**MR Imaging of Physeal Bars**

**Introduction:**
- Growth plate injuries = common
- Only a small proportion lead to physeal bars
- May result in significant deformity
- Prognosis and treatment depends on the extent
- MRI best modality for extent

**What is a physeal bar?**
- Insult to growth plate
- Formation of a fibrous / bony ‘bridge’
- Arrest of growth at the bar leads to:
  - deformity – depends on extent / position (angulation of limb)
  - or limb length discrepancies

**Classification:**
- Ogden Classification – 3 types
  - Type I = peripheral
  - Type II = extending across physis
  - Type III = central (ie surrounded by normal physis)
Ogden Classification:

- Type 1
- Type 2
- Type 3

Causes:
- Trauma - includes iatrogenic
- Infection - Meningococcus
- Radiation
- Tumours
- Thermal Injuries
- Vascular Injuries
- Corticosteroid Therapy
- Others eg Ollier’s, Eosinophilic Granuloma, Idiopathic

Imaging:
- Previously CT or Tomography (miss / underestimate)
- MRI: modality of choice
- Gradient Echo: best
- Normal growth plate = high signal
- 3D mapping of the physis

Importance of Accurate Imaging:
- Several surgical options available
- Accurate assessment of location extent needed
- 3D mapping:
  - accurate percentage
  - ‘road map’

Trauma
- Salter Harris fractures
- Higher grades = increased risk
- Plain film and CT underestimate the grade
- About 50% upgraded by MRI

Salter-Harris Classification:

- Type 1
- Type 2
- Type 3
- Type 4
- Type 5
Infection

- Usually Meningococcus
- Insult due to vasculitis - ischaemia
- Systemic disease = multiple sites

Our Study:

- Unique due to number of Meningococcus
- 6 patients: post infective bars (12 bars)
- 9 patients: post traumatic bars (9 bars)
- Gradient echo MRI
- Manual mapping of the physis

Comparison: Site/Extent

- Trauma single, infection multiple
- Infection greater extent
- Trauma: distal end of long bones
- Other causes: proximal end
- Lower limbs more affected in all

Comparison: Imaging Features

- Post infective: more physeal irregularity
- Post infective: epiphyseal distortion
- Both:
  - 'Flame shaped' projections of cartilage
  - Metaphyseal growth recovery lines
Post Infective Gradient Echo

Post Traumatic T1 WI

‘Flame Shaped’ Metaphyseal Projections Gradient Echo T1 WI

Mapping of the Physis
- Manually:
  - Divide into Sagittal and Coronal segments
  - Transpose segments onto axial map
  - Rough estimate of involved percentage
  - Time consuming

Mapping of the Physis
- Alternative = 3D reconstruction software
  - Growth plate outlined on coronal segments
  - Physeal bar also outlined
  - Calculate an accurate percentage
  - Provide a detailed map of the physis
  - Much less time consuming

3D Mapping of the Physis

Sailhan et al Eur Rad 2004

Three-dimensional MRI images in the assessment of physeal growth arrest
Sailhan et al Eur Radiol 2004
Use of DESS Sequence:

- Double Echo in Steady State
- Gradient echo optimized for cartilage
- Thin slices = multi-planar reconstruction
Conclusion:
- Physeal bars relatively uncommon
- Can lead to severe deformities
- Accurate assessment necessary for surgery
- Gradient echo MRI and 3D physeal mapping
- DESS sequences:
  - Good cartilage visualization
  - MPR

The End