Avascular Necrosis of the hip

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Osteonecrosis

- Disease entity?
- Final common pathway?
Definition
Definition

• Death of bone from ischaemia
Definition

• Reduction in O2 supply below that required to sustain life in the cellular component of bone
Cellular survival
Cellular survival

- Marrow cells: 5 - 6 hours
- Osteocytes: 12-48 hours
Incidence
Incidence

- Peak age 40 - 50 years
Site

- Proximal femur
- Distal femoral condyle (Medial)
- Proximal humerus
- Talus

- Lunate, capitellum, metatarsal heads
Hip Joint

- Fracture
- Dislocation
- Non traumatic
Fracture

- Undisplaced fractures 16%
- Displaced fractures 27%

Controversy: does delay in treatment change outcome?
Dislocation

- Reduced in < 12 hours  20% AVN
- Reduced in > 12 hours  50% AVN
- Increased risk of AVN with Posterior dislocations
Aetiology

- Traumatic
- Non Traumatic
Traumatic

• Disruption of the blood supply

• Hip, analogous to scaphoid, talus, lunate
Non Traumatic

- Idiopathic
- Infection
- Irradiation
- Haemoglobinopathies
- Gauchers
- Caissons
- Drugs
- Others
Idiopathic

- Adult Diagnosis by exclusion
- Children Perthes
Caissons

• Super-saturation of tissue with Nitrogen

• Decompression leads to bubble formation
Caissons

- Only 10% deep sea divers with AVN have history of the ‘Bends’

- 17% of compressed air workers have radiological lesions - 50% juxta-articular
Bone Death in Caissons

- Intravascular obstruction
- Extravascular compression
- Extravascular thrombosis
Caissons

• Lesions silent

• Prevention:
  – Decrease period at pressure
  – Rate of decompression
  – Number of exposures
Gauchers

• Enzyme deficiency
  – glucocerebrosidase accumulation in macrophages of cell constituents
  – Askinazi Jews
  – Polyhedral Gaucher cells in liver spleen and marrow
  – Pressure on sinusoids causes necrosis
Gauchers

- Lesions tend to become infected

- Expansion of bones because of replacement of myeloid tissue leads to Erlenmeyer Flask appearance of distal femur

- Treat: As per other causes
Blood Dyscrasia

• Sickle Cell

• HbSS - infarcts due to clumping obstruction
  – HbSA - under extremes of de-ox e.g. GA

• Infection - Salmonella - Why?
Sickle Cell

• X Ray:
  – Irregular endosteal destruction
  – Medullary sclerosis and calcification
  – Isotope scan - asymptomatic decreased uptake

• Treatment
  – Prevention
Drug induced necrosis

• **STEROIDS**
  – Renal transplant pt. - AVN 16%

• Alcohol
  – Greater than 175mg per day

• Both associated with hyperlipidaemia
Drug induced necrosis

- Fat embolism
- Marrow fat distension
- Increased intra-osseous pressure
- Stop insult
Classification

- Ficat and Arlet - Modified (Know)
- Steinberg - Research
- Ono - Research

Site and size of lesion
Pathology

Stages

1. Bone death without structural change
2. Repair and structural failure
3. New bone formation and continuing collapse - Cartilage OK
4. Secondary cartilage distortion and damage
Pathology

- Empty lacunae
- Dead trabecular bone up to chondral plate
- Crescent sign
  - Separation of cancellous bone from subchondral plate
  - Best viewed on lateral film
‘At Risk’ Bones

- Femoral head
  - Watershed

- Characteristic of bones involved
Clinically

• At Risk
  – Steroids, renal transplant, sickler etc

• Present with PAIN
  – Nagging, throbbing, deep, gradual
  – Worse at night
  – 6-8 weeks duration then subside
Investigations

- X Rays - normal or abnormal
- MRI - clinical suspicion or at risk
- Isotope Bone Scan
Radiographs

- Normal
- Increased bone density
- Crescent sign
- Combined necrotic angle (>200°)
Bone Scan

- Cold area - early stage (14-21 days)
- Later warm due to vascularisation
- 75-80% sensitivity pre collapse
- Warm both sides - OA
MRI

- Marrow changes first
- Early - decreased signal (T1)
- T2 image - Double line sign
  - (Vascular regeneration)

- 100% sensitivity, 98% specificity
MRI

• Shimizu:
  – 1/4 of head
  – 2/3 weight bearing surface

• 3/4 collapsed within 3 years
Treatment

• Must be better than natural history
Natural History

- 21 Studies  819 hips  F/U 34 months

- Various WB status
  - Stage 1  35%  (84%)
  - Stage 2  31%  (65%)
  - Stage 3  13%  (47%)

- (24 studies, 1206 hips, 36/12 f/u - Core Decompression)
Core decompression

• Bone a compartment
• Functional evaluation
Treatment

- Prevent, eliminate insult
- Investigate
- Stage IV Total hip
Stage 0, 1, 2, (3)

- Non-operative
  - Observe
  - Protect weight bear
  - Electrical stimulation (FDA°)
  - Drugs (Hydergine, Nifedipine, Stanazol)

- Operative
Operative

- Core decompression
- Non Vascularised grafts
- Vascularised grafts
Vascularised grafts

• Urbaniak criterion
  – Age <50
  – Not if embolic
  – Stage II - III disease (No collapse)
Stage III

- **Osteotomy**
  - Sugioka - High failure rate
  - May compromise THR

- **Arthrodesis**
  - but 50% bilateral

- Treat conservatively ‘till THR or ...
Stage III

• Controversial
  – Dorr et al: 91% failure of THA at 12 years
  – Smith et al: 70% failure of cortical struts at 14 years
  – Itoman et al: 39% failure of graft via neck at 9 years
Stage III - other options

• Trapdoor procedure

• Early results:
  – Meyers - 8/9 good at 3 years
  – Mont - 8/10 good at 4 years
THR

• High failure rate in several studies
  – Young
  – Diseased femora

• Await long term results of other procedures
  – THA meanwhile
Summary

• Pre collapse
  – Protect weight bear
  – Core
  – Experimental procedure

• Post collapse
  – Experimental procedure
  – Await THR
Questions