YO very active boy

- Does all sports
- Casted for 5th metatarsal fracture
- Broke cast
- Seen for continued pain
Left foot, 5th Metatarsal Fx
College freshman football athlete.

- Refracture of nonunion, Right foot, 5th metatarsal.

- Initial xrays.
2.5 months post op
2 years post op.
Right Ankle

- Ectopic bone in the plantar fascia. Plantar fascia ossification.
- Surgery:
  - Excision of mass in right calcaneus
15 YO Football Athlete

• Running on Hard Ground
• C/O heel pain walking or running
Calcaneal Stress Fractures
Stress Fractures

CALCANEAL APOPHYSITIS (Sever’s Disease)

- Repetitive microtrauma
- Normal Radiographs
- Sclerosis due to normal multicenter ossification
Accessory Ossicles

- **Specific names**
  - **Os peroneum**
    - In tendon at cuboid level
  - **Os versalianum**
    - Present in 15%
    - Insertion peroneus brevis
    - Usually bilateral
Fig. 19-25. Lateral (left) and anteroposterior (right) drawings of the foot indicating the location of the commonly found accessory bones (circles with numbers) and forefoot sesamoids (shaded circles). (1) Os tibiale externum, (2) processus uncina tus, (3) os intercuneiforme, (4) pars peronea metatarsalia 1, (5) cuboides secundarium, (6) os peroneum, (7) os vesalianum, (8) os intermetatarsaeum, (9) os supratalare, (10) talus accessories, (11) os sustentaculum, (12) os trigonum, (13) calcaneus secundarium, (14) os subcalcis, (15) os supranaviculare, (16) os talotibiale. (Keats, T. E., An Atlas of Normal Roentgen Variants That May Simulate Disease, 2nd ed., p. 371. Chicago, Year Book Medical Publishers, 1979.)
19 YO basketball player Os vesalianum bilateral feet.
Os peroneum
Medial Malleolus
9 YO Female Cheerleader

- Left ankle pain
- Fell from a stunt and has pain and localized bump, medial ankle
- Stress reaction, medial malleolar accessory ossification center
Medial Malleolus

- Left ankle:
  18 yo went up for jump shot & felt pop & sudden onset of pain over medial aspect of ankle
~ 2 weeks post ORIF

~ 2 months post ORIF
Radiographs in ER post injury
Post injury – Salter IV distal tibia nonunion

2 months

4 months
Surgery – 9 months post injury
17 YO Male

- Left ankle pain x3 weeks
- Trying to get in shape, played more basketball than usual
- Possible stress fracture of the medial malleolus
3 months after initial presentation
5 Months after initial presentation
7 months after initial presentation
Small Blue Cell Tumor

Ewing’s sarcoma vs. Lymphoma
CONCLUSIONS

• Know differences of ossicles vs. stress fractures based on physical exam and radiographic appearance
The End . . .  Thank You!

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