Yao’s Bone Fracture
Houston Rockets center Yao Ming suffered a hairline fracture of the navicular bone on his left foot during a playoff game with the Los Angeles Lakers on May 8. Yao may need surgery to insert a pin in the foot, a bone graft or even realignment of the foot.

A bone scan showed that the fracture was not healing properly.
Disclosures:
Reality Check: Sports Foot Ankle Injuries

- 60 million patients/yr
- 22-33% of all football & basketball injuries
  - Drakos et al. Sports Health 2010
- Increasing demands, Great Opportunity
General Exam Pearls …

◦ Expose both legs, knee down
◦ Look at the shoewear, gait, bracing, etc. See what they brought vs. what they say they use or were playing in
◦ Observe patient sitting and standing. Be sure to watch them leave.
◦ Could they ambulate before or after the injury. Did they finish the game? Could they perform at their desired level?
Foot/Ankle Work-Up:

- **HX**: prior /recurrent injury
- **PE**: compare with contralateral limb
- **XR**: always, WB when possible, get joint above and below
- **OTHER TESTS**: CT for Pilon (distal tibia), Calc, Navicular, LisFranc: MRI OCD or tendon tear
- **RX**: Non-Operative splint/PRICE/offload
- **REFER**: in recalcitrant cases
REMEMBER:

◦ The foot is gravity dependent:
  ◦ LONG recovery period: 3 mos to 1 year
  ◦ CHRONIC swelling
  ◦ NEEDS to bear some weight post op
  ◦ BEWARE the neuropathic or non-complaint patients
  ◦ UNPARELLED size/stress ratio:
    ◦ Cannot tolerate small differences like other areas
    ◦ If you screw up Pts will say (insert your name here) with every step …
Some History:

- 1855: Breithaupt German surgeon described stress fracture in soldiers before X ray was invented.
- 1905: Kirschner described radiology findings prior to symptoms appears 2 to 3 weeks earlier.
- 1980s: Stress Reactions with increased uptake and bone edema on MRI and often normal radiograph without fracture line.
### Table 31-1 Ranking of Frequency of Stress Fractures in Running Athletes

<table>
<thead>
<tr>
<th>Location</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tibia</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Fibula</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>–</td>
<td>2</td>
</tr>
<tr>
<td>Metatarsals</td>
<td>3</td>
<td>–</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>–</td>
</tr>
<tr>
<td>Tarsal navicular</td>
<td>4</td>
<td>2</td>
<td>–</td>
<td>4</td>
<td>1</td>
<td>–</td>
</tr>
<tr>
<td>Medial malleolus</td>
<td>6</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Talus</td>
<td>7</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Calcaneus</td>
<td>8</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Sesamoids</td>
<td>5</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Femur</td>
<td>–</td>
<td>4</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Pelvis</td>
<td>–</td>
<td>5</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>


D1, general athletic population; D2, track athletes; D3, distance runners.

Some Numbers:

1 to 7 % in sports injury
80% of which in Lower Extremity: tibia, fibular, metatarsal and calcaneous


Factors Associated with Foot Ankle Stress Fracture:

Table 1. Intrinsic and extrinsic factors related to stress fractures of the foot and ankle

<table>
<thead>
<tr>
<th>Intrinsic Factors</th>
<th>Extrinsic Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cavus feet</td>
<td>Type of activity</td>
</tr>
<tr>
<td>Leg length discrepancies</td>
<td>Excessive/new training regimen</td>
</tr>
<tr>
<td>Excessive forefoot varus</td>
<td>Poor equipment/footwear</td>
</tr>
<tr>
<td>Tarsal coalitions</td>
<td>Improper technique</td>
</tr>
<tr>
<td>Prominent posterior calcaneal process</td>
<td>Type of training surface</td>
</tr>
<tr>
<td>Tight heel cords</td>
<td>Sleep deprivation</td>
</tr>
<tr>
<td>Osteopenia/osteoporosis</td>
<td></td>
</tr>
<tr>
<td>Poor vascular supply</td>
<td></td>
</tr>
<tr>
<td>Abnormal hormonal levels</td>
<td></td>
</tr>
</tbody>
</table>

Stress Fractures of the Foot and Ankle in Athletes

Stephanie W. Mayar, MD,1 Patrick W. Joyner, MD,1 Louis C. Almekinders, MD,1 and Selene G. Parekh, MD, MBA**
The faces of our patients:

- Military Recruits
- Runners
- Dancers
- Female athletes: long distance runner, figure skating, gymnastics
What’s in common?

- Repetitive lower extremity activity with exhaustive training
- CHANGE IN ACTIVITIES: intensity increase
- Bone Insufficiency: female athlete triad
- Poor Conditioning: too much too soon
- Improper Technique
- Change in Surface
- Improper Equipment: wrong type of shoe wear
Table 2. High- and low-risk stress fractures of the foot and ankle

<table>
<thead>
<tr>
<th>High Risk</th>
<th>Low Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medial malleolus</td>
<td>Calcaneus</td>
</tr>
<tr>
<td>Talus</td>
<td>Cuboid</td>
</tr>
<tr>
<td>Navicular</td>
<td>Cuneiforms</td>
</tr>
<tr>
<td>Fifth metatarsal base</td>
<td>Lateral malleolus</td>
</tr>
<tr>
<td>Sesamoid</td>
<td></td>
</tr>
</tbody>
</table>

Stress Fractures of the Foot and Ankle in Athletes

Stephanie W. Mayer, MD,† Patrick W. Joyner, MD,† Louis C. Almekinders, MD,‡ and Selene G. Parekh, MD, MBA§
Spotting Stress Fractures:

- History: increasing pain with activities related to all risk factors
- More History to Know: diet, nutrition, medication, footwear, activities and menstruation
- Physical: ONE LEG HOPPING elicit pain during prodromal, callus formation and point tenderness when osteoclastic resorption & fracture occurs in 2 weeks. Also pay attention to alignment and deformities for underlying pathology
- Imaging: Plain film, CT, MRI vs Bone Scan
Imaging Modalities:

- Plain Film: main stay of imaging however not helpful in early stage when no bony disruption occurs
- Bone Scan: highly sensitive but not specific
- MRI: Sensitive and Specific
- CT: to define fracture line complete vs incomplete however not able to pick up stress reactions
What to Do with Stress Fx?
NonOP management for the Majority of Stress Fractures

◦ Activity modification: Stress Reaction 6 to 8 weeks
◦ CAM boot or Cast
◦ Calcium Vit D: not proven to prevent stress fracture but improve BMD
◦ Bone stimulator: NOT enough evidence
When Considering Surgery:

- What make it HIGH RISK:
  1. Blood supply
  2. Shear force
  3. Location Location Location: Anterior Tibial Stress Fracture, navicular fracture, Jones fracture