Stress Fracture Introduction

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Patient 1: Where is the fracture?
Our Patient

• CM presented with persistent hip and pelvic pain while walking i.e. bone pain
• Bone is tender to touch if palpable – otherwise it is painful on range of motion
Differential Based on History

Differential:

- Tumors (mets, or primary Ewing's)
- Osteoid osteoma
- Osteomyelitis
- Osteomalacia
- Stress fracture
- Shin splints
Menu of Radiologic Imaging Tests to Evaluate Bone Pain

Menu:
1. Plain Films
2. RN Bone Scan
3. Bone CT
4. MRI
Patient 2: Typical RN
Bone Scan with Stress Fractures

“Hot Spots” in common locations

Rockwood and Green’s Fractures in Adults 4th edition 1996
Stress Fractures

• Occur most commonly in lower extremity: metatarsals > calcaneus > tibia
• Uncommon locations are uncommon
• Bone Scan is a sensitive study. As early as 24 hours after injury it approaches 100%
• Plain film findings occur later
Patient 3: Evolution of a Stress Fracture
Stress Fractures

• MRI is both sensitive and specific. A recent study in military recruits examined the accuracy in diagnosing a stress fracture of the femoral neck – a rare type. The MRI was specific for stress fractures differentiating from many other diagnoses like synovial pits, iliopsoas tears, unicameral bone cysts, early AVN, and finally the all too common external obturator tendinitis.
Patient 4: MRI Femoral Neck Stress Fracture

- Transverse Fracture – Unstable
- Tension Fractures Unstable
- Compression Fractures Stable

Patient 5: MRI Stress Fracture of Pubic Ramus T1 Coronal

Note the fracture line and bone marrow oedema
Patient 5 cont.: MRI Stress Fracture of Pubic Ramus on STIR Coronal

Note fracture, bone and surrounding soft tissue oedema
Patient 5 cont.: Stress Fracture of Sacrum – T2 Axial

Incidental finding of a sacral stress fracture
Patient 5: Original Film:
Do you see fracture now?

Highlights that plain films are often inadequate for diagnosing stress fractures.

These were the areas seen to be affected on MRI.
## Distribution of Fractures

### Female Athlete Triad

*in between*

<table>
<thead>
<tr>
<th>Terminology</th>
<th>Stress</th>
<th>Insufficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where</td>
<td>Characteristic places</td>
<td>Anywhere</td>
</tr>
<tr>
<td>Stress</td>
<td>Abnormal or fatiguing</td>
<td>Normal</td>
</tr>
<tr>
<td>Activity</td>
<td>New onset strenuous</td>
<td>New or normal</td>
</tr>
<tr>
<td>Stereotype</td>
<td>Military, amateur marathoner</td>
<td>Elderly Women</td>
</tr>
</tbody>
</table>
Female Athlete Triad

- Some women athletes combine the cause of stress and insufficiency fractures by entering an estrogen deficient state
- Eating disorder, amenorrhea and resultant osteoporosis - due to an effort to minimize body fat.
- Some believe young teenagers with eating disorders are also at risk
Forces and Strength

- Fractures can occur in normal bone subjected to sub maximal, repetitive stresses, OR abnormal bone subjected to even minimal stresses.
- Muscle fatigue may play a role in both of these scenarios by conspiring to expose bone to a greater or different load profiles.
Putative Mechanism

• Any abrupt increase in stress is believed to jumpstart both osteoclastic and osteoblastic activity – So why does the bone fracture?
• The osteoclasts respond more quickly to impulse increases in bone stress. This leads to microfractures which grow to stress fractures - still small when compared to other types of fractures.
References

Wheeless’ Textbook of Orthopedics accessed portal http://www.medmedia.com, slide # 6,8 Stress Fractures

Acknowledgements

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