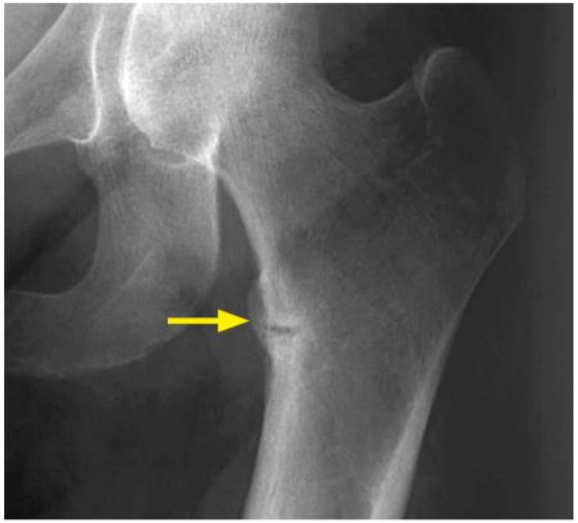
# Osteomalacia

- **B**one softening due to insufficient mineralization of the osteoid.
- Secondary to any process that results in vitamin D deficiency or defects in phosphate metabolism:
- Abnormal mineralization of osteoid in trabecular and cortical bone
- Best diagnostic clue
  - Child: growth plates (physes) wide, frayed, and cupped
  - Adult: Looser zones (late finding), smudgy trabeculae
- Location
  - Common physes involved: distal radius and ulna, distal femur, proximal and distal tibia, proximal humerus, ribs
  - Common sites of Looser zones: lateral border scapula, medial femur, posterior ribs, pubic and ischial ram

## Osteomalacia



Osteomalacia:

Frontal radiograph of the hip demonstrates an incomplete linear lucency (arrow) through the medial (weight-bearing) proximal femur, representing a Looser zone.

*Case courtesy Stacy Smith, MD, Brigham and Women's Hospital.*

- Osteomalacia is faulty mineralization of bone matrix caused by vitamin D deficiency. The same process is called osteomalacia in adults and rickets in children. Rickets is discussed in the pediatric imaging section.
- Osteomalacia manifests as diffuse osteopenia; however, a *Looser zone* (pseudofracture) is highly specific. A *Looser zone* is a cortical stress fracture that is filled with abnormal, poorly mineralized osteoid and appears as a radiolucency through the cortex. Common sites for *Looser zones* are the medial proximal femurs, distal scapulae, and pubic bones.
- Osteomalacia may be complicated by insufficiency fracture.

# Etiology

- Vitamin D deficiency (most common)
  - inadequate intake or absorption
    - dietary deficiency of vitamin D
    - lack of sunlight exposure
    - gastric surgery (e.g., gastrectomy or gastric bypass)
    - small bowel disease (e.g., Crohn disease, celiac disease)
    - pancreatic insufficiency (e.g. cystic fibrosis)
  - deficiency of vitamin D metabolism
    - cirrhosis (25-hydroxylation of vitamin D)
    - chronic kidney disease (1-hydroxylation of 25-vitamin D)
    - cytochrome P450 inducers (e.g. phenobarbital, antiepileptic drugs)
- Phosphate deficiency
  - inadequate intake or absorption
    - antacids
  - renal phosphate wasting
    - hereditary hypophosphatemic rickets
    - Fanconi syndrome
    - tumor-induced (oncogenic) osteomalacia, most commonly due to phosphaturic mesenchymal tumor
- Decreased deposition of calcium in bone
  - bisphosphonates (for the treatment of Paget disease)

# Osteomalacia, with Looser zone

Looser's zones are incomplete stress fractures which heal with callus lacking in calcium

# Looser zone