

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 pain
- 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

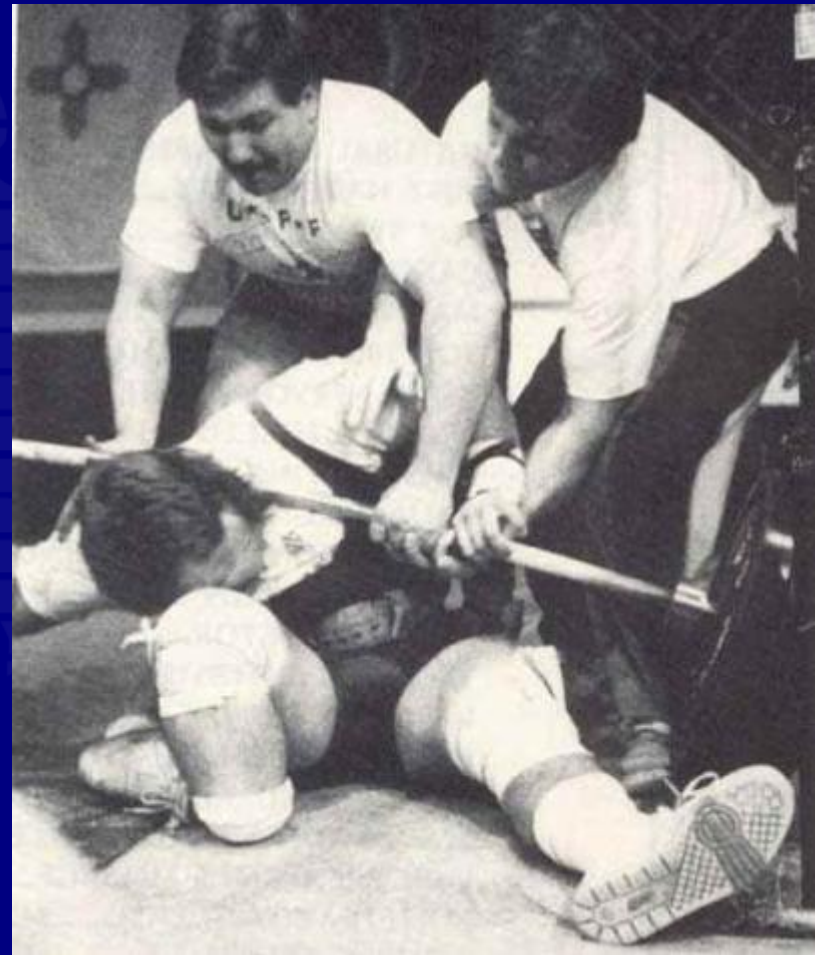


Biomechanics and Loading

- 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



<http://come.to/crashes>

17.04



Bone Stress Clinical spectrum

Silent
Stress
reaction



Stress
reaction



Stress
Fracture



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

Grade	Periosteal Oedema (T2 images)	Marrow Oedema	Fracture Line	Clinically	Bone Scan
1	Mild to moderate	None	None	Stress Reaction	None or Mild
2	Moderate to severe	T2 images	None	Stress Reaction	Mild-mod ?fracture
3	Moderate to severe	T1 and T2 images	None	Stress Fracture	Moderate
4	Moderate to severe	T1 and T2 images	Visible	Stress Fracture	Severe transcortical

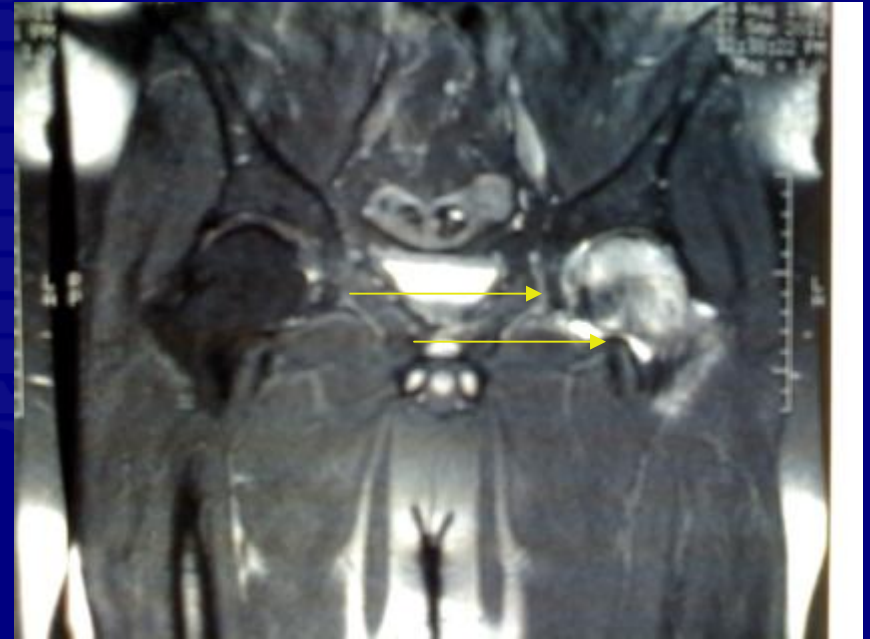
Summary of grading

Grade	Clinical and Radiological Features
1 Mild	Post exercise pain only. No medications used. Minor radiological changes.
2 Moderate	Pain during exercise. Possible antalgic gait with exercise. Unicortical features on MRI/Bone Scan.
3 Severe	Pain walking. Unable to perform weight bearing sport. Possible transcortical imaging findings with x-ray changes also.
4 Advanced	Rest pain; possible night pain. Using regular medications. Using walking aids. ?Surgical opinion



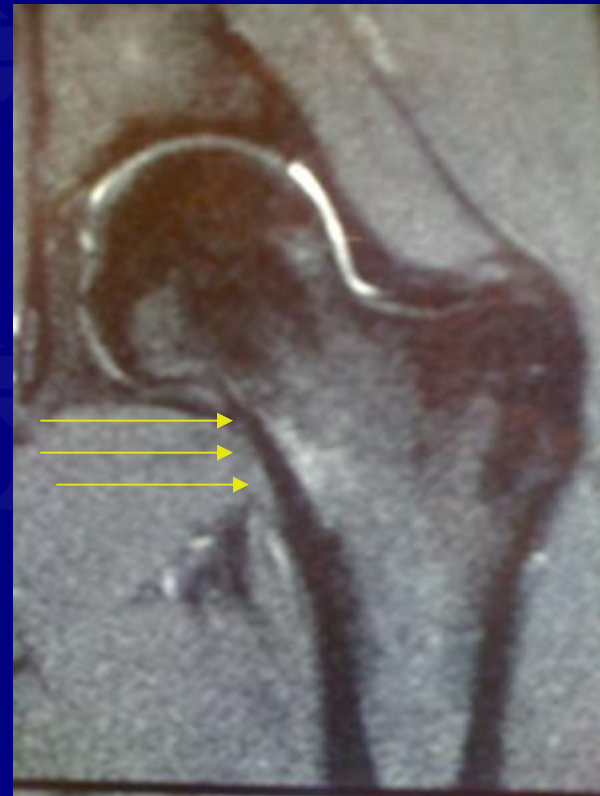
Case 1- 52 yo male, groin pain and limp

Obese (BMI 31), FHx osteoporosis
increase walking 3 months



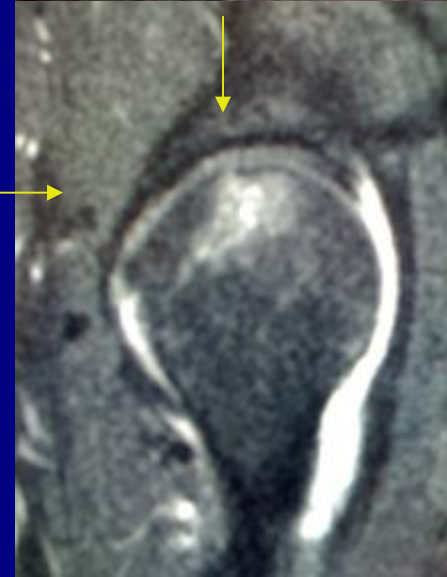
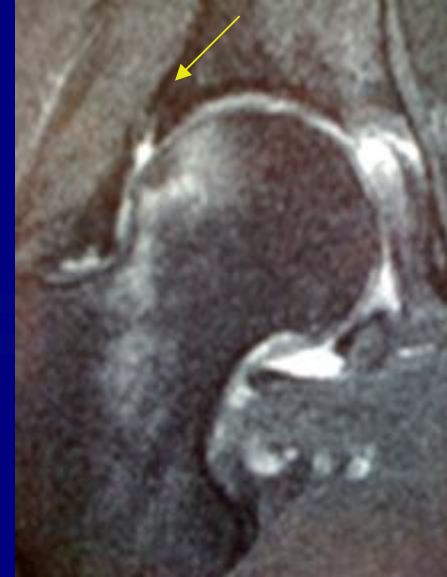
Case 2 – 28 yo female, healthy

- 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 glutealis
- 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)

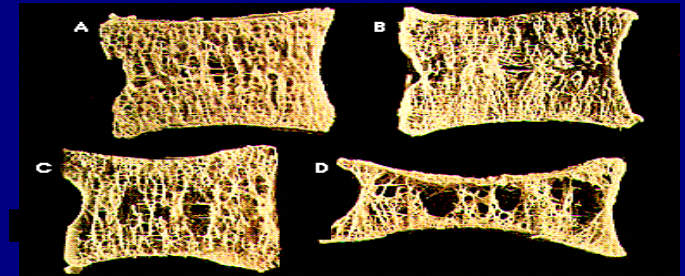
Upgrade running by 10% per week (grass? treadmill)

Total volume may reduce by 25% of pre-injury levels

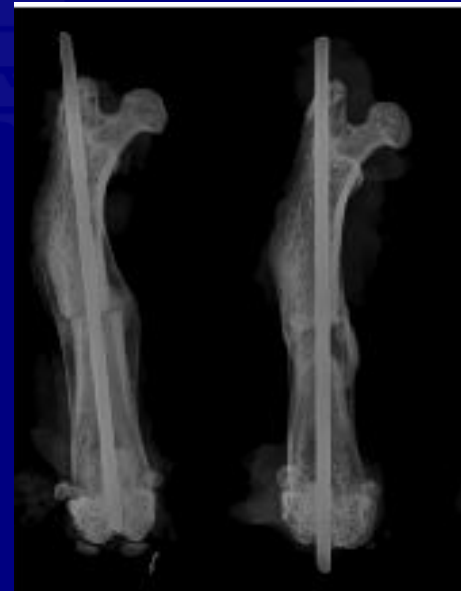
- 1-2 Minimise impact.
- 3-4 Walk for essential activity only.
- 5-6 Walk for extra 20 minutes (=2km if 6 kmph) 3/wk
- 7-8 Walk 30 minutes 3/week
- 9 Walk 5 minutes, jog 5 minutes for 30 minutes
- 10 Walk 3 minutes, jog 7 minutes for 30 minutes
- 11 Walk 3 minutes, jog 7 minutes for 40 minutes
- 12 Walk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

Source: (1) Rockwood, CA, Jr., et al., Rockwood and Green's Fractures in Adults, Philadelphia: JP Lippincott Company, 1994. (2) Bockman, RS and Weinerman, SA, Steroid-induced osteoporosis, The Orthopedic Clinics of North America, Vol. 21, No. 1, pp. 97-107, 1990. (3) Mathiassen, B, et al., Long-term bone loss in insulin-dependent diabetes mellitus, Journal of Internal Medicine, Vol. 227, pp. 325-327, 1990

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 $30 \text{ mW/cm}^2 \rightarrow 2 \text{ mg/cm}^2$
- 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

