Management of Stress Fractures

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Outline

• Brief Overview of Stress fractures
  – Prevalence
  – Aetiology – Loading and biomechanics
  – Diagnosis – case studies
• Unloading the Fracture
• Reloading the area
• Accelerating Bone healing
• Assessing and Managing Poor Bone Health
Stress Fracture Prevalence

- 5-10% sports injuries
- 25% shin pan
- 95% lower limb
  - 34% tibia
  - 24% fibula
  - 18% metatarsal
  - 10% neck of femur
- Femoral shaft, patella, navicular, talus, sesamoid, humerus, radius, hook of hamate, metacarpal

(Diehl et al 2006)
Stress Fracture Aetiology

• F > M → ? Bone health
  – Menses, diet, eating d/o, family history

• Volume / load
  – Last 6-12 weeks
  – >10% per fortnight
  – ? Plan / goals

• Previous injuries – overuse, bone stress, weakness, stiffness

• Biomechanics

• Technical (eg cricket bowlers)

• Personality
Biomechanics and Loading

• Forces on initial ground impact (Ounpuu, 1994)
  – Vertical force
    • 2-3 times body weight tibia
    • 4-5 times body weight NOF
  – Force dissipation occurs <200msec
• Subtalar joint is major site of transmission
• Variations in biomechanics effect the timing of the gait cycle and load dissipation
• Hip weakness is a risk factor for NOF bone stress
  – (Schnackenburg 2011)
Stress Fracture Diagnosis

• Clinical
  – History
    • Consider risk factors
    • Beware night pain
  – Examination
    • Hop test
    • Point tenderness

• Investigations
  – Plain films
  – Bone scan, MRI, CT

• Grading
  – Combines the above
Bone Stress
Clinical spectrum

Silent Stress reaction

Stress reaction

Stress Fracture
### MRI and Bone Scan may grade severity (Fredricson et al 1997, 2003)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Periosteal Oedema (T2 images)</th>
<th>Marrow Oedema</th>
<th>Fracture Line</th>
<th>Clinically</th>
<th>Bone Scan</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mild to moderate</td>
<td>None</td>
<td>None</td>
<td>Stress Reaction</td>
<td>None or Mild</td>
</tr>
<tr>
<td>2</td>
<td>Moderate to severe</td>
<td>T2 images</td>
<td>None</td>
<td>Stress Reaction</td>
<td>Mild-mod ?fracture</td>
</tr>
<tr>
<td>3</td>
<td>Moderate to severe</td>
<td>T1 and T2 images</td>
<td>None</td>
<td>Stress Fracture</td>
<td>Moderate</td>
</tr>
<tr>
<td>4</td>
<td>Moderate to severe</td>
<td>T1 and T2 images</td>
<td>Visible</td>
<td>Stress Fracture</td>
<td>Severe transcortical</td>
</tr>
<tr>
<td>Grade</td>
<td>Clinical and Radiological Features</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>--------</td>
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</tr>
<tr>
<td>1 Mild</td>
<td>Post exercise pain only. No medications used. Minor radiological changes.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2 Moderate</td>
<td>Pain during exercise. Possible antalgic gait with exercise. Unicortical features on MRI/Bone Scan.</td>
<td></td>
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</tr>
<tr>
<td>3 Severe</td>
<td>Pain walking. Unable to perform weight bearing sport. Possible transcortical imaging findings with x-ray changes also.</td>
<td></td>
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<tr>
<td>4 Advanced</td>
<td>Rest pain; possible night pain. Using regular medications. Using walking aids. ?Surgical opinion</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Case 1- 52 yo male, groin pain and limp
Obese (BMI 31), FHx osteoporosis
increase walking 3 months
Case 2 – 28 yo female, healthy

- Healthy
- Eating disorder as a teenager
- No amenorrhoea
- Increase distance running
  - 25km /week for 2 years
  - Doubled over 3 months for half-marathon
- Confused about footwear/orthotics
- Weak gluteales
- Getting married 3 months

- Infero-medial SFNOF
- Normal X-ray
Case 3 – 44 yo F
DM, unfit, no exercise, night pain, limp, normal xray
? Bone stress, ? Avascular necrosis, ?OA
Management - Unloading

• Must be pain free with impact
• Crutches – 40% ↓
• Stick – 25% ↓
• Air cast boot – 30% ↓
  – 21 v 77 days RTPlay
  – Swenson, Dickson 2004
  – Alternate training
    • ? HR monitor
  – Bike is 30% less efficient than running

• Alternate training options
  – Bike
  – Cross-trainer
  – Boxing
  – Swimming (care with SFNOF)
  – Paddling
  – Rowing
  – Pool regime
  – Grinder
  – Table tennis!! (170bpm HR max)
Management - Reloading

- Pre-exercise re-assessment
- Calf strengthening especially intrinsic muscles (tibialis posterior)
- Build up endurance and strength before running
- Review gluteal and core strength
- Add in rest days (eg 2/1)
- Never increase volume by >10% per week
Reloading Plan – Moderate Severity Tibial Stress Fracture (Weeks)
Upgrade running by 10% per week (grass? treadmill)
Total volume may reduce by 25% of pre-injury levels

- 1-2  Minimise impact.
- 3-4  Walk for essential activity only.
- 5-6  Walk for extra 20 minutes (=2km if 6 kmph) 3/wk
- 7-8  Walk 30 minutes 3/week
- 9    Walk 5 minutes, jog 5 minutes for 30 minutes
- 10   Walk 3 minutes, jog 7 minutes for 30 minutes
- 11   Walk 3 minutes, jog 7 minutes for 40 minutes
- 12   Walk 5 minutes, jog for 20 minutes, walk 5 minutes (total 30 minutes)
Management – Accelerating Bone Healing

- Bone Stimulation
  - Pulsed ultrasound
  - Vibration plate
- Medication if there is osteopenia or osteoporosis
- Stop smoking!
- Reduce or stop alcohol

6 week OVX DMT v control
Vibration treatment
Factors Known to Retard Fracture Healing (1)

- Smoking
- Vascular compromise
- Injury Severity
- Injury Location
- Anaemia
- Delayed manipulation
- NSAIDS

- Corticosteroids (2)
- Anticoagulants
- Patient Age
- Gender
- Diabetes (3)
- Obesity
- Nutritional Deficiency

Pulsed Ultrasound (LIPUS) and Bone Healing

- Accelerate healing of delayed unions, fresh fracture, and tendon repair
- Low-intensity ultrasound is a mechanical force
  - Low intensity of 30 mW/cm² -> 2mg/cm²
- Schofer et al 2010 (Level 1)
  - 38% accelerated healing rate
  - 101 patients: 51 LIPUS and 50 Sham. Multi-centre RC trial

- Non invasive
- Application over fracture site
- 20 min treatment daily
Vibration Therapy and Bone Healing

- Low magnitude mechanical signals are anabolic and anti-catabolic
  - Type II a muscle and bone
- Post-menopausal women increase BMD (Rubin 2004)
- Children with Cerebral Palsy (Ward 2004)
- Increases bone and muscle in teenagers (Gilsanz 2005)

- No evidence for stress fracture healing
A few words about osteoporosis

• “osteoporosis is a disease characterized by low bone mass and deterioration of bone structure that causes bone fragility and increases the risk of fracture”

• Bone is soft as it lacks bone mineral e.g. calcium

• Bone Density - given a T score (number of standard deviations from normal)

• Nearly two million Australians have osteoporosis and this is expected to rise to three million in 2021

• 40% females; 20% males

• Significant co-morbidity with associated fractures

• 35% of people will not take prescribed pharmacotherapy due to side effects or cost
Osteoporotic Hip Fractures

• 20% die within first year
• 2/3 never regain independence
  – 50% need long term help with ADL
• Increased risk of
  – Falls
  – Further fractures
• Rehab tends to be overlooked
Management
Assess and Manage Poor Bone Health

• At risk patients
• Bone Density Studies
• Blood Tests
  – Biochemistry, Vitamin D (35% adults deficient) , Hormone Analysis
• Diet and Lifestyle Review  www.foodnut.com.au
  – Calcium intake, WB exercise
• Intervention
  – Supplementation, medication, bisphosphonate infusion
• Detailed Education and Review – VERY SERIOUS
Summary

• Stress fractures are common and appear to be increasing in prevalence
• Be suspicious with any lower limb overuse injury with impact pain and failure to respond to non-impact treatments
• Recovery is slow but invariably complete
• Consider associated bone health disorders and address with vigilance
Thank You

• Orthosports Education Team
• Dr Doron Sher