

18th GRANDROUND MUSCULOSKELETAL ONCOLOGY
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BONE DESTRUCTION AND ITS TYPES

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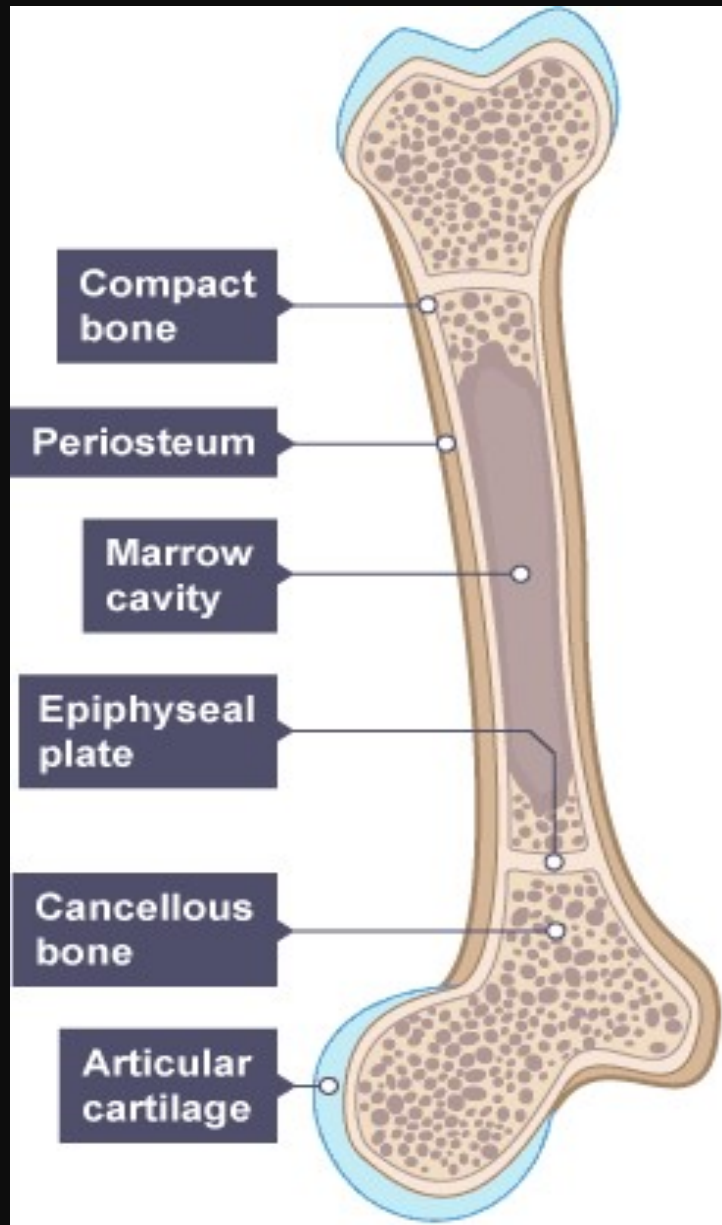
Denpasar

Overview

- Underlying process of bone destruction
- Type of bone destruction
- Cortical disturbance
- Cases
- Take home message

UNDERLYING PROCESS OF BONE DESTRUCTION

- Different patterns of bone destruction → caused by a variety of disease process affecting the bone.
- Type of destruction → Intensity of bony involvement
Aggression of the disease
Ability of host bone to repair
- Age of patient must be considered when the lesions are evaluated.



Bony destruction → osteoclasts resorptive activity on both the cortical and cancellous bone surfaces

- **Destruction of cortical bone :**

Seen more easily → because of the great contrast density between a local area of lysis as compared to cancellous bone

- **Destruction of cancellous bone :**

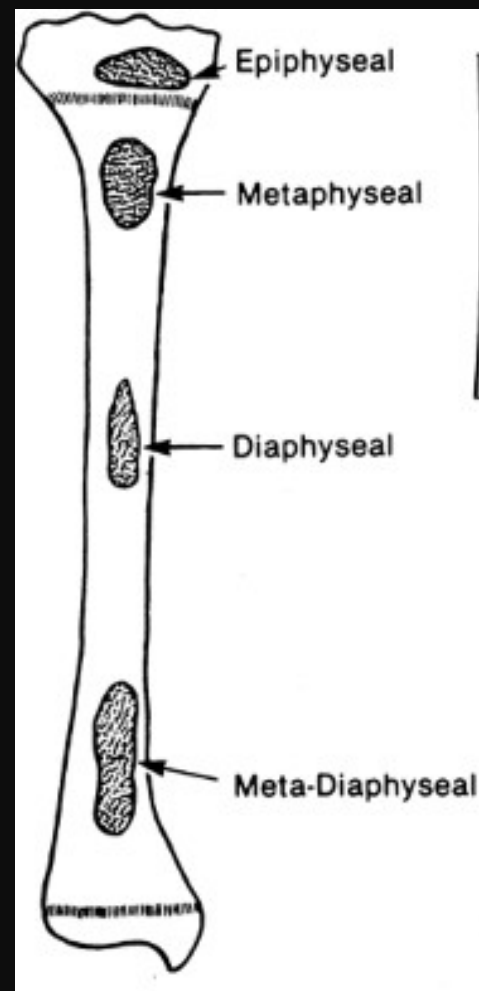
A large amount of cancellous bone must be destroyed before the loss will be evident on plain radiographs → lesions arising in cancellous bone may go undetected for long periods of time

Specific sign must be considered in this order of priority :

- The pattern of bone destruction
- Zone of transition of the lesion
- Penetration of bone cortex by the lesion
- The presence or absence of a sclerotic rim
- The presence and extent of an expanded cortical shell

Age and location of bone destruction

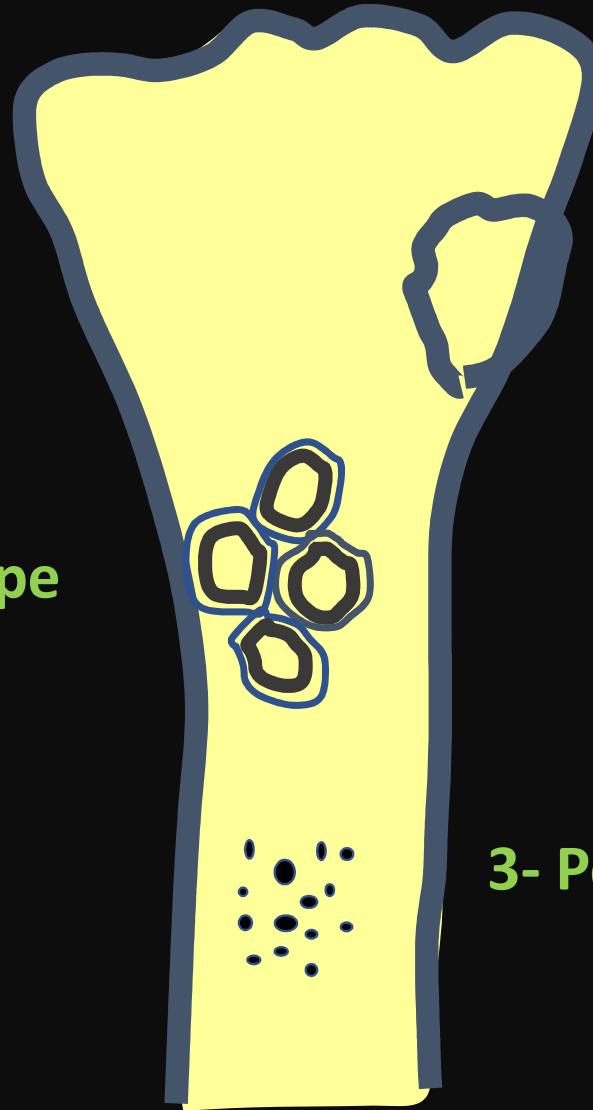
- Age of patient
- Location within the bone
 - Epiphyseal, metaphyseal or diaphyseal
 - Central within the bone, eccentric or cortical
 - Within specific bones or within specific areas of that bone



TYPE OF BONE DESTRUCTION

LODWICK CLASSIFICATION

2- Moth eaten type



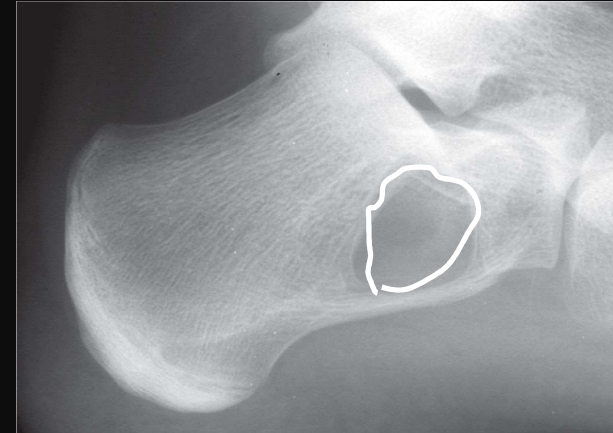
1- Geographic type

A
B
C

3- Permeative type

Geographic Bone Destruction

- The **least aggressive**
- Indicative of a **slowly growing lesion**
- Well-defined
- Easily separated from the surrounding normal bone → **narrow zone of transition (can be drawn by a fine-point pen)**
- A sclerotic margin of variable thickness surrounds the lesion
- **The thicker and more complete the sclerotic margin, the less aggressive the process.**



Geographic Bone Destruction...

Three subtypes :

A—Geographic lesions with sclerotic margin

B—Geographic lesions without sclerotic margins

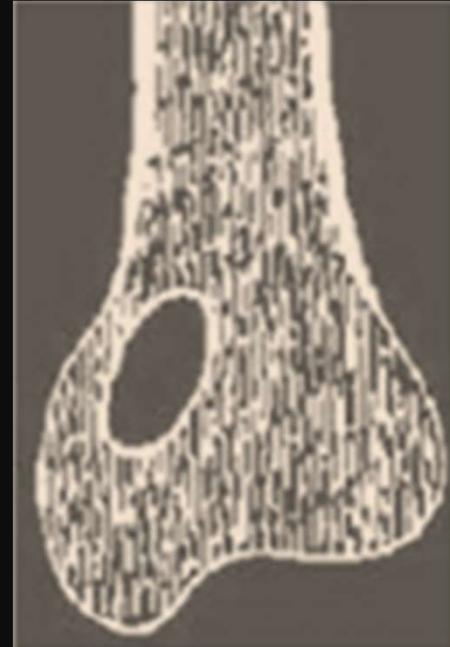
C—Geographic lesions with ill-defined margins

The relative biological aggressiveness increases from type A to C



IA—Geographic lesions with sclerotic margin

- Benign
- Slow-growing disorders
 - Unicameral bone cyst
 - Non—ossifying fibroma
 - Enchondroma
 - Chondromyxoid fibroma
 - Chondroblastoma
 - Fibrous dysplasia



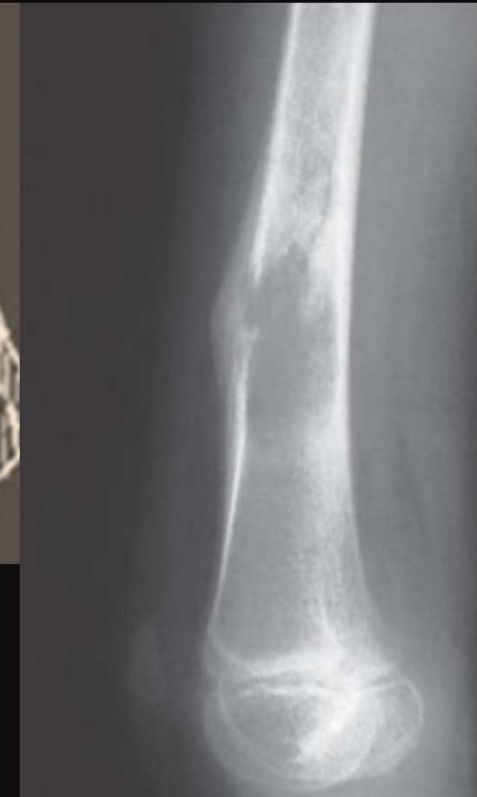
IB -Geographic lesions without sclerosis margin

- Sharply defined edges but no sclerotic margins.
- Normal trabeculae are present up to the edge of the lesion but totally removed along a plane of contact between the tumor and normal bone.
- Giant cell tumors



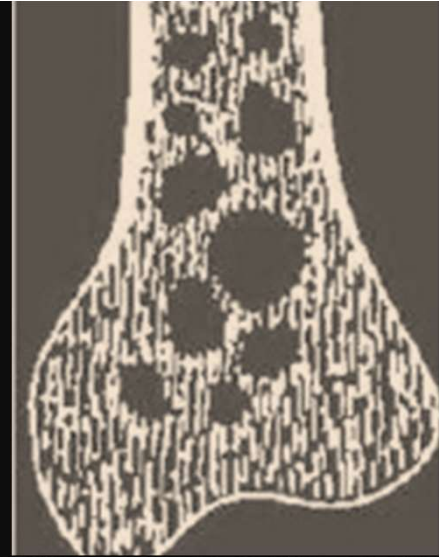
IC - Geographic lesions with ill-defined margins

- Focally destructive but also **locally infiltrative**
- The disease spreads more than visible lytic lesion
- Creates **a wider zone of transition** at the margin of the lesion → less well-defined.
- If a **soft tissue mass** present → indicates **complete cortical penetration**
- **GCT, fibrosarcoma, chondrosarcoma.**
- Aggressive form enchondroma, chondroblastoma, desmoplastic fibroma



Moth Eaten Bone Destruction

- A **more aggressive** pattern of bone destruction
- Lesion that is growing more rapidly
- A **less well-defined** lesion margin
- A longer zone of transition from normal to abnormal bone.
- Consists of **multiple scattered holes** that vary in size and seem to arise separately → coalesce to form larger areas of bone destruction.

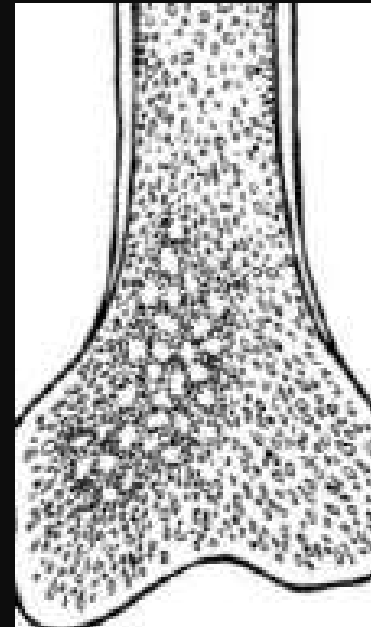


Moth Eaten Bone Destruction...

- Frequently seen with malignant neoplasms :
 - Ewing's sarcoma
 - Primary lymphoma of bone
 - Chondrosarcoma
 - Fibrosarcoma
 - Osteosarcoma
- The aggressive form of osteomyelitis
- Some benign processes: EG

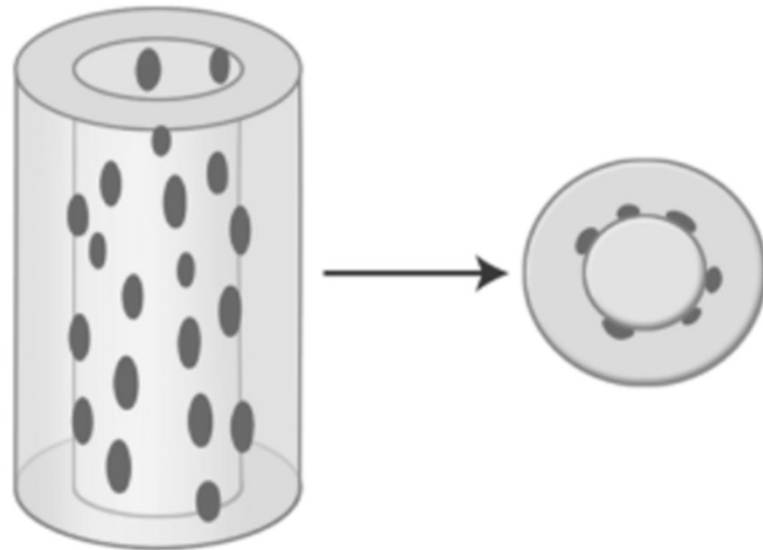
Permeative Bone Destruction

- An **aggressive** bone lesion with **rapid growth**
- **Poorly demarcated** lesion
- Not easily separated from the surrounding normal bone (**wide zone of transition**).
- Its true size is larger than that evident on radiographs.

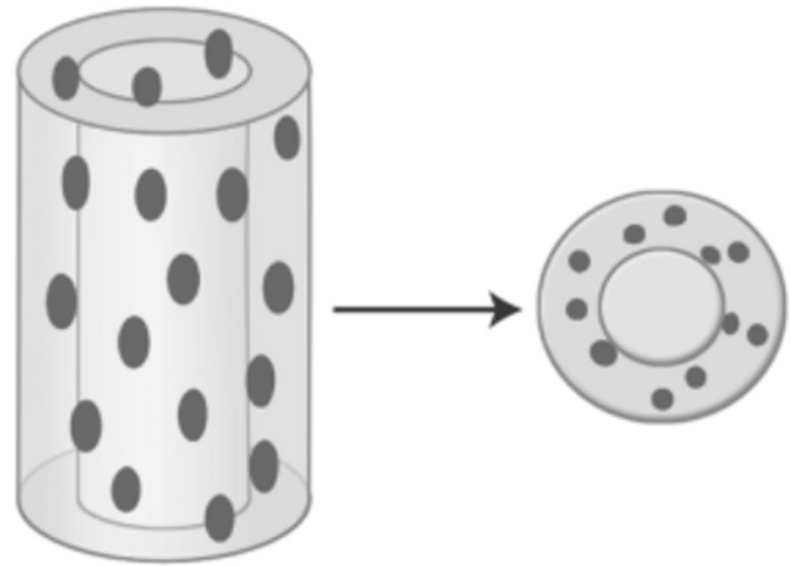


Permeative Bone Destruction...

- Neoplastic, mechanical inflammatory, metabolic
- Malignant lesion → tend to infiltrate the marrow space diffusely
(primary round cell tumors, fibrosarcoma, high-grade chondrosarcoma, and angiosarcoma)
- An occasional benign process : osteomyelitis



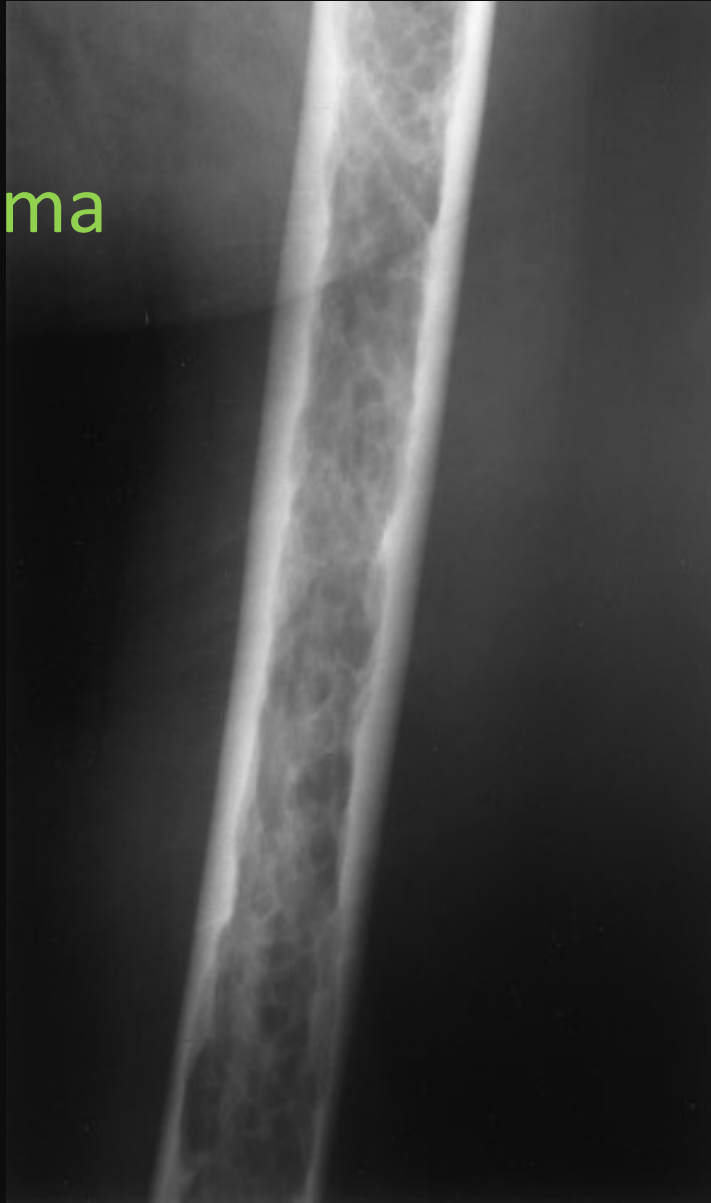
A Permeative



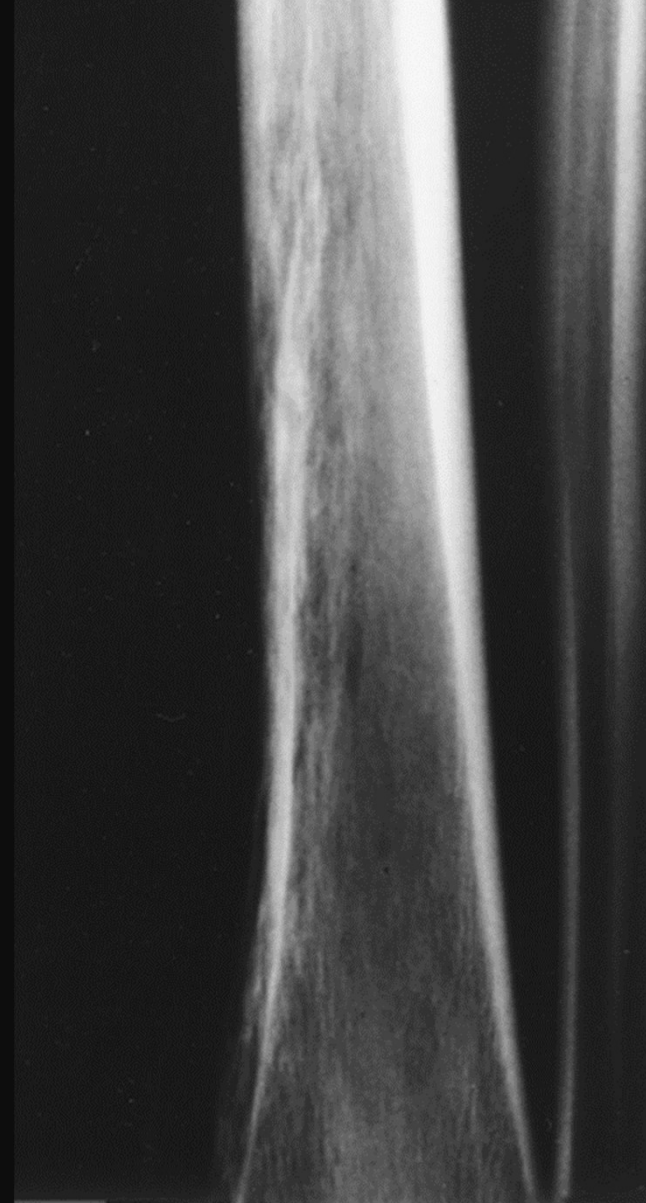
B Pseudopermeative

Figure 44.5. Differentiation of Permeative Process. A. Schematic of a permeative lesion. A true permeative process has multiple small holes secondary to endosteal involvement with sparing of the cortex. This represents a marrow process. B. Schematic of a pseudopermeative process. A pseudopermeative process such as osteoporosis has multiple small cortical holes that are then superimposed over the marrow, giving a similar appearance to a permeative process.

Myeloma



Hemangioma



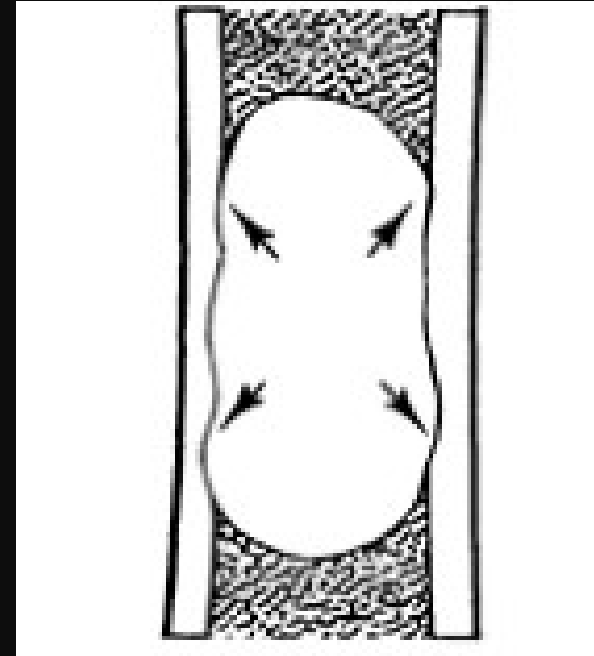
Combination of Patterns of Bone Destruction

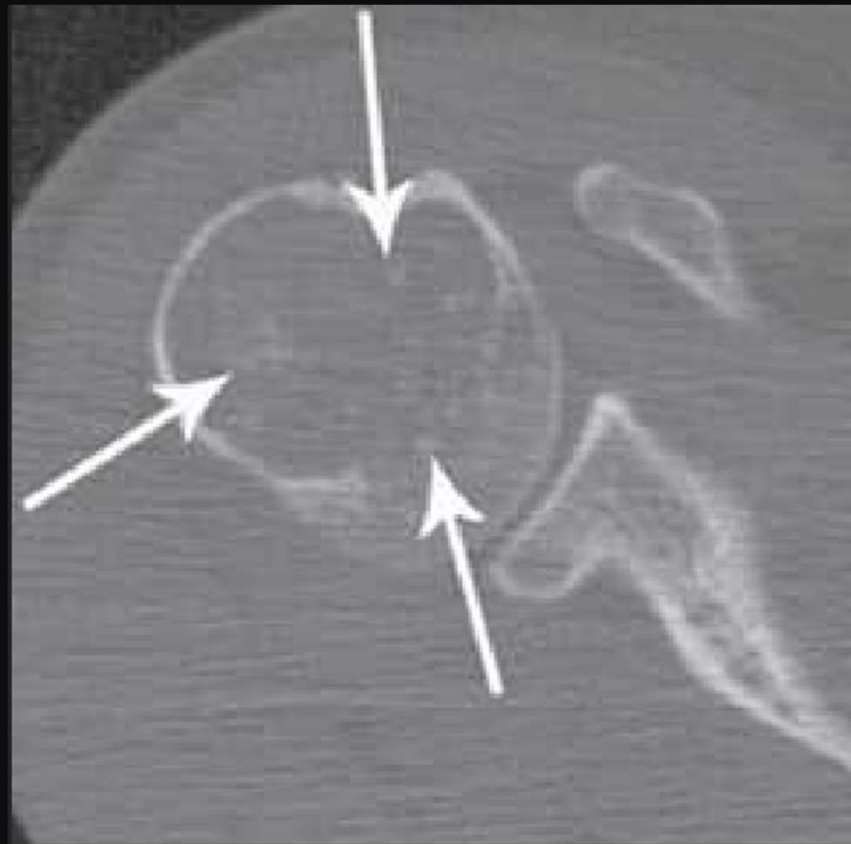
- Any combination of geographic, 'moth-eaten', and permeative patterns in a single lesion → indicates **a change towards a more aggressive local growth.**
- When benign lesions become **more active**, undergo **malignant degeneration**, or **fracture.**
- Documented by observing a sequence of radiographs

PATTERN OF CORTICAL DISTURBANCE

ENDOSTEAL SCALOPPING

- Focal resorption of the inner layer of the cortex (the endosteum) of bones, most typically long bones, due to slow-growing medullary lesions.
- Benign: $< 1/3$ Cortical thickness
- Malignant : $> 2/3$ cortical thickness

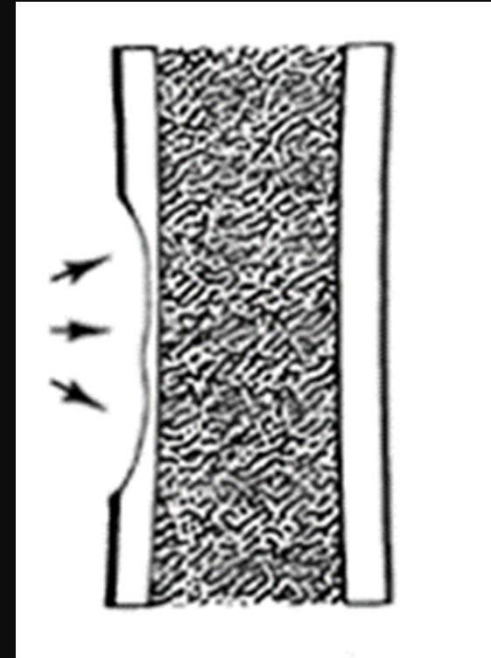




Murphey et al. RadioGraphics 2003;23: 1245-78

SAUCERIZATION

- Lesions arising in the periosteum or adjacent to the cortex cause a shallow erosion of the external surface of the cortex
- Ewing's tumor and periosteal osteosarcoma.



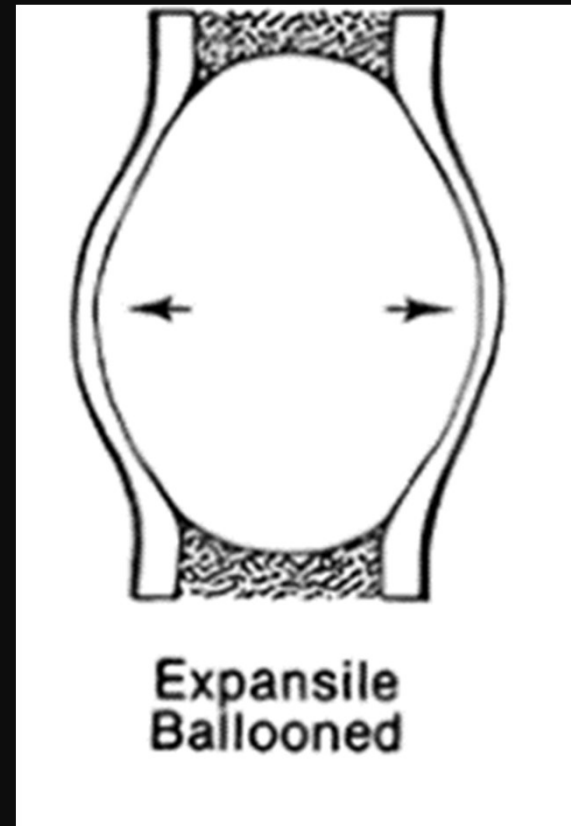
Ewing Sarcoma



[AJR Am J Roentgenol. 2015 Sep; 205\(3\): 640–651.](#)

Expansile Ballooned

- **Destruction** of endosteal cortical bone + **addition of new bone** on the outside, occur at the same rate → expansion.
- This '**neocortex**' can be smooth and uninterrupted, but may also be focally interrupted in more aggressive lesions like GCT.

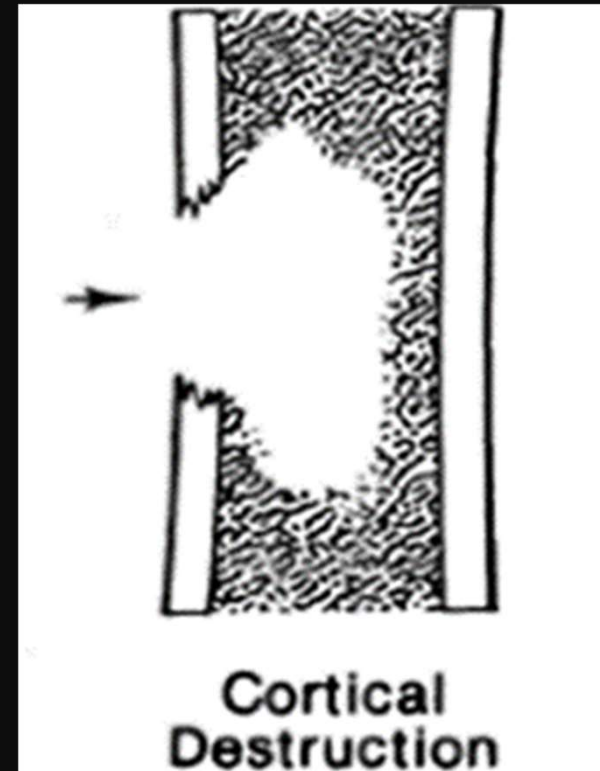


GCT



Cortical destruction

- Complete destruction :
 - High-grade malignant lesions
 - Locally aggressive benign lesions (EG and osteomyelitis)
- More uniform cortical bone destruction:
 - Benign lesion
 - Low-grade malignant lesions



CASES

UBC



<https://reference.medscape.com/article/395783-overview>

FCD



https://openi.nlm.nih.gov/detailedresult.php?img=PMC3389949_poljradiol-76-4-32-g002&req=4

NOF



<https://emedicine.medscape.com/article/389590>

FD



20 yo

Chondromyxoid fibroma





CHRONIC
OSTEOMYELITIS

Enchondroma



<https://emedicine.medscape.com/article/389224>

Chondroblastoma



<https://radiopaedia.org>

Intraosseus Lipoma :

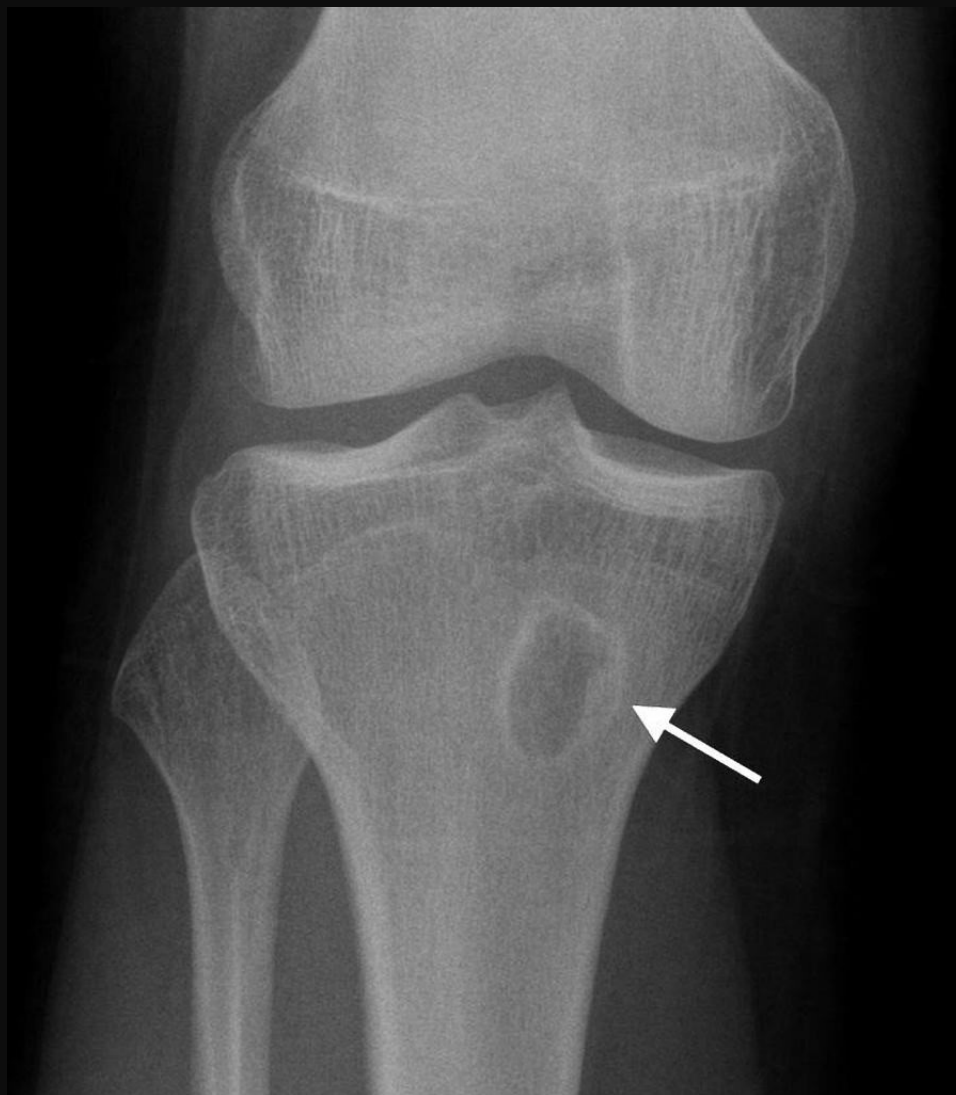
Target sign



Calcaneal lipoma

<https://www.mypacs.net/cases/>

Brodie Abscess



<https://radiopaedia.org>

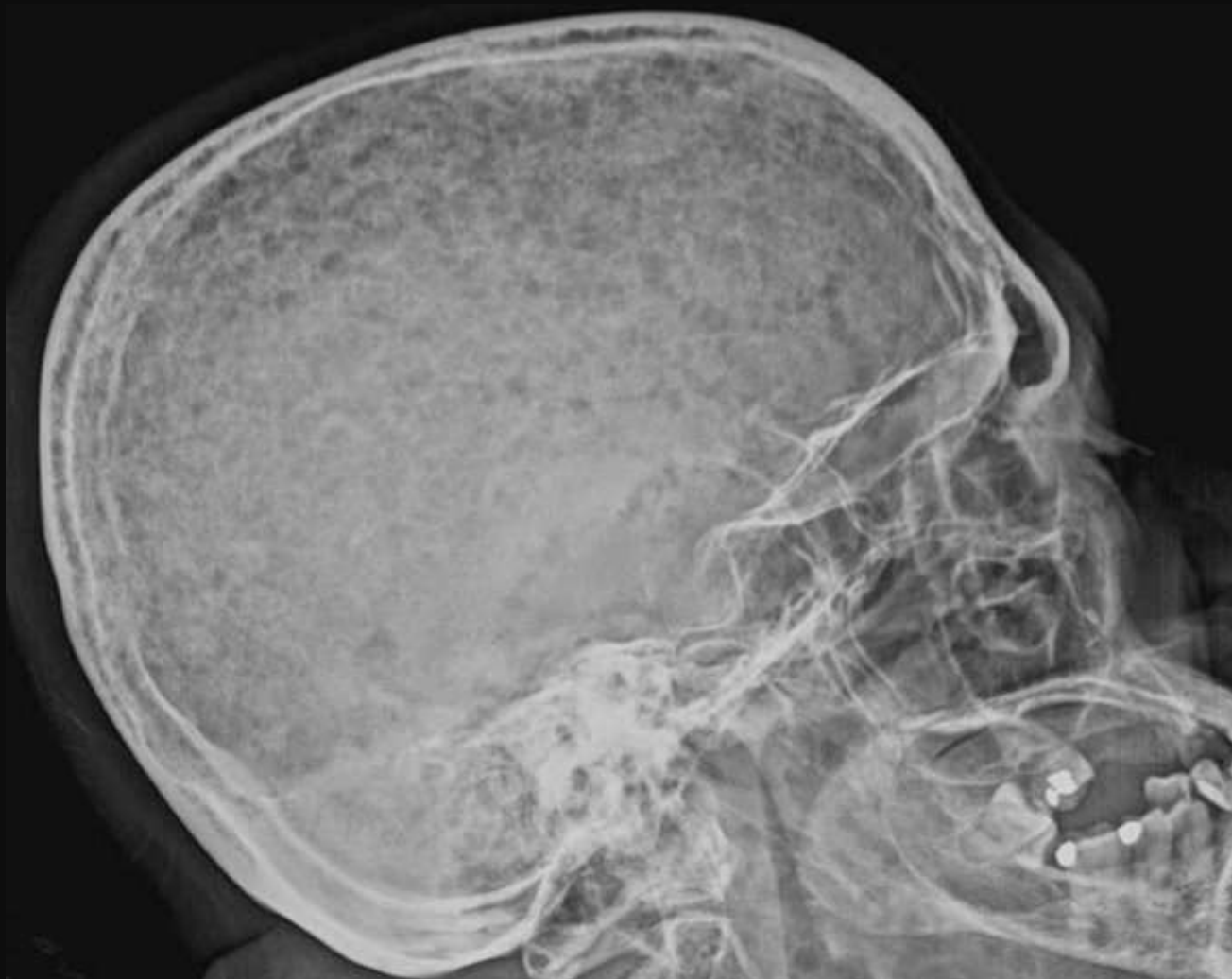
Child



Eosinophilic
Granuloma

<https://www.med-ed.virginia.edu>

MM



75 yo



45

Disuse
osteoporosis

<https://radiologykey.com>



70 yo

osteoporosis process

19 yo

Ewing's Sarcoma



Ro right Ankle AP/Lateral

35 yo

Calcaneal
GCT

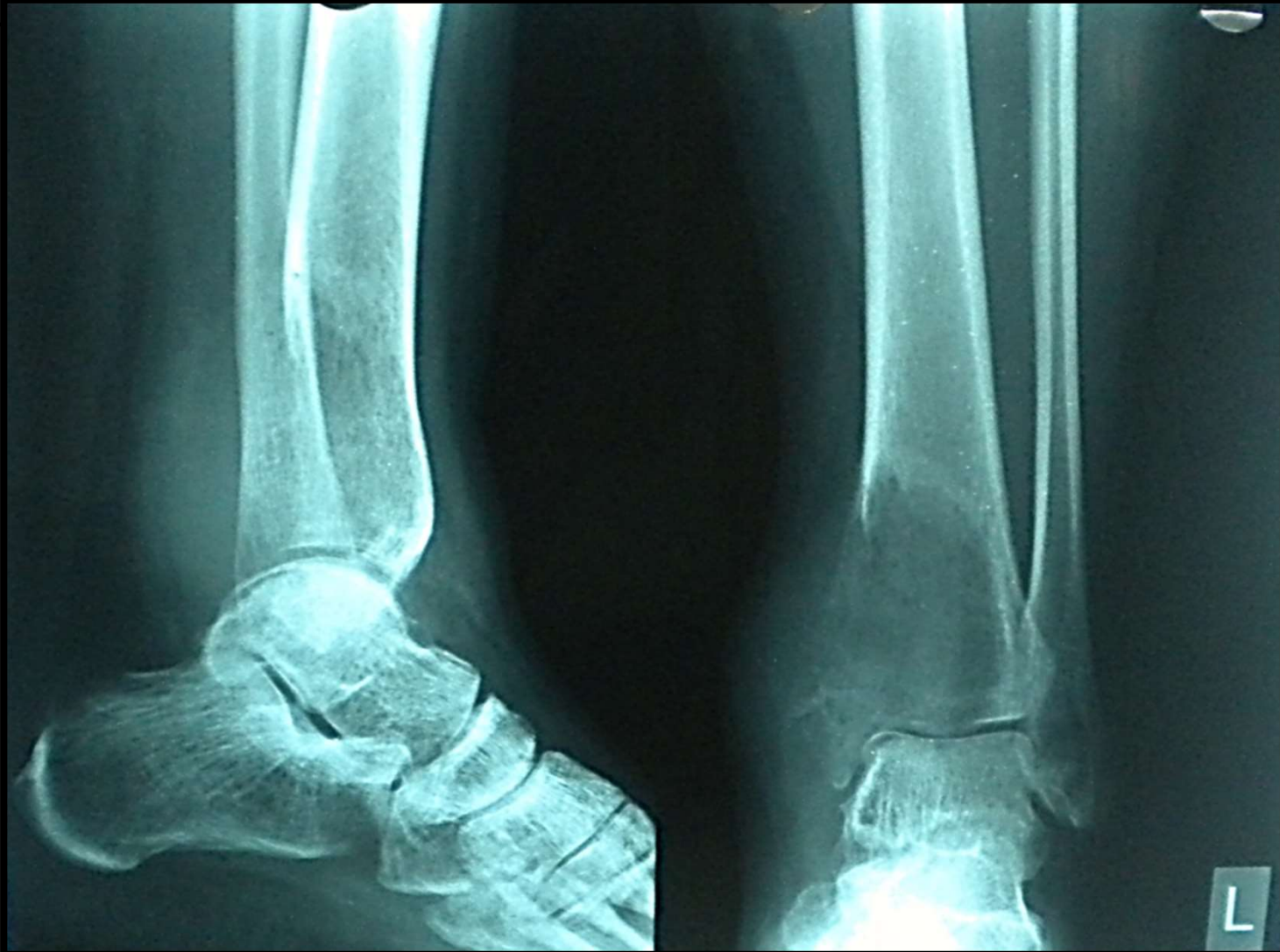


R6

25 yo

GCT

Ar



Osteosarcoma

16 yo



15 yo

OSTEOSARCOMA



TAKE HOME MESSAGE

- There are several types of bone destruction in skeletal tumor, knowing the type of bone destruction is helpful for determining tumor aggressiveness.
- Other findings such as age, tumor location, tumor matrix, periosteal reaction and soft tissue involvement are important aspect to establish the diagnosis of bone tumor.