Can rickets be confused with NAI?

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Rickets

8 months later
Distal tibia in 5 month old
Healing CML

- Little haemorrhage (and SPNBF)
- Resorption causes lucency along fracture line
- Inconspicuous sclerosis along fracture
Healing proximal tibial CML

**initial**

**2 weeks later**
Long-bone fracture
Rickets
Pathological fracture
Pathological fracture 2 weeks later
Rickets mimicking NAI
Rickets mimicking NAI: rachitic changes
Keller and Barnes 2008

• Vitamin D deficiency is extremely common among mothers and infants all over the world
• Metaphyseal changes and ‘Looser zones’ in neonatal rickets may mimic NAI
• Four cases given of infants with no history of trauma and unexpected bone changes attributed to NAI
• Suggestion that these infants had rickets, not NAI
NAI or rickets?
Keller and Barnes 2008
NAI or rickets?
Keller and Barnes 2008
‘Looser zones’ in rickets
Silverman 1985: Caffey’s pediatric X-ray diagnosis
Criticisms of Keller and Barnes

- Slovis and Chapman 2008
  - Weak supporting evidence and subjectivity in radiographic identification of rickets
  - None of K&B’s patients had generalised signs of rickets
  - Selection bias
  - None of the children had documented vit D levels
  - No increase in neonatal fractures to accompany the vitamin D deficiency epidemic
Criticisms of Keller and Barnes

- Feldman 2009
  - Serious misrepresentations of clinical scenarios
    - Head injuries, cervical spine injuries, numerous fractures, etc
  - Serious conflict of interest (‘defence’ witnesses)
  - Non-disclosure of the (medicolegal) sources of their patients
Chapman 2010

- Review of 45 children under 2 y with radiographic rickets or raised alk phos
- 17% had fractures
- These all occurred in children over 6 mo old
- Easily distinguishable from injuries of NAI
Chapman 2010
Fractures in rickets

After treatment
Schilling et al 2012

165 children under 2 admitted to hospital with fractures

118 enrolled in study

8% vitamin D deficient, 31% vitamin D insufficient

60% of fractures innocent, 31% NAI, 9% indeterminate
Schilling et al 2012

- Children with rib fractures had higher PTH
  - Younger
- Children with metaphyseal fractures had similar vitamin D levels to those without
- Abused and non-abused children had similar vitamin D levels
Perez-Rossello et al 2012

365 children identified from larger study

45 had vitamin D deficiency

40 of those returned for wrist and knee radiographs
• Results
  – Definite rickets present in only 2/40
  – 24 indeterminate cases
    • $\kappa = 0.33$ for interobserver agreement of rachitic changes
    – $\kappa = 0.37$ for presence of definite demineralisation
    – Best biochemical predictor of rickets was alkaline phosphatase
  – No fractures
Mild rickets
Perez-Rossello et al 2012
Perez-Rossello et al 2012

Conclusions

• In asymptomatic vitamin D deficiency:
  – Rachitic changes rare
  – Fractures very rare (none found)

• Poor agreement among radiologists for mild changes of rickets and demineralisation
Overall conclusions

- There has been much debate about possible confusion between rickets and NAI
- Recent research has shown that vitamin D insufficiency is very common
- Fractures are not commoner in children without radiographically obvious rickets
- No correlation has been found between vitamin D deficiency and injuries due to NAI