Radiographic Evaluation of Musculoskeletal Tumors

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Staging Studies

- Plain Radiograph
- MRI
- CT scan
- Chest CT
- Bone Scan

Plain Radiographs

- **Evaluate:**
  - Rate of tumor growth
  - Tumor interaction with surrounding non-neoplastic tissue
  - Internal composition of tumor

MRI

- Visualize entire bone and adjacent joint
- Best test for intraosseous extent and soft tissue extent
- Identify skip metastases
- Tumor proximity to neurovascular structures
- Occasionally helpful in diagnosis of bone or soft tissue tumors (experienced radiologist)

TABLE 1. *MRI signal intensities of various tissues*

Tissue	Image	
	T1-weighted	T2-weighted
Hematoma	High	High
Fat, fatty marrow	High	Intermediate
Muscle, nerves, hyaline cartilage	Intermediate	Intermediate
Cortical bone, tendons, ligaments, fibrocartilage, scar tissue, air	Low	Low
Hyaline cartilage	Intermediate	Intermediate
Red (hematopoietic) marrow	Low	Intermediate
Fluid	Intermediate	High
Tumors (generally)	Intermediate-to-low	High
Lipoma	High	Intermediate
Hemangioma	Intermediate (slightly higher than muscle)	High

CT

- Good for evaluating cortical details and destruction
- Subtle cortical erosions (endosteal;periosteal) not detectable on plain x-ray or MRI
- Subtle calcifications / ossification (Visible tumor matrix mineralization)

Pain Radiographs

- The next three slides demonstrates how plain radiographs should be utilized to evaluate a bone tumor
- There are specific characteristics that should be identified on plain radiographs that aid in the differential diagnosis of a bone tumor

Plain Radiographs

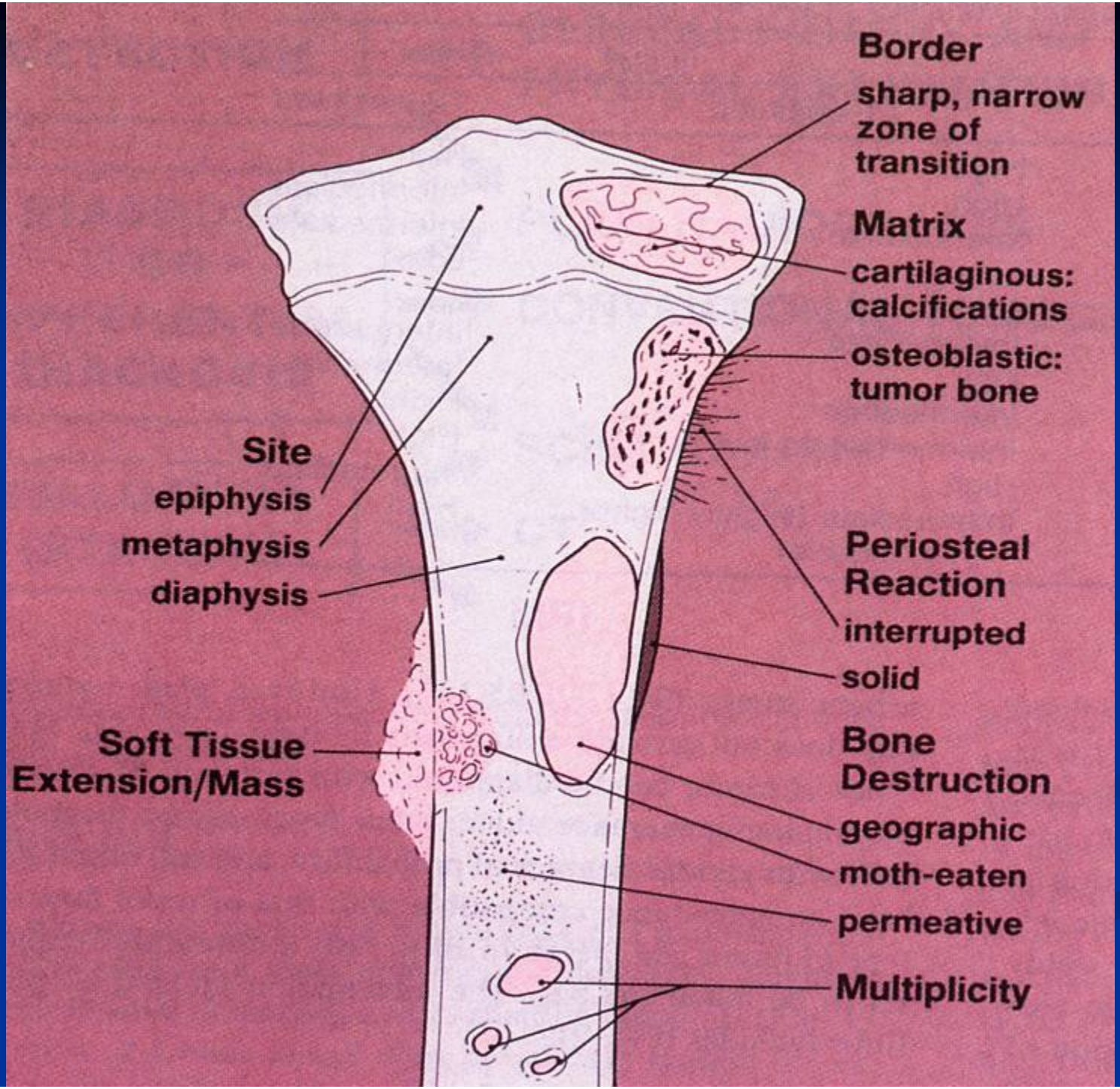
- Bone involved
- Is involved bone normal?
- What part of the bone?
- Open or closed growth plate
- Epicenter of lesion (cortex or medullary canal)
- Tumor contour and zone of transition between tumor and host bone

Plain Radiographs

- Mineralized matrix?
- Cortical destruction?
- Periosteal reaction? What type
- Involvement of joint space?
- Tumor multifocal?
- Is tumor of uniform appearanceor does it have several different components?

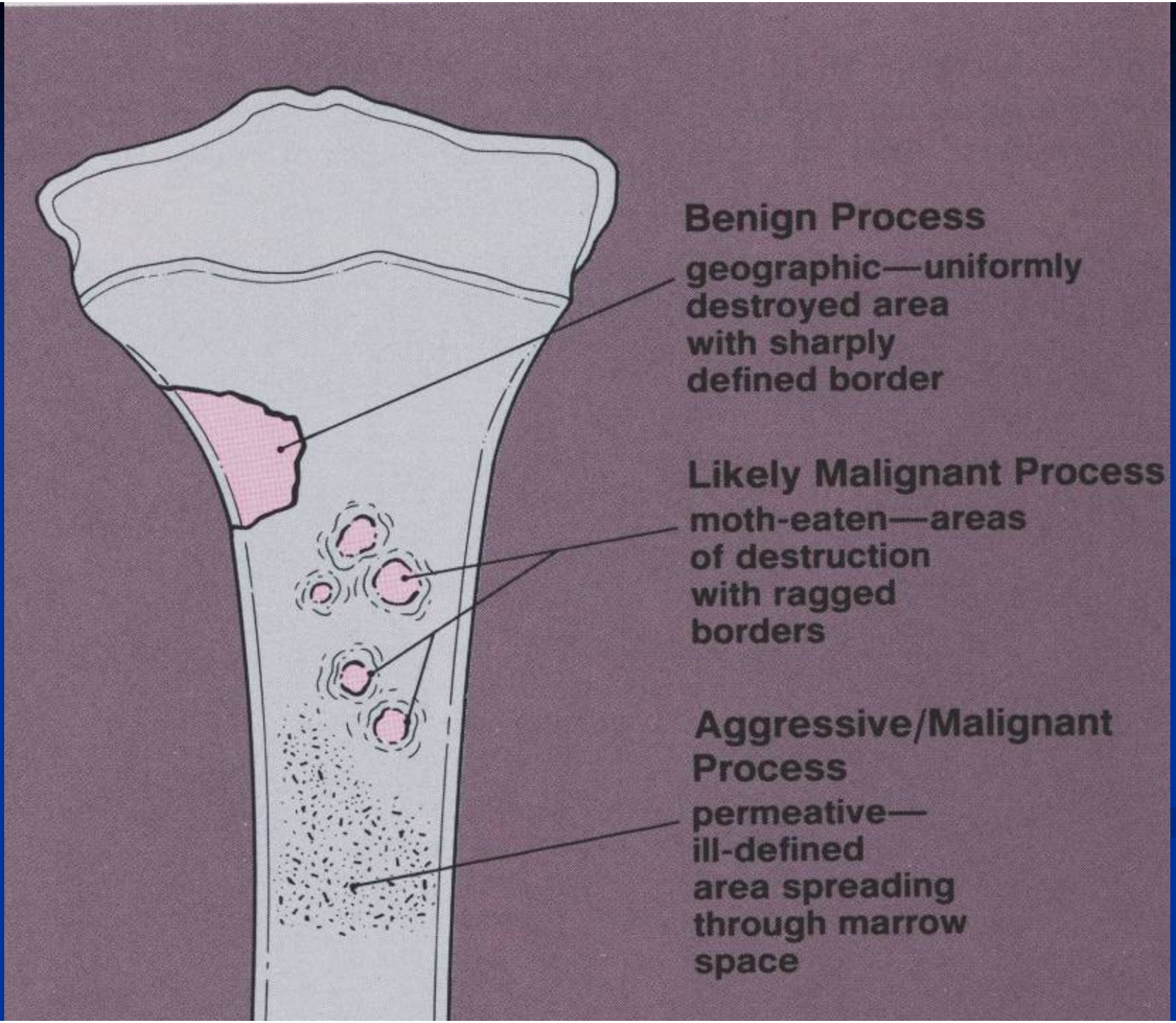
Radiographic Evaluation

- Bone Involved and Position in the Bone
- Pattern of Bone Destruction
  - Geographic, Permeative, Moth Eaten
- Margin of the Lesion
- Presence of Visible Tumor Matrix (Calcification/Ossification)
- Internal Trabeculations
- Cortical Erosion, Penetration, Cortical Expansion
- Periosteal Response
  - Continuous or Interupted


Border
sharp, narrow zone of transition
Matrix
cartilaginous: calcifications
osteoblastic: tumor bone
Site
epiphysis
metaphysis
diaphysis
Periosteal Reaction
interrupted
solid
Soft Tissue Extension/Mass
Bone Destruction
geographic
moth-eaten
permeative
Multiplicity

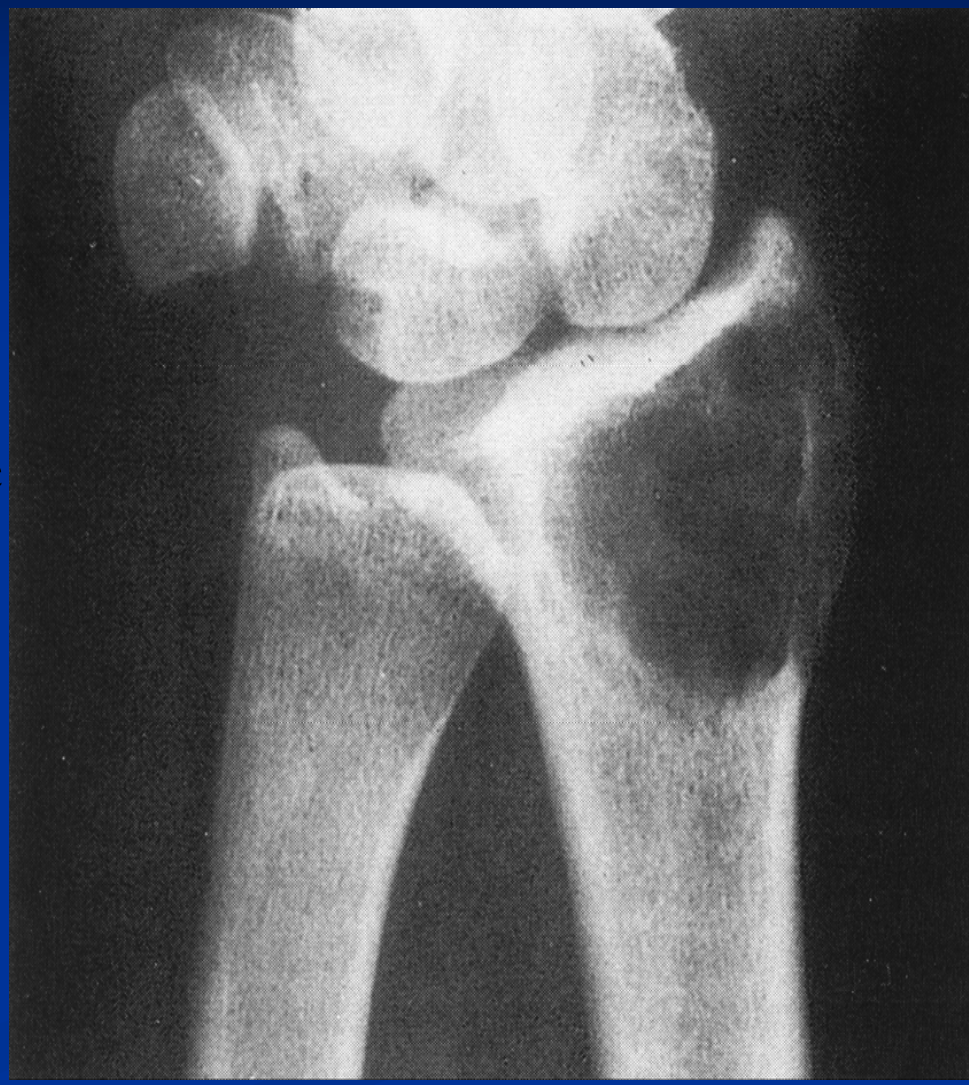
Patterns of Bone Destruction

- Geographic
- Motheaten
- Permeative

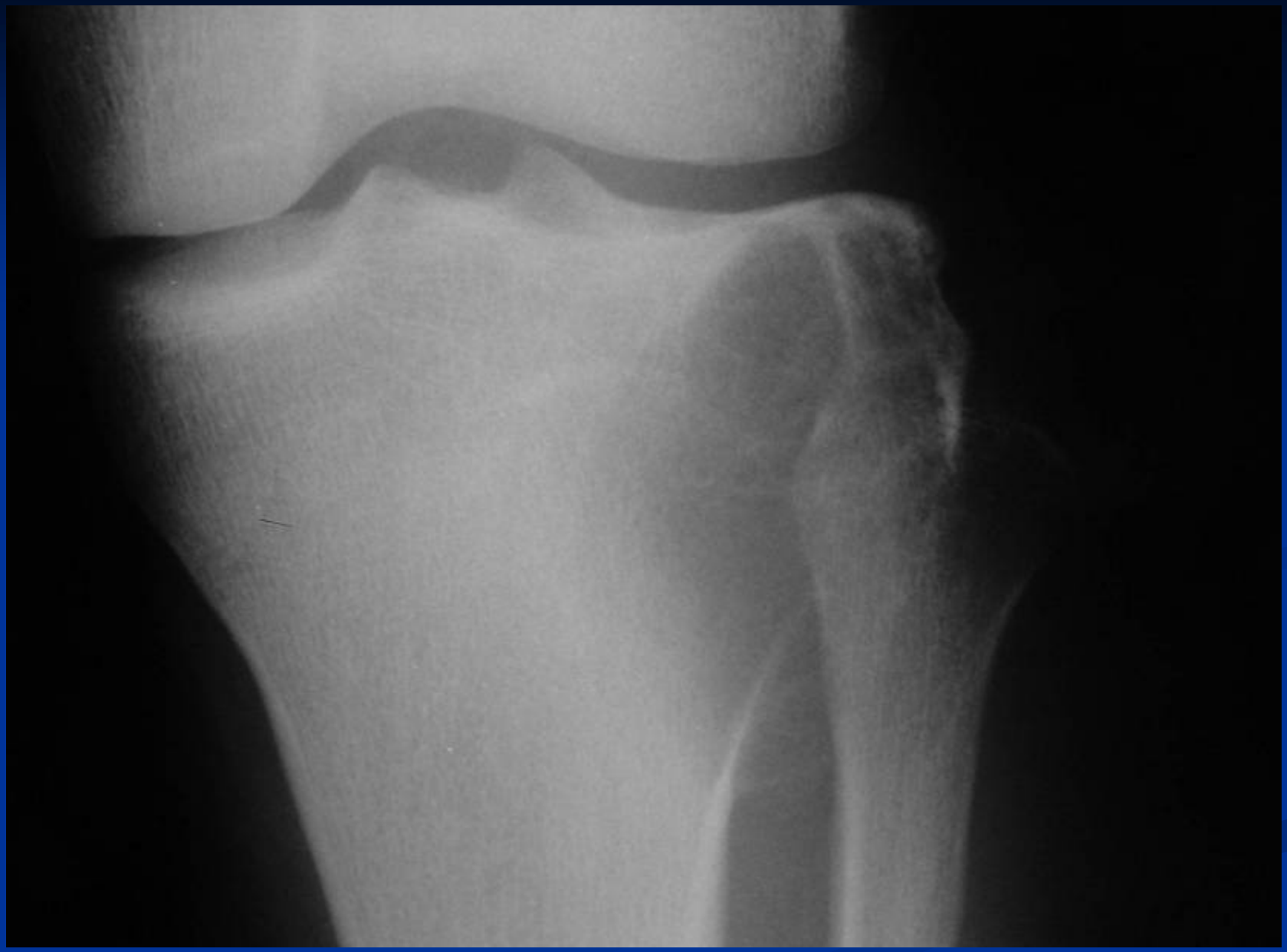

Benign Process
geographic—uniformly destroyed area with sharply defined border
Likely Malignant Process
moth-eaten—areas of destruction with ragged borders
Aggressive/Malignant Process
permeative—ill-defined area spreading through marrow space

Geographic Bone Destruction

- Least Aggressive Pattern
- Slow Growing Lesion-Usually Benign
- Clearly Demarcated Lesion
  - Clearly Delineated Borders of Lesion
- Narrow Zone of Transition between Tumor and Normal Bone
- May have Sclerotic Margin
- Thicker Sclerotic Margin is Less Aggressive
- No Surrounding Sclerosis means more Aggressive/Faster Growing
- Usually Benign; also Myeloma, Mets, Osteomyelitis (Especially Granulomatous) can be Geographic



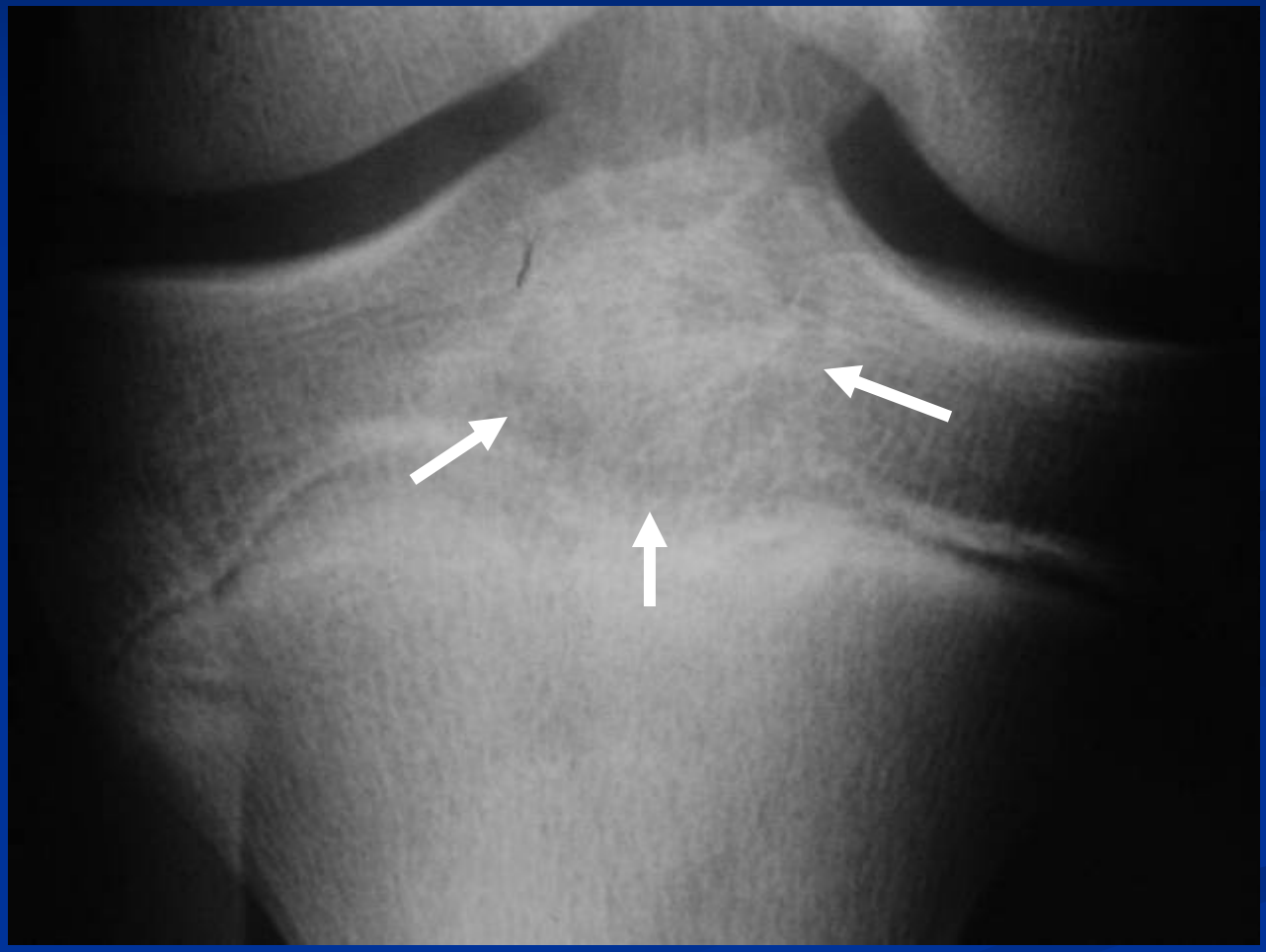
Geographic Bone Destruction



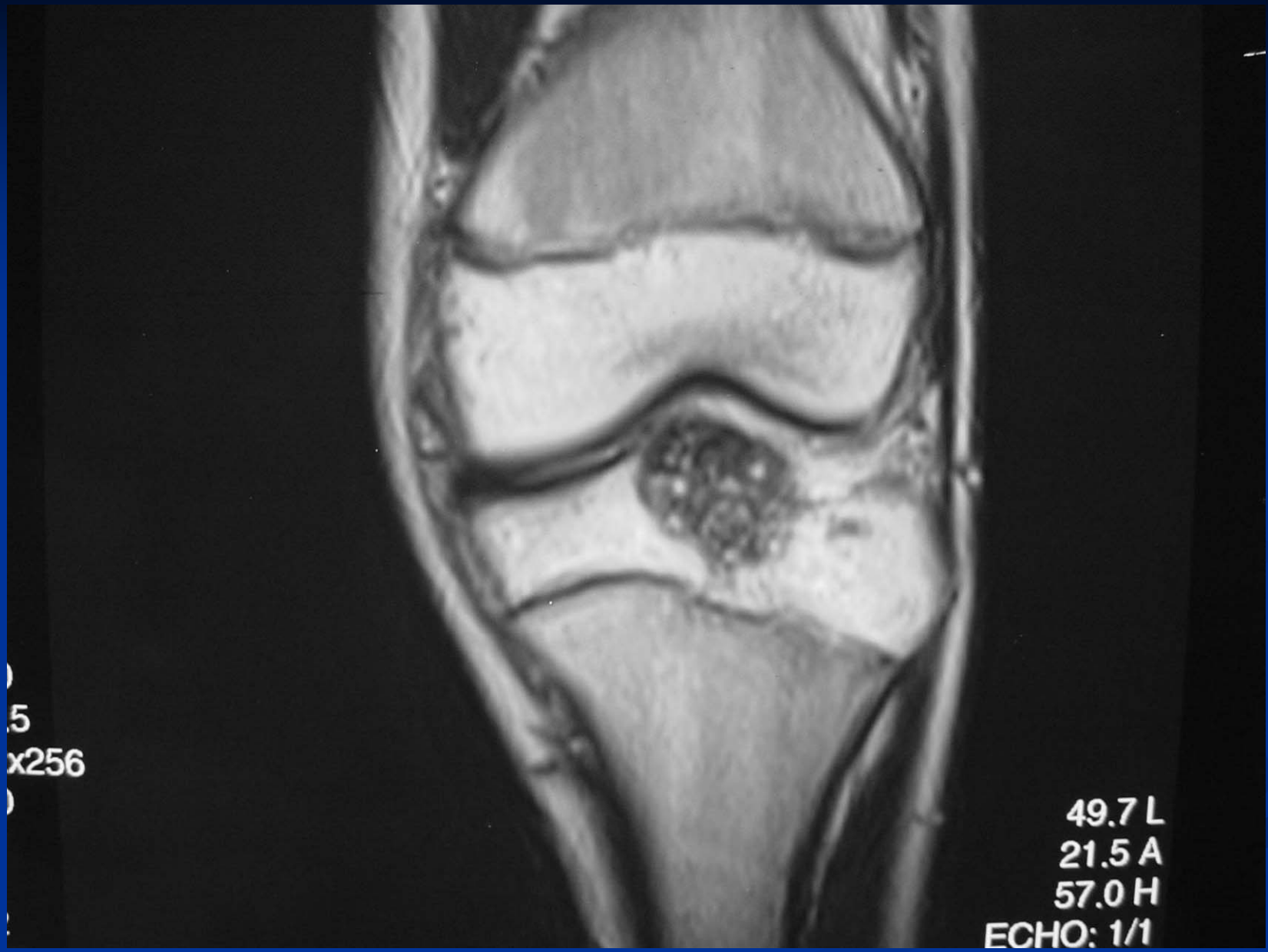
Giant Cell Tumor

Giant Cell Tumor

Geographic Bone Destruction

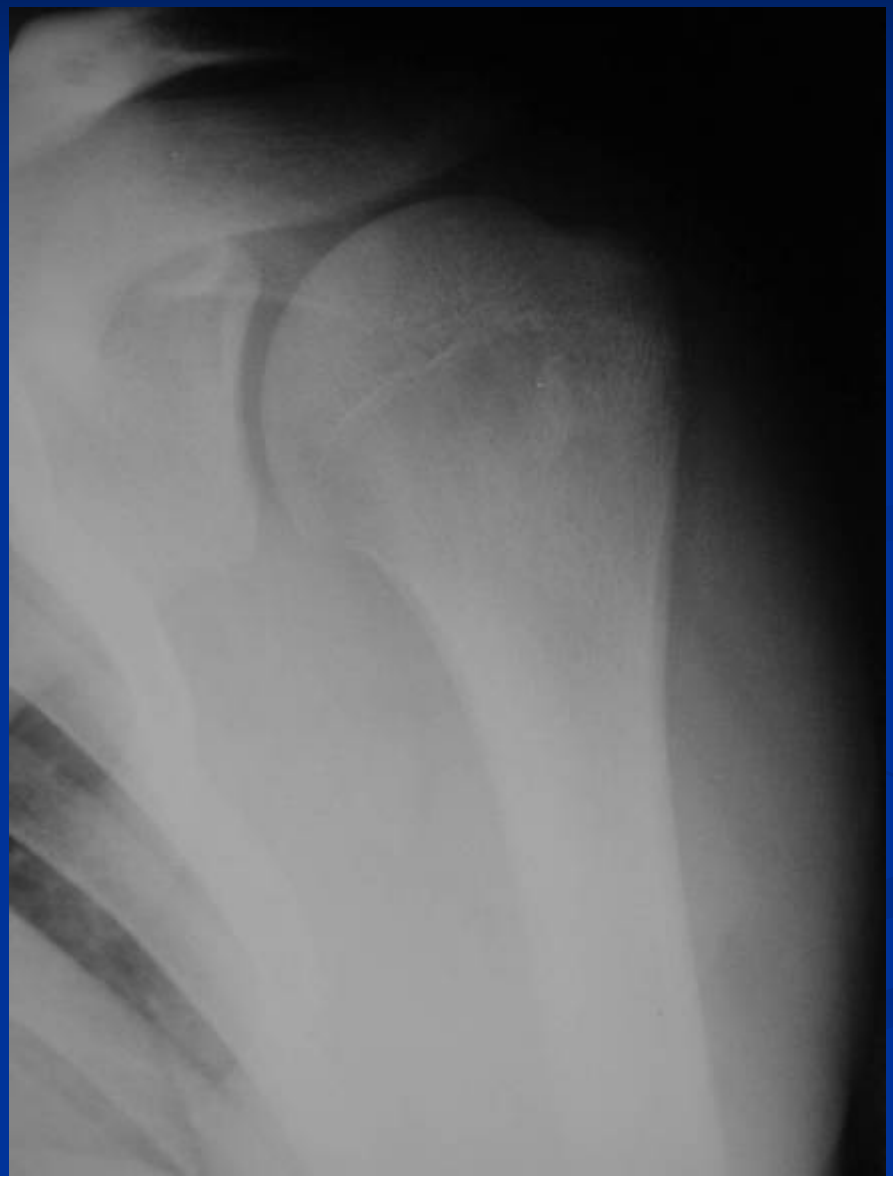


A
L
R

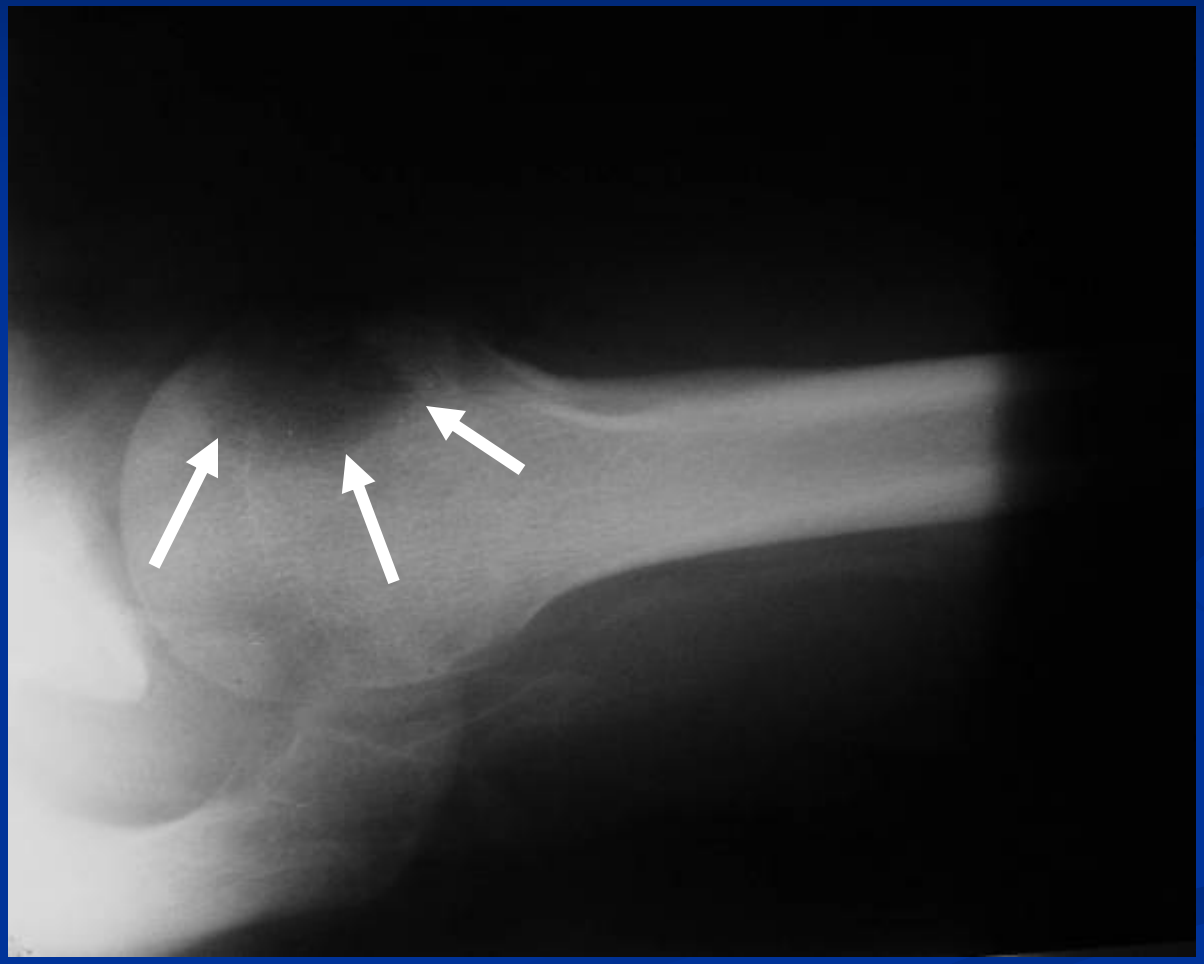

.5
x256
49.7 L
21.5 A
57.0 H
ECHO: 1/1

Chondroblastoma

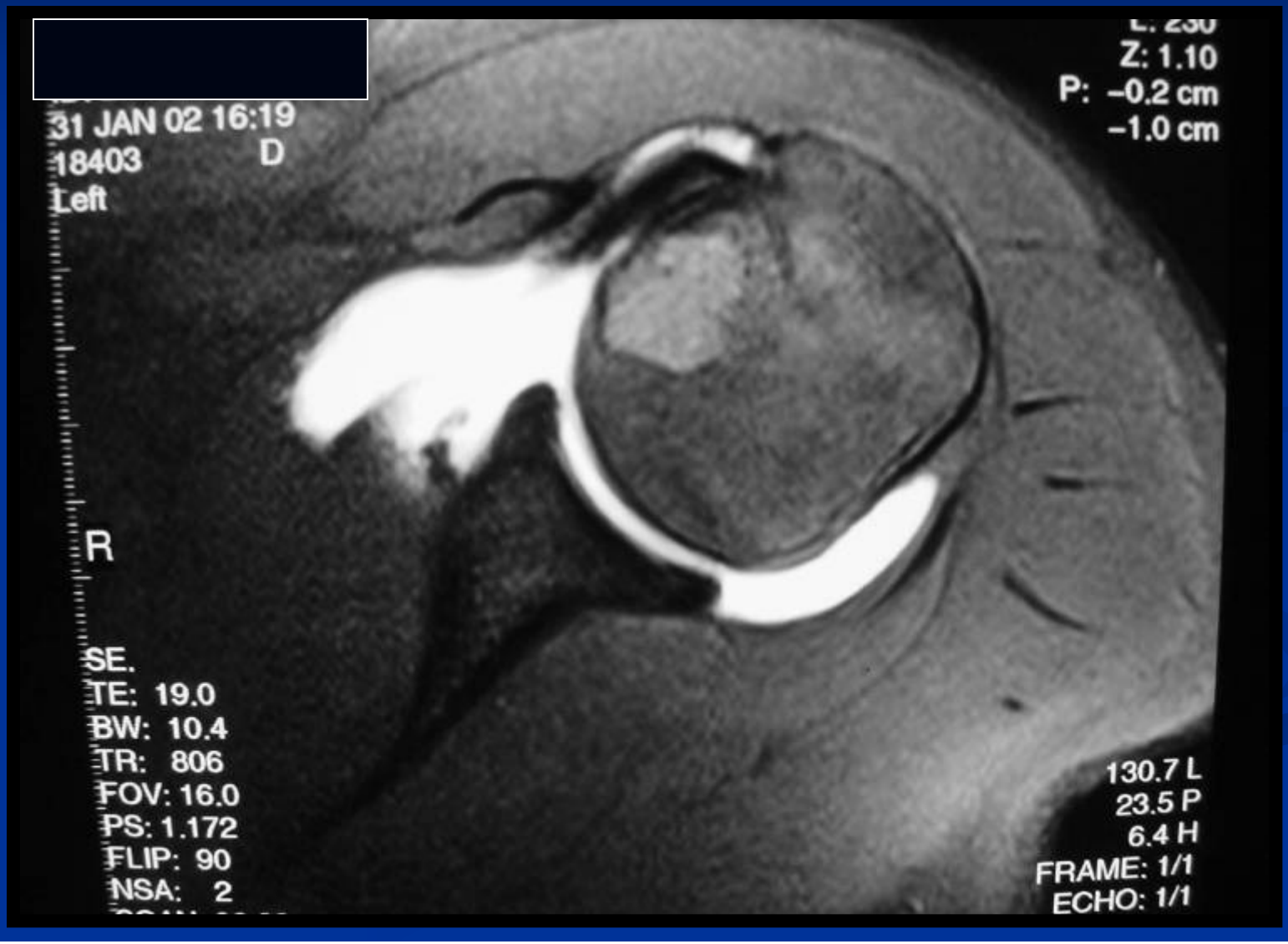
Geographic Bone Destruction



Geographic Bone Destruction



Geographic Bone Destruction



Geographic Bone Destruction
ABC- Aneurysmal Bone Cyst

Geographic Bone Destruction
Fluid-Fluid Levels on MRI
ABC

I WANT YOU!!!!!!!!

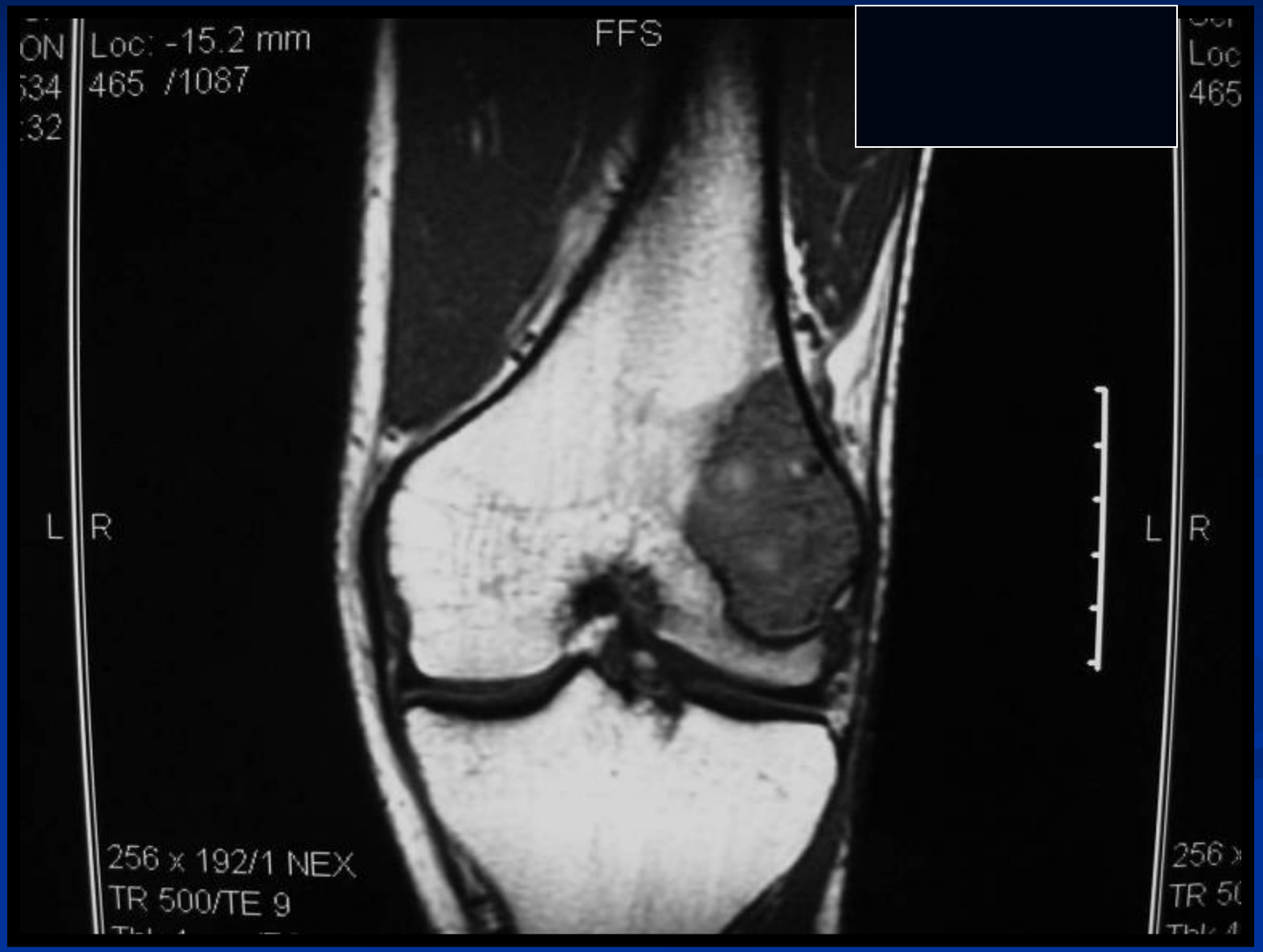
BE ALL THAT YOU CAN BE!!!

NYU NURSE PRACTITIONERS

GOOOO TUMORS!!!!!!!

Geographic Bone Destruction
Giant Cell Tumor

MRI

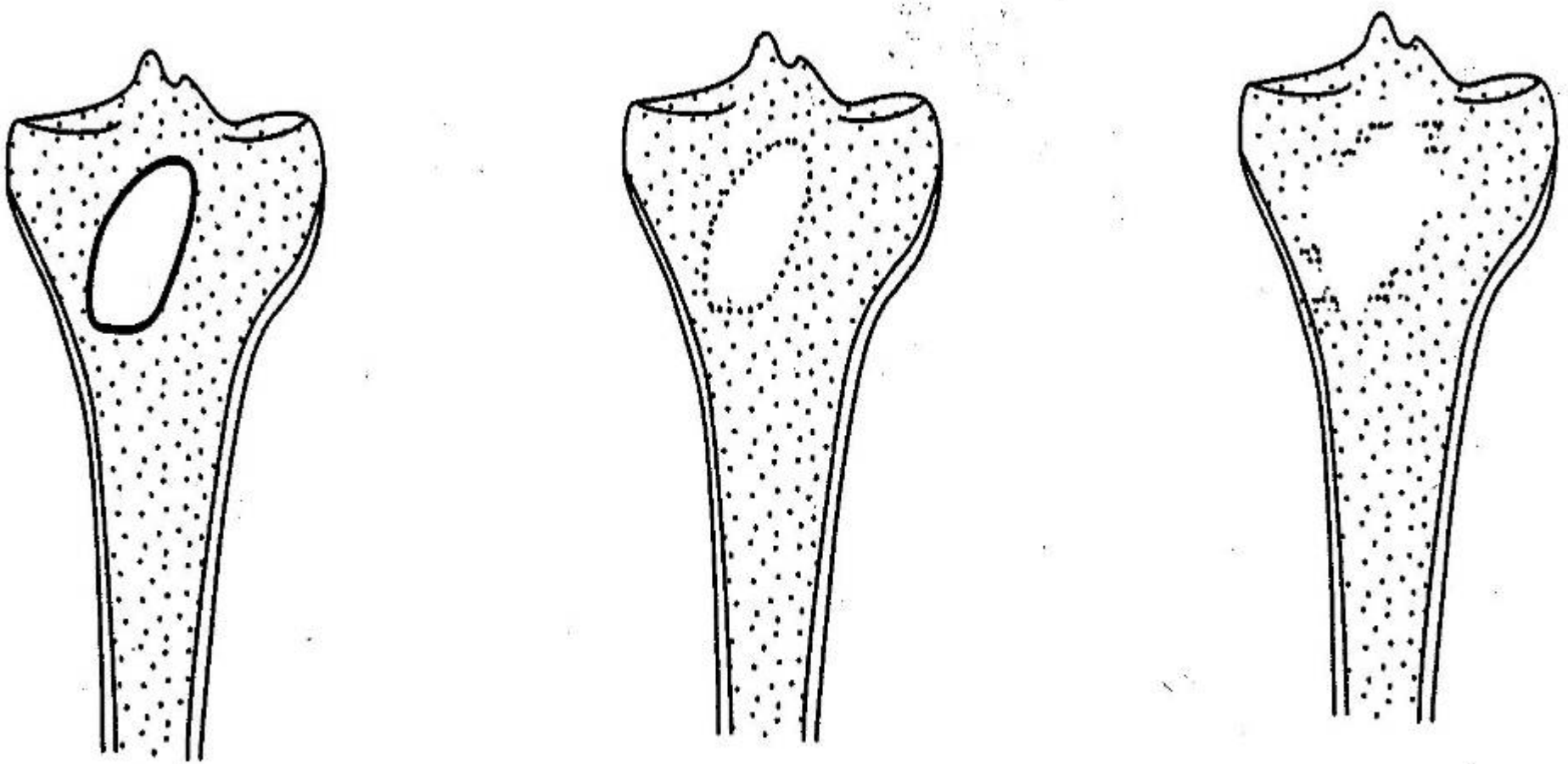


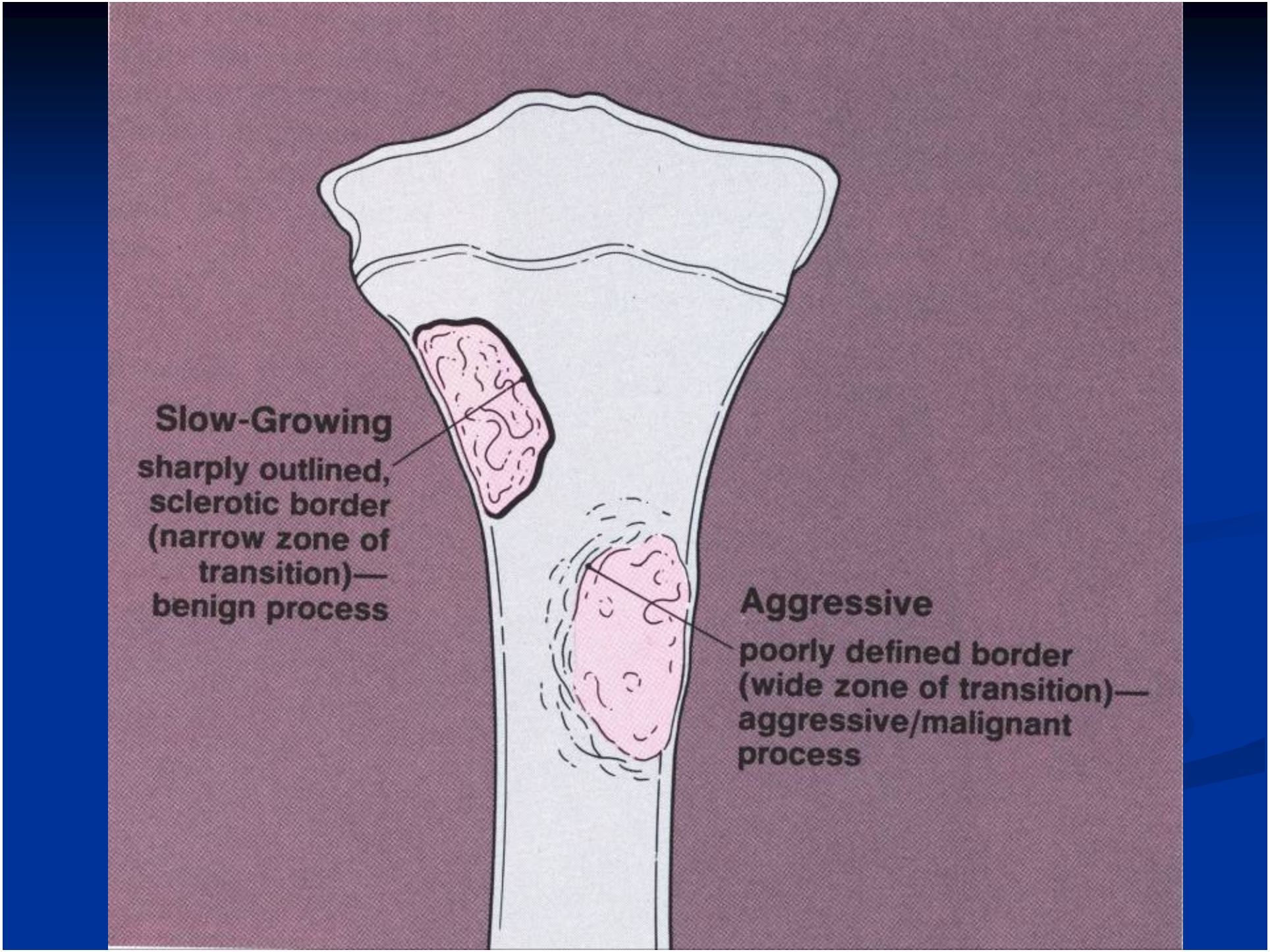
CT Scan


Im:12
JUN 27, 2002
512
DFOV 16.0cm
STND
L
2
1
L
1
8
1
R
L
kV 120
mA 280~
Smart mA 261
Large
3.0mm/1.6:1
Tilt 0.0

Geographic Bone Destruction

- Types of Margins Around Lesion
  - IA (Thick Complete Sclerotic Margin)
    - Indolent Lesion
  - IB (Thin and Incomplete)
    - Active Lesion
  - IC (No Sclerotic Margin)
    - Aggressive Lesion

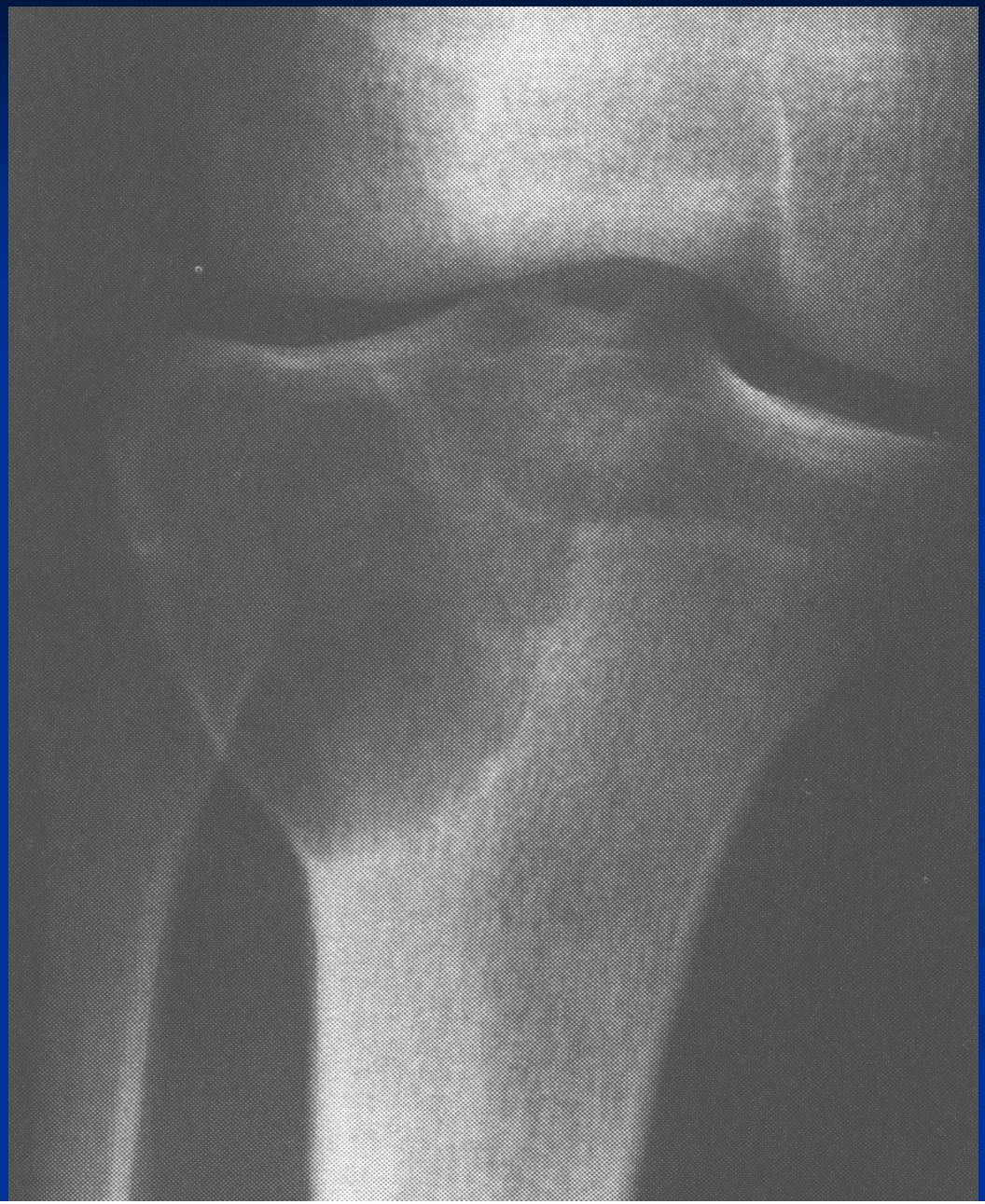

1A
1B
1C


Slow-Growing
sharply outlined, sclerotic border (narrow zone of transition)— benign process
Aggressive
poorly defined border (wide zone of transition)— aggressive/malignant process

IA

IA-Non Ossifying Fibroma

IB—Giant Cell Tumor



IB

IB

IB

IC

IC

IC—Giant Cell Tumor

IB/IC

IC

IC—CT Demonstartion

Motheaten Bone Destruction

- More Aggressive Bone Destruction
- Less Well Defined Margins
- Larger Zone of Transition From Normal to Abnormal (Tumor)
- Multiple Punched Out Holes in the Bone
- Malignant Bone Tumors, Osteomyelitis, Eosinophilic Granuloma

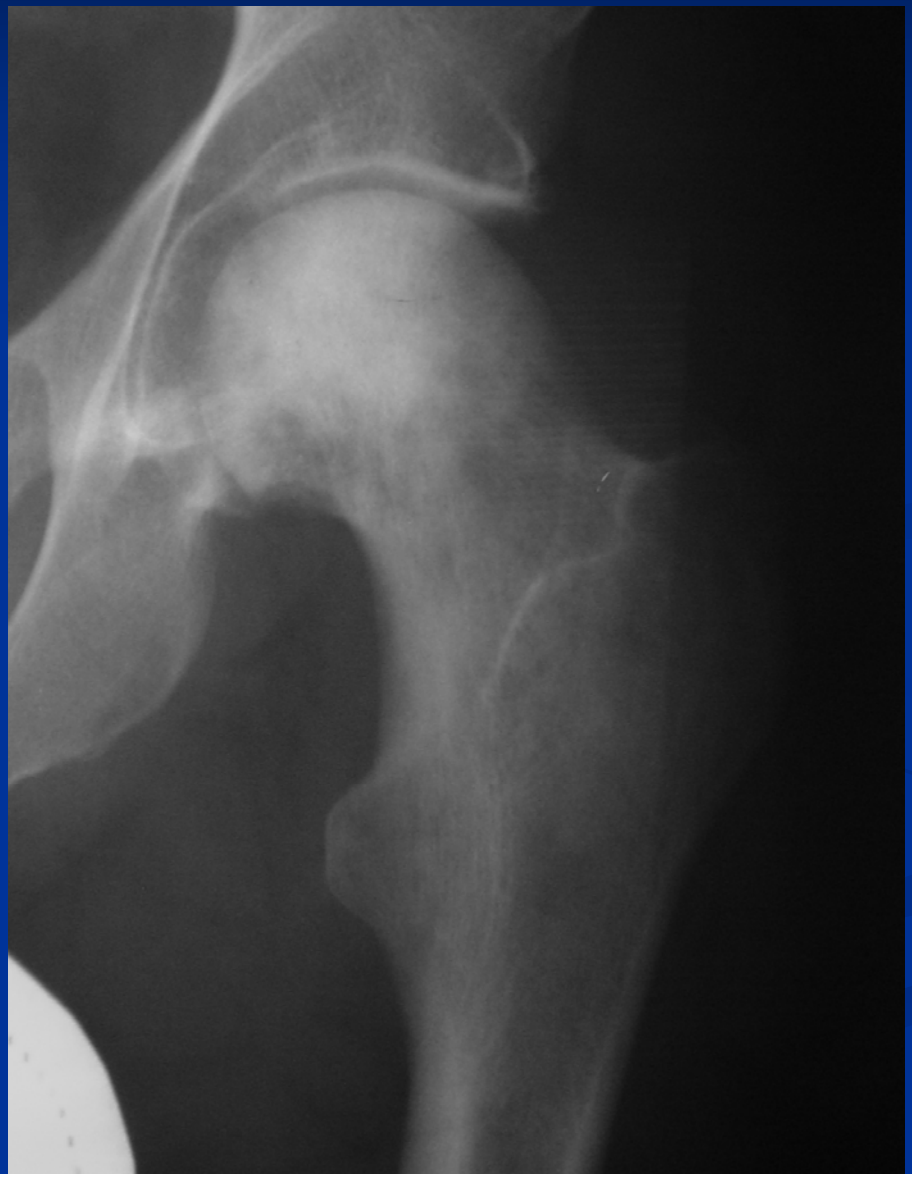
Motheaten Bone Destruction

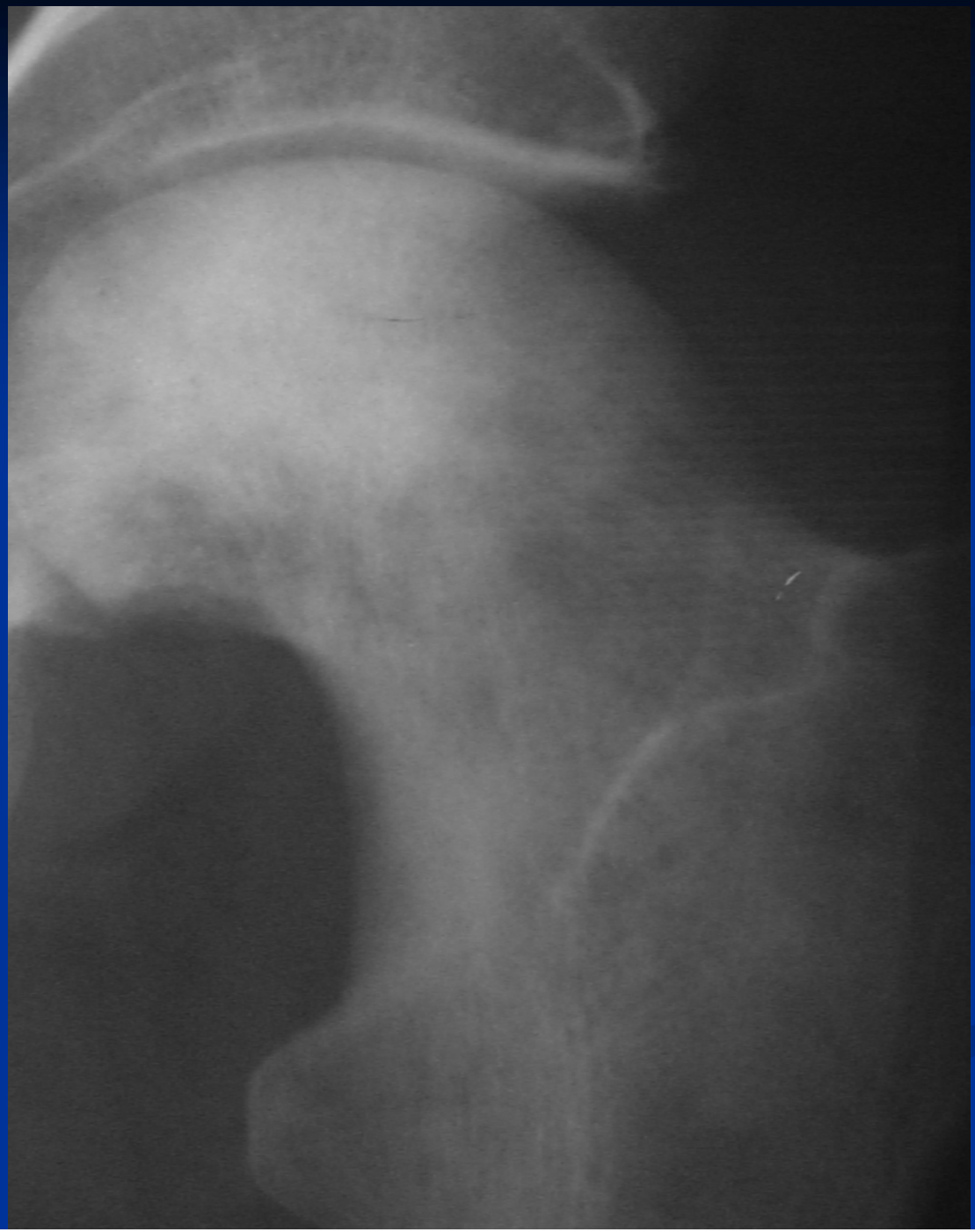
Permeative Bone Destruction

- Aggressive Lesion
- Rapid Growth Potential
- Poorly Demarcated and May Merge Imperceptibly with Uninvolved Bone
- Can Not Delineate Where Tumor Begins and Ends
- Tumor Not Clearly Demarcated From Normal Bone
- Malignant Bone Tumors (Ewings sarcoma;Osteosarcoma), Osteomyelitis, Osteoporosis

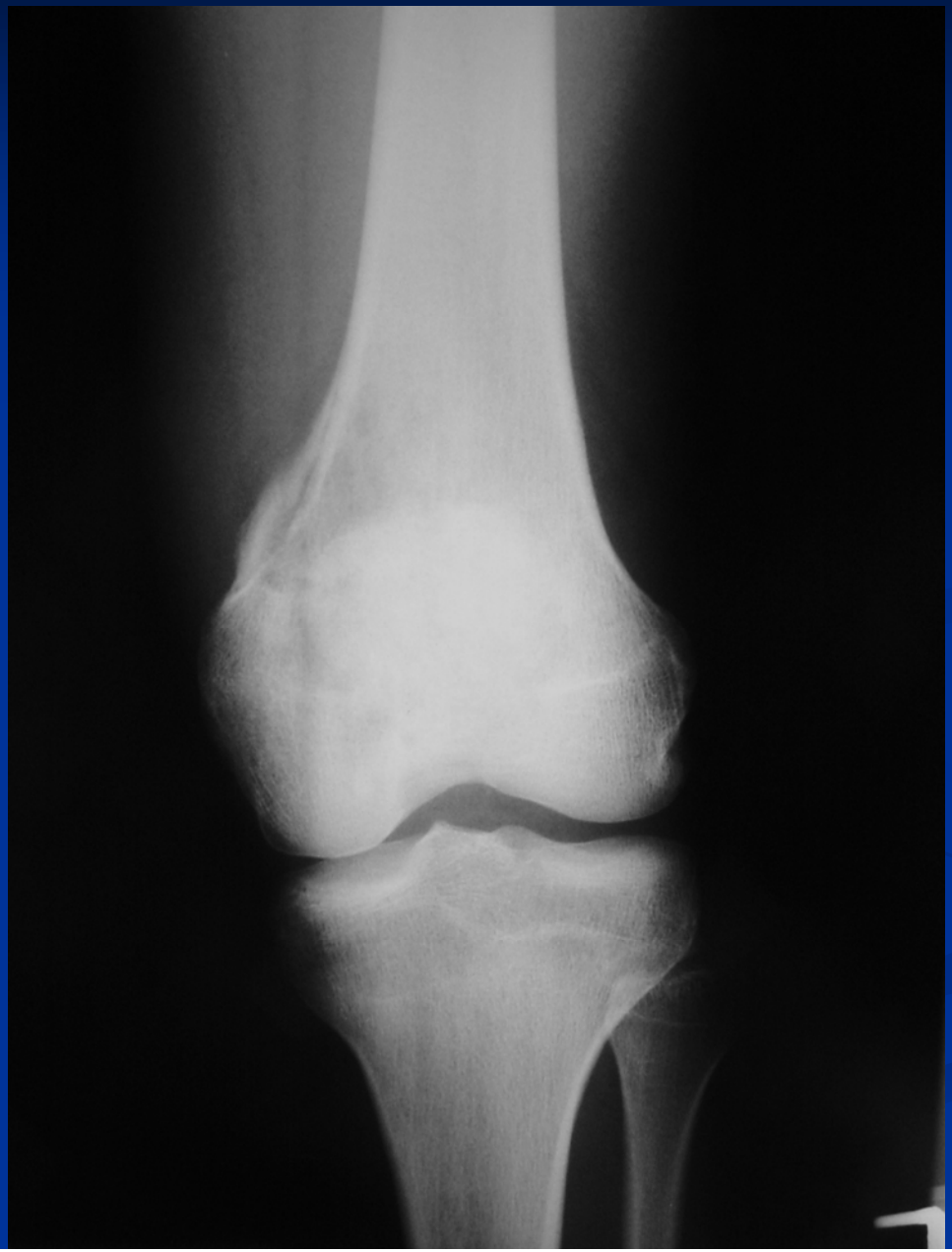
Permeative Bone Destruction
Lymphoma

Permeative



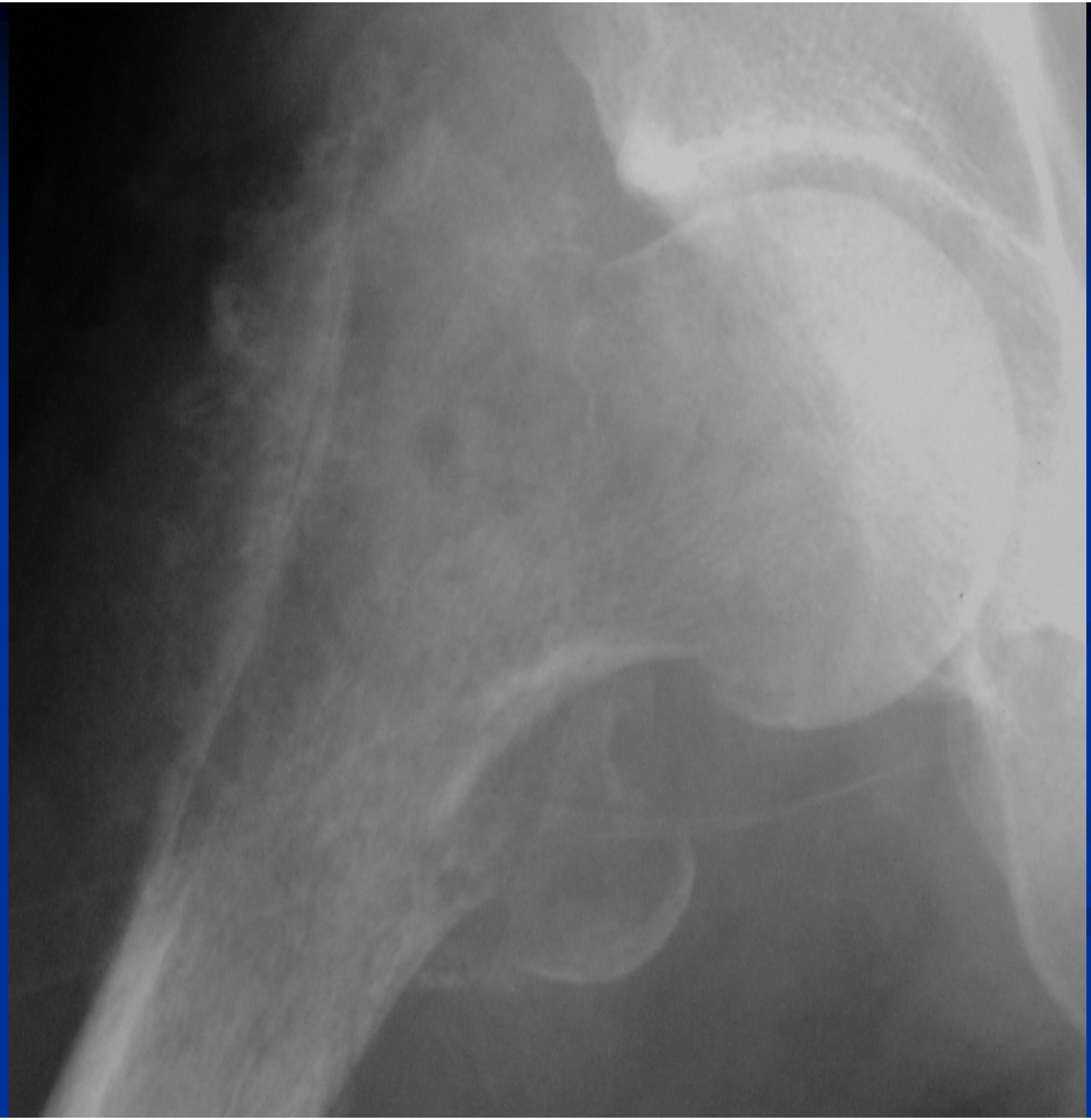


Permeative--Osteosarcoma



Permeative--Osteosarcoma

Permeative--Lymphoma

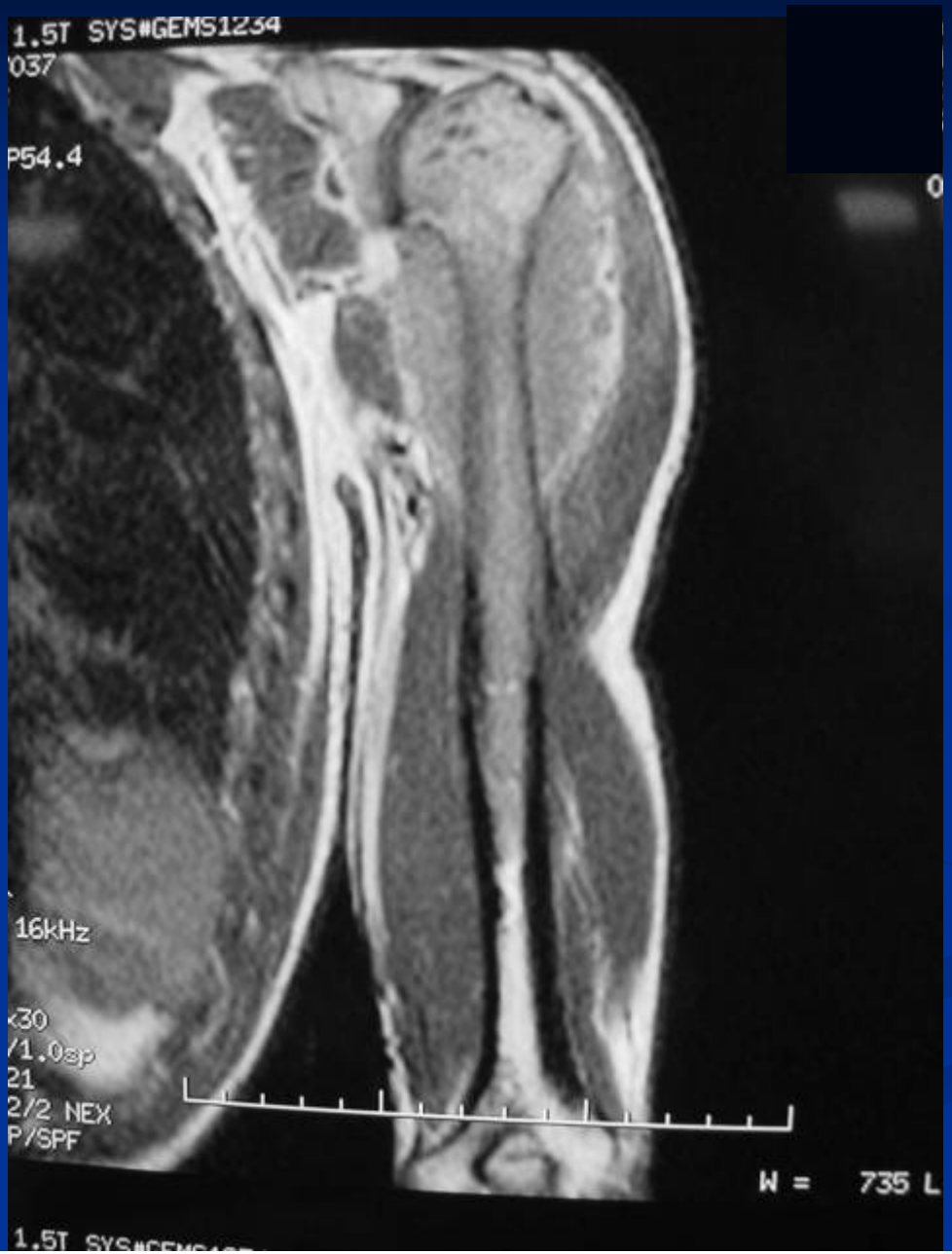


Permeative

Permeative

Permeative

Permeative—MRI Shows Extent

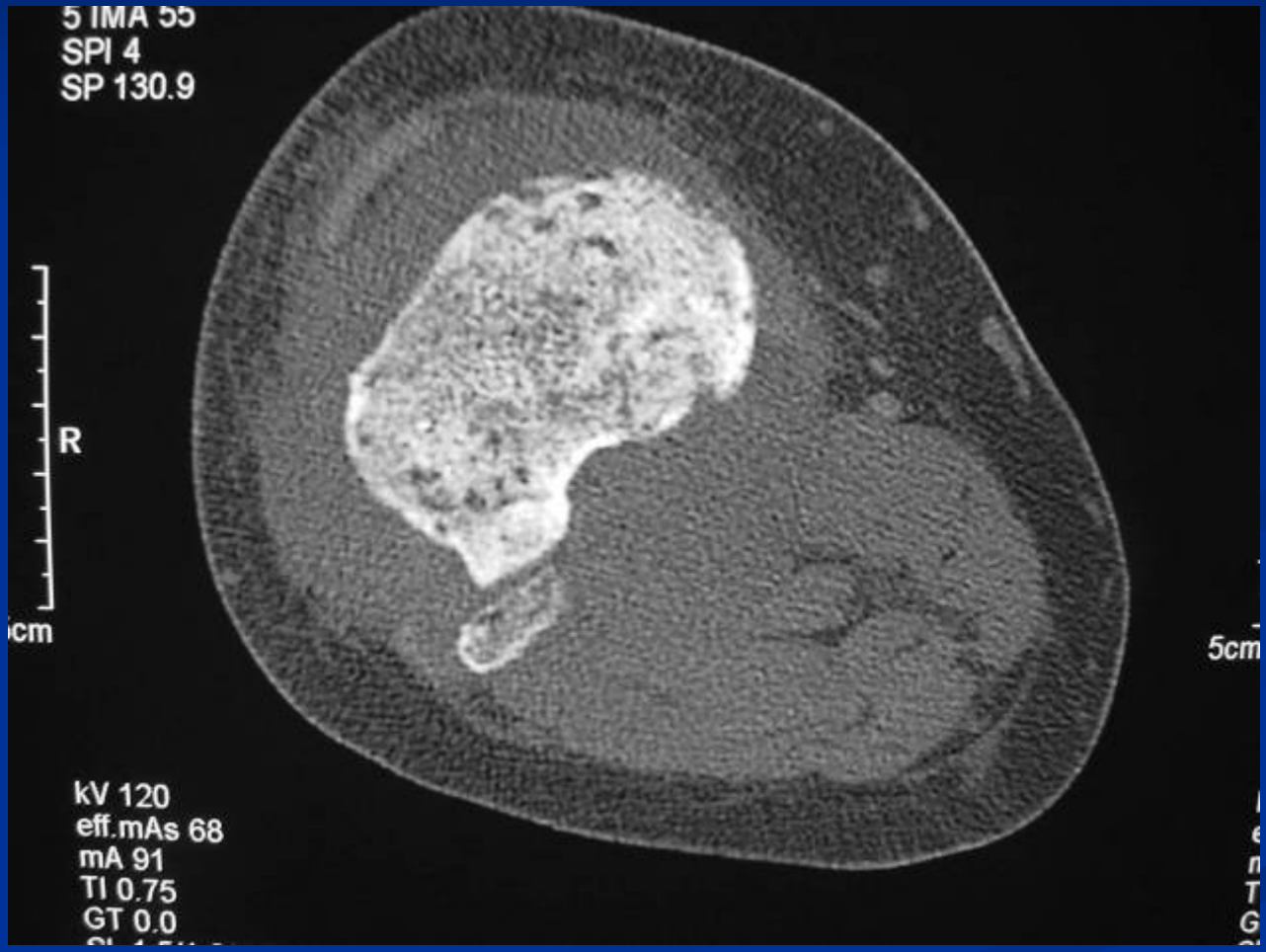


Permeative Lesion Barely Perceptible on X-Ray

Permeative

Permeative—MRI Demonstrates Tumor Extent Better

Permeative—CT Example
The Tumor is Not Clearly Demarcated

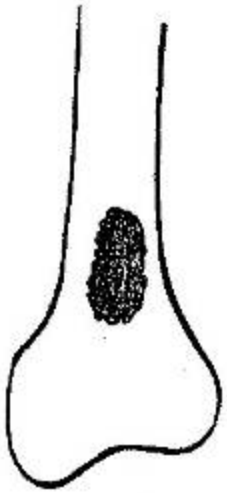


Permeative

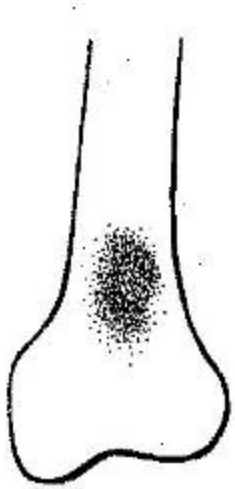
Permeative

Visible Tumor Matrix

- Calcification
  - Stippled, Flocculent, Rings and Arcs
- Ossification
  - Solid, Cloud-Like, Ivory-Like
- Must Differentiate Mineralization from Calcification Due to Dead or Necrotic Tissue, Fracture Callus (Pathologic Fracture), Sclerotic Response of Non-Neoplastic Bone to Adjacent Tumor Deposit

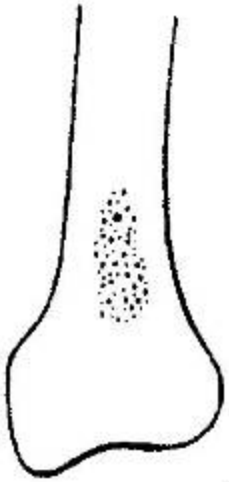


Solid



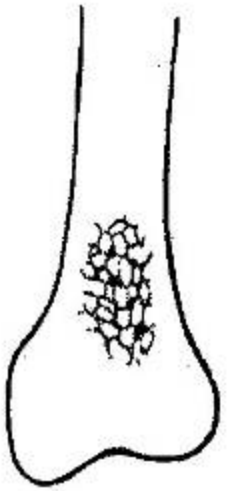
Cloud-Like

Ivory-Like



Stippled

Flocculent



Rings and Arcs

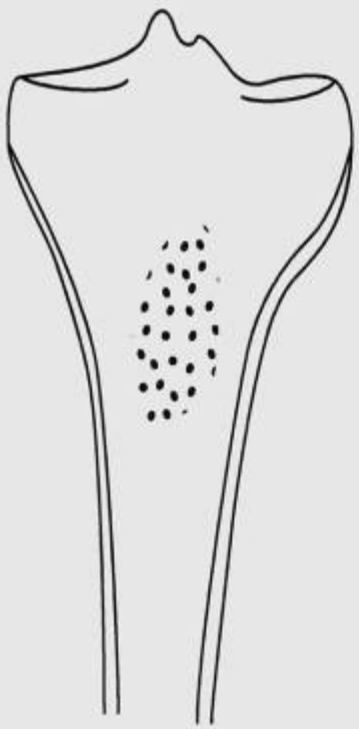
Visible Tumor Matrix

- **Calcification**
  - Rings, Arcs, Flocculent, Fleck-like
  - **Cartilage Tumors**
    - Enchondroma
    - Chondrosarcoma
    - Chondroblastoma
    - Chondromyxofibroma

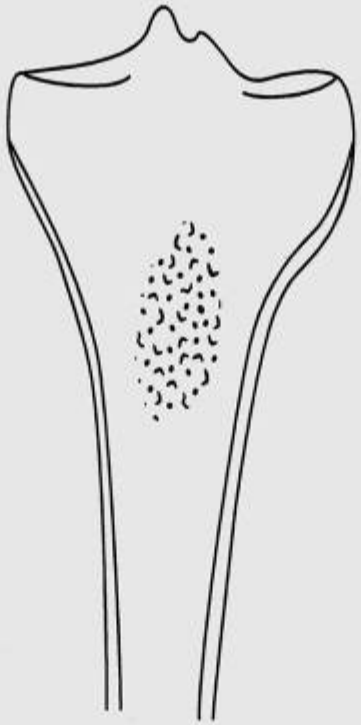
Visible Tumor Matrix

- Cartilage grows in a lobular manner or in a ball like manner
- Calcification occurs around the periphery of these lobules
- If the calcification occurs completely around the periphery (circumference) it forms a circle or a **Ring** of calcification that is detectable on the Xray
- If the calcification occurs only partially around the lobule, it forms only part of a circle or an **Arc** that is detectable on the Xray

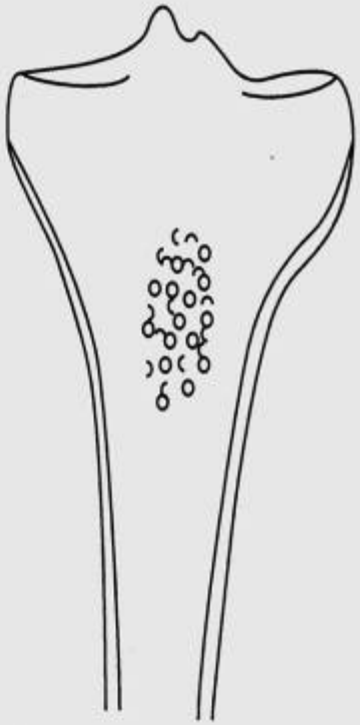
Cartilage Matrix



Stippled



Flocculent



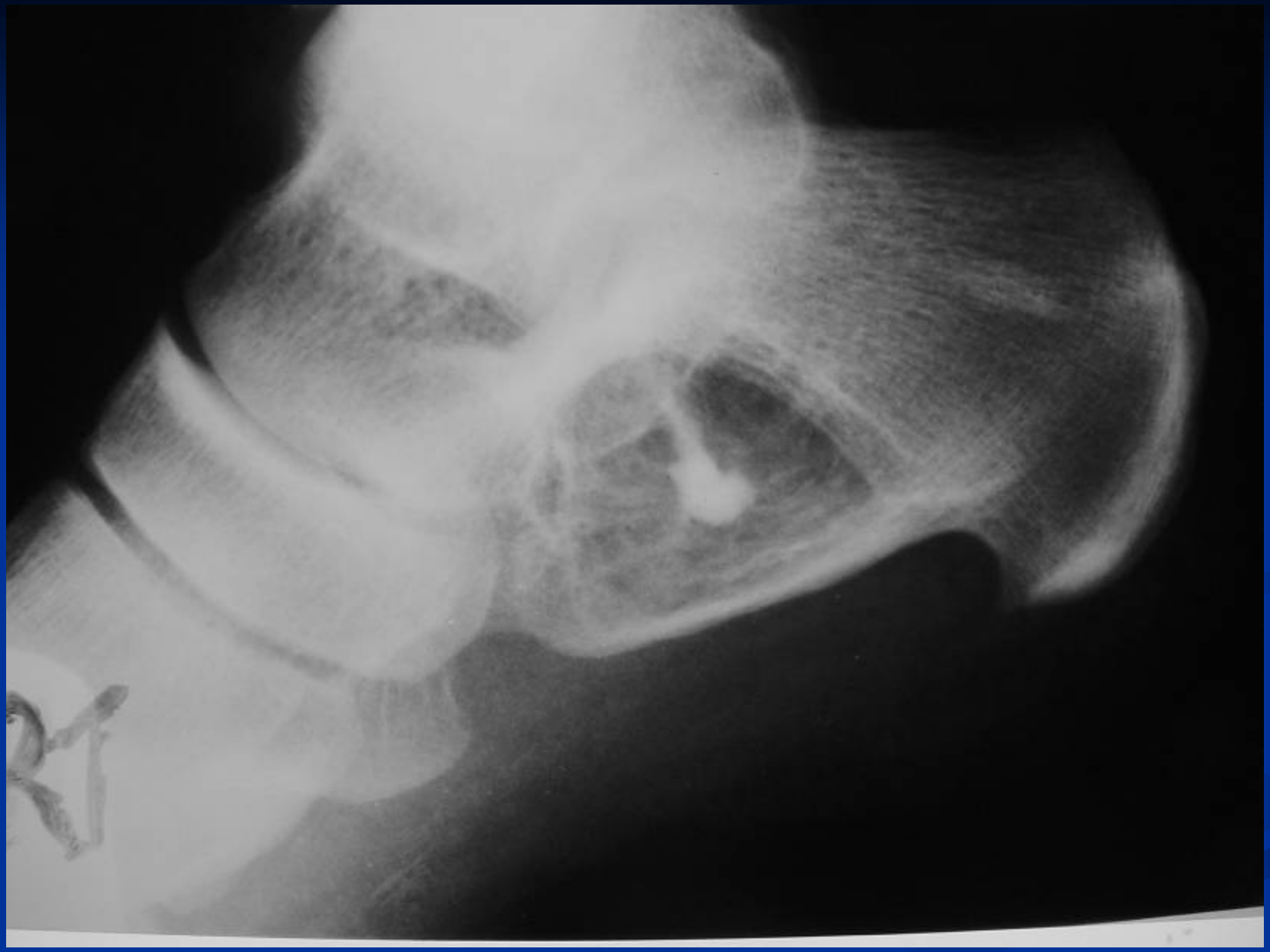
Rings and Arcs
("o"'s and "c"'s)

A

Enchondroma or Low Grade Chondrosarcoma

Enchondroma

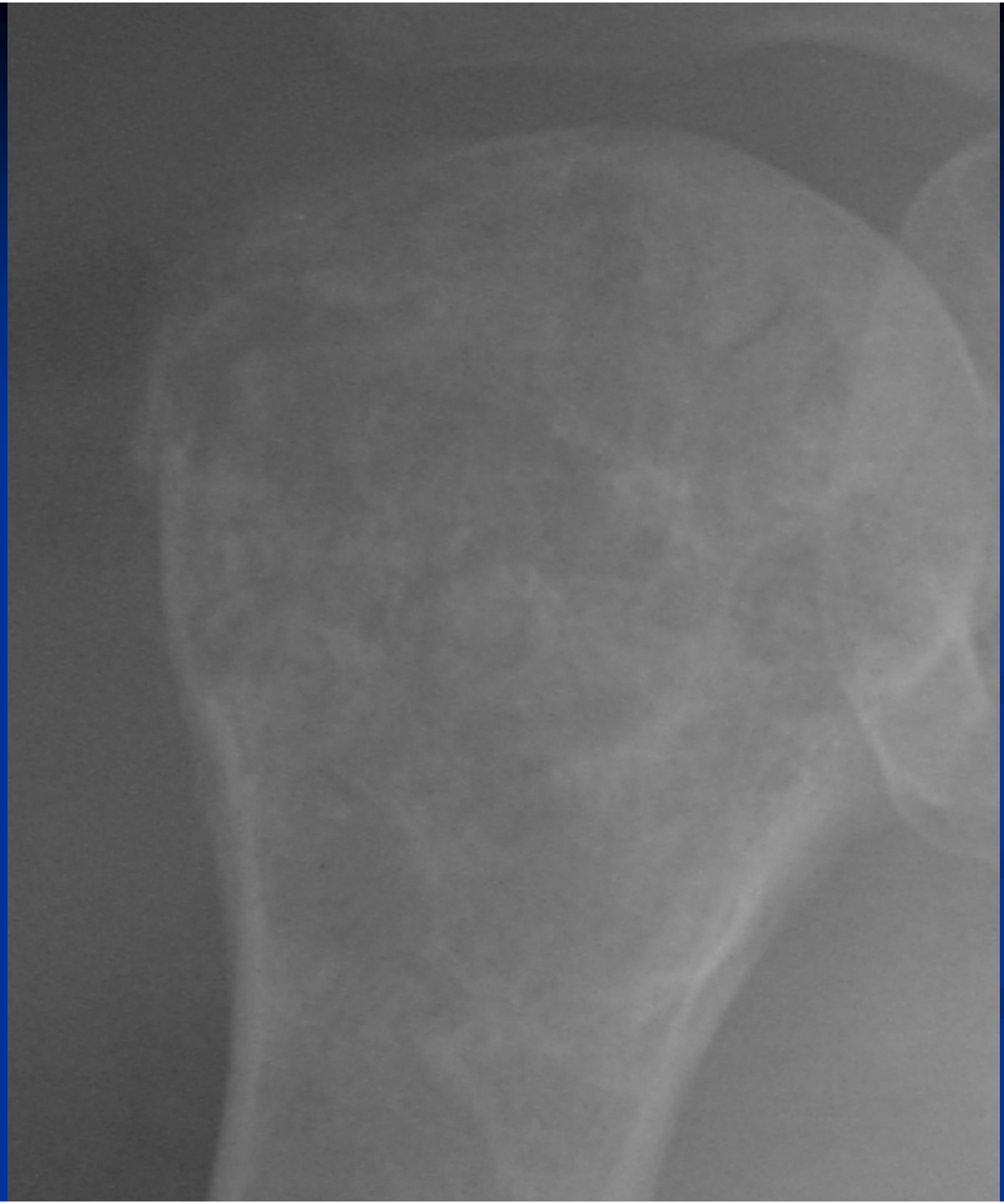
Chondrosarcoma

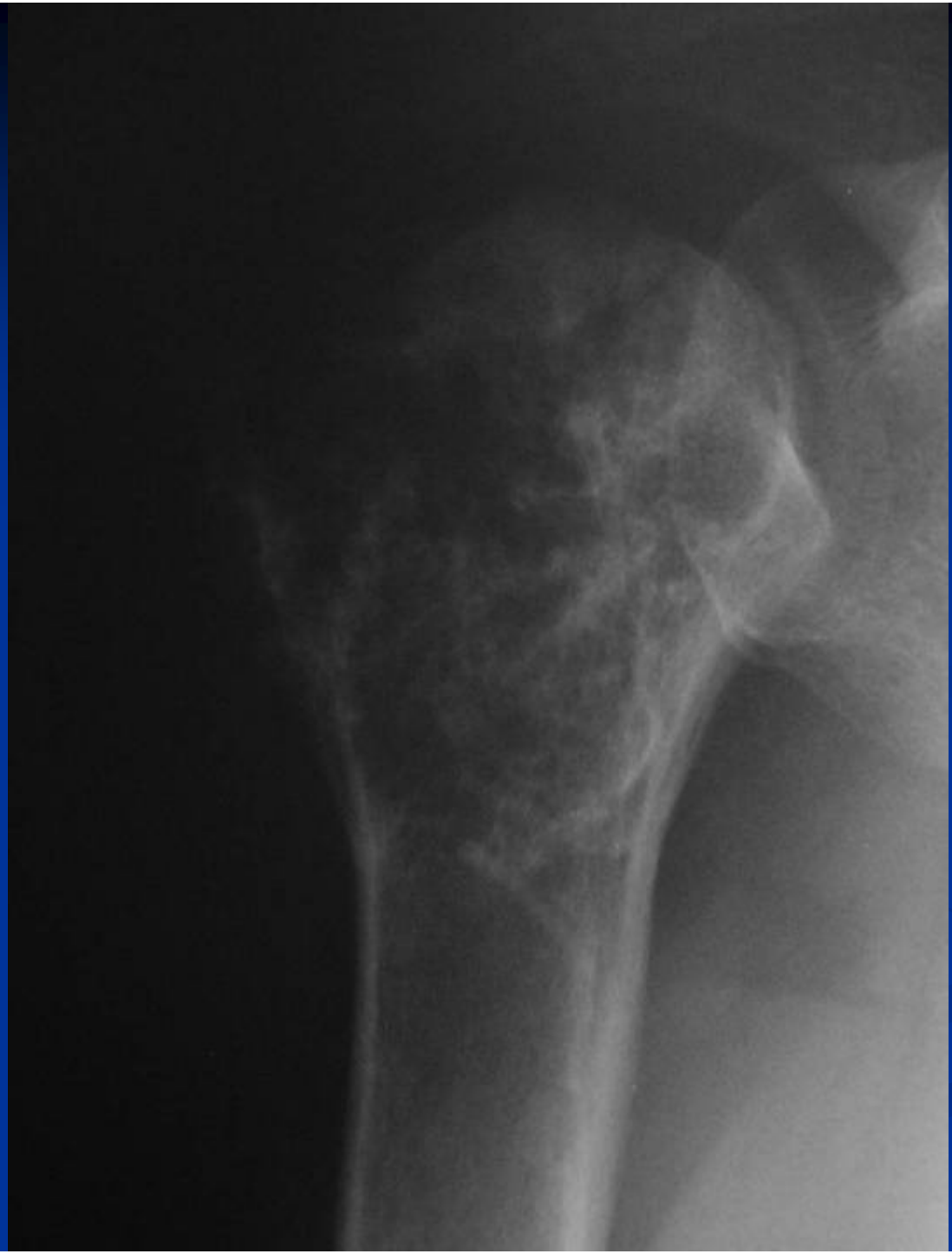


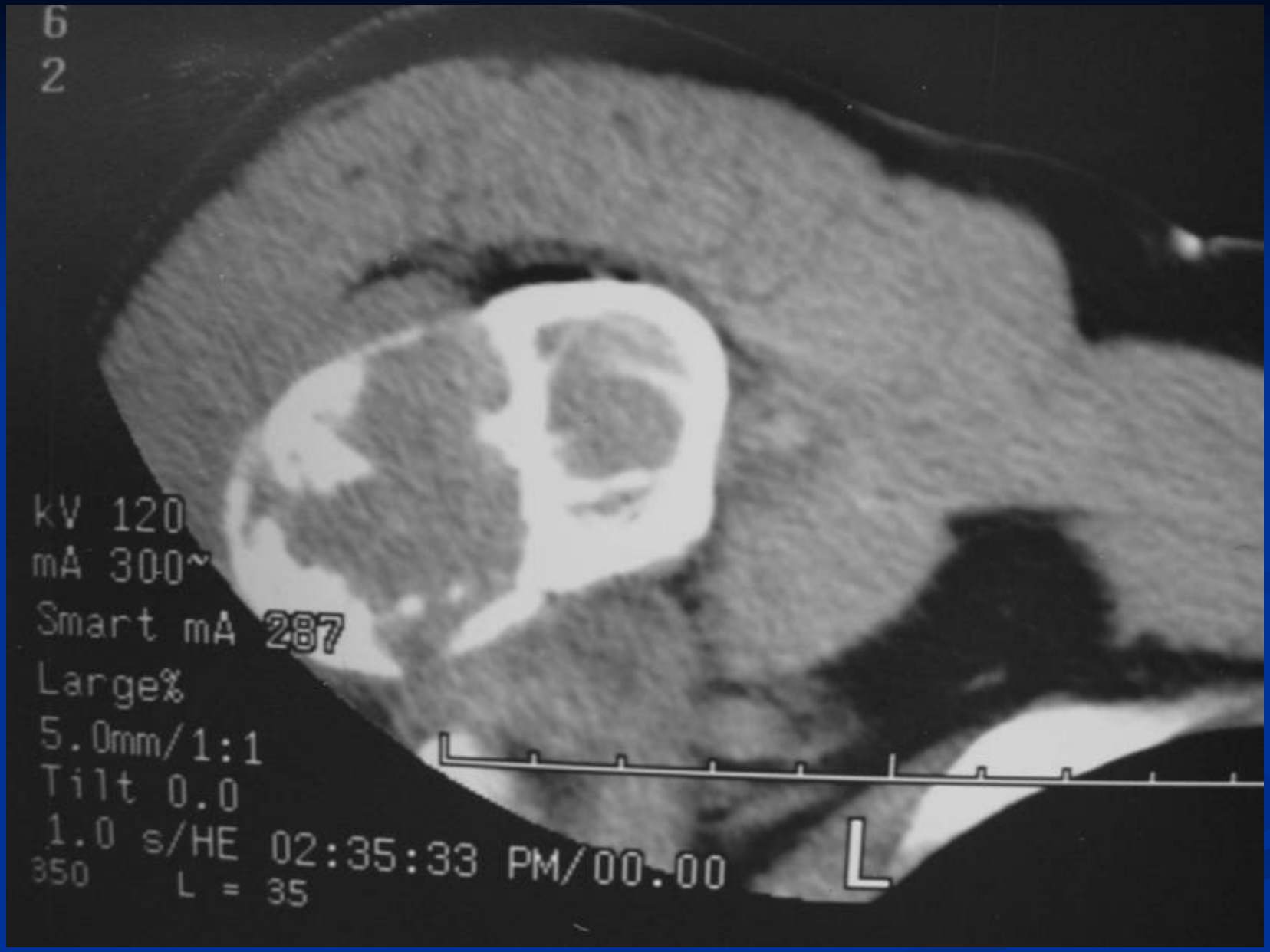
Intraosseous Lipoma


52:14 PM/40.67 P79

Chondrosarcoma



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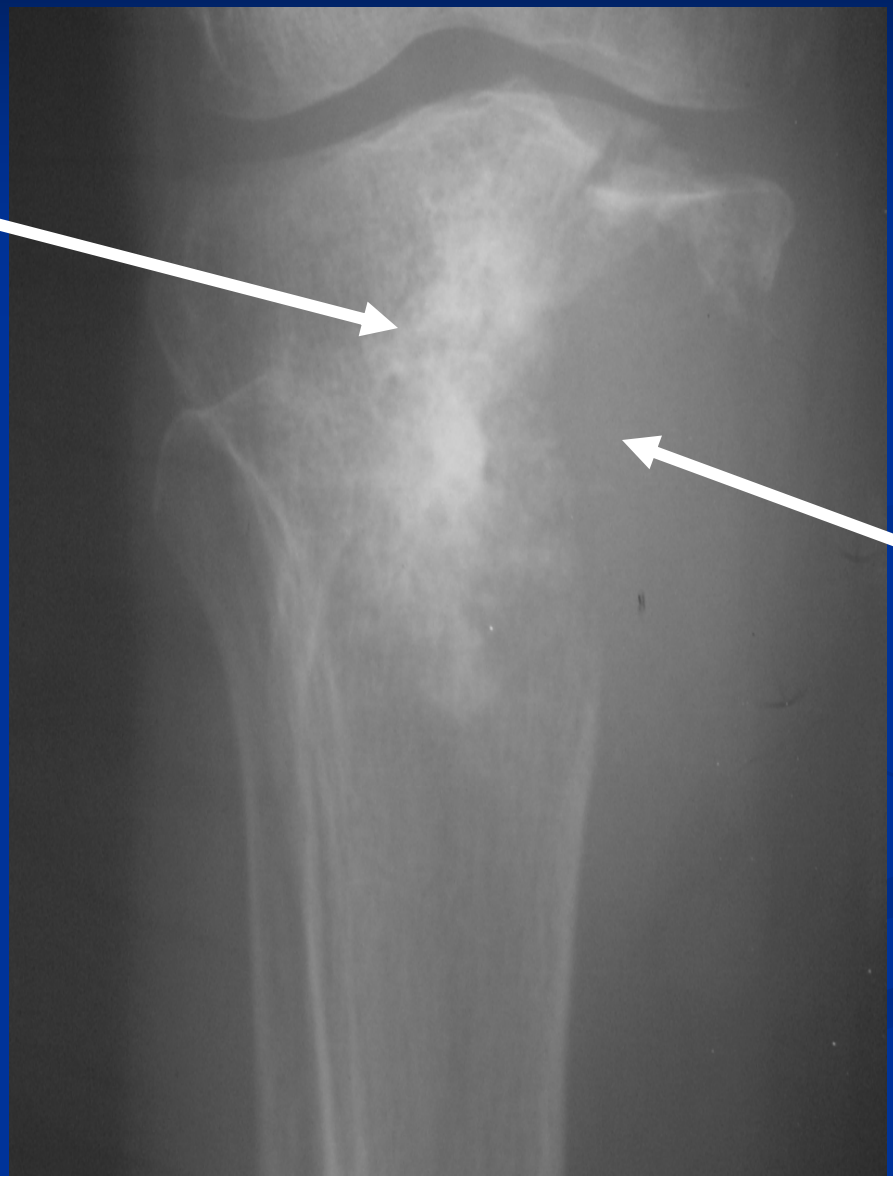
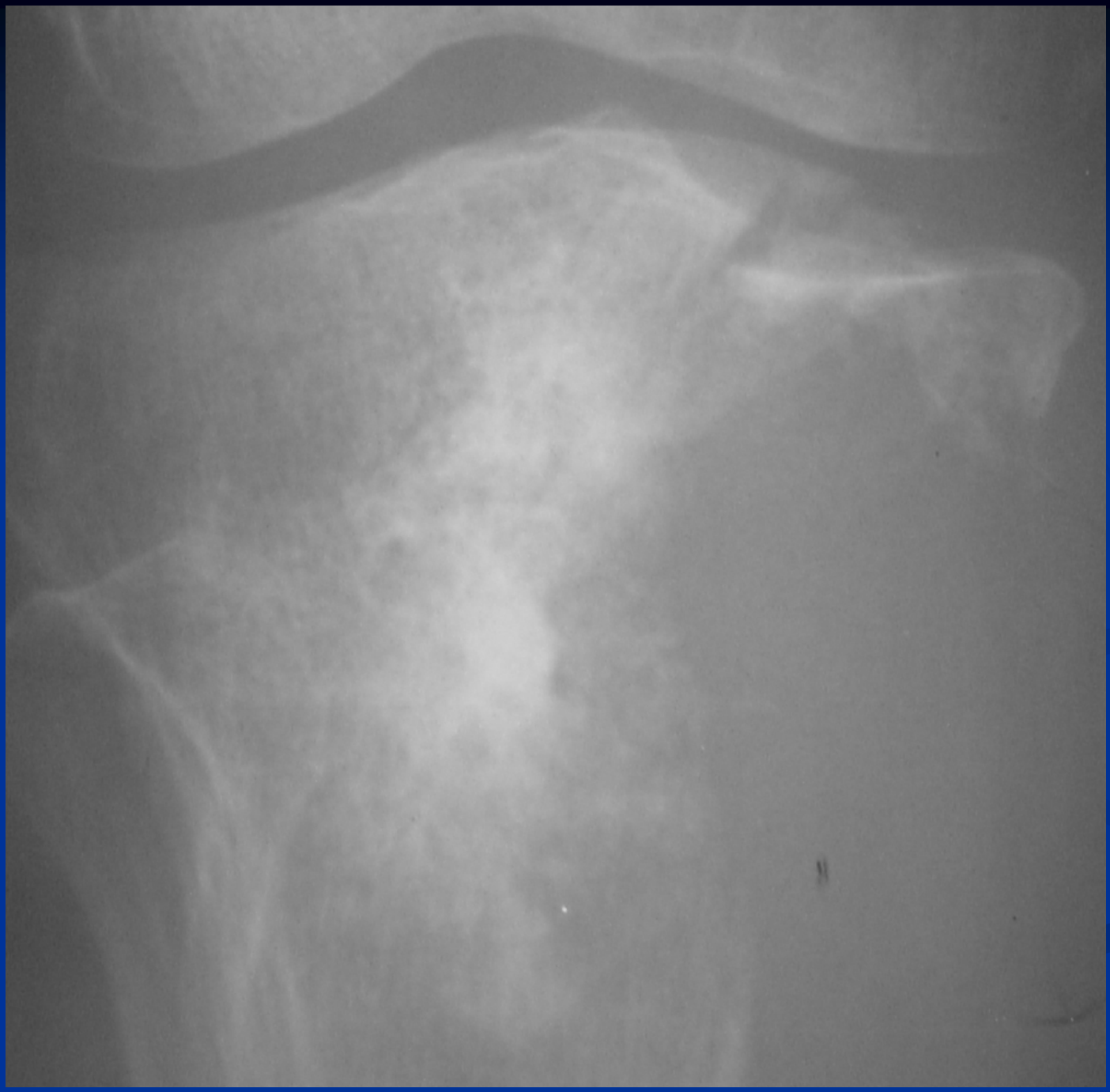
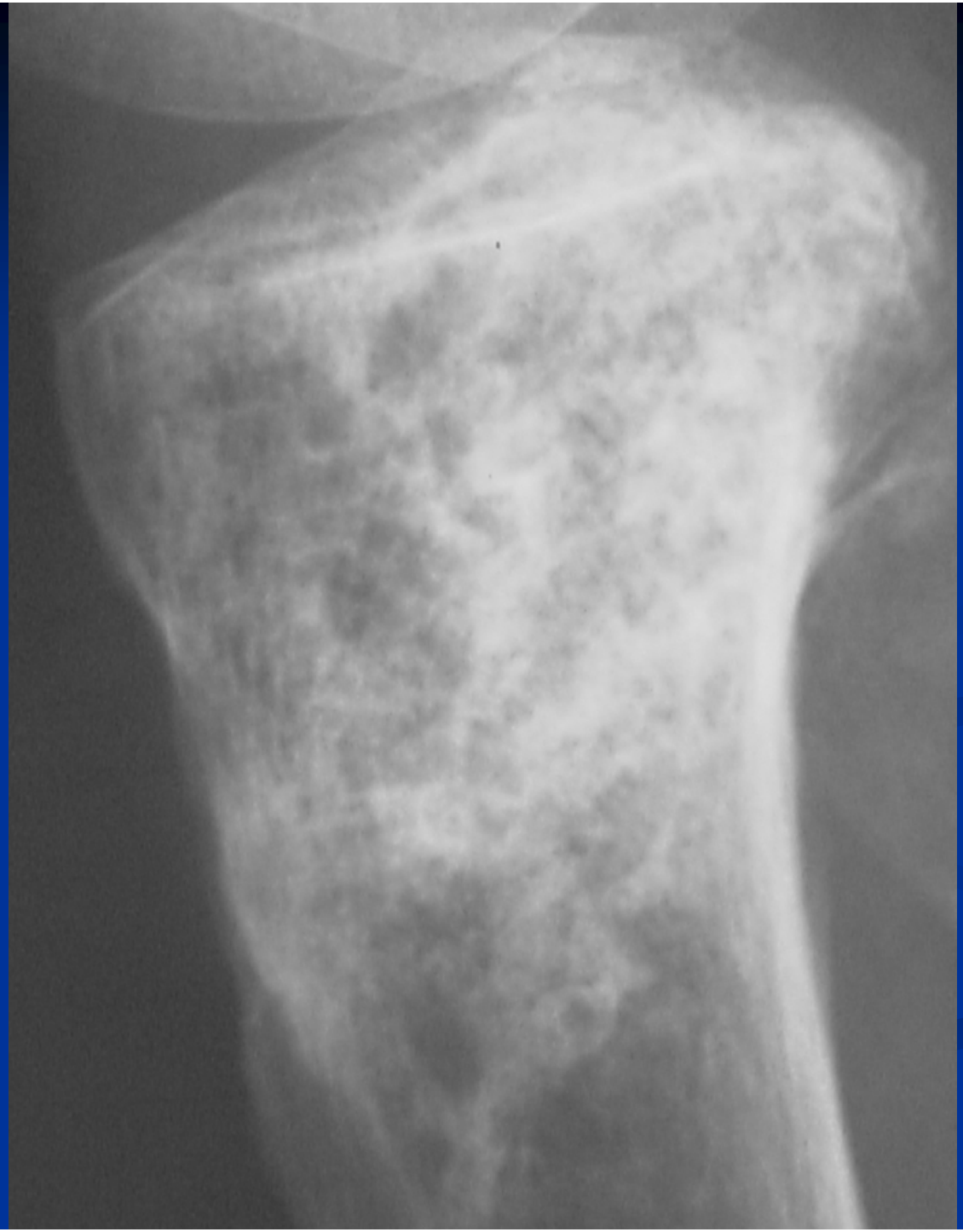
Osteochondroma

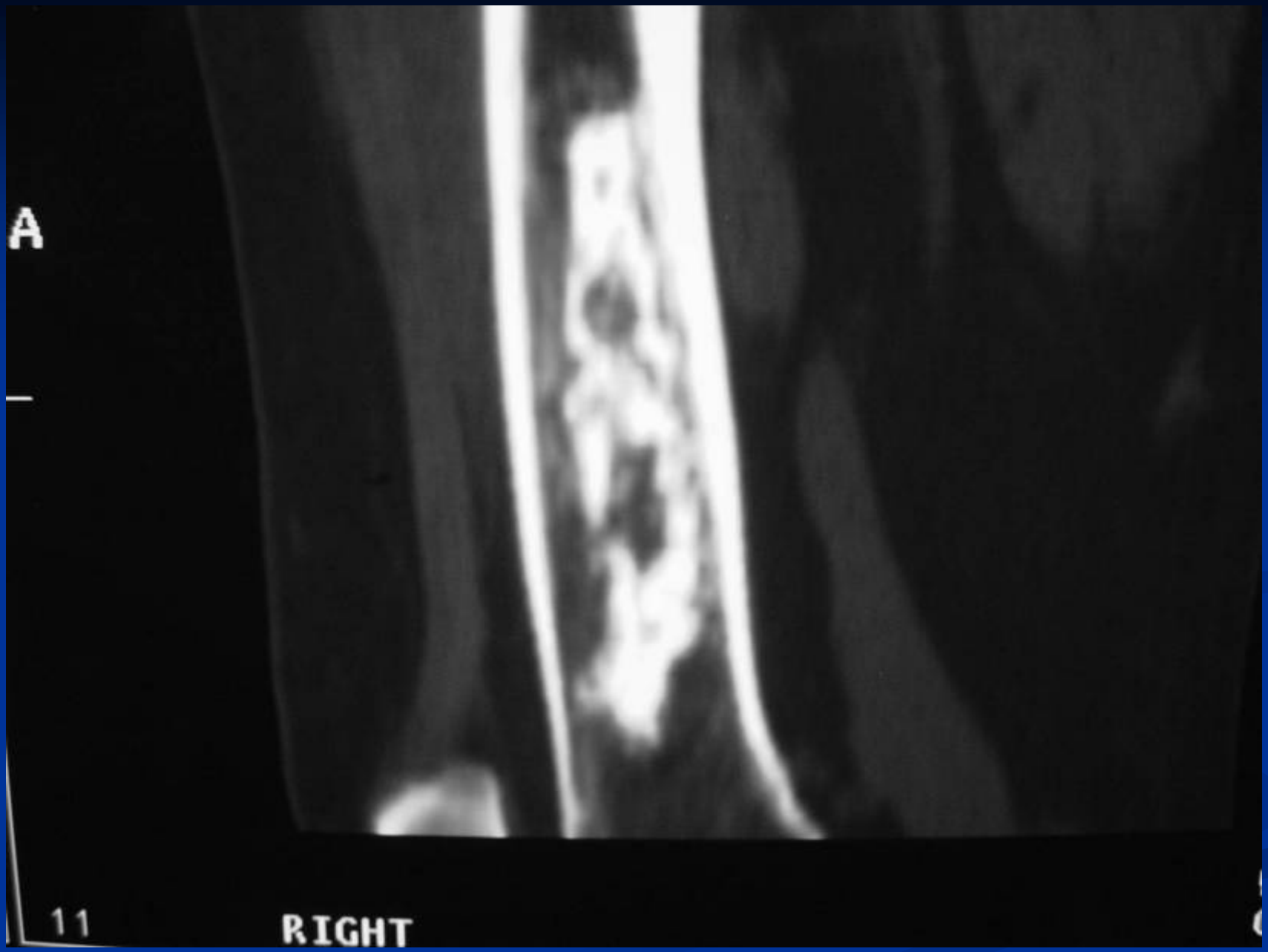
Dedifferentiated Chondrosarcoma



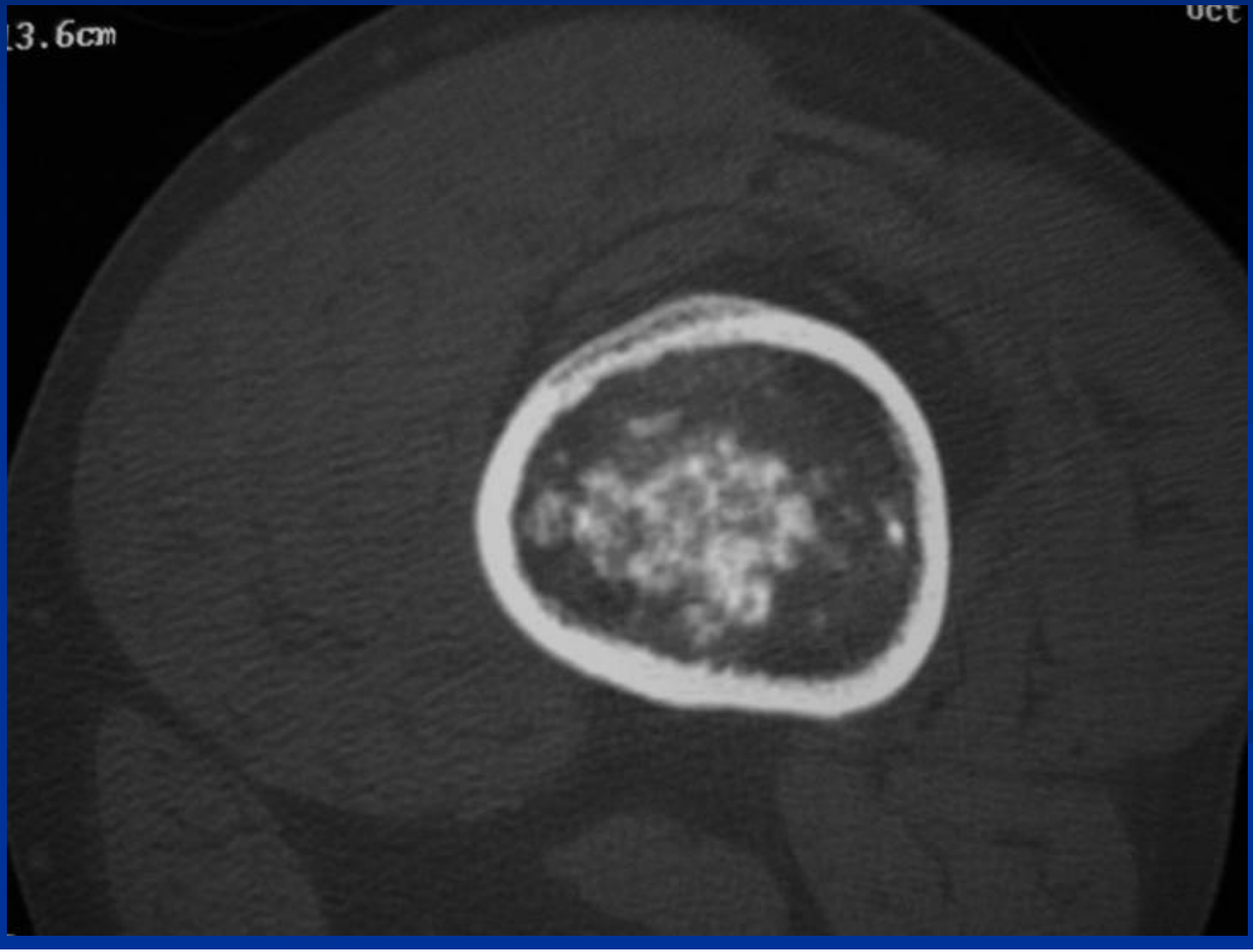


Rings and Arcs



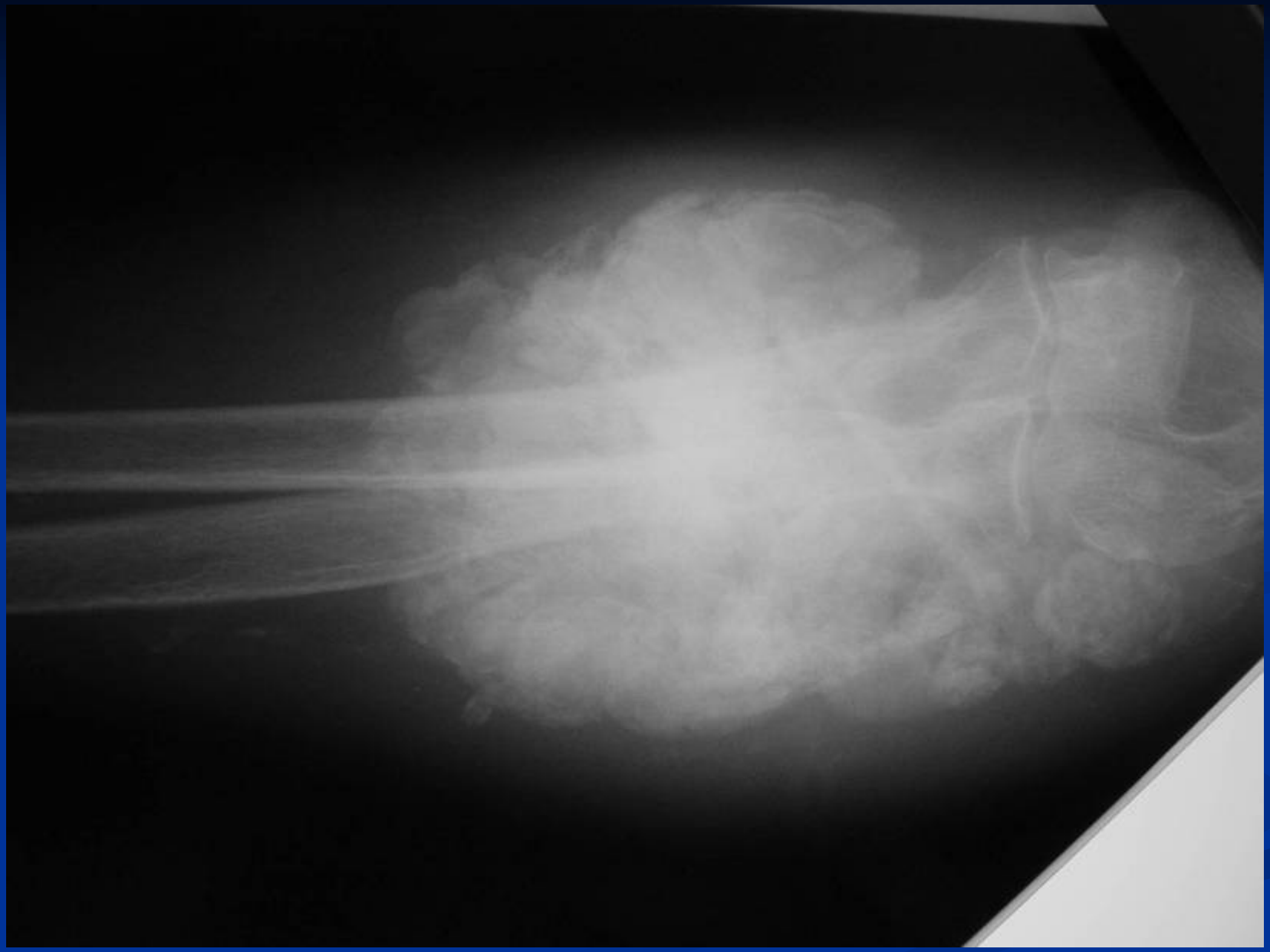

A
11
RIGHT

Rings and Arcs-Calcifications
Cartilage Tumor

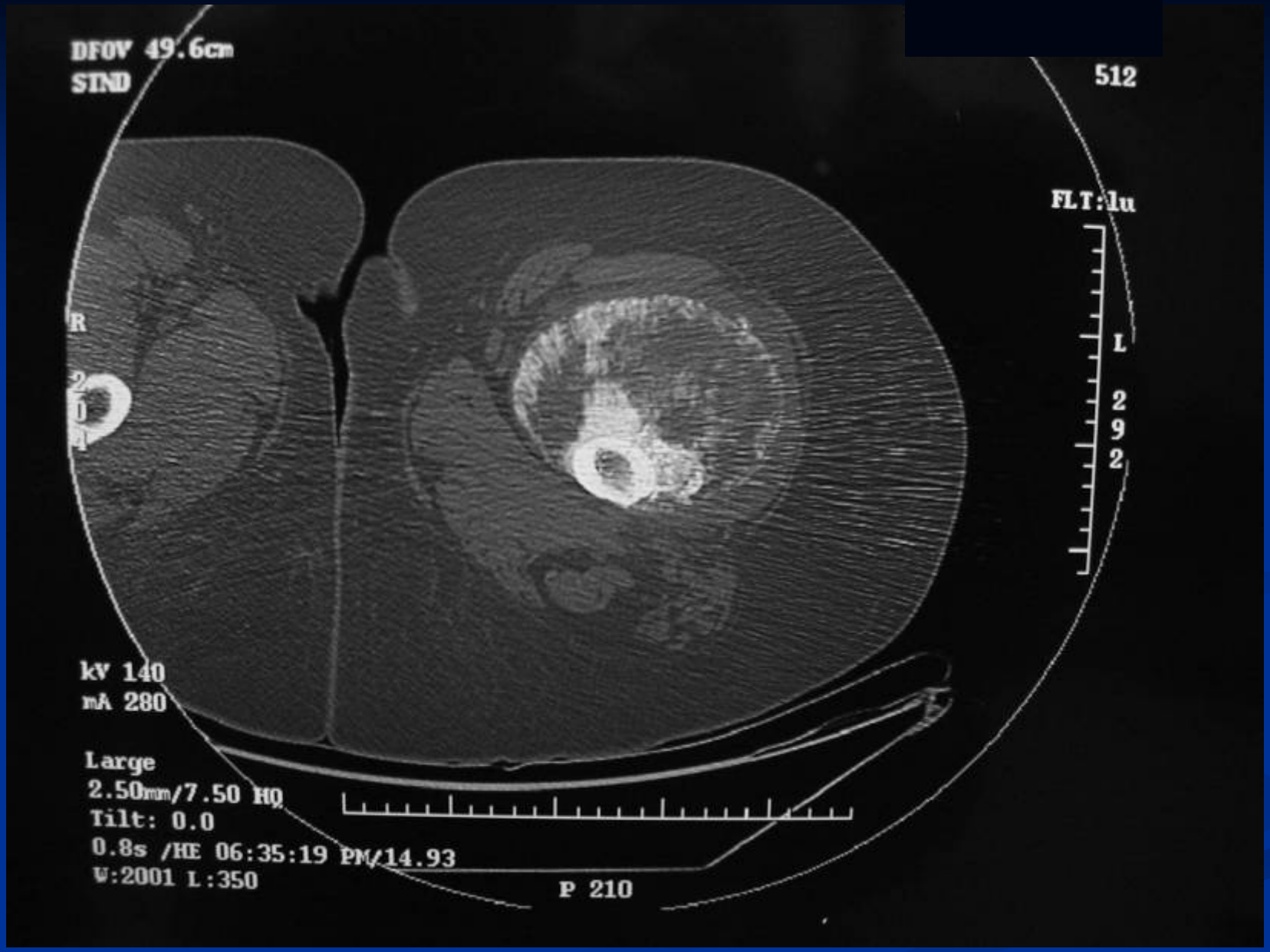


Visible Tumor Matrix

- **Ossification**
  - Cloudlike, Fluffy, Marble-like
    - Osteosarcoma
    - Parosteal Osteosarcoma
    - Osteoblastoma
    - Osteoma



Osteosarcoma


DFOV 49.6cm
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kV 140
mA 280
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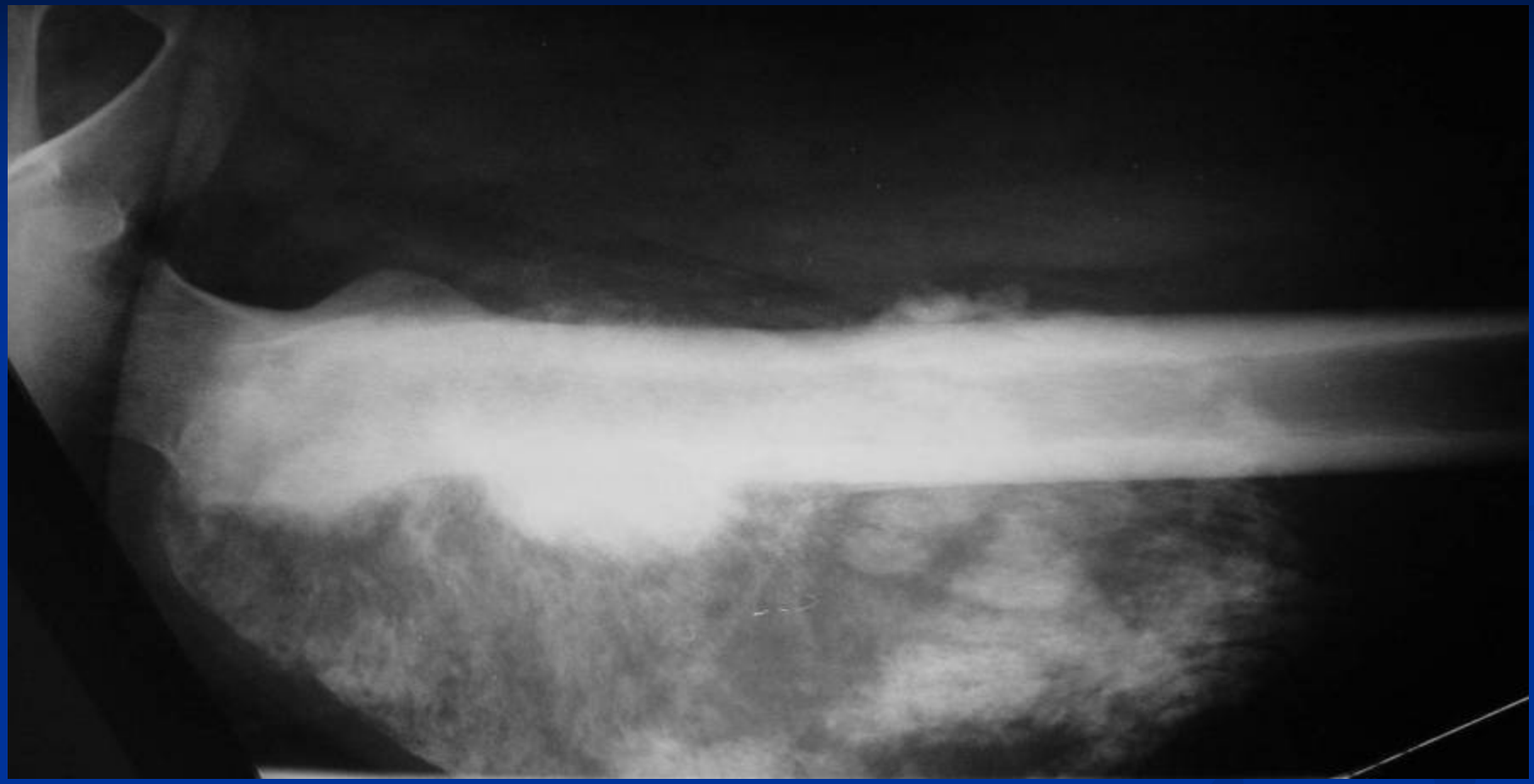
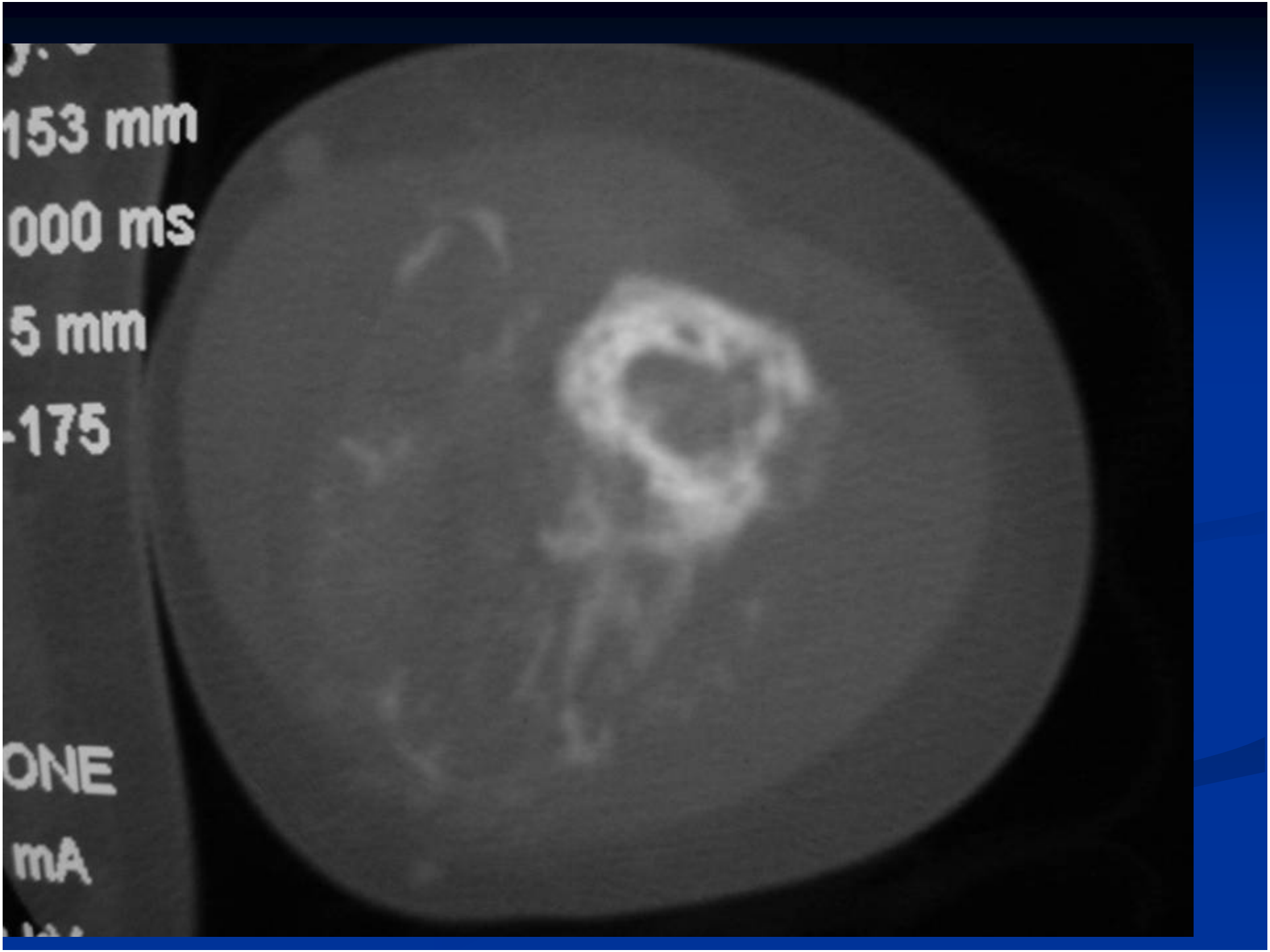
W:2001 L:350
P 210



Osteosarcoma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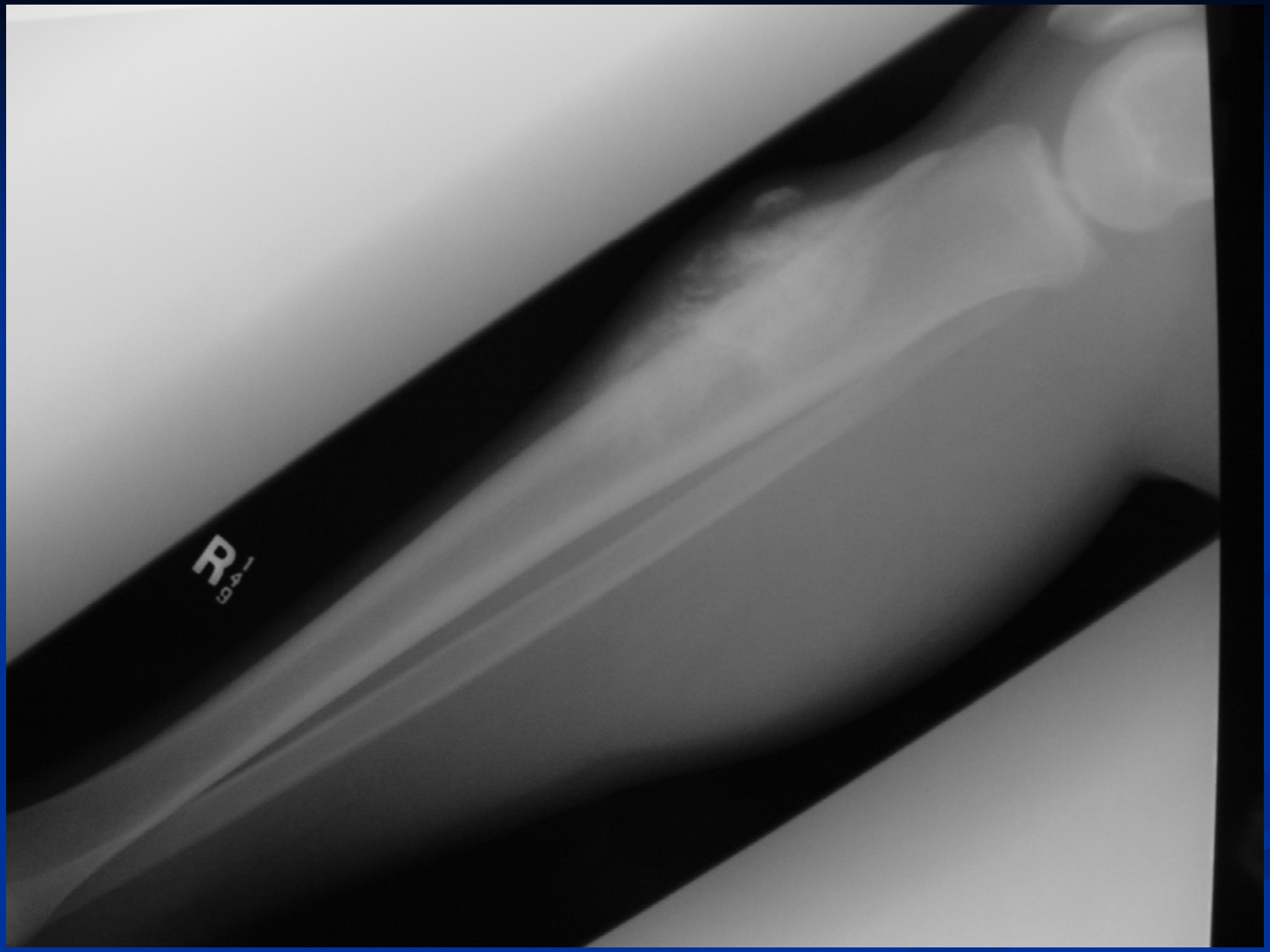
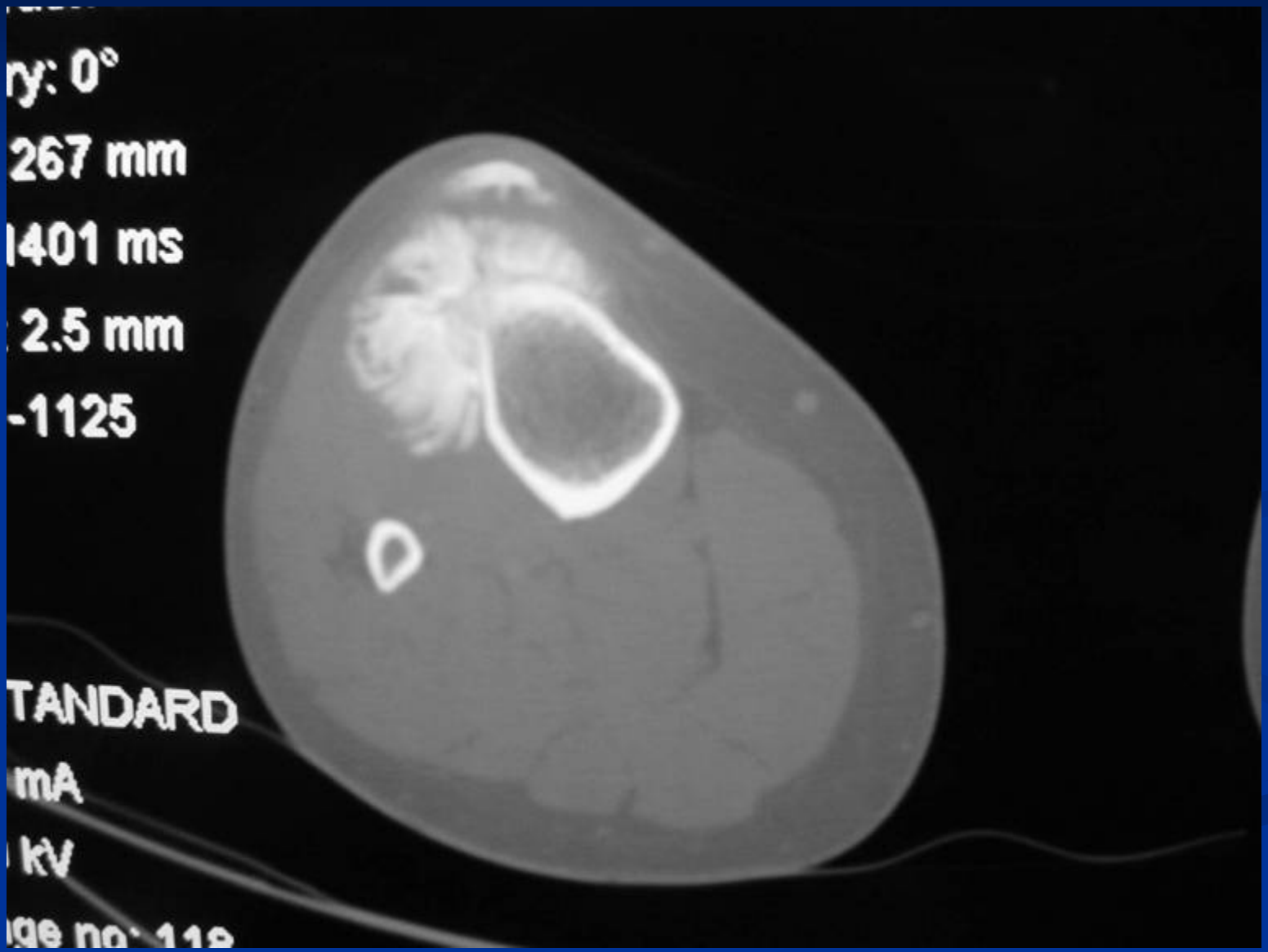
ONE
mA

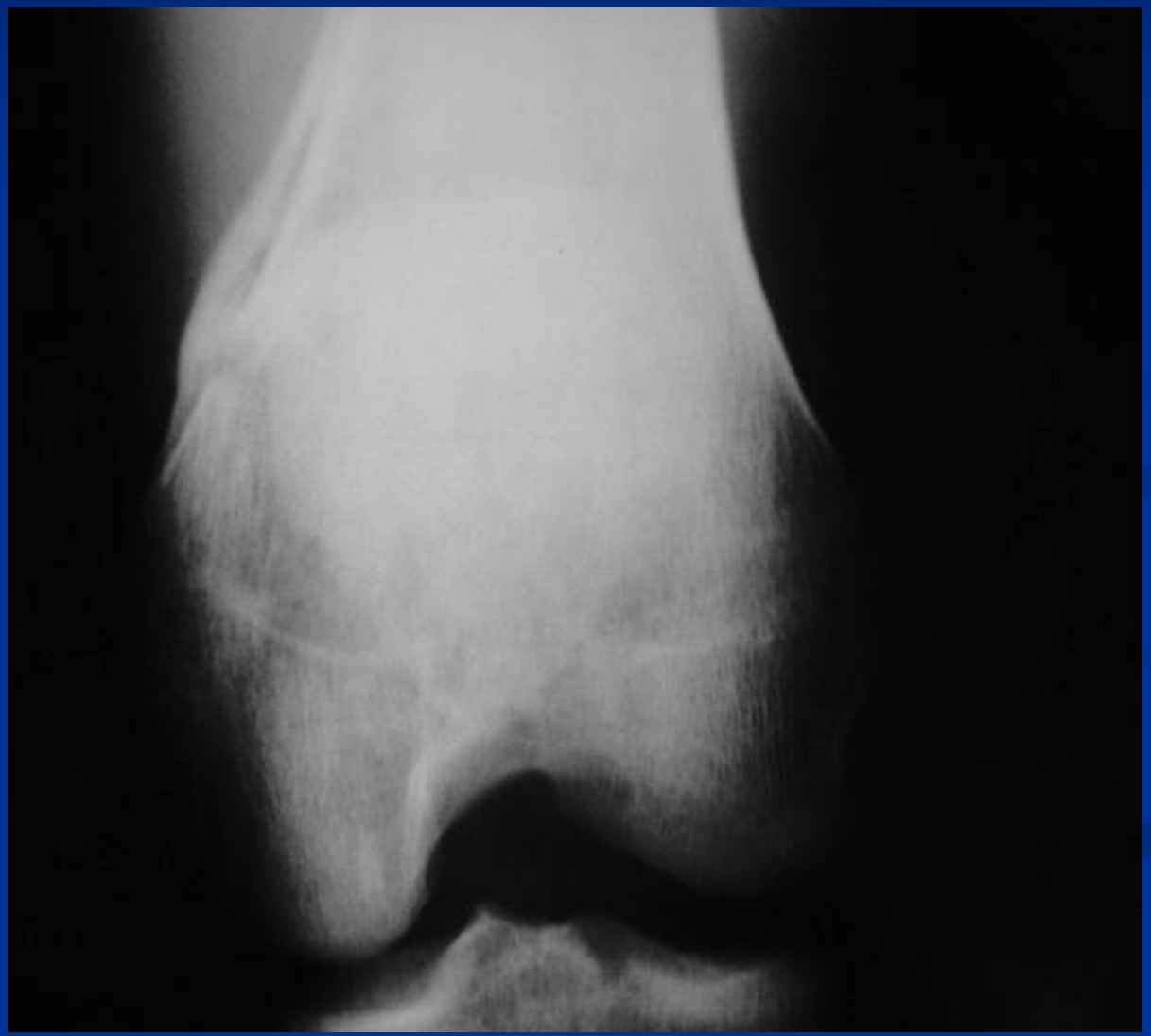
Periosteal Osteosarcoma



Periosteal Osteosarcoma CT Scan



Conventional Intramedullary Osteosarcoma



Conventional Intramedullary Osteosarcoma

Marble-Like Ossification
Osteosarcoma


65 660762-6
92 1994.07.03
CLOEX-/L
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L
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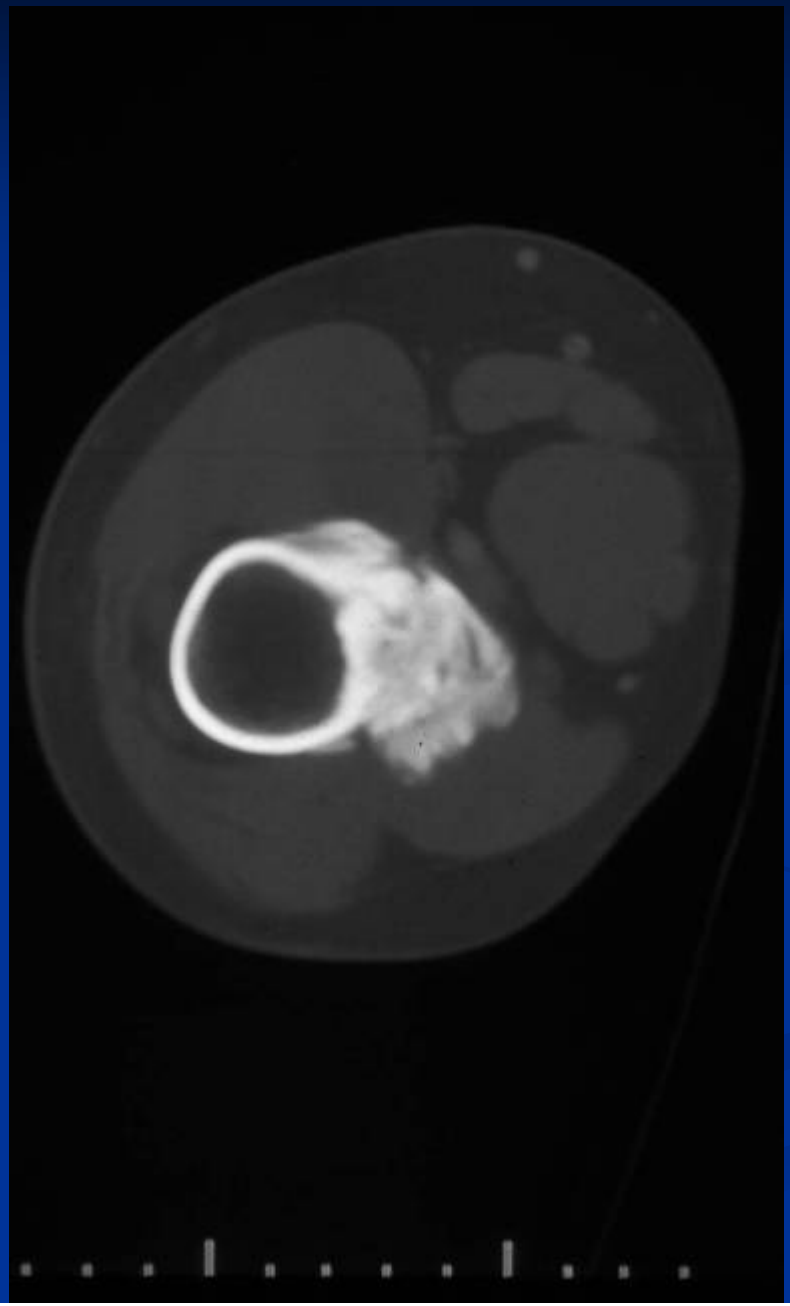
Parosteal Osteosarcoma

Parosteal Osteosarcoma

Parosteal Osteosarcoma CT Scan

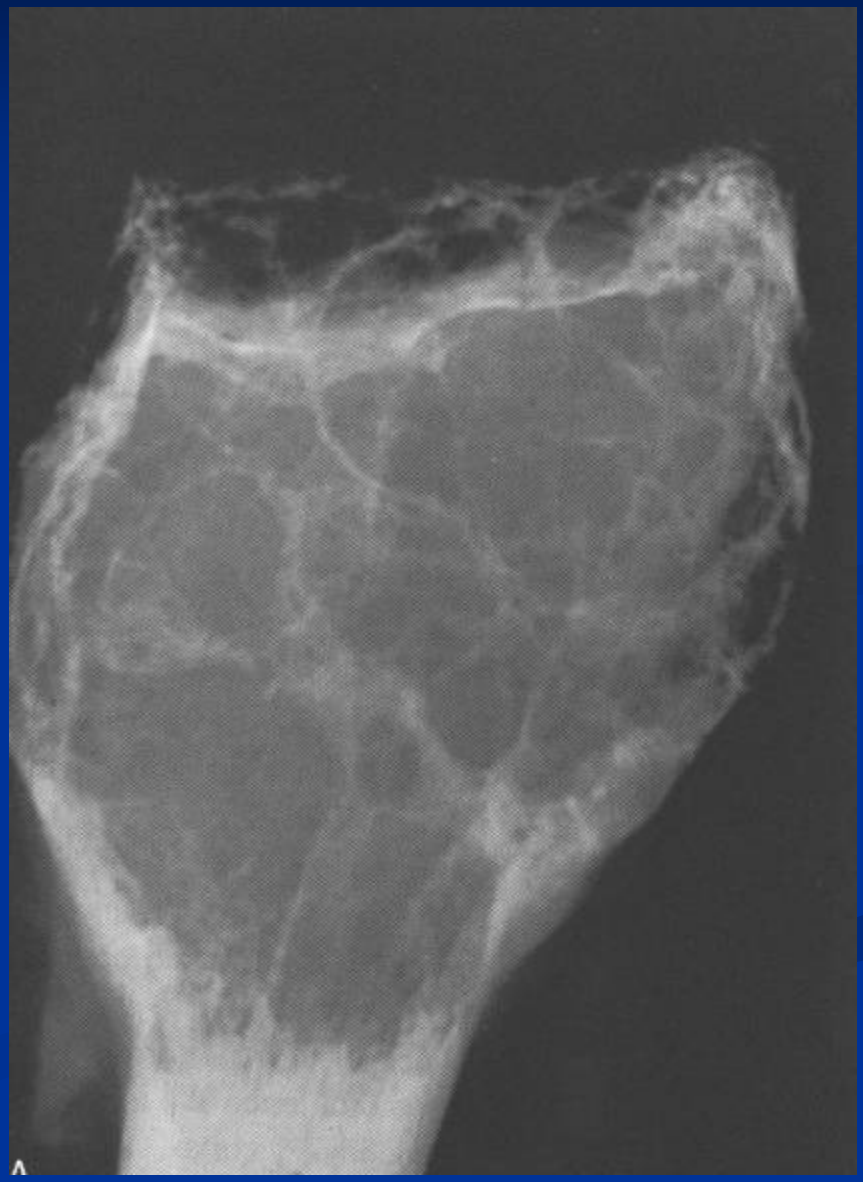
Parosteal Osteosarcoma

Parosteal Osteosarcoma CT Scan



Internal Trabeculations

- Residual Trabeculae or New Bone Formation Due to Adjacent Tumor
- **Differential Diagnosis:**
- **Giant Cell Tumor**
- **Chondromyxofibroma**
- **Desmoplastic Fibroma**
- **Nonossifying Fibroma**
- **Aneurysmal Bone Cyst**
- **Hemangioma**



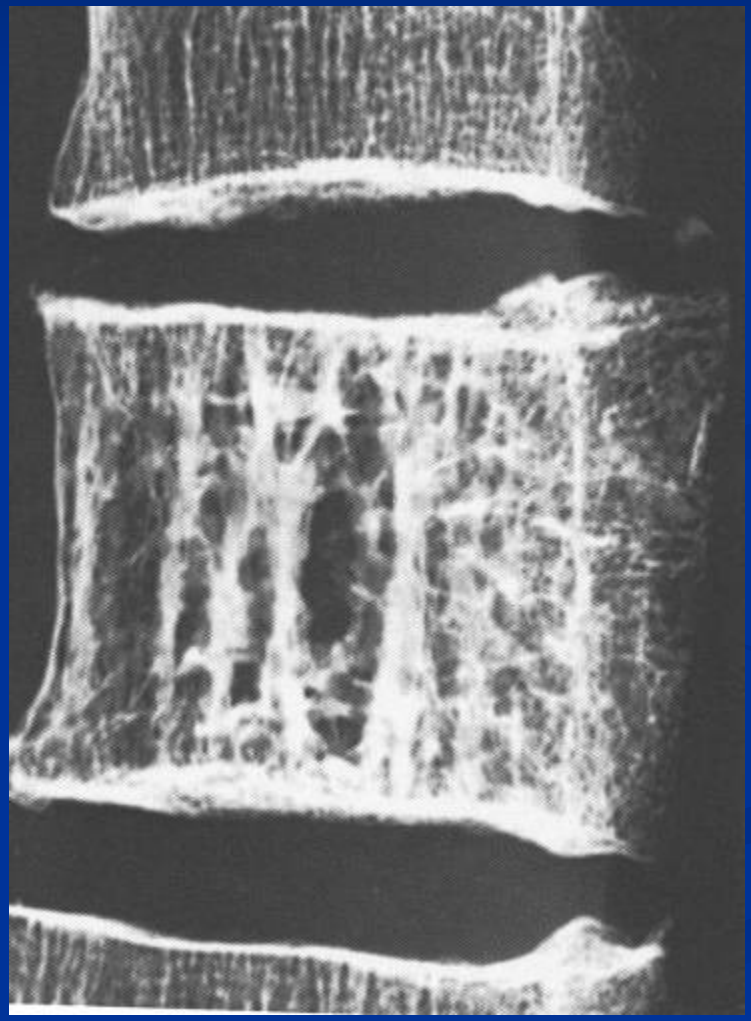
Giant Cell Tumor

Desmoplastic Fibroma

Chondromyxofibroma

Nonossifying Fibroma

Hemangioma



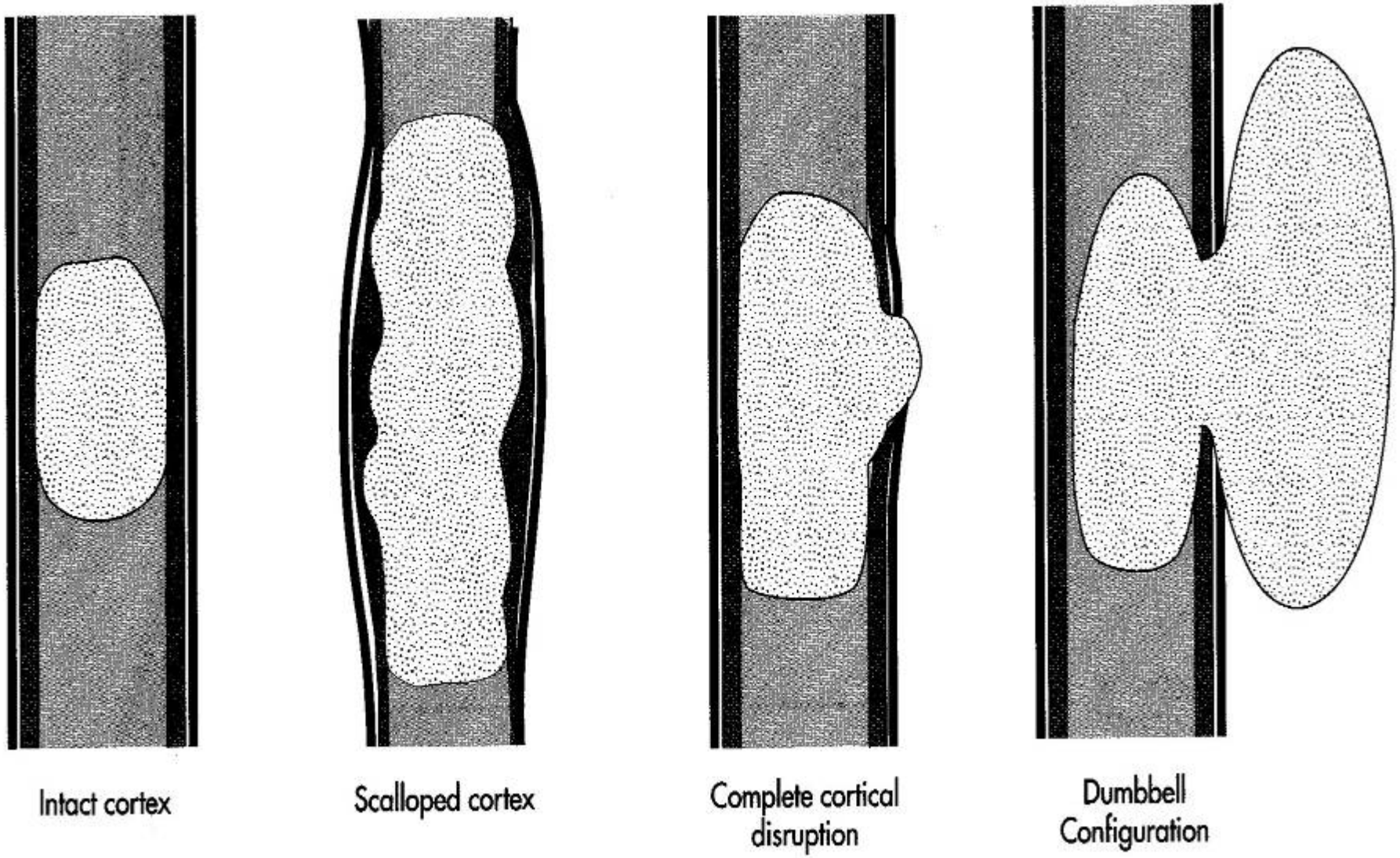
ABC

Cortical Erosion, Expansion, Penetration

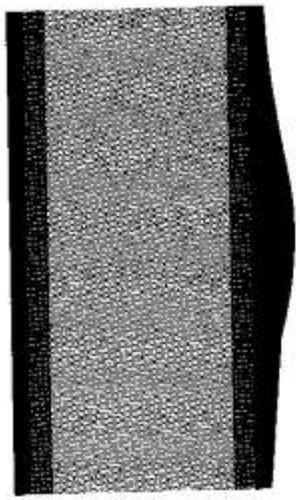
- Bone Cortex Can Be an Effective Barrier To Tumor Growth of Certain Tumors
- Certain Tumors Penetrate the Cortex Partially or Completely (Benign and Malignant)
- Progressive Endosteal Erosion that is Accompanied by a Periosteal Reaction Leads to an Expanded Bony Contour (Like an ABC)
- Aggressive lesion that Penetrates the entire Cortex or Penetrates Haversian Canals will Elevate the Periosteum and Lead to a Periosteal Reaction

Cortical Erosion, Expansion, Penetration

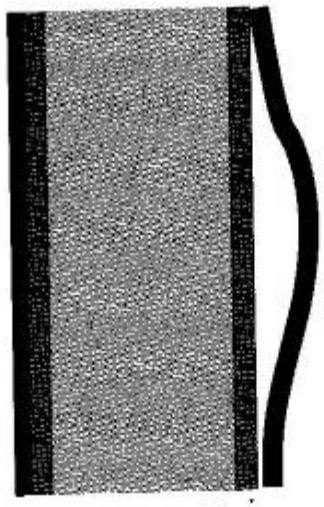
- It is important to understand that both benign and malignant tumors can penetrate the cortical bone and form a soft tissue mass. The fact that there is a soft tissue mass does not automatically confer that the tumor is malignant. Certain benign tumors can also form a soft tissue mass. The periosteum usually remains intact around a benign soft tissue mass. This may only be detectable on a CT scan demonstrating an "Egg-Shell" rim of calcification around the periphery of the mass. The periosteum is usually destroyed by malignant tumors and does not remain intact around the soft tissue component of a malignant tumor.


Intact cortex
Scalloped cortex
Complete cortical disruption
Dumbbell Configuration

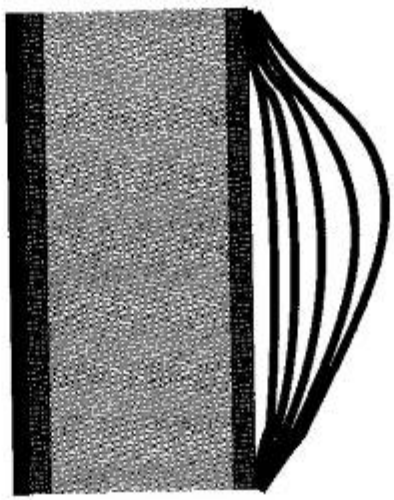
Continuous



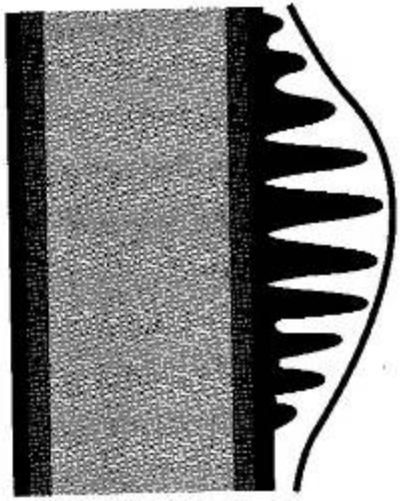
Solid



Single lamellar

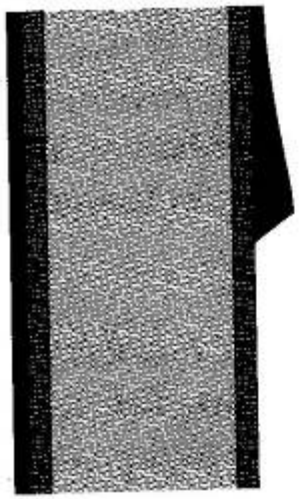


Onion-skin

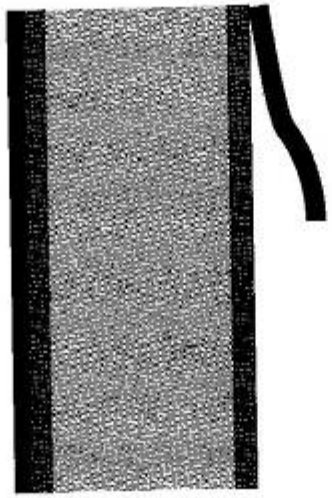


Spiculated

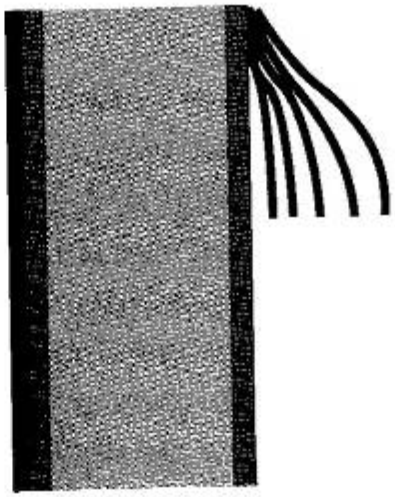
Interrupted



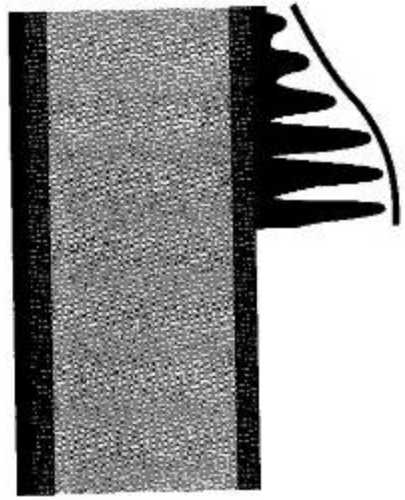
Buttress



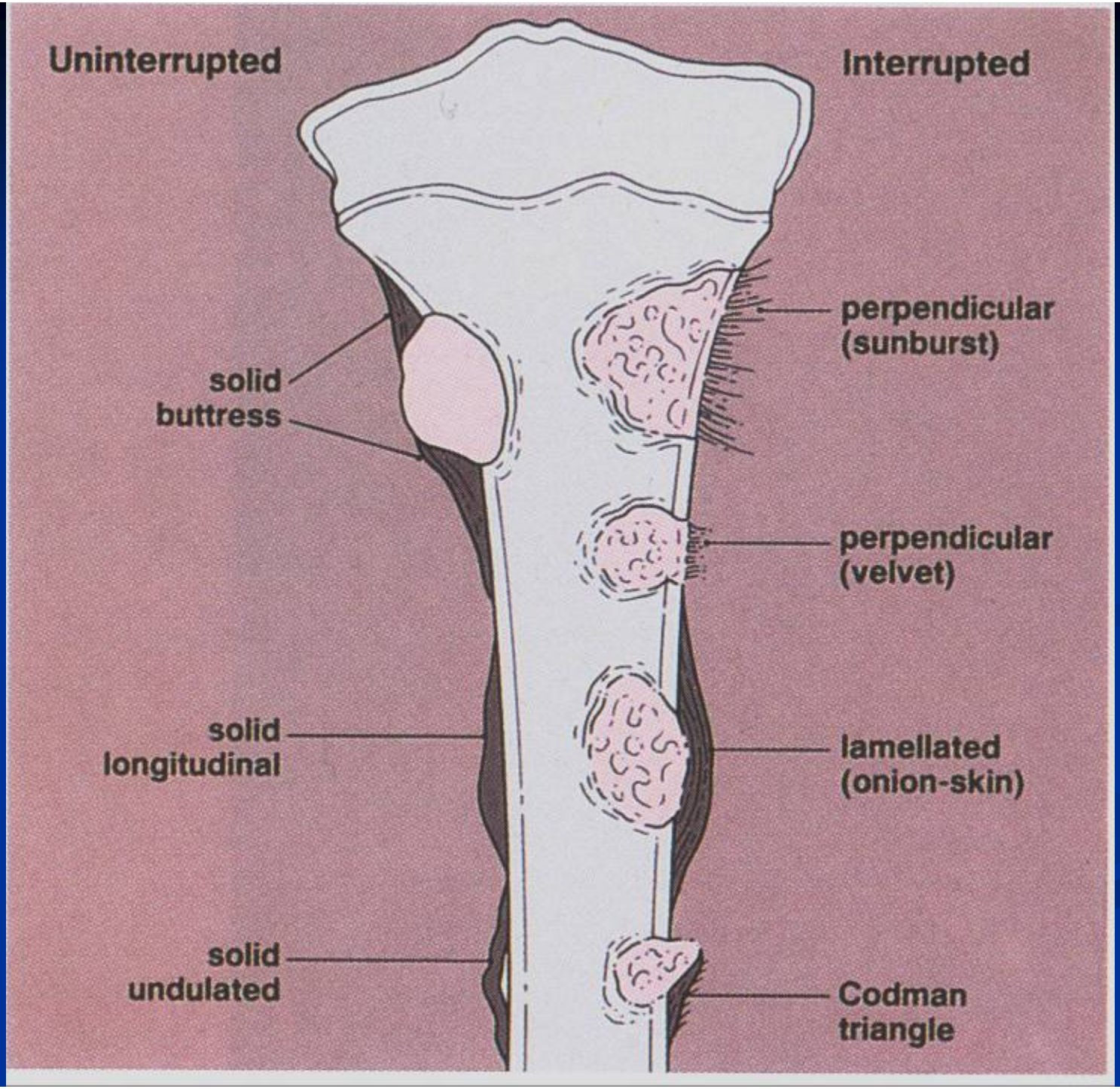
Codman's triangle



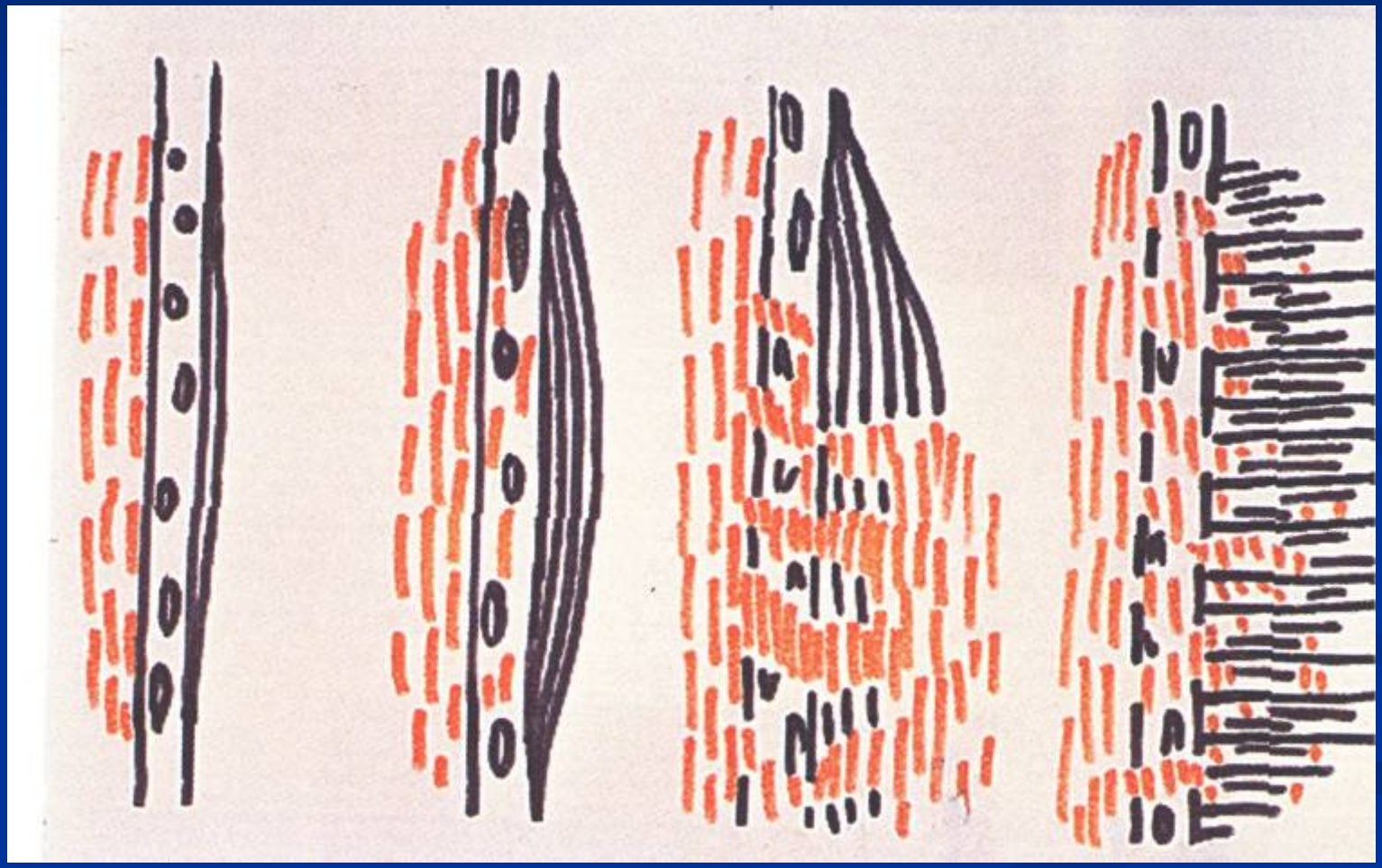
Lamellar



Spiculated


Uninterrupted
Interrupted
perpendicular (sunburst)
solid buttress
perpendicular (velvet)
solid longitudinal
lamellated (onion-skin)
solid undulated
Codman triangle

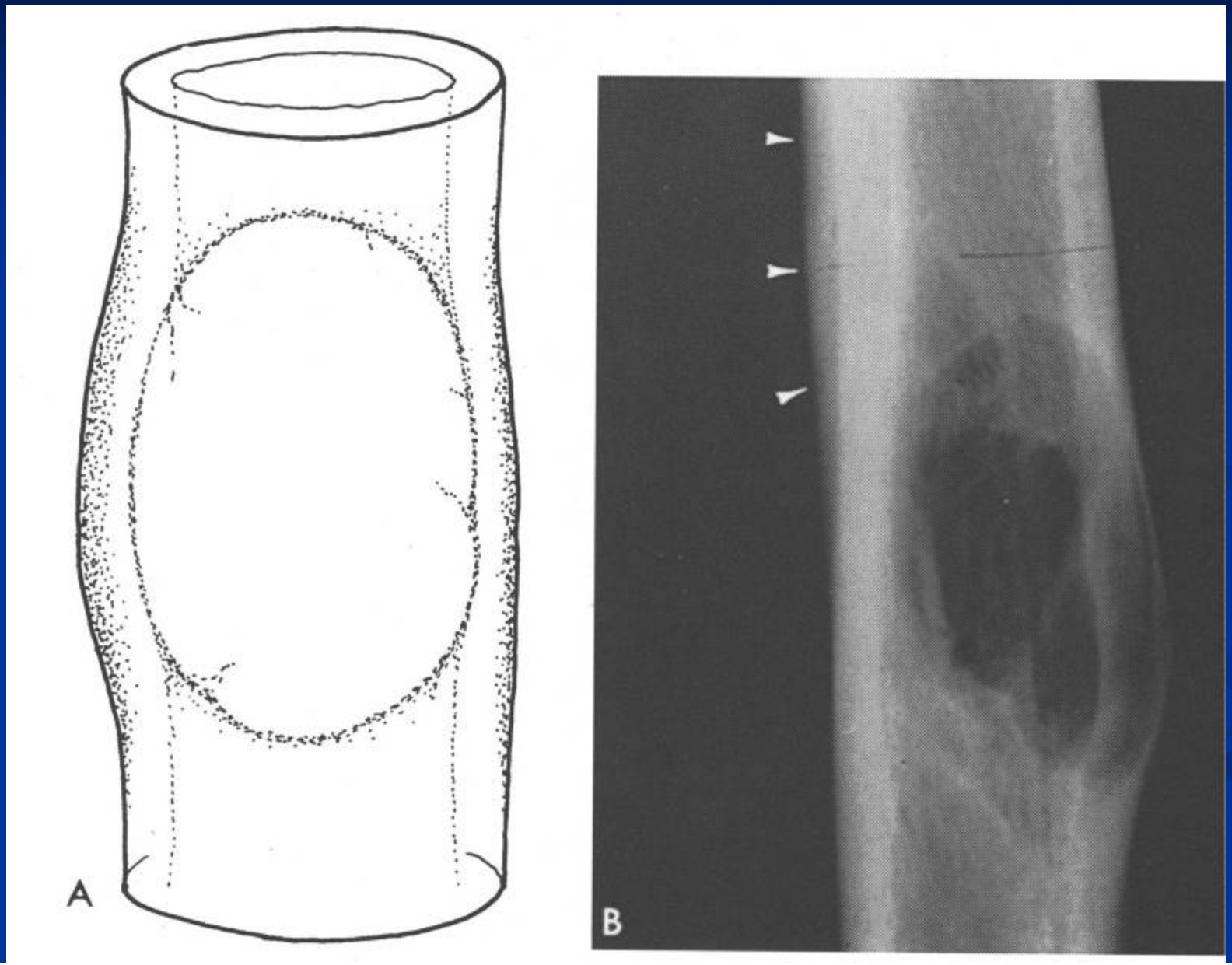
Periosteal Reactions as Related to Tumor Growth



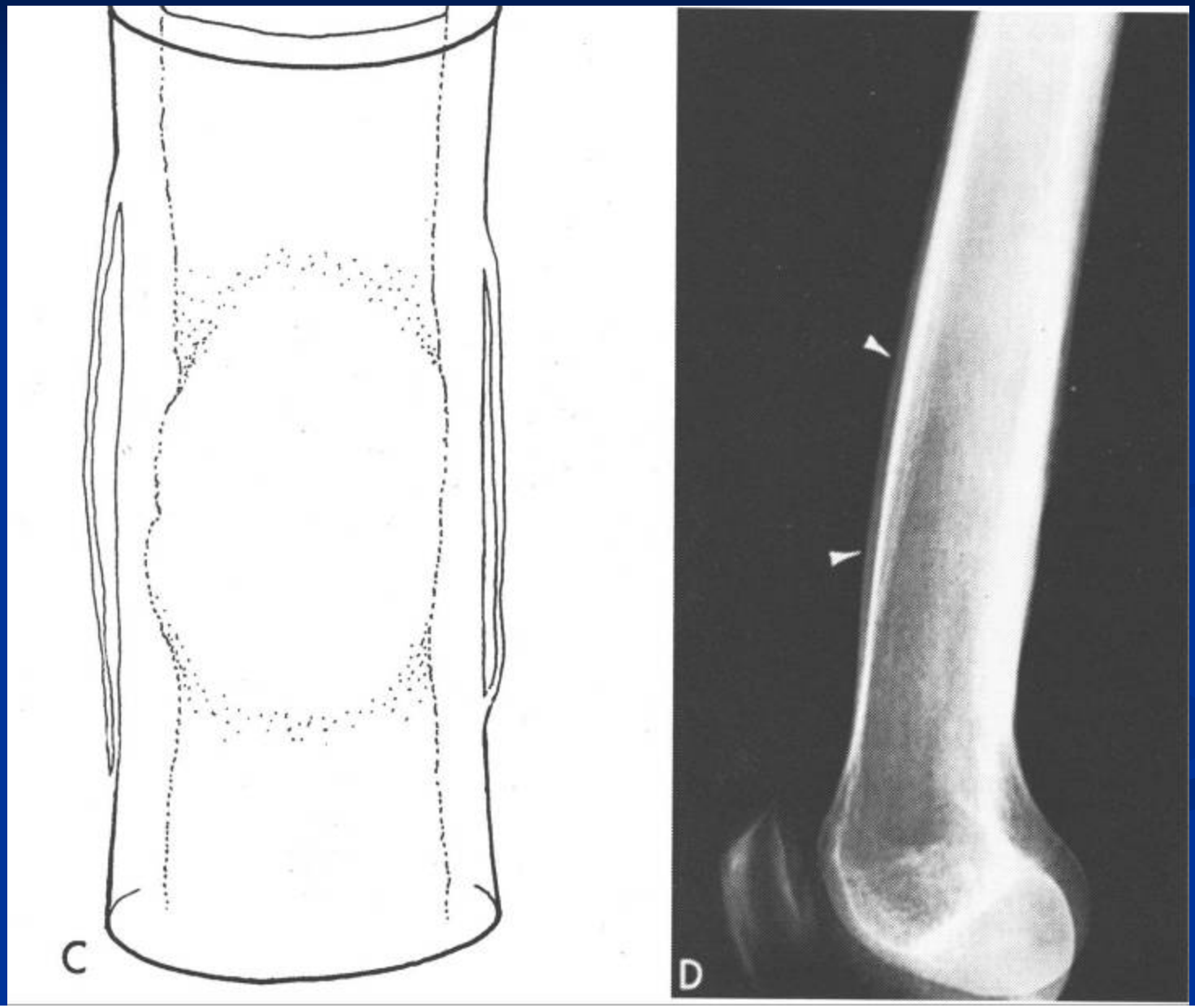
Periosteal Response

- **Benign: Buttressing Pattern; Single Lamellar; Cortical Thickening; Bony Expansion**
  - Endosteal Erosion Leads to Periosteal Proliferation
  - Can Be Same or Diminished Thickness Compared to Normal Cortex
  - Buttressing: Interface Between Normal and Expanded Cortex is Filled In with Bone

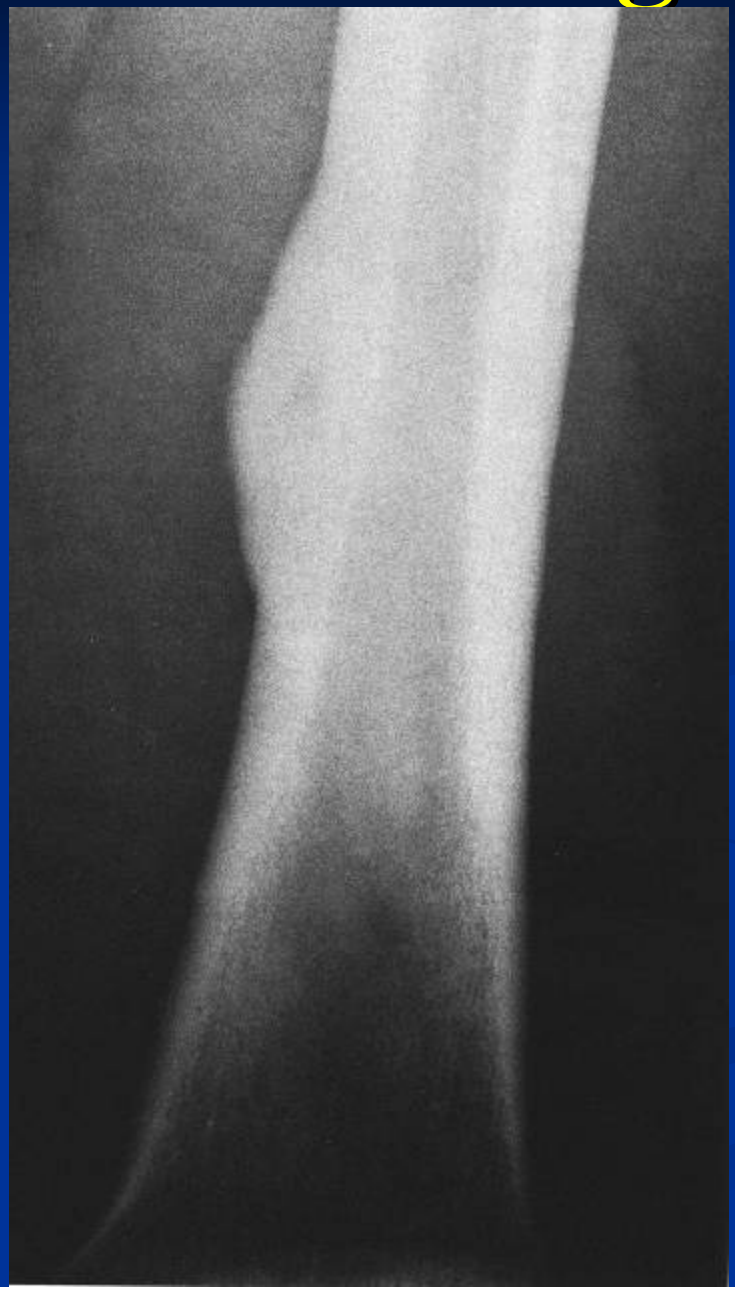
Buttressing



Buttressing



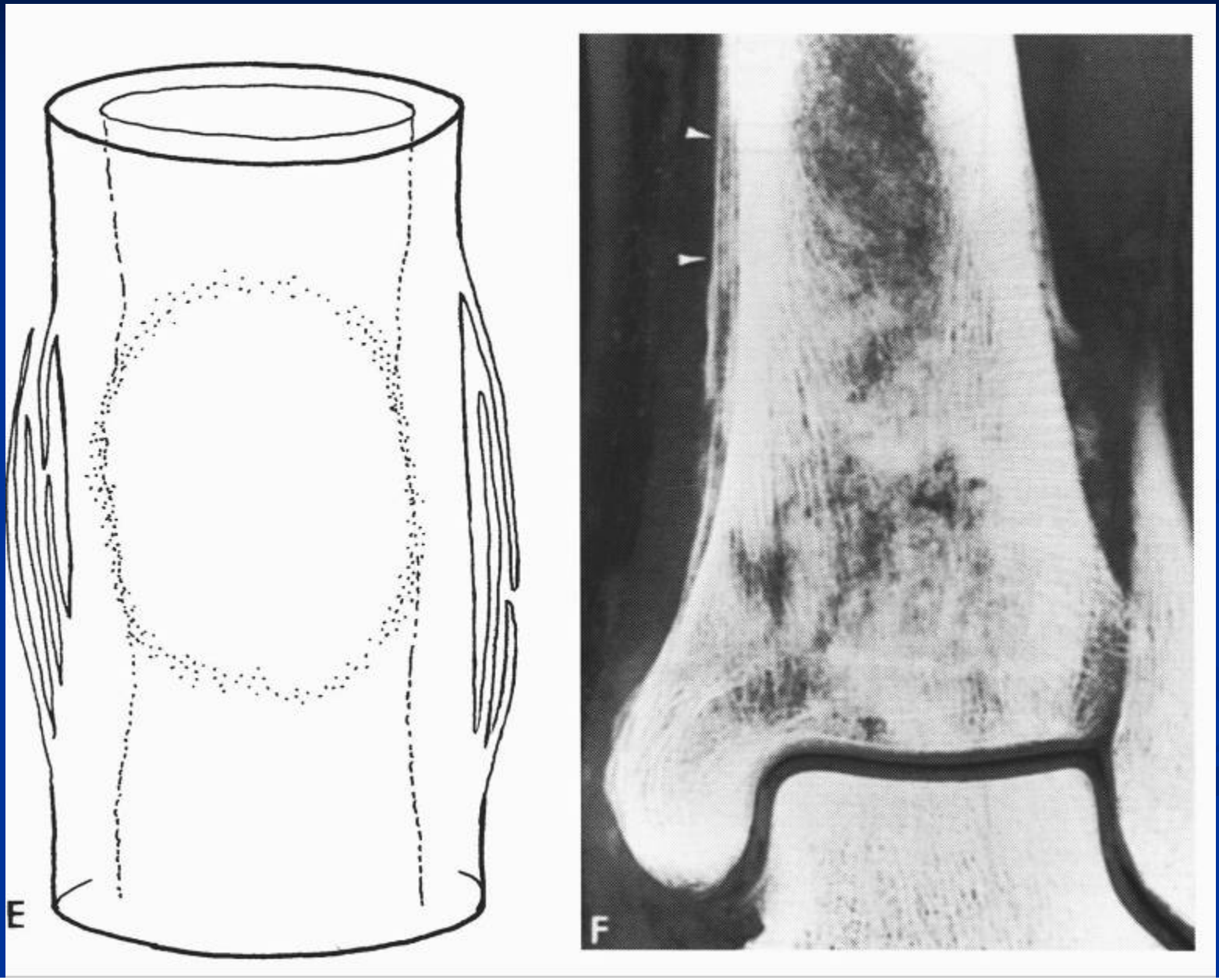
Buttressing



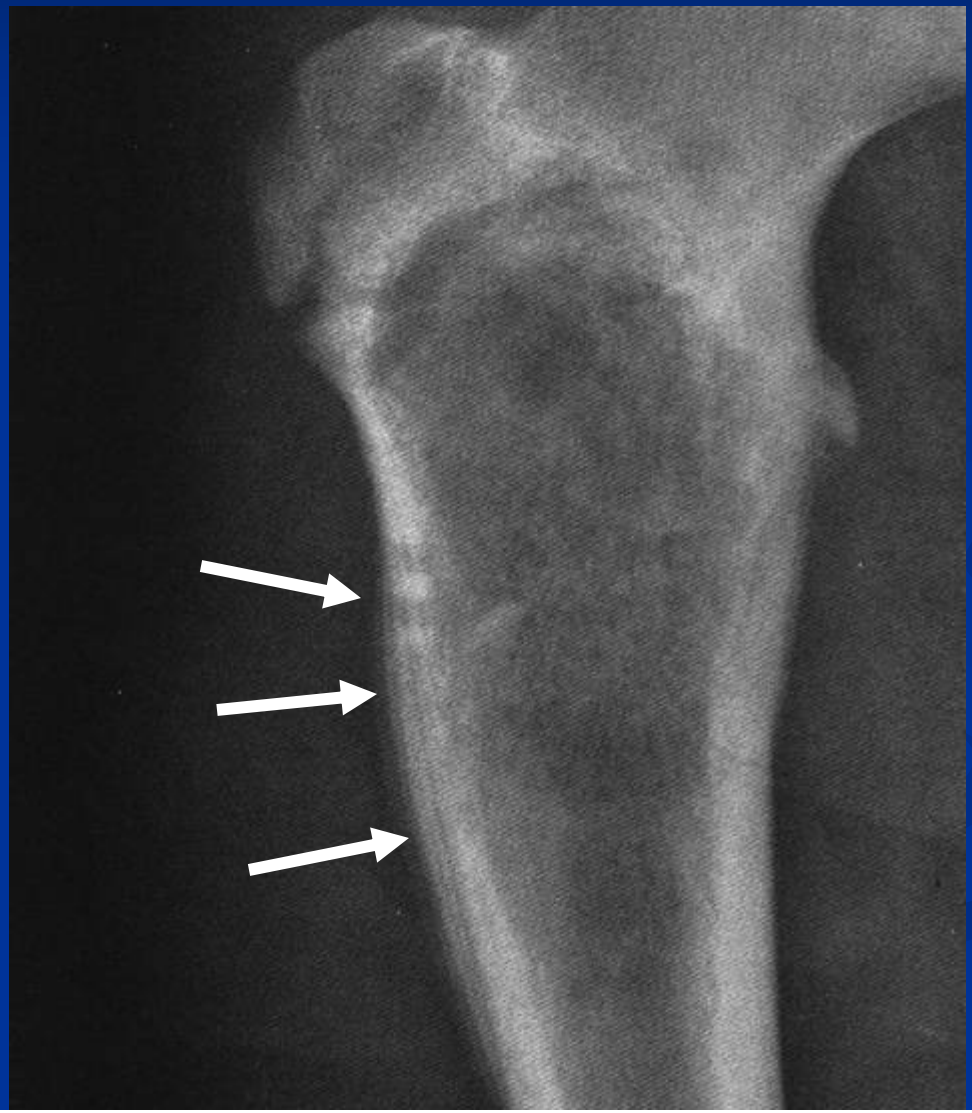
Periosteal Response

- **Malignant Tumors:** Rapid Tumor Growth May Lead to Single or Multiple Concentric Layers
- **Types of Malignant Periosteal Reactions:**
  - Onion Skin: Multiple Concentric layers
  - Codman's Triangle: Occurs at the Periphery of a Lesion or Infective Focus
  - Sun Burst: Delicate Rays that Extend Away from the Bone (Angled with Bone)
  - Hair On End: Rays are Perpendicular to Bone

Onion Skin Appearance



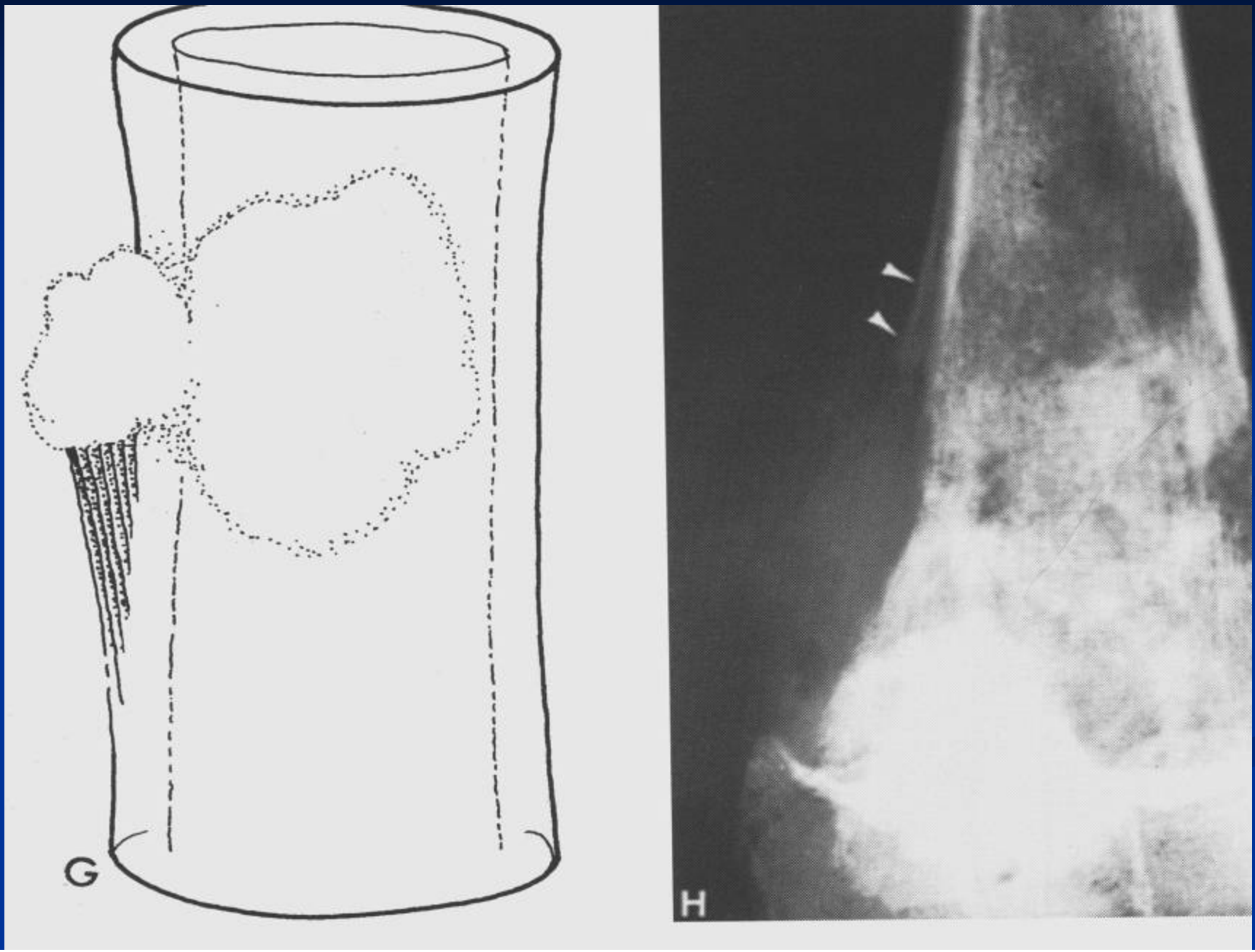
Onion Skin



Onion Skin

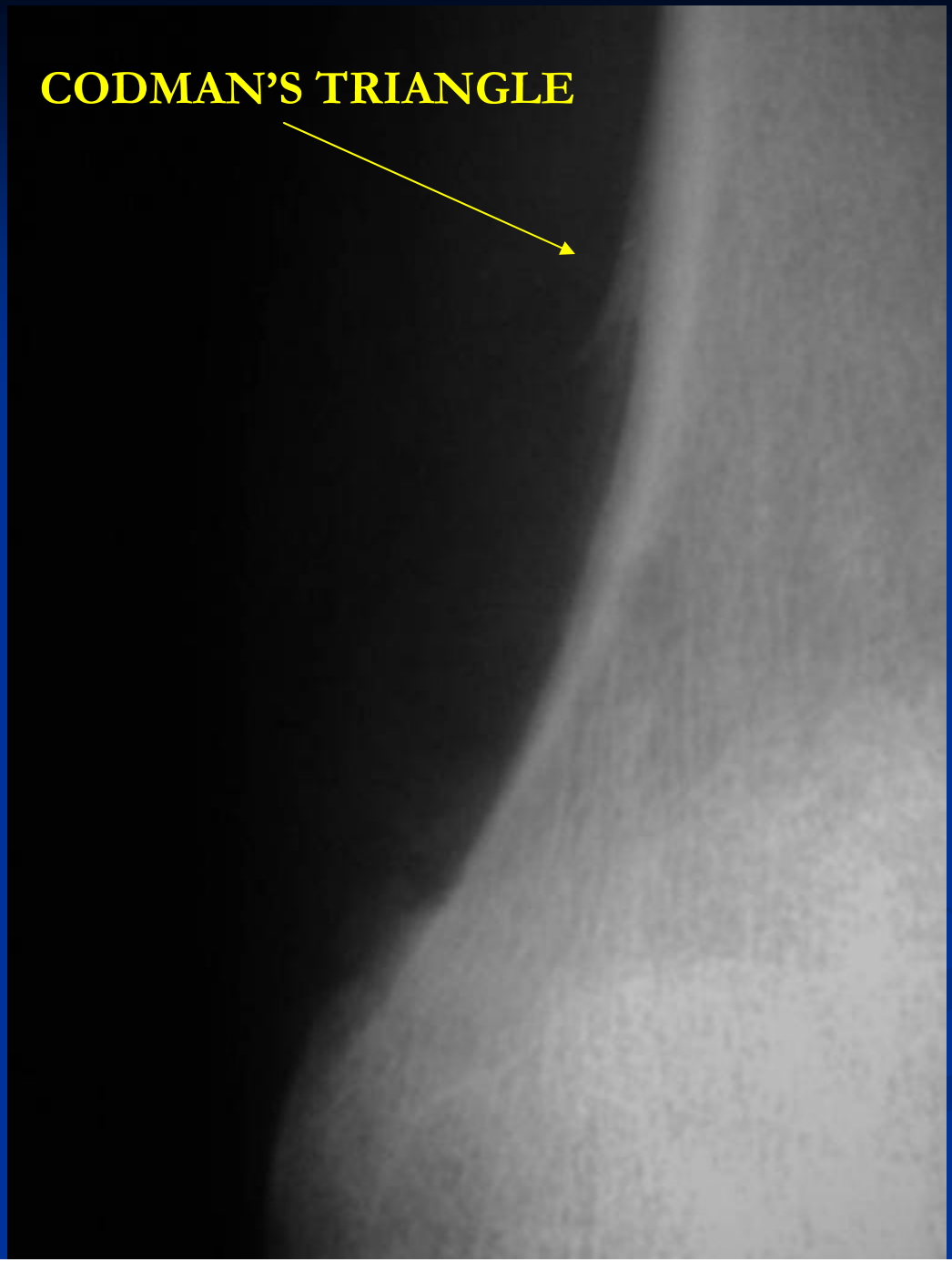
Onion Skin

Codman's Triangle



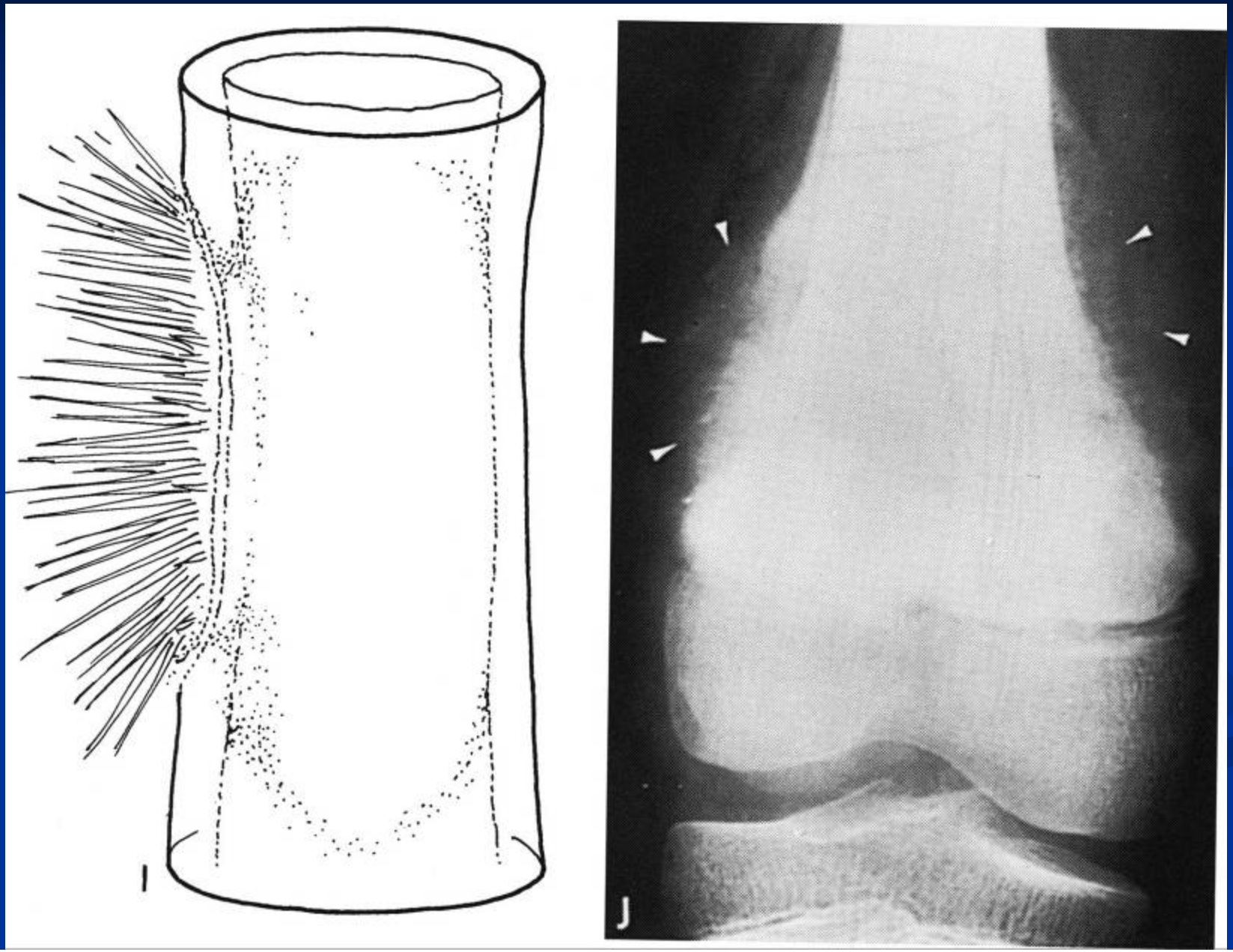
Codman's Triangle

Codman's Triangle


CODMAN'S TRIANGLE

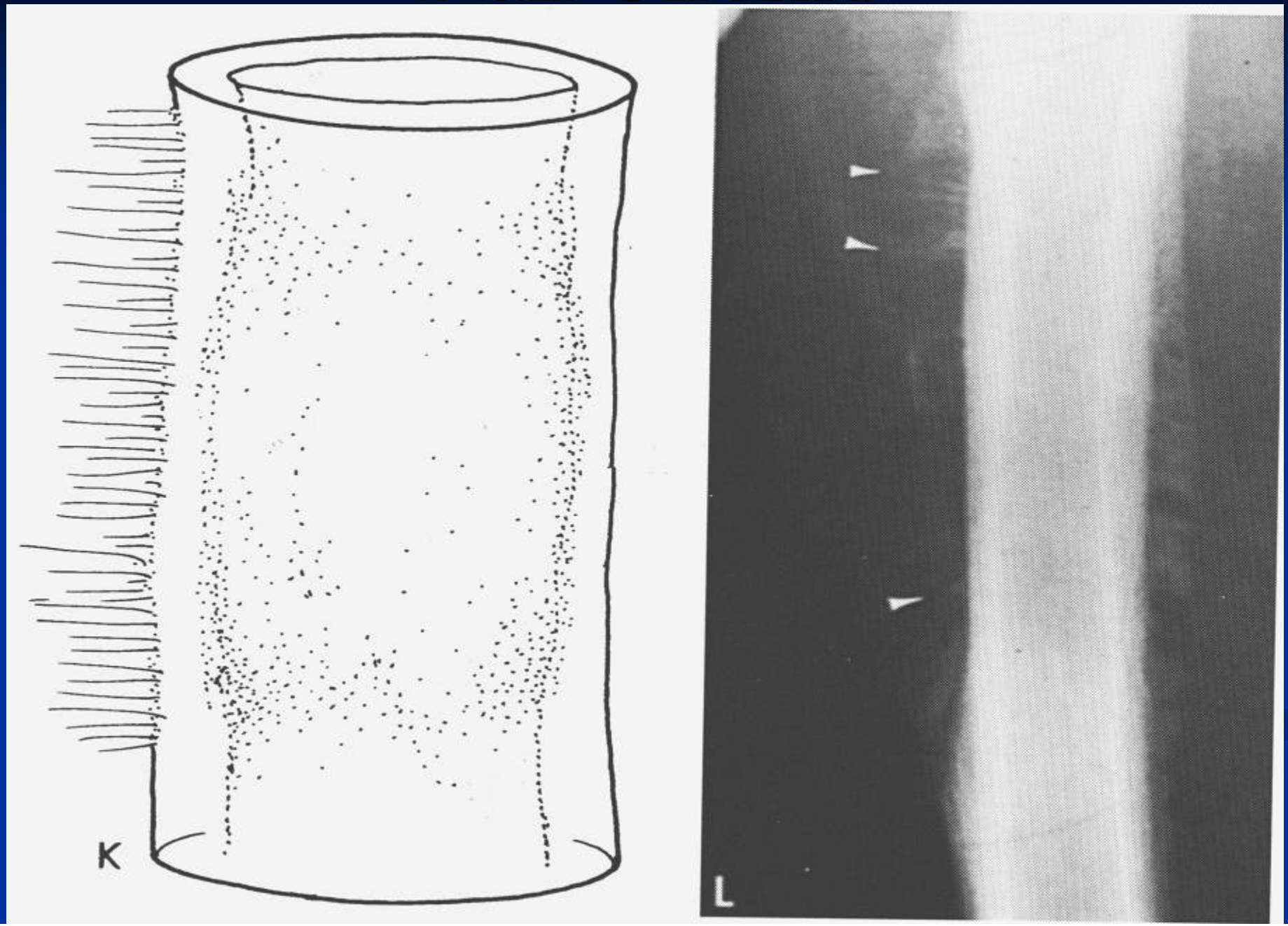
CT Scan of Codman's triangle

Sunburst Pattern

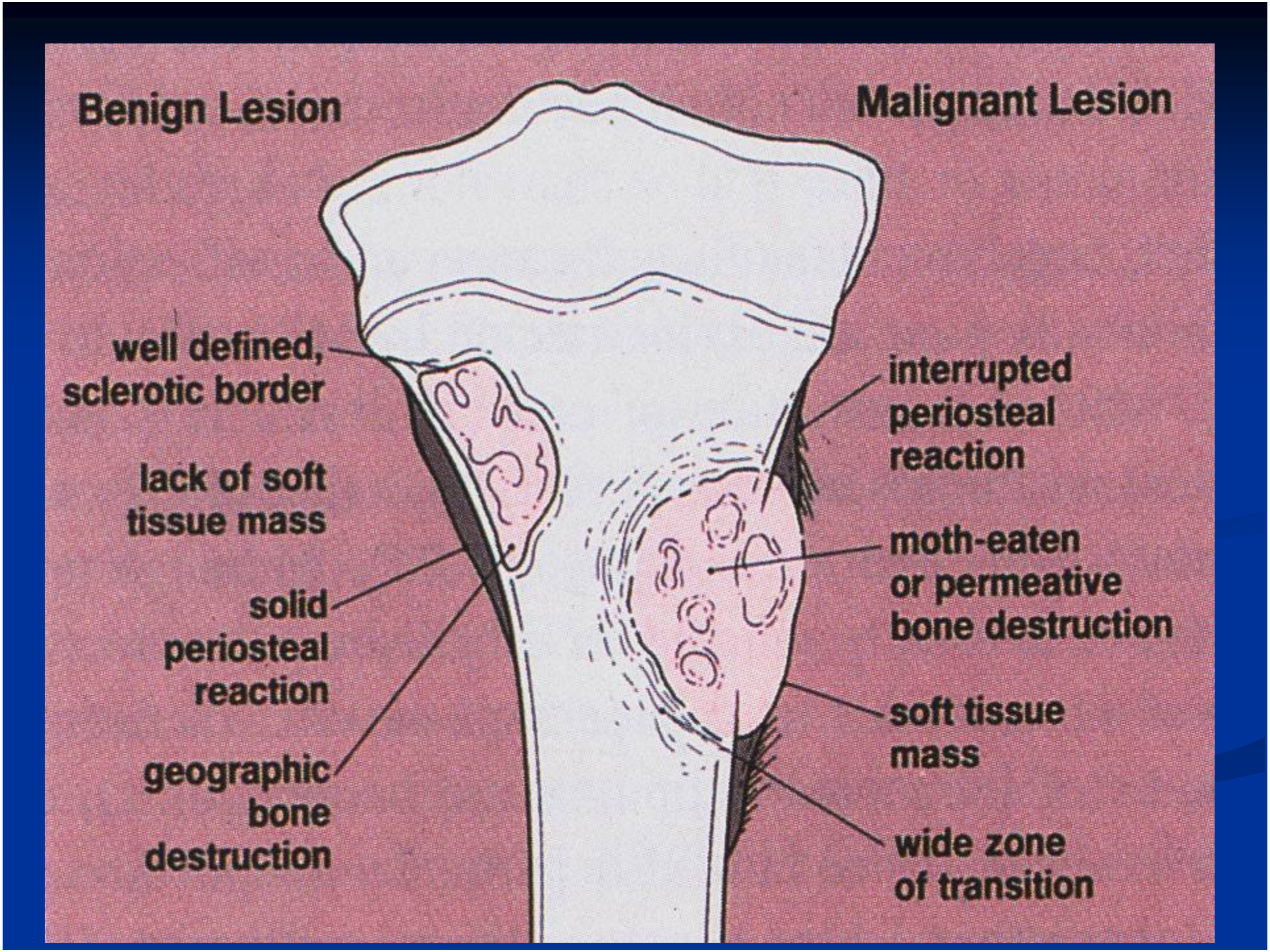


Sunburst Pattern

Hair On End

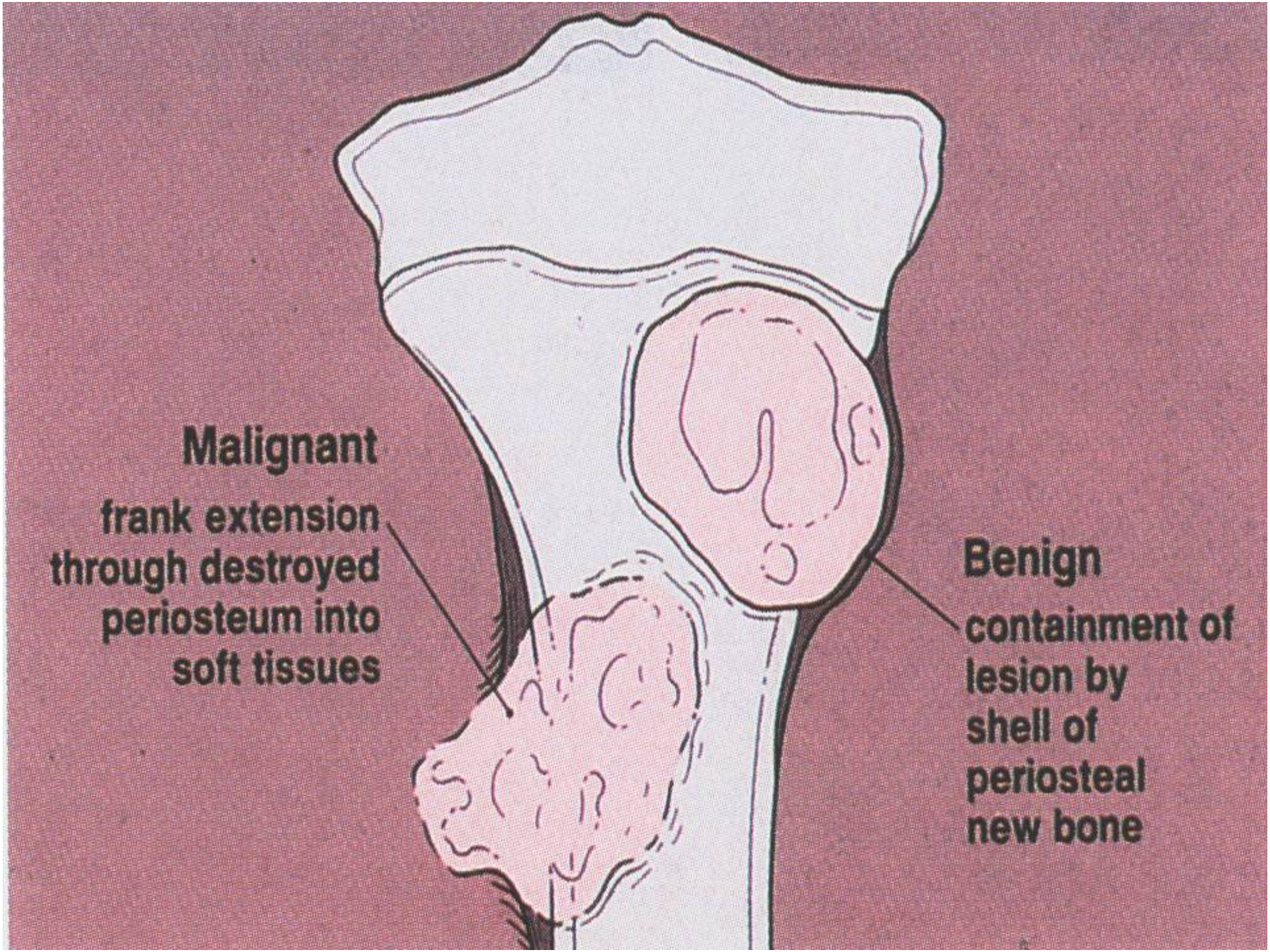


Hair on End Periosteal Reaction

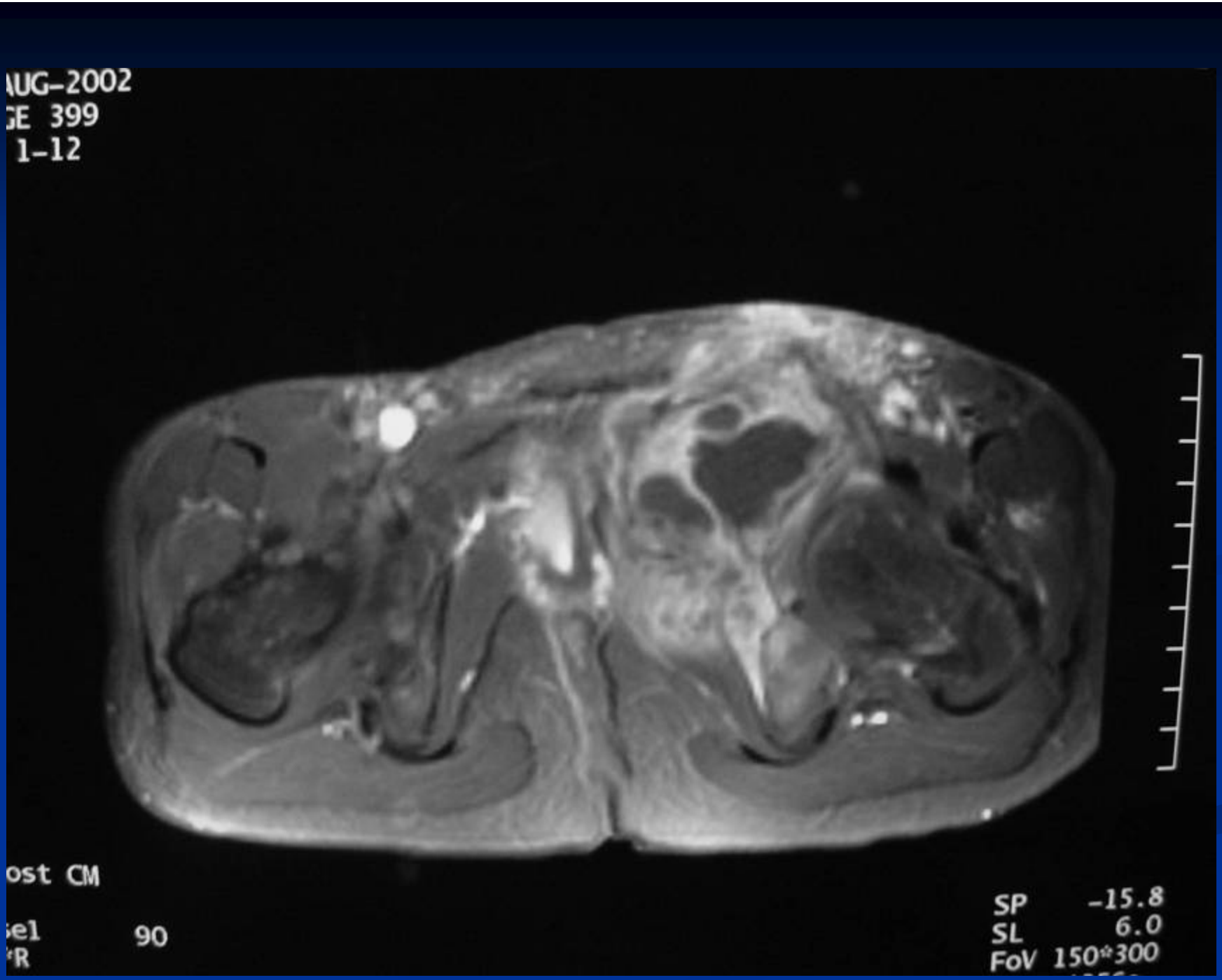

Benign Lesion
Malignant Lesion
well defined, sclerotic border
lack of soft tissue mass
solid periosteal reaction
geographic bone destruction
interrupted periosteal reaction
moth-eaten or permeative bone destruction
soft tissue mass
wide zone of transition

Soft Tissue Mass

- Primary Malignant Bone Tumors
- Benign Aggressive Bone Tumors
- Mets
- Osteomyelitis


Malignant
frank extension through destroyed periosteum into soft tissues
Benign
containment of lesion by shell of periosteal new bone

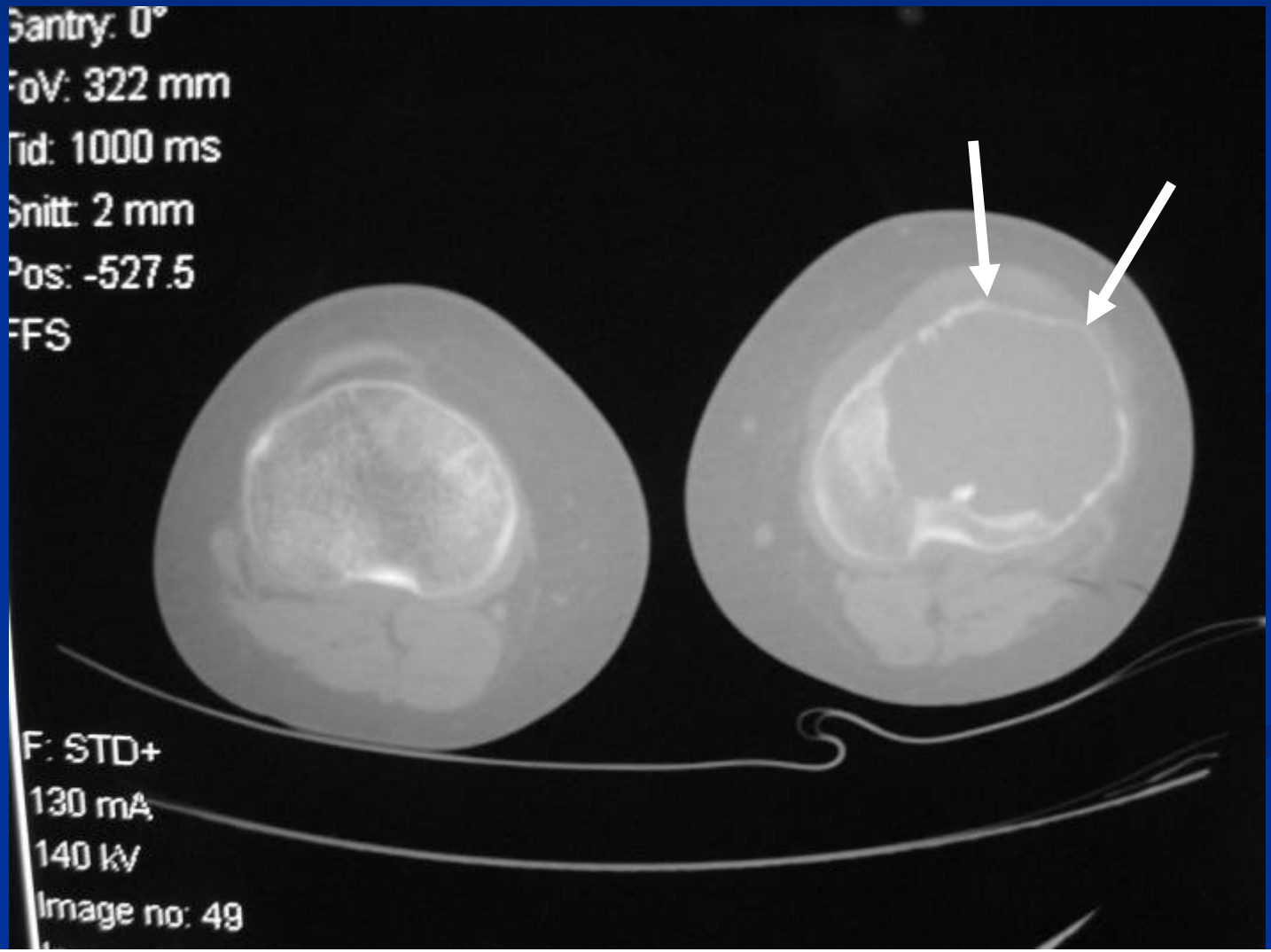
Benign Aggressive Tumor

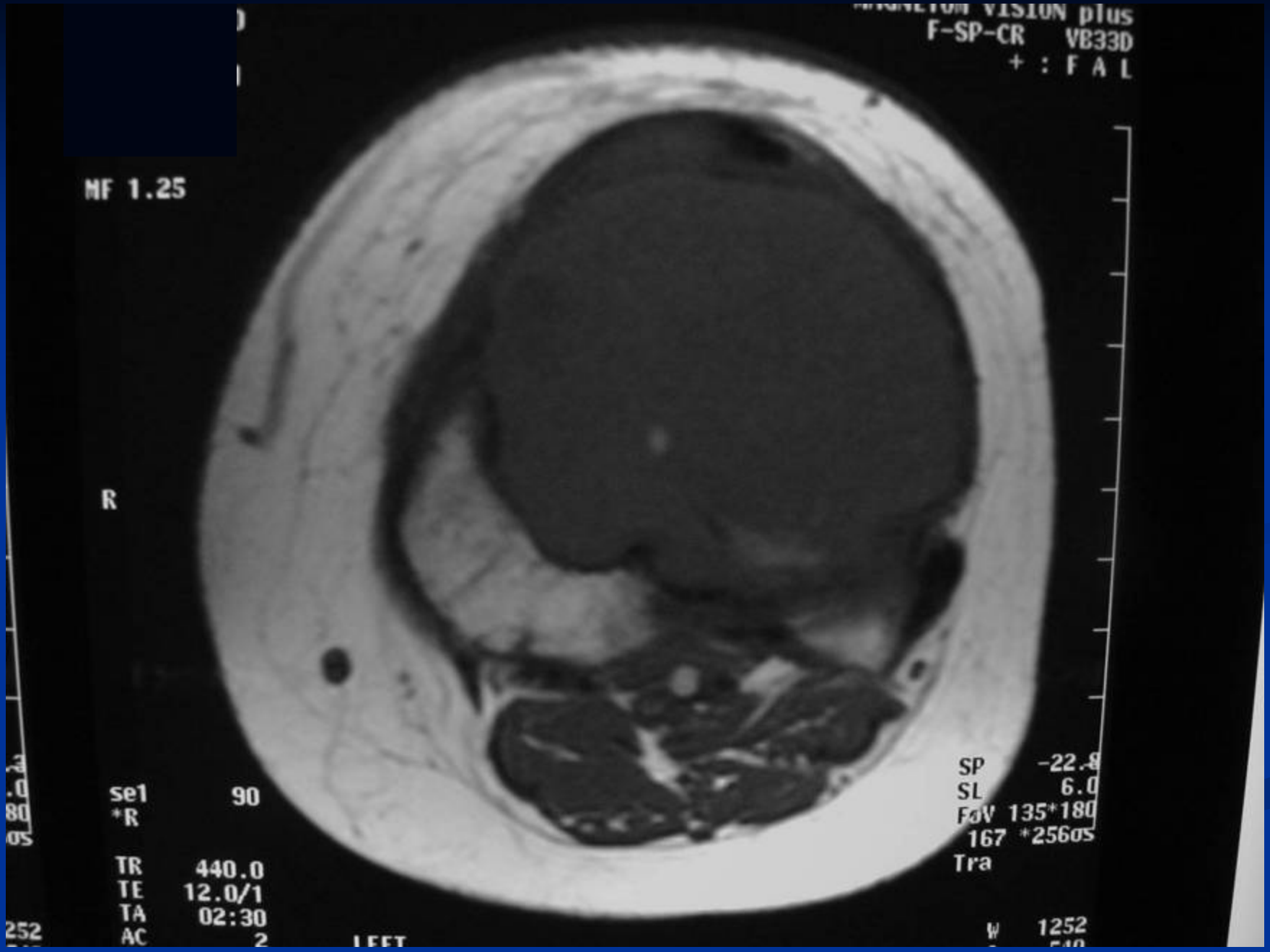

UG-2002
E 399
1-12
ost CM
el
R
90
SP -15.8
SL 6.0
FoV 150*300

Periosteum Intact Around Periphery of Soft Tissue Mass

Benign Aggressive Giant Cell Tumor

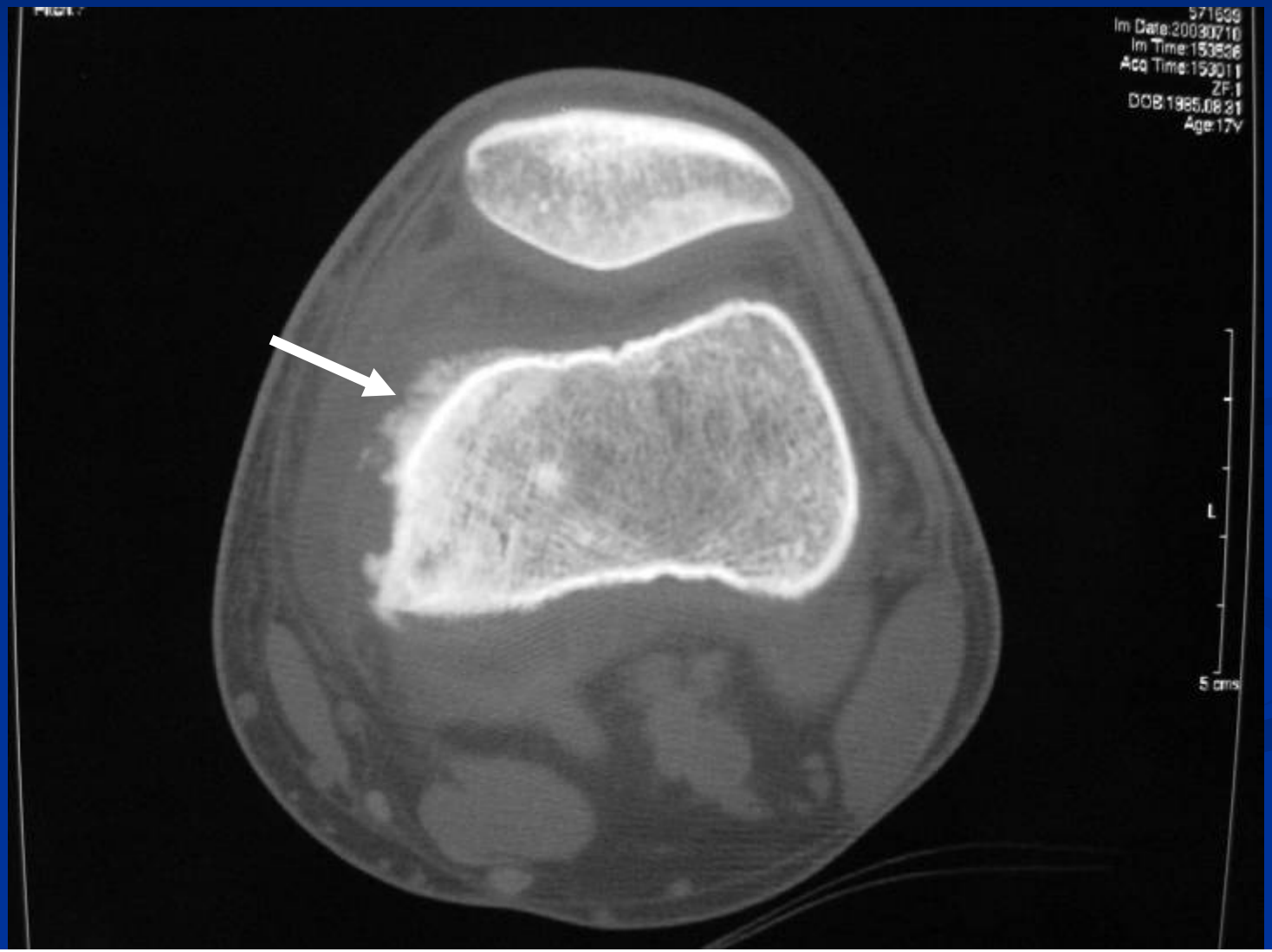
Periosteum Intact Around Periphery



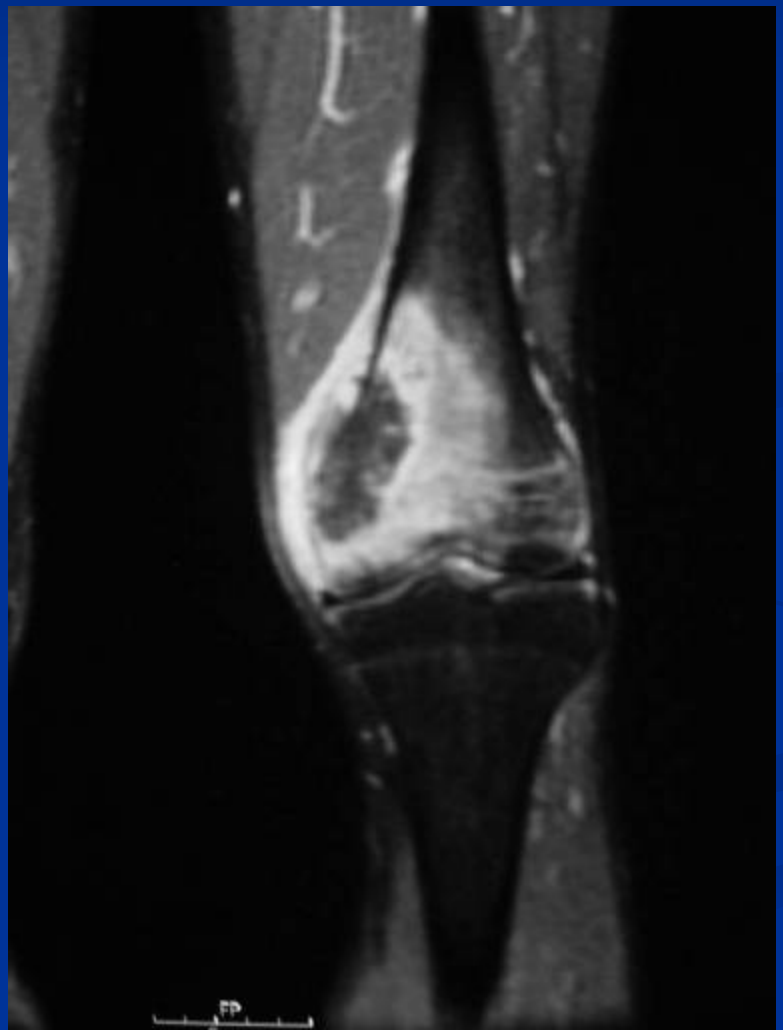

F-SP-CR VB33D
+ : F A L
NF 1.25
R
se1 90
*R
TR 440.0
TE 12.0/1
TA 02:30
AC 2
SP -22.8
SL 6.0
FoV 135*180
167 *256os
Tra
W 1252

Malignant-- Osteosarcoma

Periosteum Not Intact Around Soft Tissue Mass

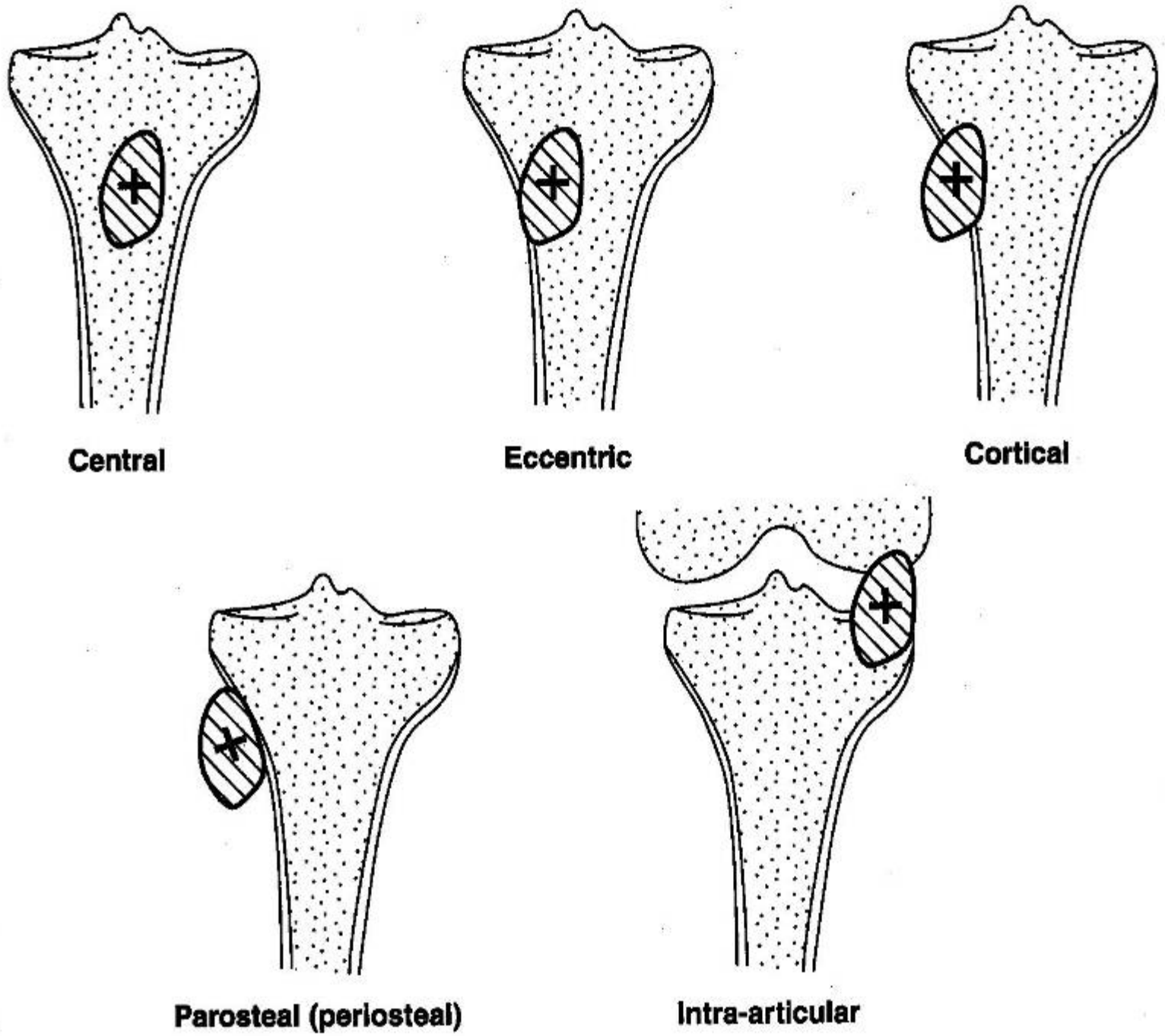


MRI of Osteosarcoma Periosteum Not Intact Around Soft Tissue Mass



Distribution in Bone

- **Position in Transverse Plain**
  - Central
  - Eccentric
  - Cortical
  - Juxtacortical (Periosteal/Parosteal)
  - Soft Tissue Location


Central
Eccentric
Cortical
Parosteal (periosteal)
Intra-articular

A

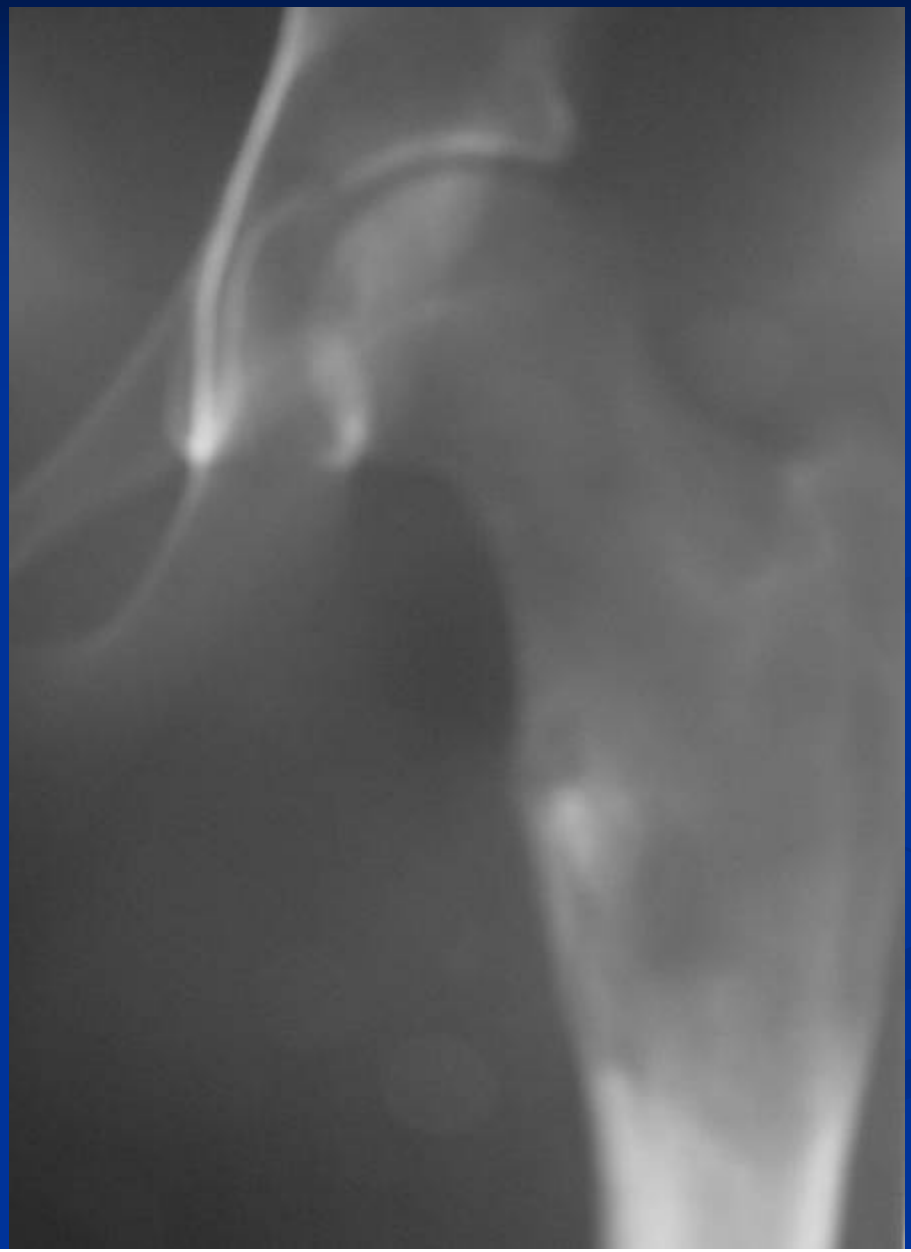
Central Axis

- Enchondromas
- Fibrous Dysplasia
- Simple Bone Cysts

UBC

UBC

Fibrous Dysplasia



Fibrous Dysplasia

Fibrous Dysplasia

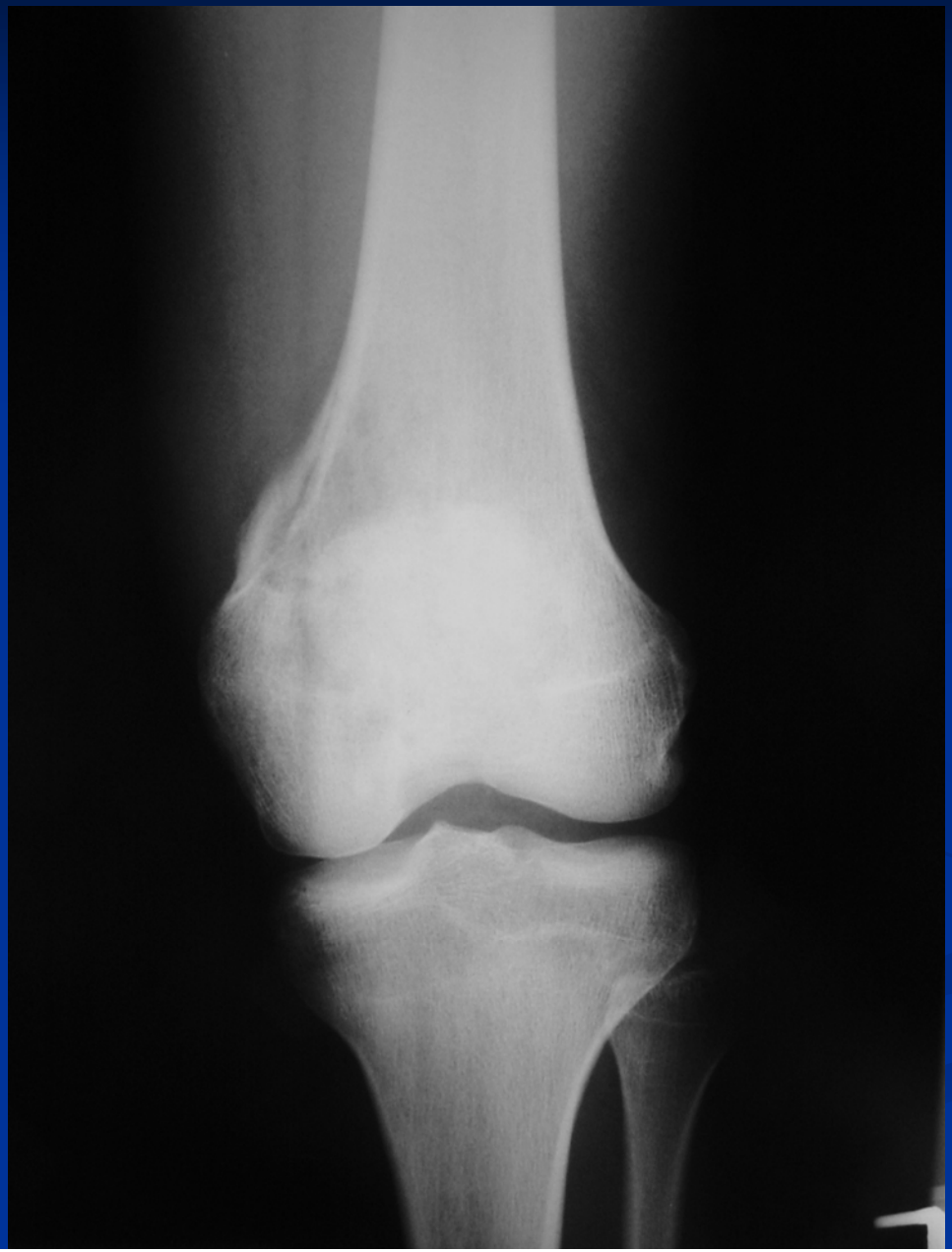
Enchondroma

Eccentric Lesions

- Giant Cell Tumor
- Osteosarcoma
- Chondrosarcoma
- Chondromyxofibroma

GCT

Osteosarcoma

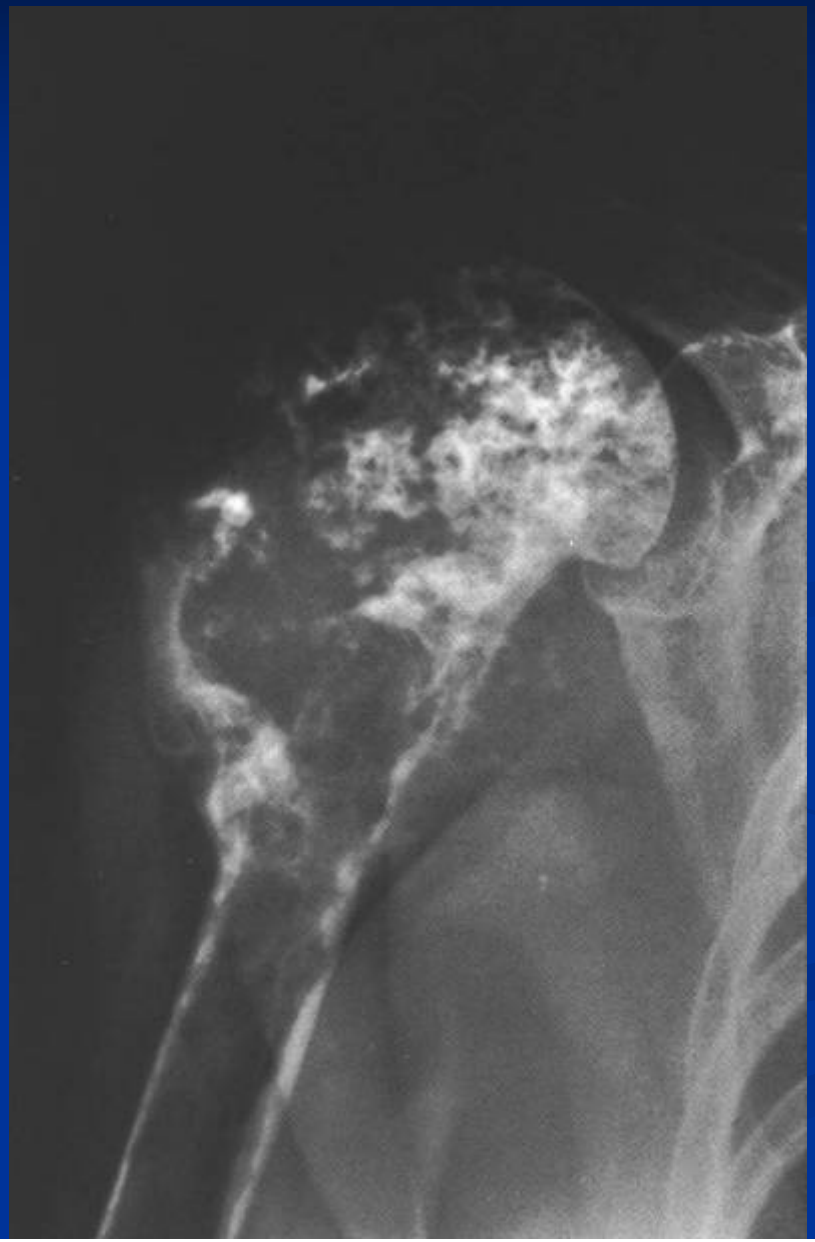


Osteosarcoma

Osteosarcoma

Osteosarcoma

Chondrosarcoma



Chondromyxofibroma

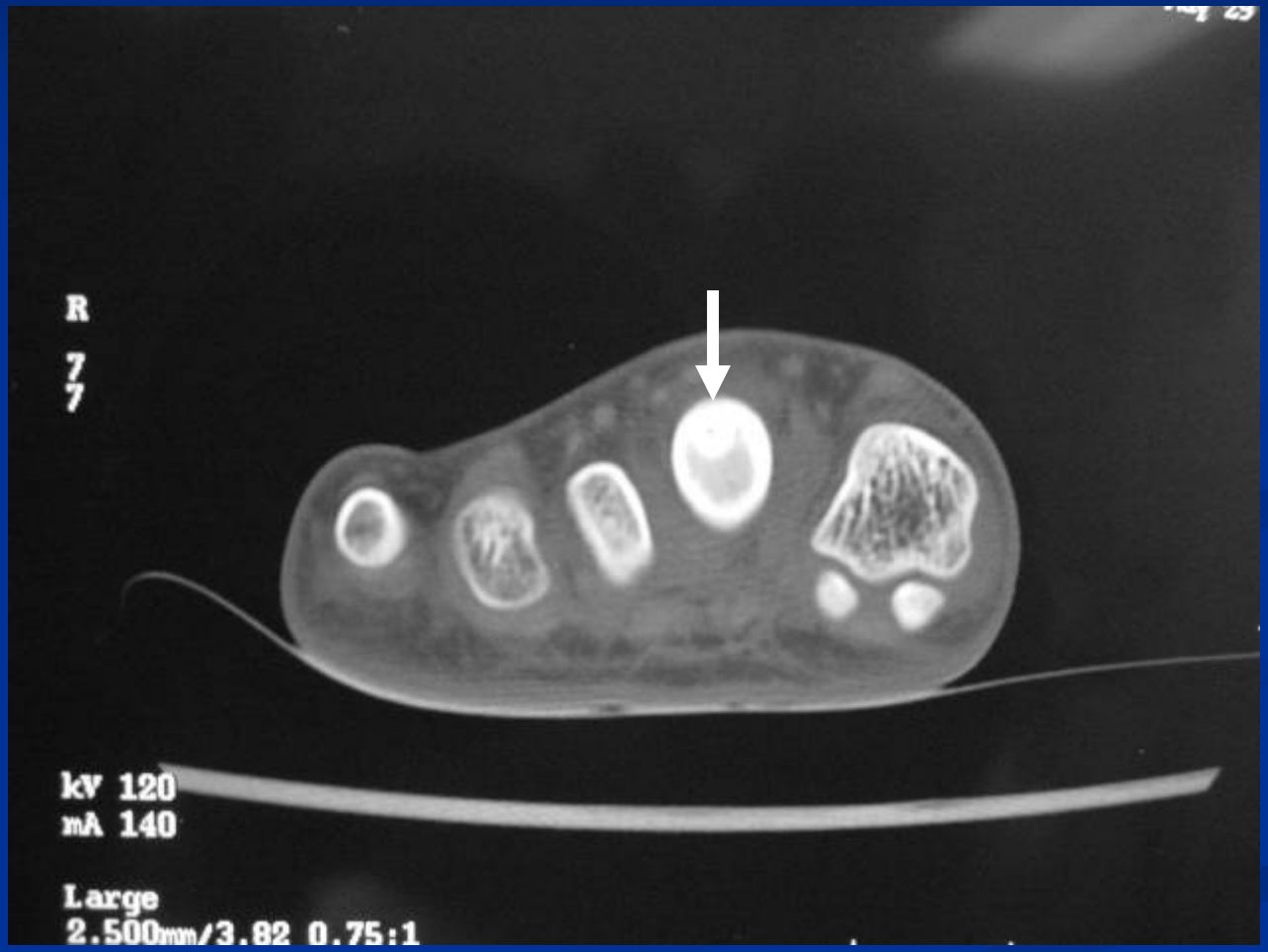
Cortical Lesions

- Nonossifying Fibromas
- Osteoid Osteomas

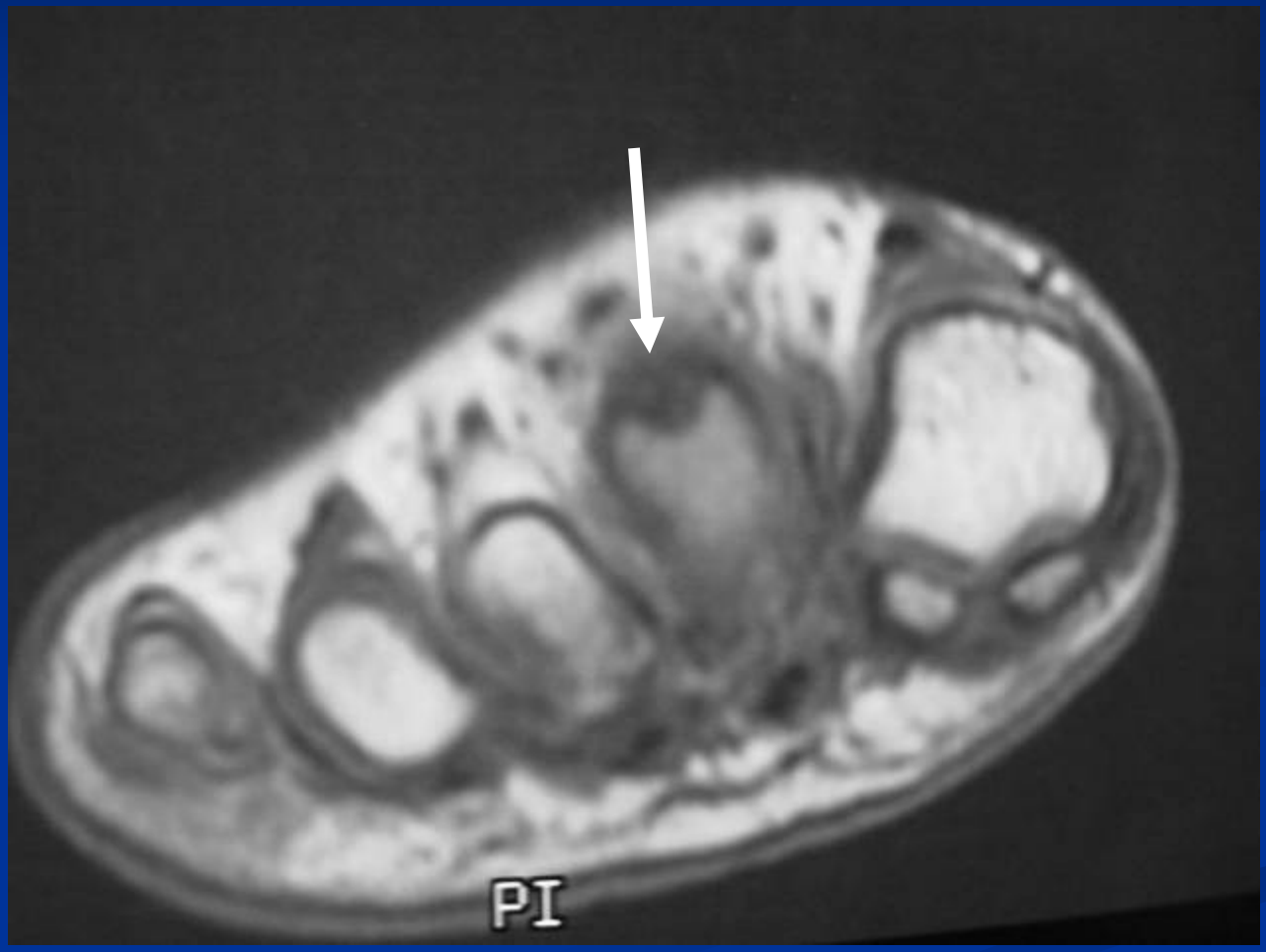
Nonossifying Fibroma

Osteoid Osteoma

Osteoid Osteoma



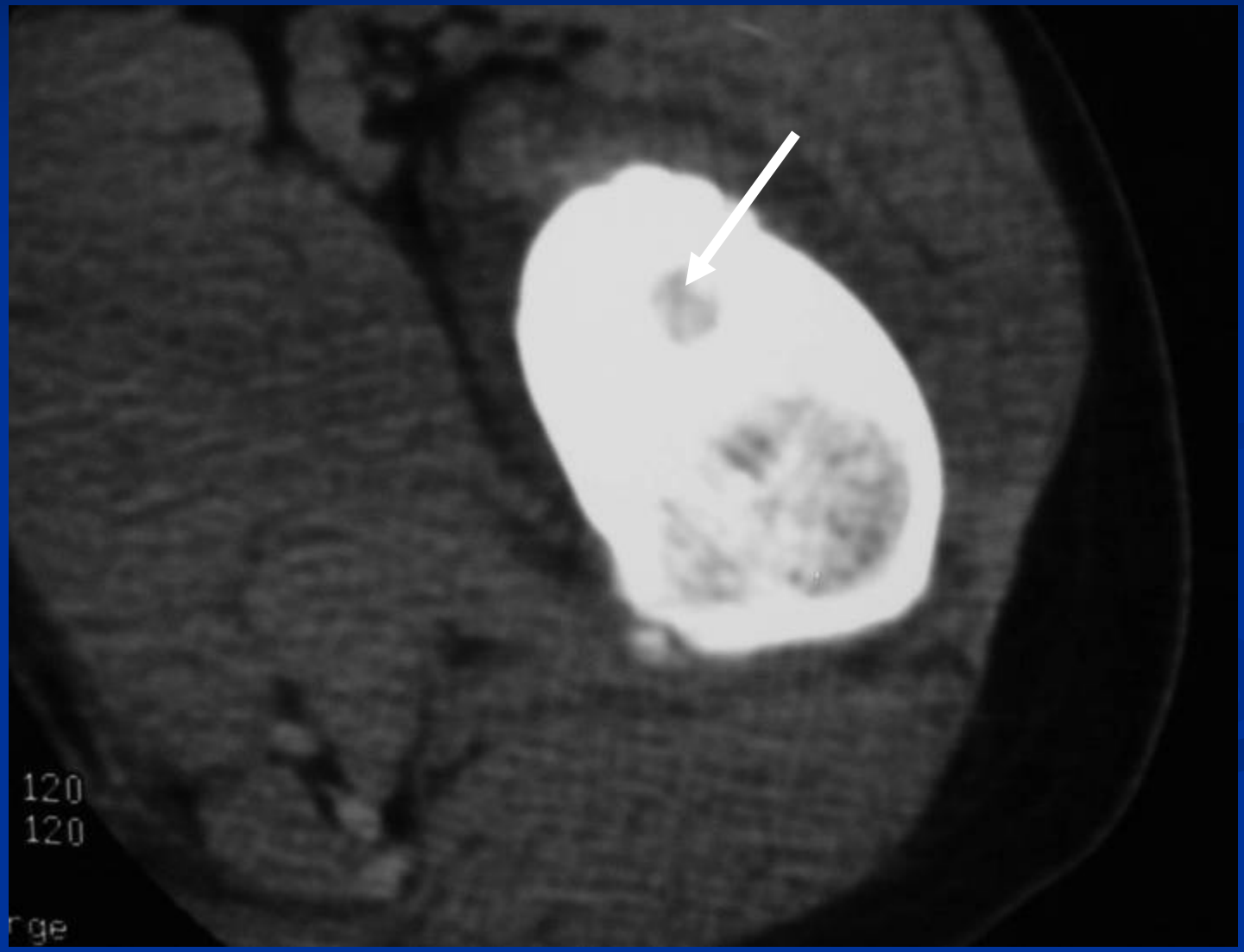
Osteoid Osteoma



Osteoid Osteoma

Osteoid Osteoma

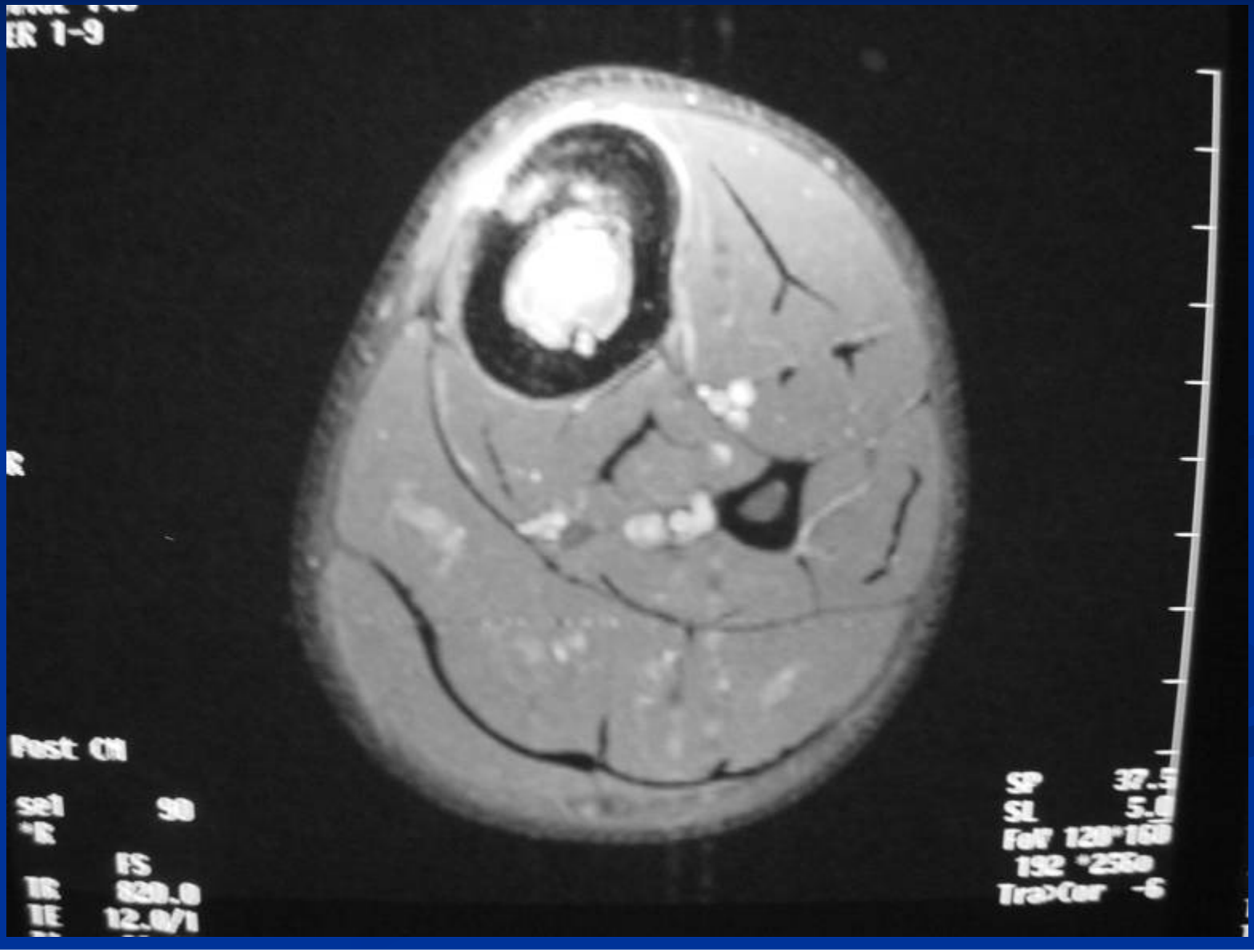
Osteoid Osteoma



Brodie's Abscess

Brodie's Abscess

Brodie's Abscess

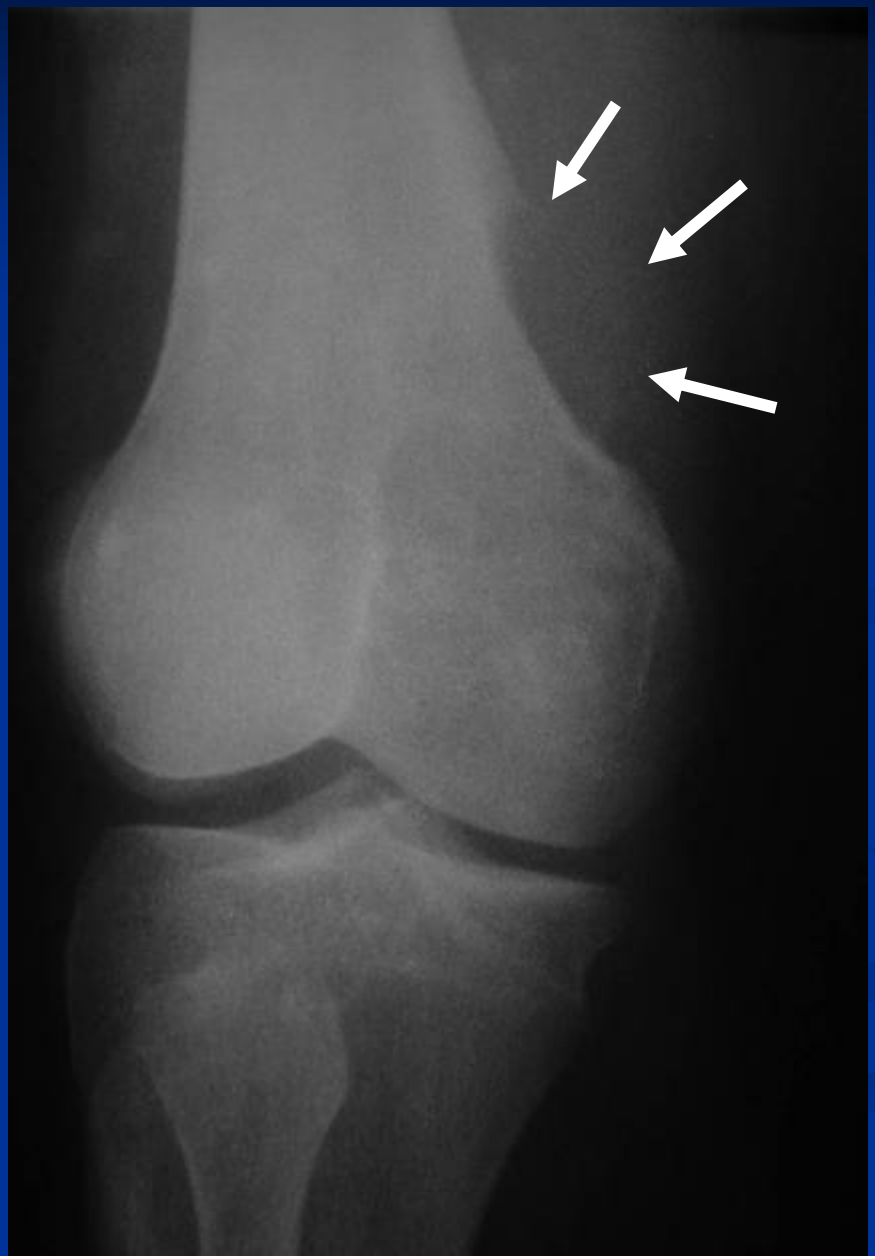


Juxtacortical Lesions

- Juxtacortical Chondroma
- Periosteal Osteosarcoma/Chondrosarcoma
- Parosteal Osteosarcoma

Periosteal Chondroma

Periosteal Chondrosarcoma

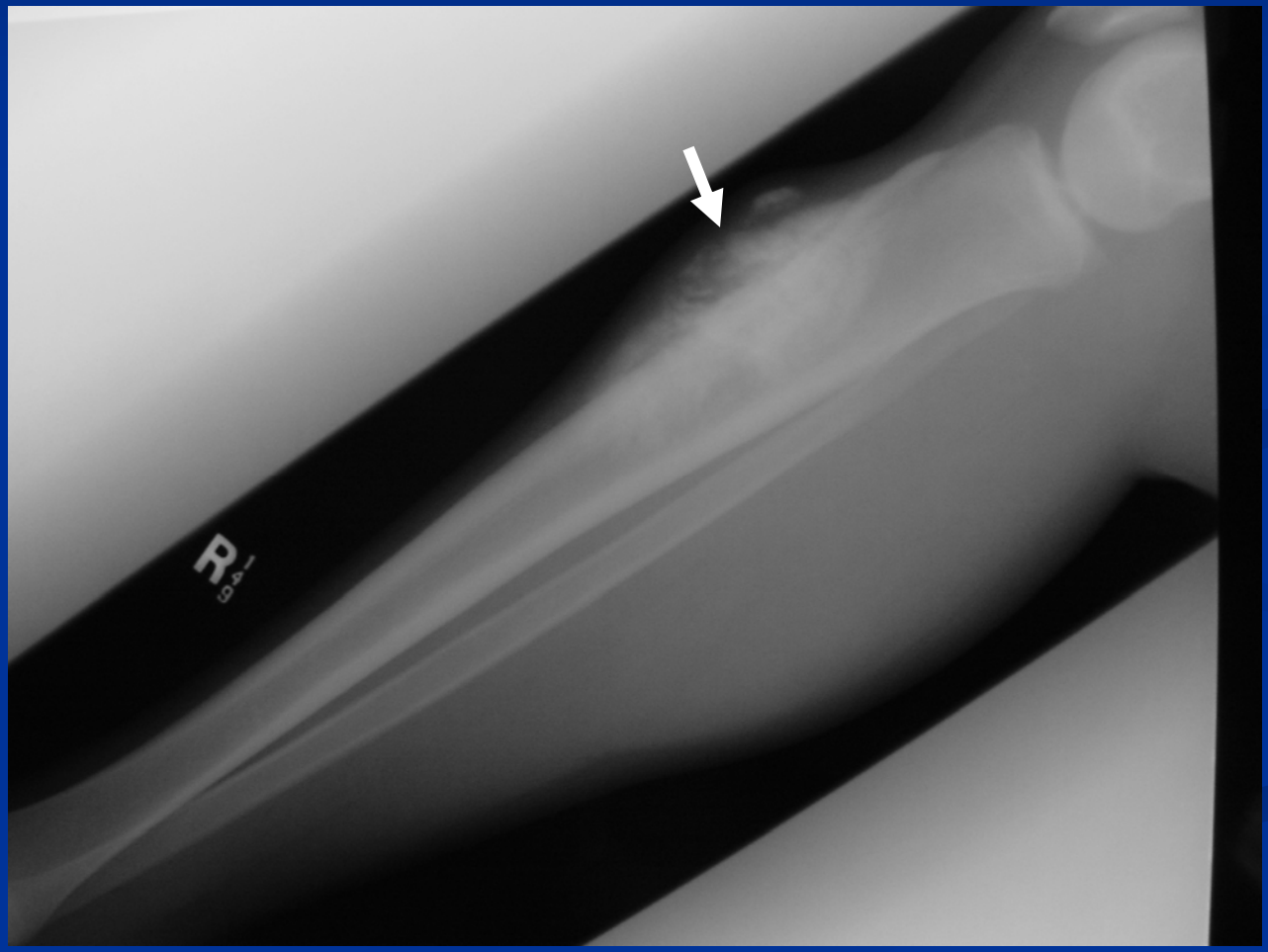


Periosteal Osteosarcoma

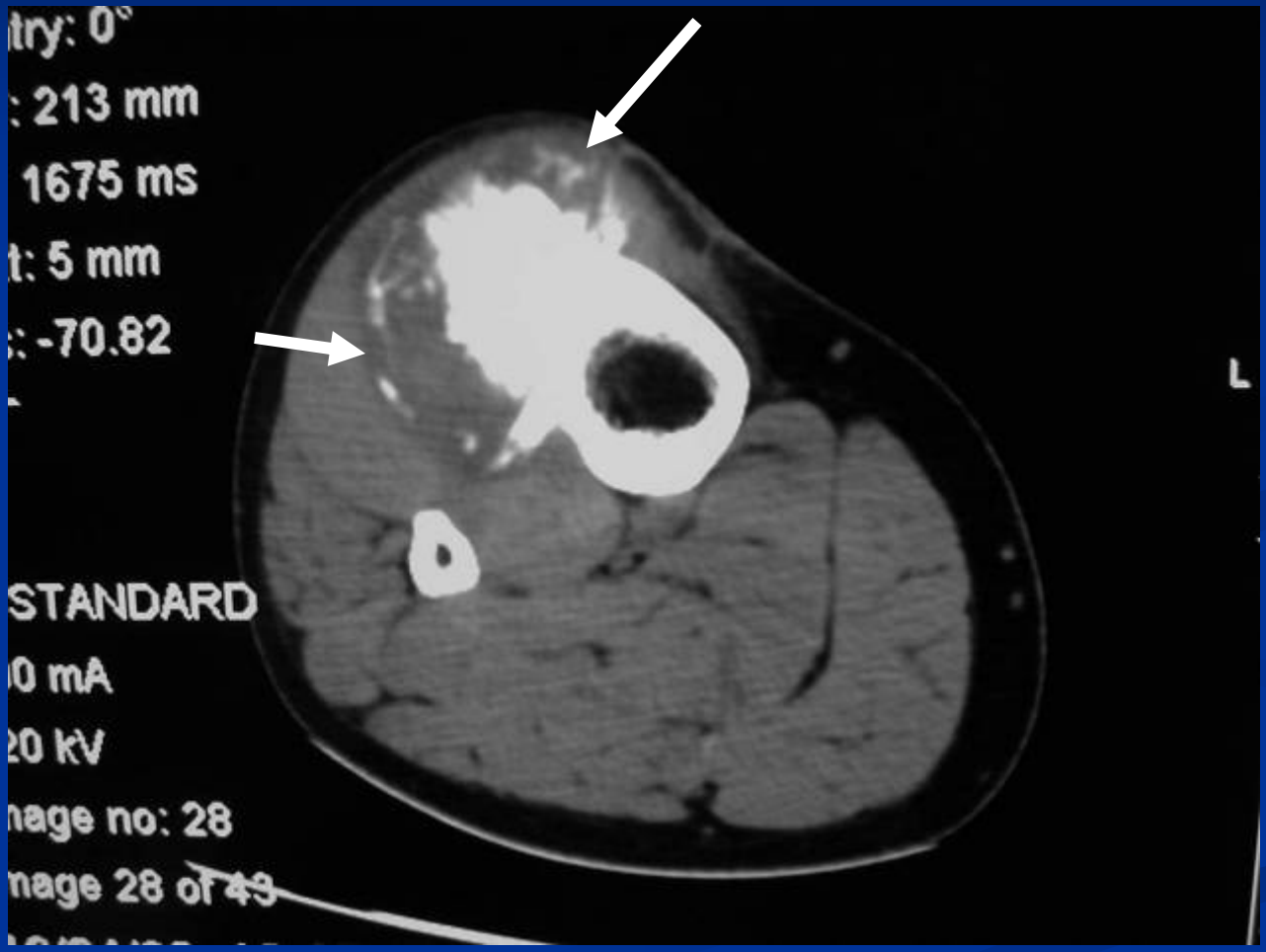
Periosteal Osteosarcoma

Periosteal/High Grade Surface Osteosarcoma

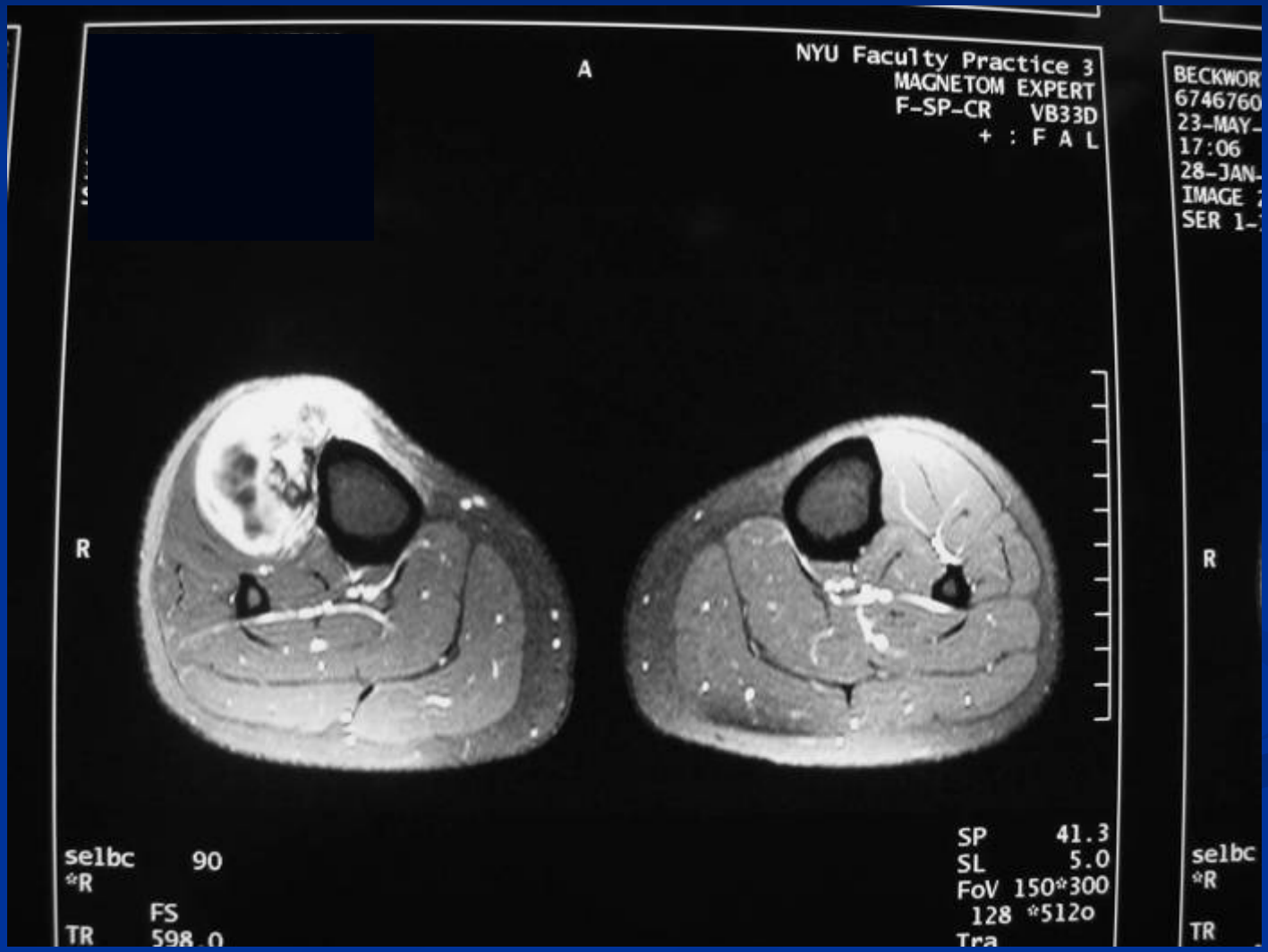
Periosteal/HGS Osteosarc



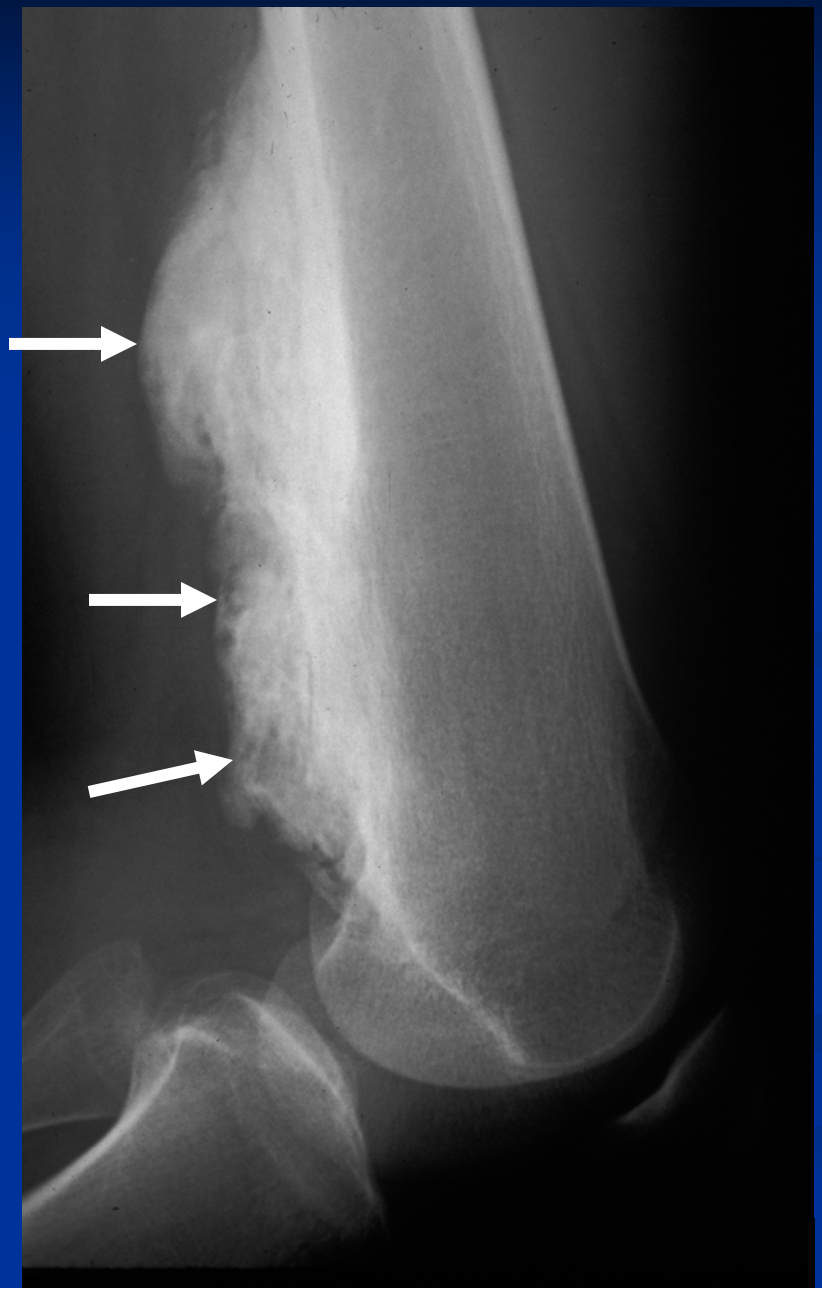
Periosteal/HGS Osteosarc



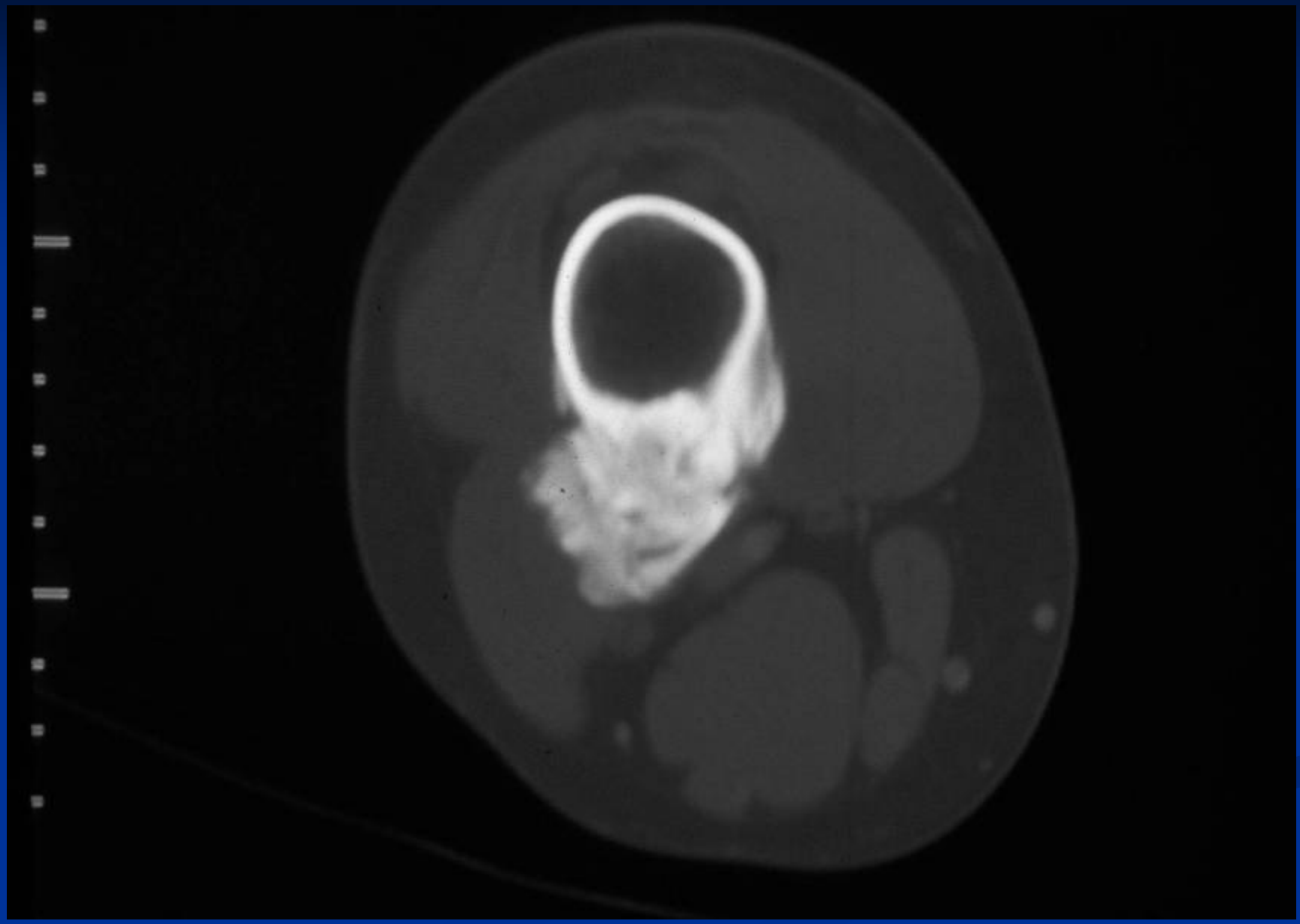
Periosteal/HGS Osteosarcoma



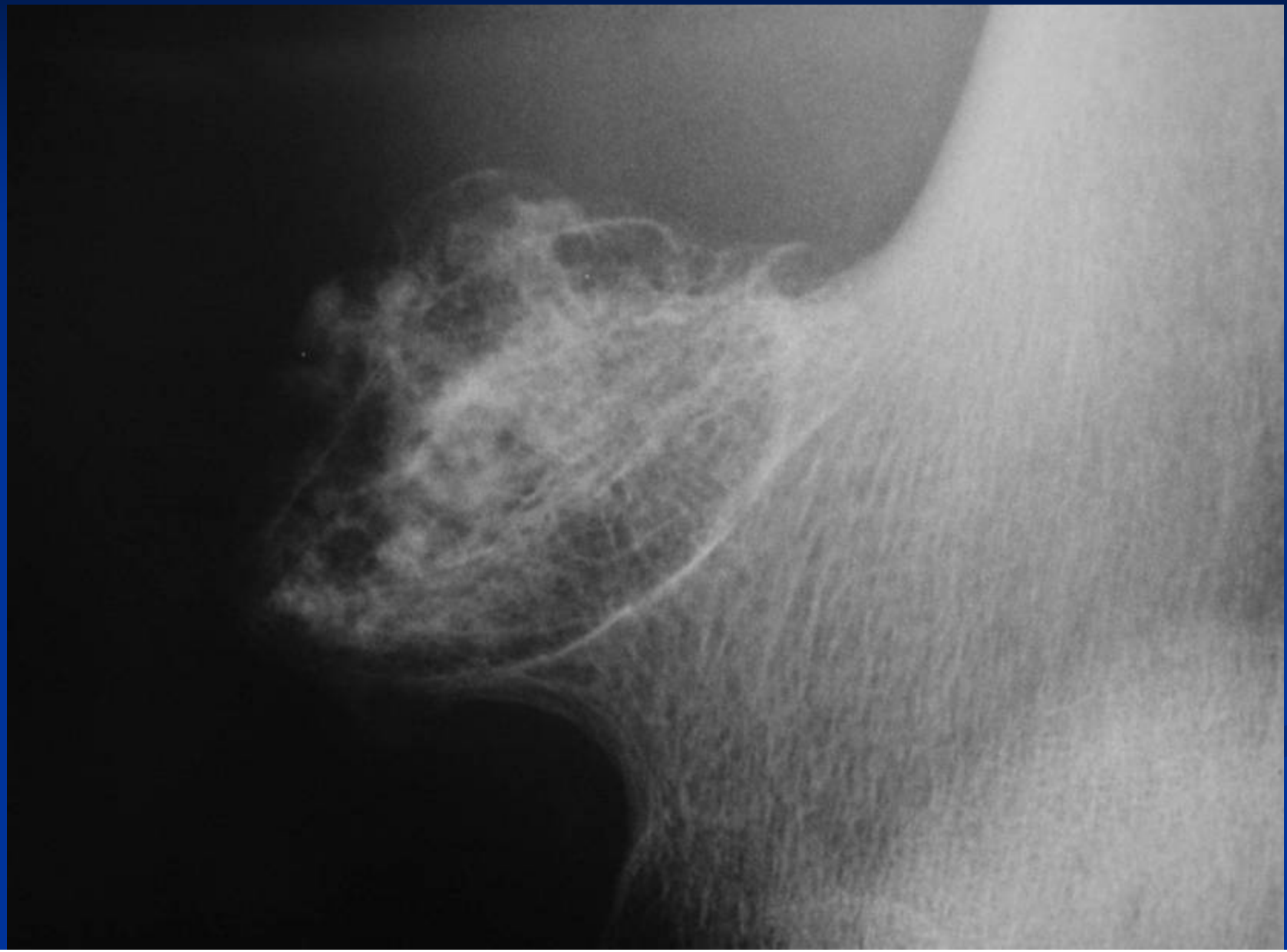
Parosteal Osteosarcoma



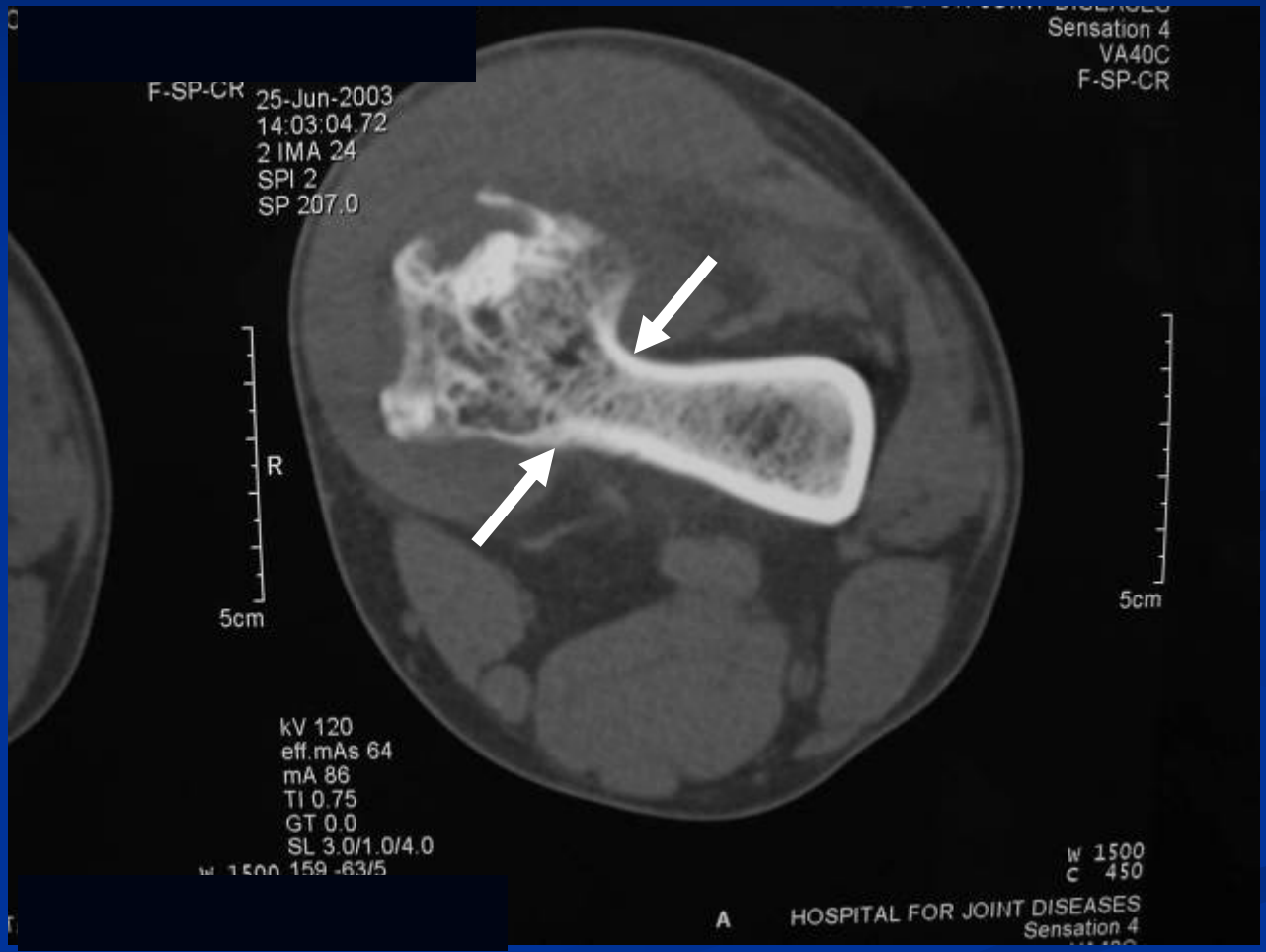
Parosteal Osteosarcoma



Osteochondroma



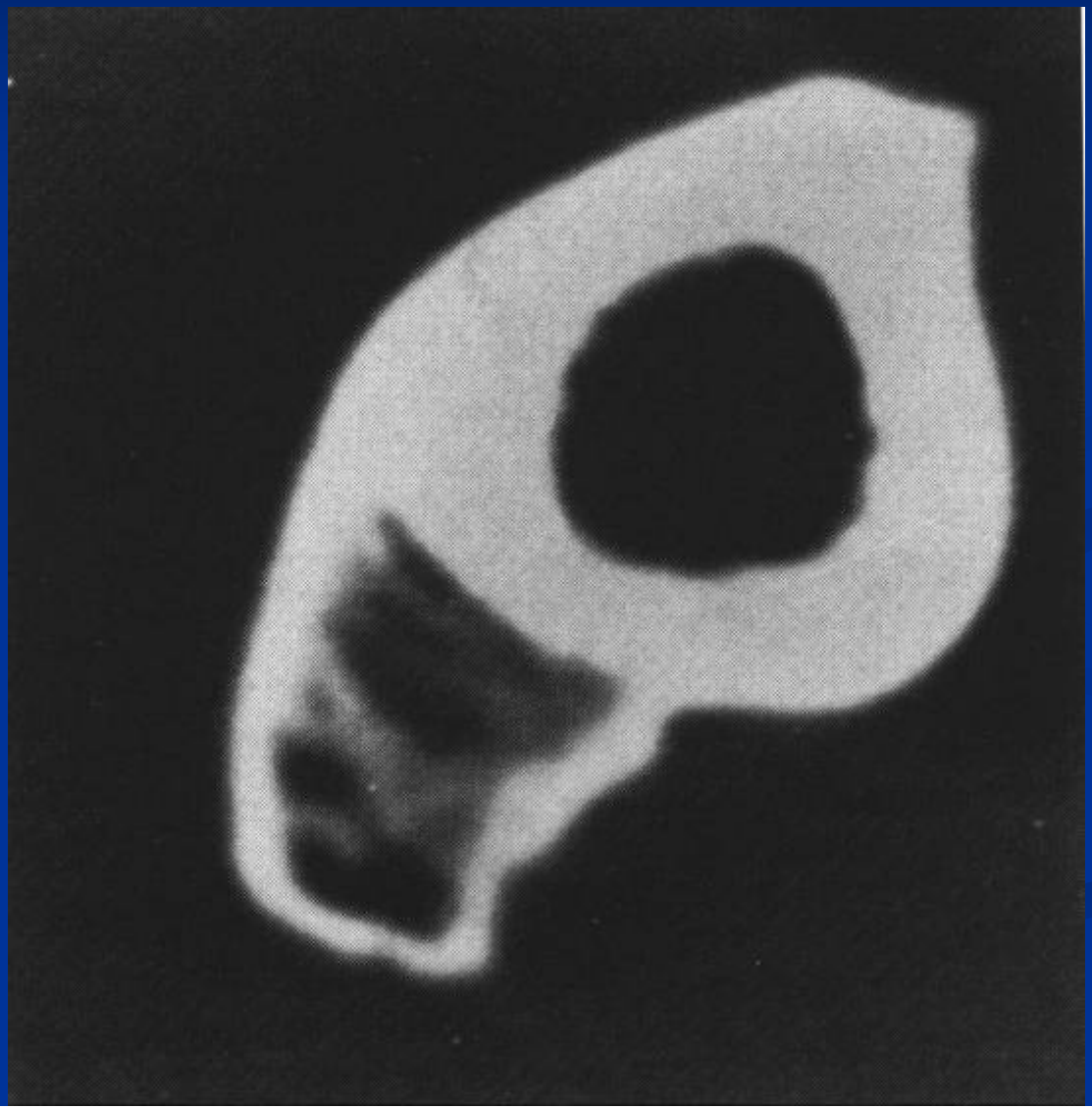
Osteochondroma
Cortico-Medullary Continuity



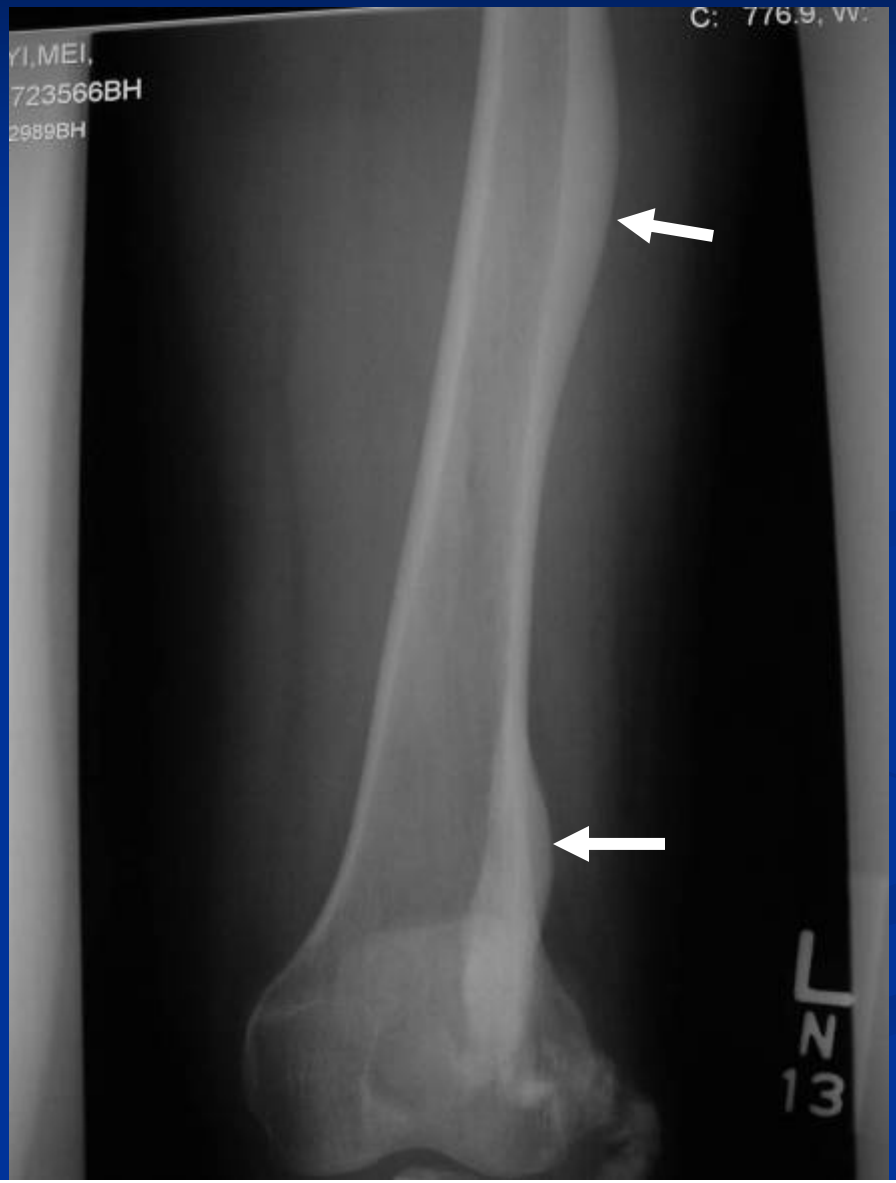
Surface Osteoma

Myositis Ossificans

Myositis Ossificans
Zonal Phenomenon—Central Lucency



Melorrheostosis
"Candle Wax Drippings"



Position of Lesion in Longitudinal Plane

- Epiphysis
- Metaphysis
- Diaphysis

Epiphyseal Lesions

- Adults:
  - Clear Cell Chondrosarcoma
  - Metastasis, Myeloma, Lymphoma
  - Lipoma
  - Intraosseous Ganglion

Epiphyseal Lesions

- Children:
  - Chondroblastoma
  - Osteomyelitis
  - Osteoid Osteoma
  - Enchondroma
  - Eosinophilic Granuloma

Metaphyseal Lesions

- GCT (extends to epiphysis)
- Nonossifying Fibroma
- Chondromyxoid Fibroma
- Simple Bone Cyst (Unicameral Bone Cyst)
- Osteochondroma
- Brodie's Abscess
- Osteosarcoma
- Chondrosarcoma
- MFH/Fibrosarcoma

Diaphyseal Lesions

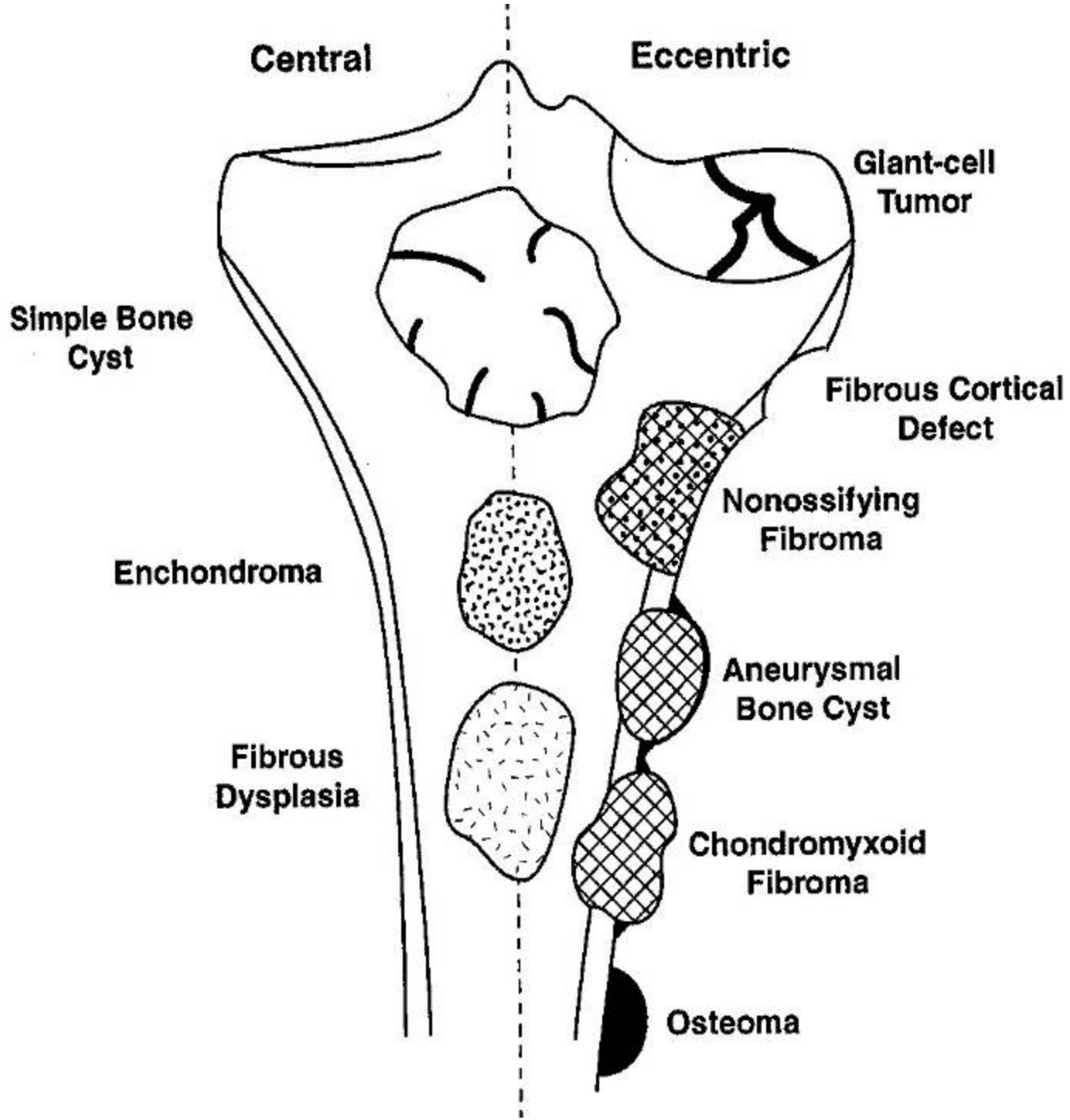
- Ewing's Sarcoma
- Nonossifying fibroma
- Simple Bone Cysts
- Aneurysmal Bone Cysts
- Enchondromas
- Osteoblastomas
- Fibrous Dysplasia
- Adamantinoma
- Osteofibrous Dysplasia

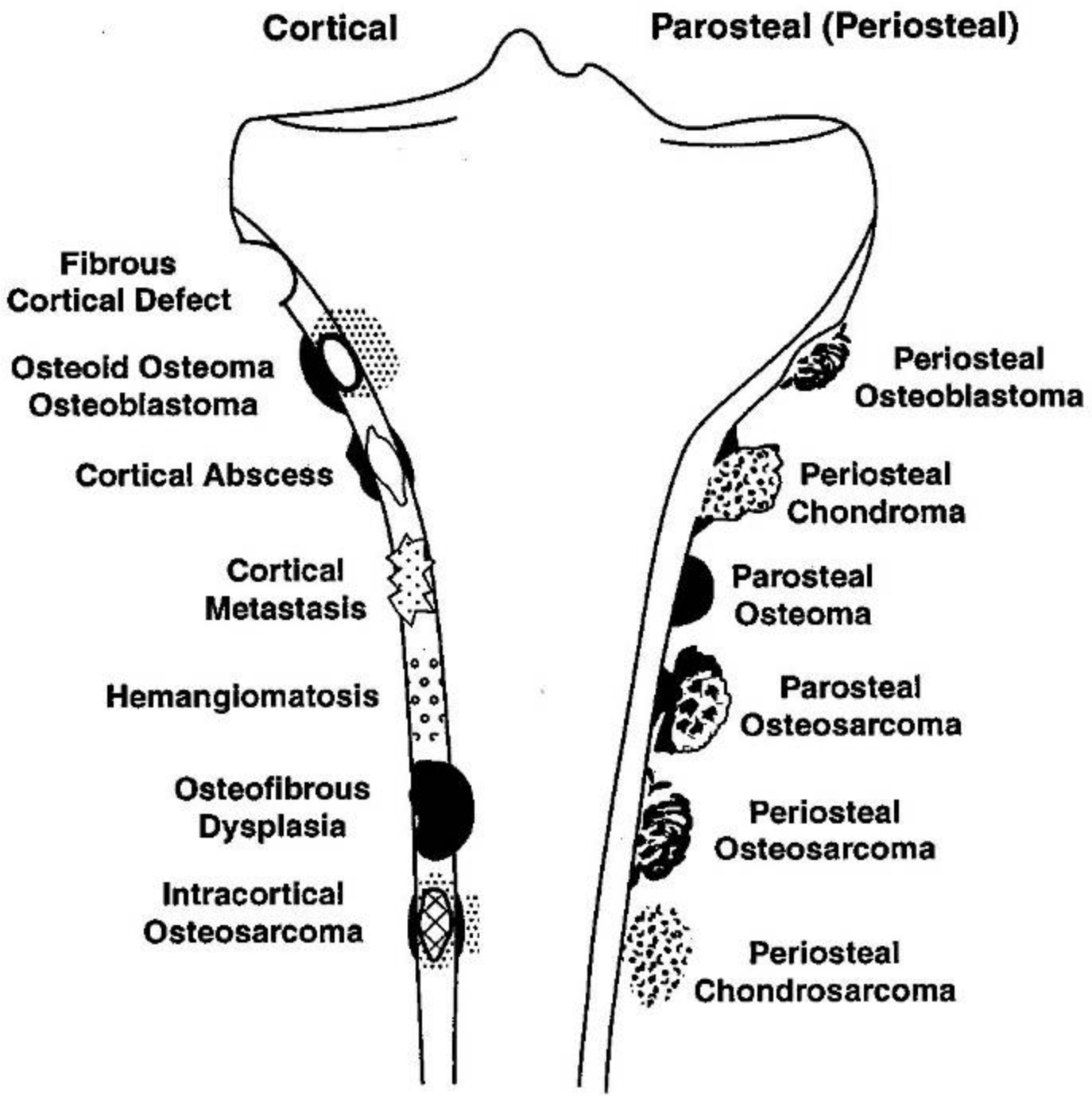
Epiphyseal Equivalent Areas

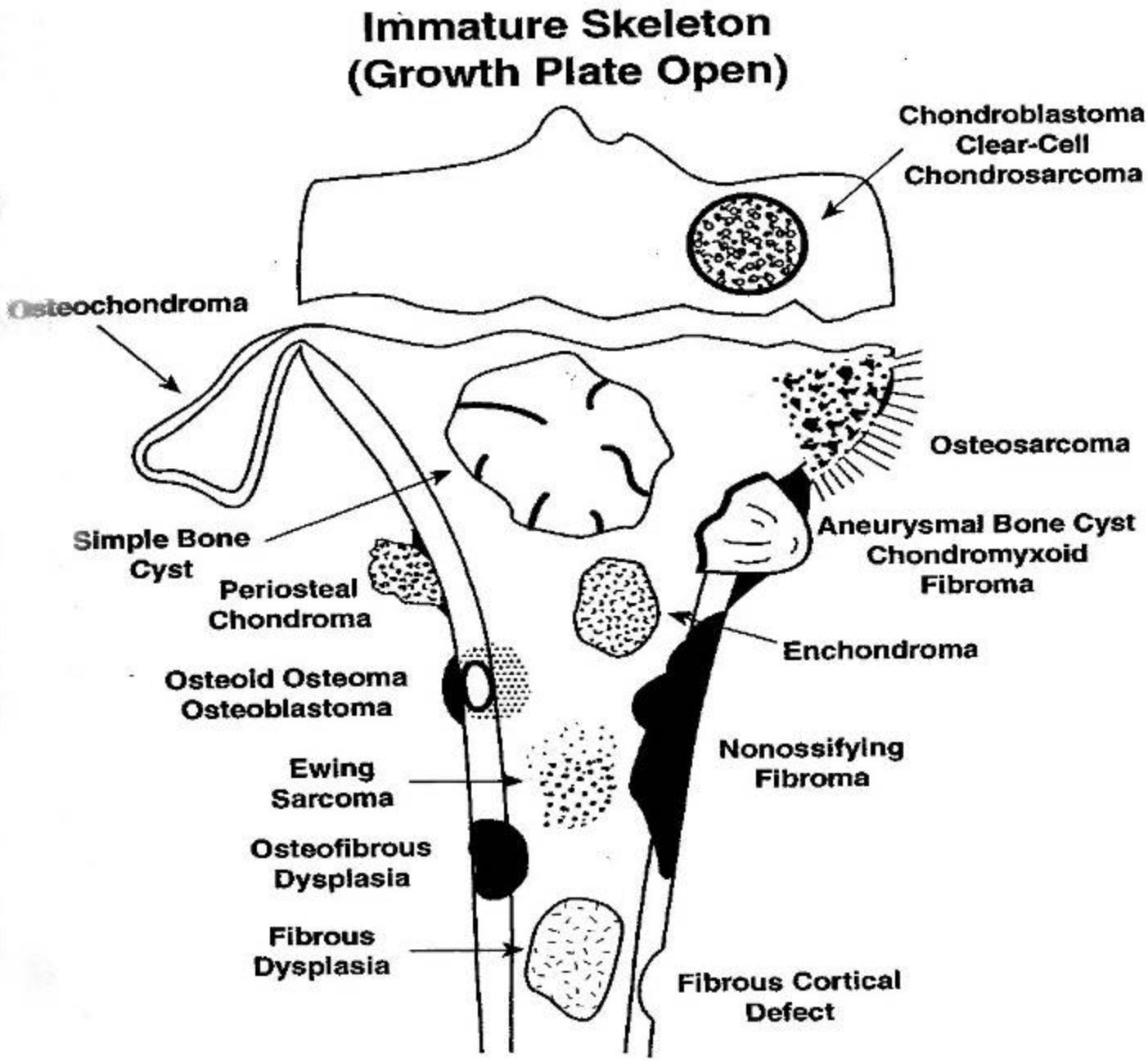
- Subchondral Regions of Acetabulum and Scapula
- Tarsal Bones
- Calcaneus, Talus

Growth Plate

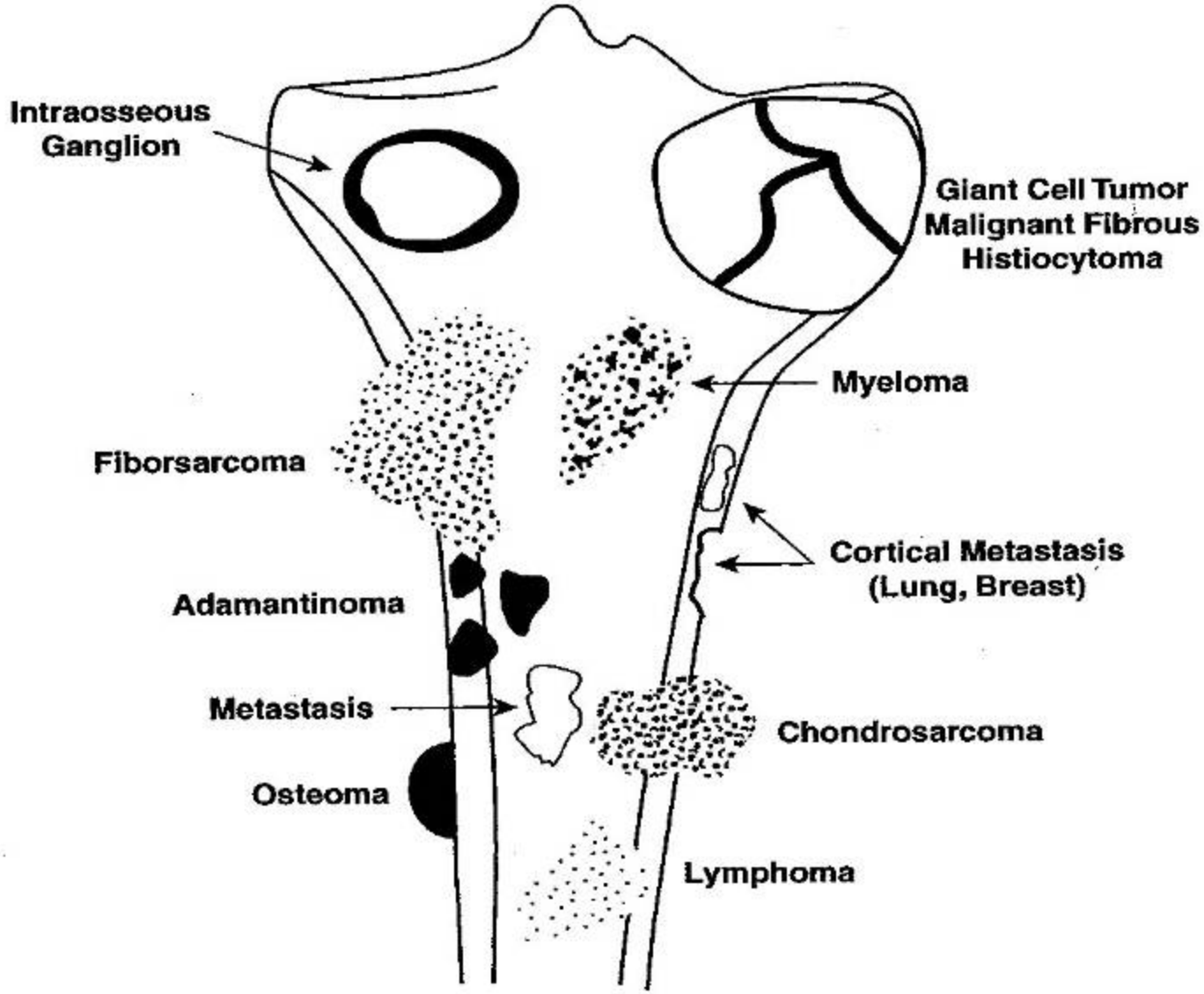
- Tumors Usually Do Not Cross Growth Plate
- Think Infection


Central
Eccentric
Giant-cell Tumor
Simple Bone Cyst
Fibrous Cortical Defect
Nonossifying Fibroma
Enchondroma
Aneurysmal Bone Cyst
Fibrous Dysplasia
Chondromyxoid Fibroma
Osteoma


Cortical
Parosteal (Periosteal)
Fibrous Cortical Defect
Osteoid Osteoma Osteoblastoma
Cortical Abscess
Cortical Metastasis
Hemangiomatosis
Osteofibrous Dysplasia
Intracortical Osteosarcoma
Periosteal Osteoblastoma
Periosteal Chondroma
Parosteal Osteoma
Parosteal Osteosarcoma
Periosteal Osteosarcoma
Periosteal Chondrosarcoma


Immature Skeleton
(Growth Plate Open)
Chondroblastoma
Clear-Cell
Chondrosarcoma
Osteochondroma
Osteosarcoma
Simple Bone
Cyst
Aneurysmal Bone Cyst
Chondromyxoid
Fibroma
Periosteal
Chondroma
Enchondroma
Osteoid Osteoma
Osteoblastoma
Nonossifying
Fibroma
Ewing
Sarcoma
Osteofibrous
Dysplasia
Fibrous
Dysplasia
Fibrous Cortical
Defect

Mature Skeleton
(Growth Plate Closed)



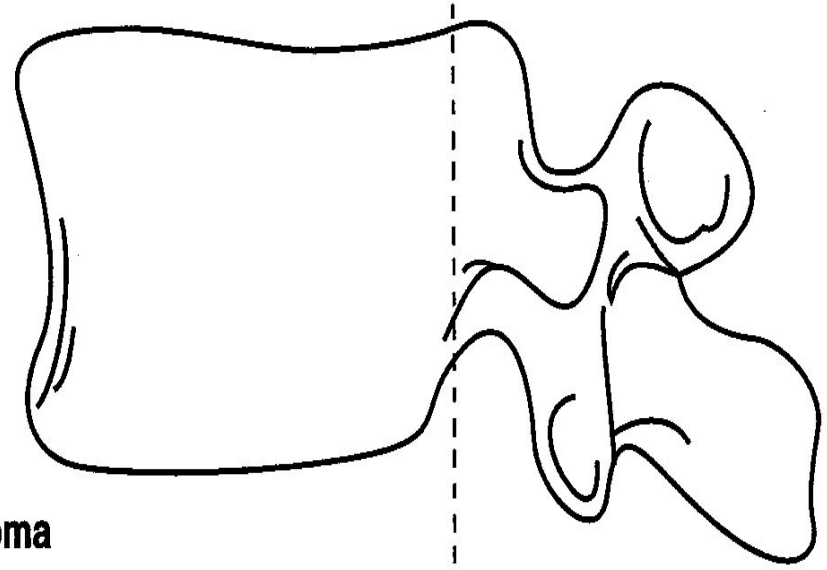
MALIGNANT

Lymphoma
Hodgkin
Myeloma
Ewing
Osteosarcoma
Chondrosarcoma
Metastasis

Exceptions:
Hemangioma
Langerhans-cell Granuloma
Fibrous Dysplasia

BENIGN

Osteoblastoma
Osteoid Osteoma
Aneurysmal Bone Cyst
Osteochondroma
Chondromyxoid Fibroma



C

Anterior *Posterior*

Specific Bones

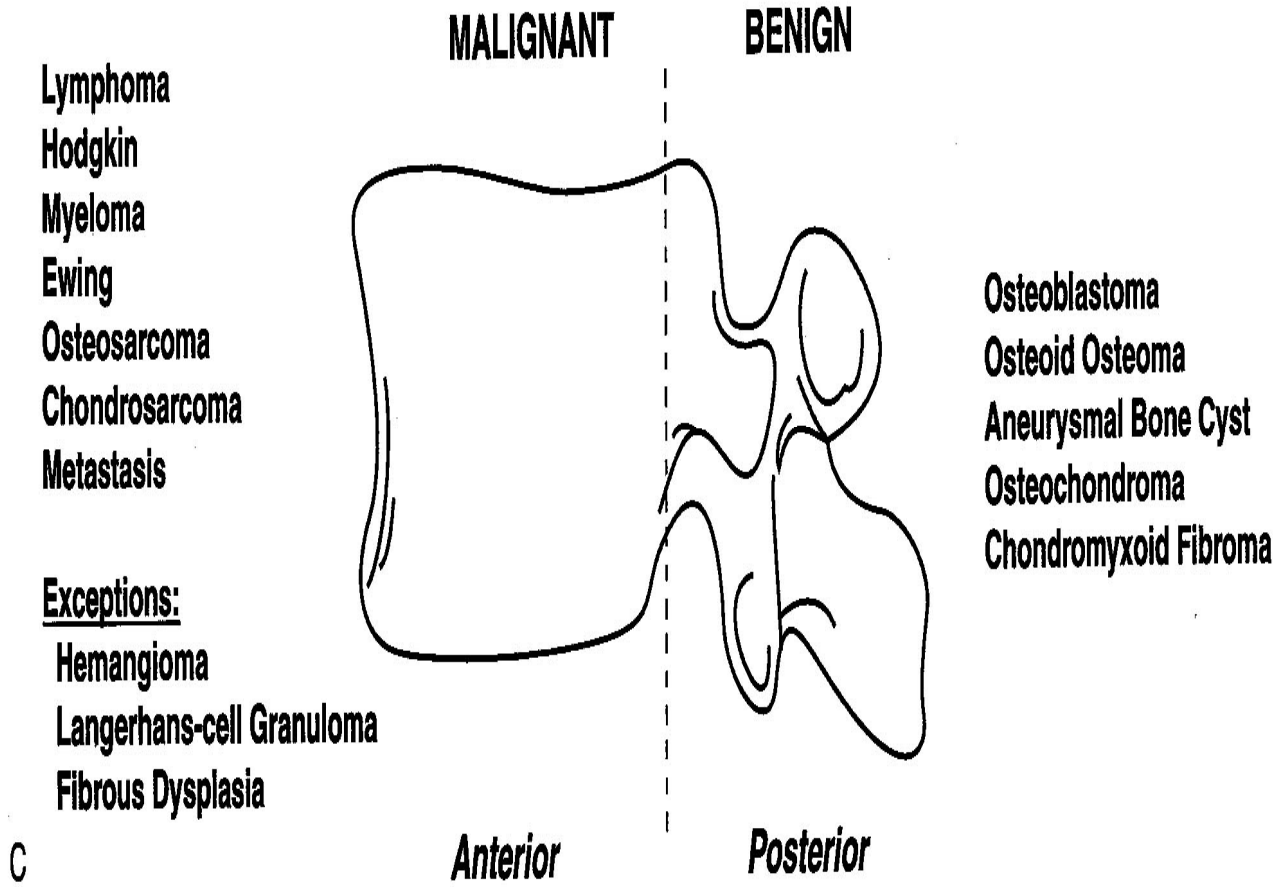
- Heamatopoietic Marrow—predilection for sites with red marrow; rich sinusoidal vasculature
- Axial and Appendicular Skeleton in Children
- **Axial Skeleton in Adults**
  - Metastatic Disease
  - Myeloma
  - Ewing's Sarcoma
  - Histiocytic Lymphoma

Specific Bones

- **Areas of Rapid Growth**
- Primary Bone Tumors
  - Distal Femur
  - Proximal Tibia
  - Proximal Humerus

Specific Bones

- Vertebrae (Adults)
  - Skeletal Mets
  - Myeloma
  - Hemangioma
  - Lymphoma
  - Osteomyelitis
- Vertebrae (Children)
  - Eosinophilic Granuloma
  - ABC
  - Osteoblastoma
  - Osteoid Osteoma
  - Lymphoma
  - Leukemia
  - Osteomyelitis



Specific Bones

- **Sacrum**
  - Chordoma
  - Myeloma/Plasmacytoma
  - Giant Cell Tumor
  - Mets
  - Simple Cysts
  - Neurogenic Tumors /Schwannoma

Specific Bones

- **Ribs**
  - Mets
  - Fibrous Dysplasia
  - Enchondroma

Specific Bones

- **Metacarpals and Phalanges**
  - Giant Cell Tumor
  - Giant Cell Reparative Granuloma
  - Sarcoidosis
  - ABC
  - Fibrous Dysplasia
  - Enchondroma

Specific Bones

- **Terminal Phalanges**
  - Inclusion Cyst
  - Glomus Tumor
  - Mets (Lung)

Figure 15.28 Examples of Tumors and Tumor-Like Lesions With a Predilection fo Specific Bones, Sites in Bones, and Location*

LESION	BONE	ANATOMIC SITE	LOCATION
Simple bone cyst	Humerus Femur	Metaphysis Proximal diaphysis (see Figs. 17.26, 17.27)	Central
Osteoid osteoma	Femur Tibia	Neck of femur (see Figs. 16.4, 16.16)	
Chondroblastoma		Epiphysis (see Figs. 15.6, 16.52, 16.53)	Eccentric
Parosteal osteosarcoma	Femur	Posterior aspect, distal end (see Figs. 15.18, 18.14)	
Chordoma	Clivus C-2 Sacrum		Central
Osteofibrous dysplasia Adamantinoma	Tibia	Anterior aspect (see Fig. 17.20)	
Giant cell tumor	Femur Tibia Radius	Articular end (see Figs. 17.36, 17.39, 17.41, 17.42, 17.43)	Eccentric
Aneurysmal bone cyst	Tibia Humerus	Metaphysis (see Fig. 17.32)	Eccentric
Chondromyxoid fibroma	Tibia	Metaphysis (see Figs. 16.55, 16.56)	Eccentric
Multiple myeloma	Pelvis Spine Skull	 Vertebral body Calvaria (see Figs. 18.43, 18.45)	

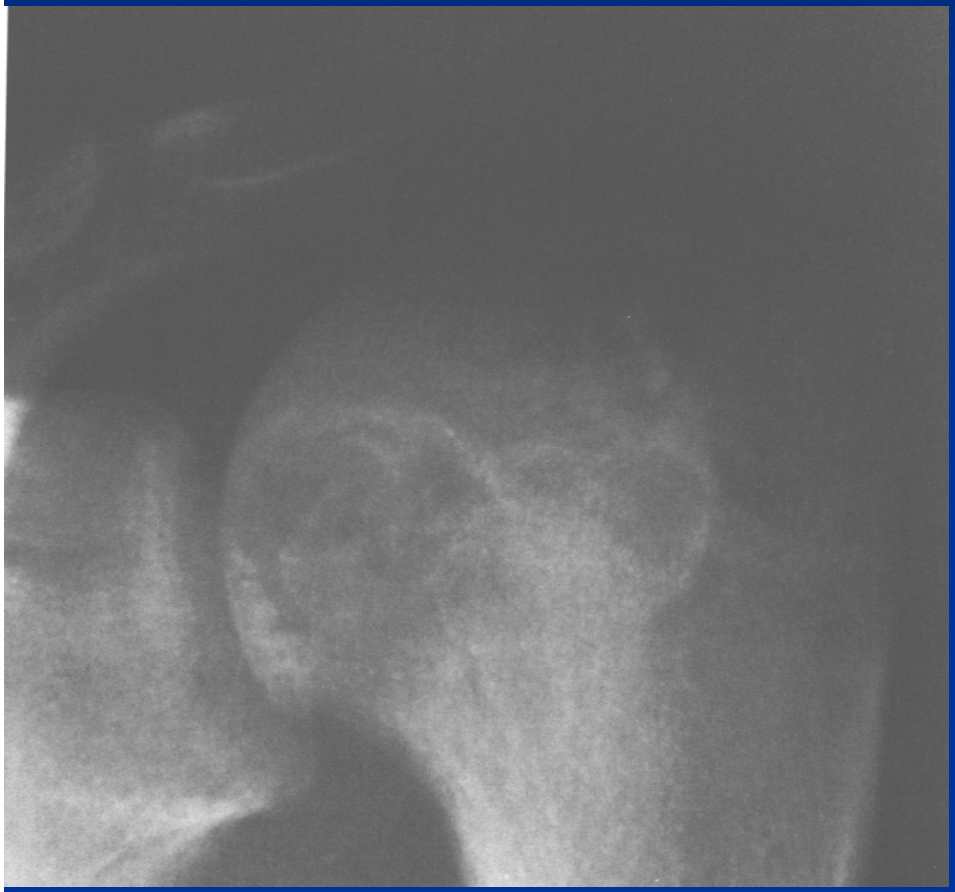
Unknown Examples

Unknown #1

Unknow #1

- Epiphyseal Lesion with Geographic Pattern of Bone Destruction (Probably Benign)
- Eccentric
- Internal Mineralization/Calcifications (indicates most likely cartlaginous nature)
- Sclerotic IA/IB Margin

Chondroblastoma



Unknown #2

Unknown #2

- Spine Lesion
- Posterior Elements
- Geographic Pattern of Bone Destruction (Probably benign)
- Internal Mineralization indicative of bone producing or cartilage producing tumor

Osteoblastoma

Unknown #3

Unknown #3

- Small Cortical Lesion
- Geographic pattern of Bone Destruction
- Extensive Surrounding Sclerosis
- Buttressing Periosteal Reaction (Benign Periosteal Reaction)
- Internal Mineralization

Osteoid Osteoma

Unknown #4

Unknown #4

- Central, Diaphyseal Lesion
- No Periosteal Reaction
- No Cortical destruction
- Calcifications in a Ring and Arc Like Manner

Enchondroma

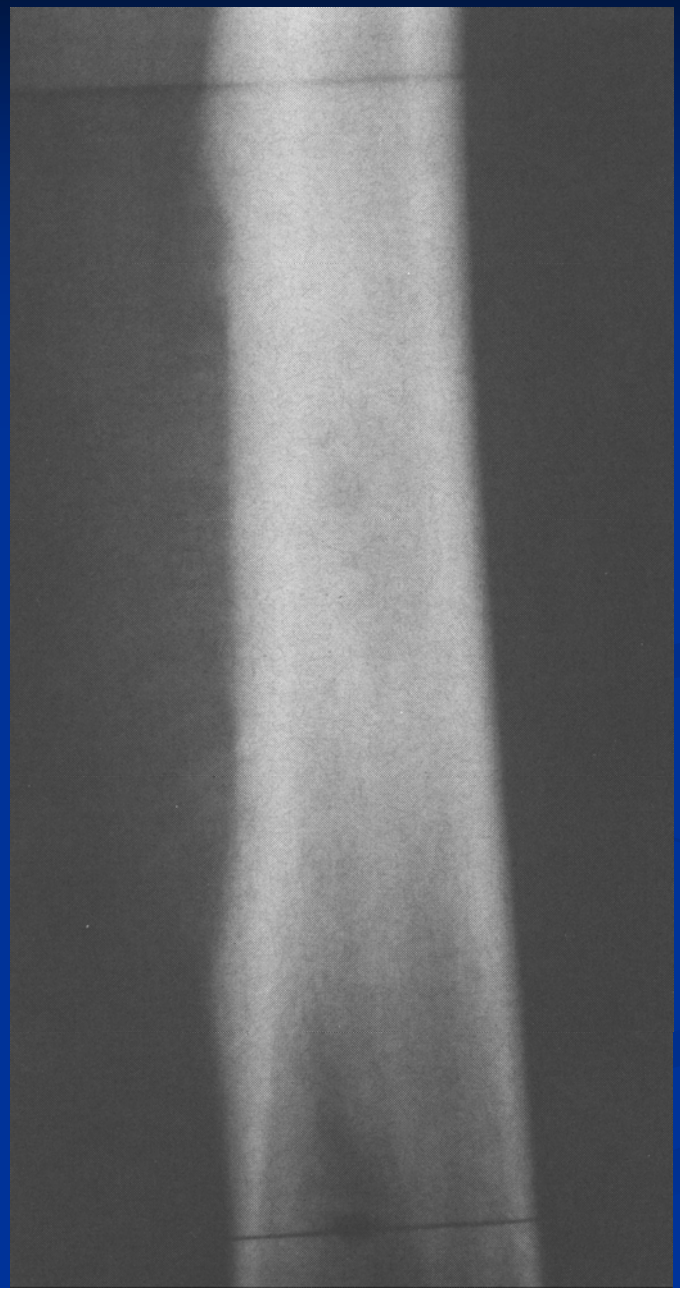
Unknown #5

Unknown #5

- Metaphyseal Eccentric Lesion
- Permeative Lesion (Malignant)
- Cortical Destruction
- Calcifications in a Ring and Arc Manner indicative of a cartilage tumor

Dedifferentiated Chondrosarcoma

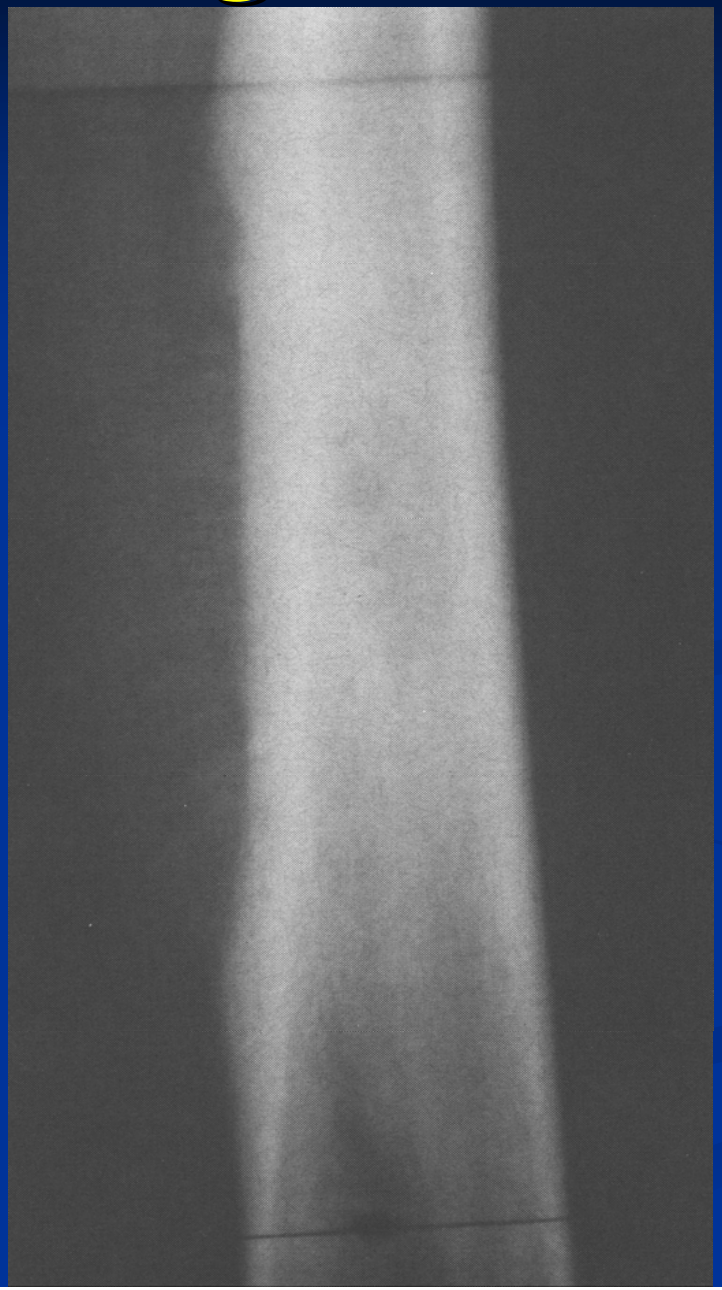
Unknown #6



Unknown #6

- Permeative Pattern of Bone Destruction
- Diaphyseal
- Cortical penetration
- Hair on End Periosteal Reaction
- No Internal Mineralization (probably not bone or cartilage producing)
- Malignant Appearing

Ewing's Sarcoma



Unknown #7

Unknown #7

- Metaphyseal, Central lesion
- Permeative Pattern of Bone Destruction (malignant)
- No Internal Mineralization (probably not cartilage or bone producing—no visible matrix)
- No Periosteal Reaction
- Malignant Appearing

Fibrosarcoma of Bone

Unknown #8

Unknown #8

- Central Lesion
- Geographic Pattern of Bone Destruction (Benign Appearing)
- Metadiaphyseal
- Bone is Expanded (Benign Periosteal reaction)
- No Internal Mineralization (Probably not Cartilaginous or Bone Producing)
- Ground Glass Appearance

Fibrous Dysplasia

Unknown #9

Unknown #9

- Eccentric Lesion
- Metaphyseal with Epiphyseal Extension
- No Internal Mineralization
- Cortex is Thinned and Slightly Expanded
- Thin, Incomplete Sclerotic Margin (Type IB)
- Benign Appearing

Giant Cell Tumor

Unknown #10

Unknown #10

- Metadiaphyseal Lesion
- Motheaten and Permeative (Malignant Appearing)
- No Internal Mineralization
- Cortical Destruction
- No Periosteal Reaction

Malignant Fibrous Histiocytoma of Bone

Unknown #11

Unknown #11

- Central Location
- Metaphyseal
- Multiloculated
- Geographic
- Bone is Expanded
- Skeletally Immature
- No Mineralization
- Benign Appearing

Unicameral Bone Cyst

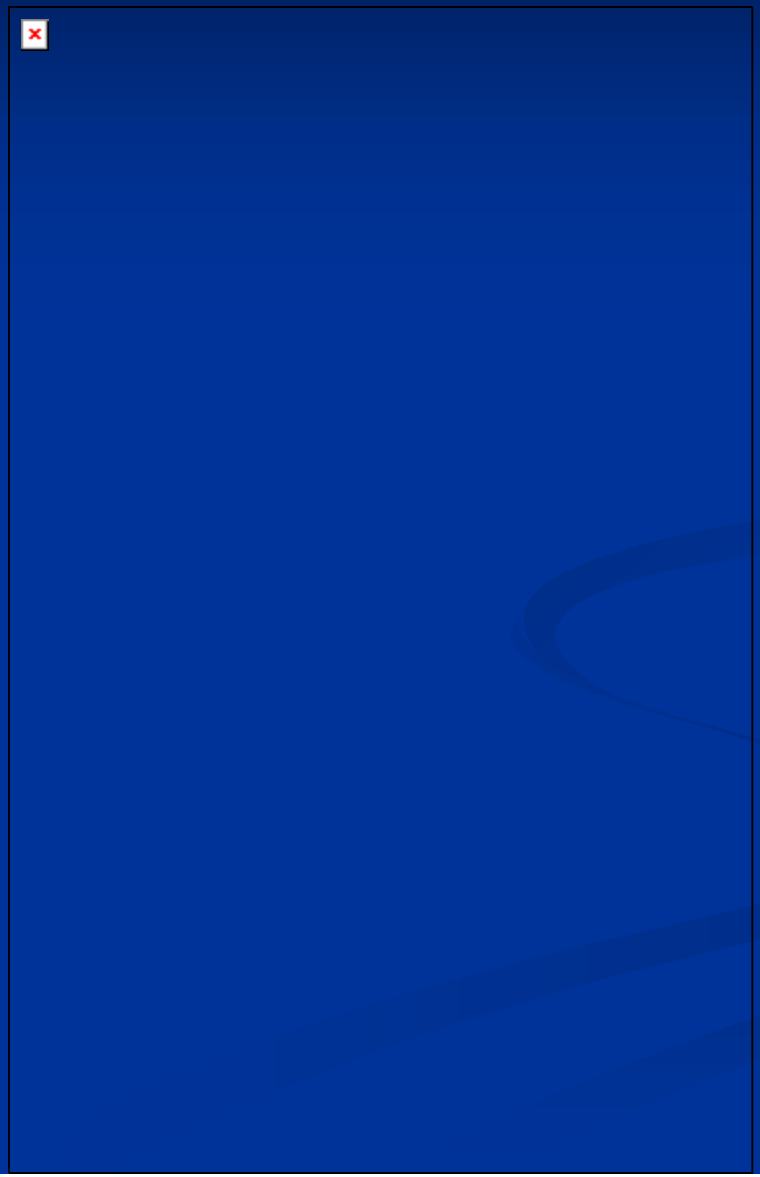
Unknown #12

Unknown #12

- Eccentric/Cortical Lesion
- Metaphyseal
- Geographic pattern of Bone Destruction
- Well Circumscribed (Type IA Margin: Indolent)
- No Internal Mineralization
- Bone has Expanded Contour
- Benign Appearing

Nonossifying Fibroma

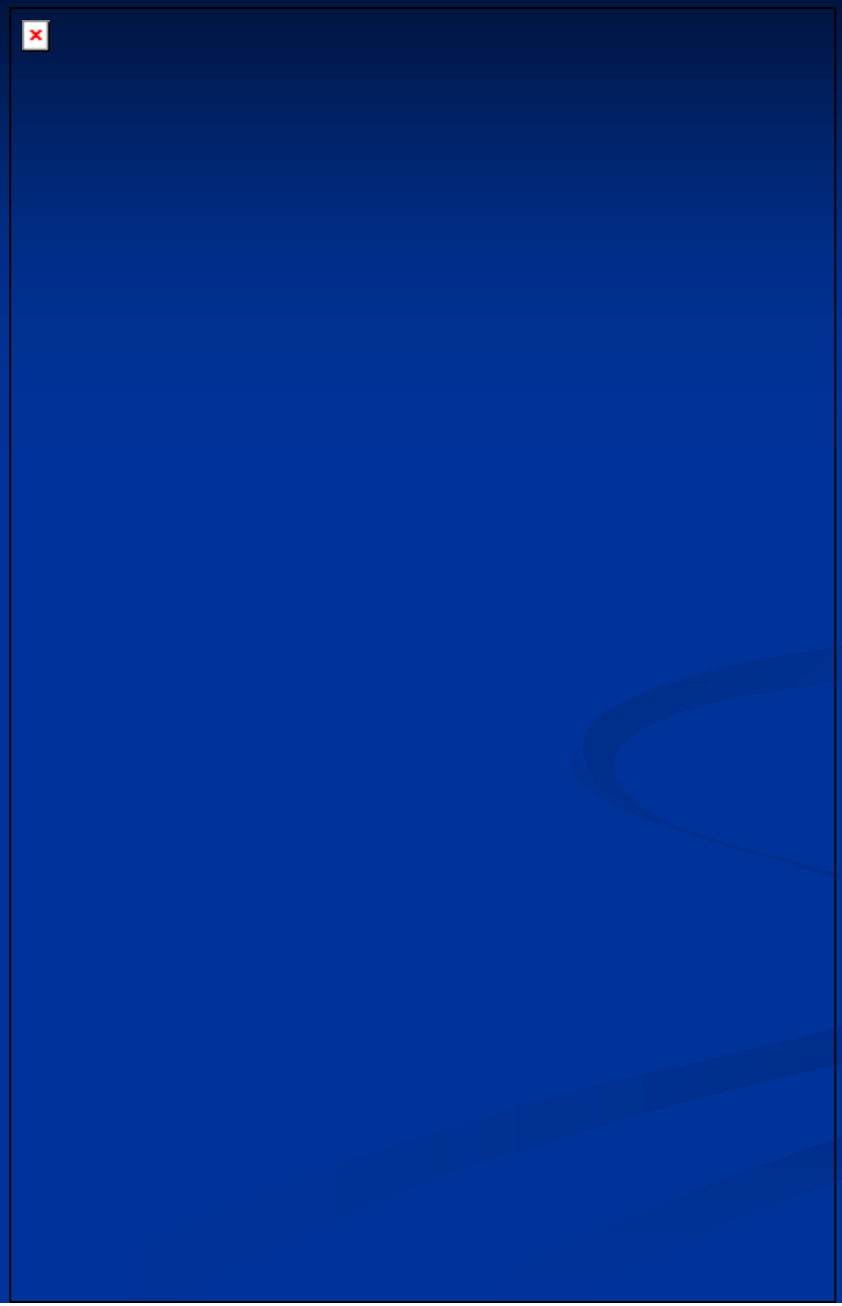
Unknown #13



Unknown #13

- Geographic, Central Lesion in a Phalange
- Lobular Growth Contour with Endosteal Erosion
- Punctate calcifications (arrows)--Cartilaginous
- Appears Benign

Enchondroma



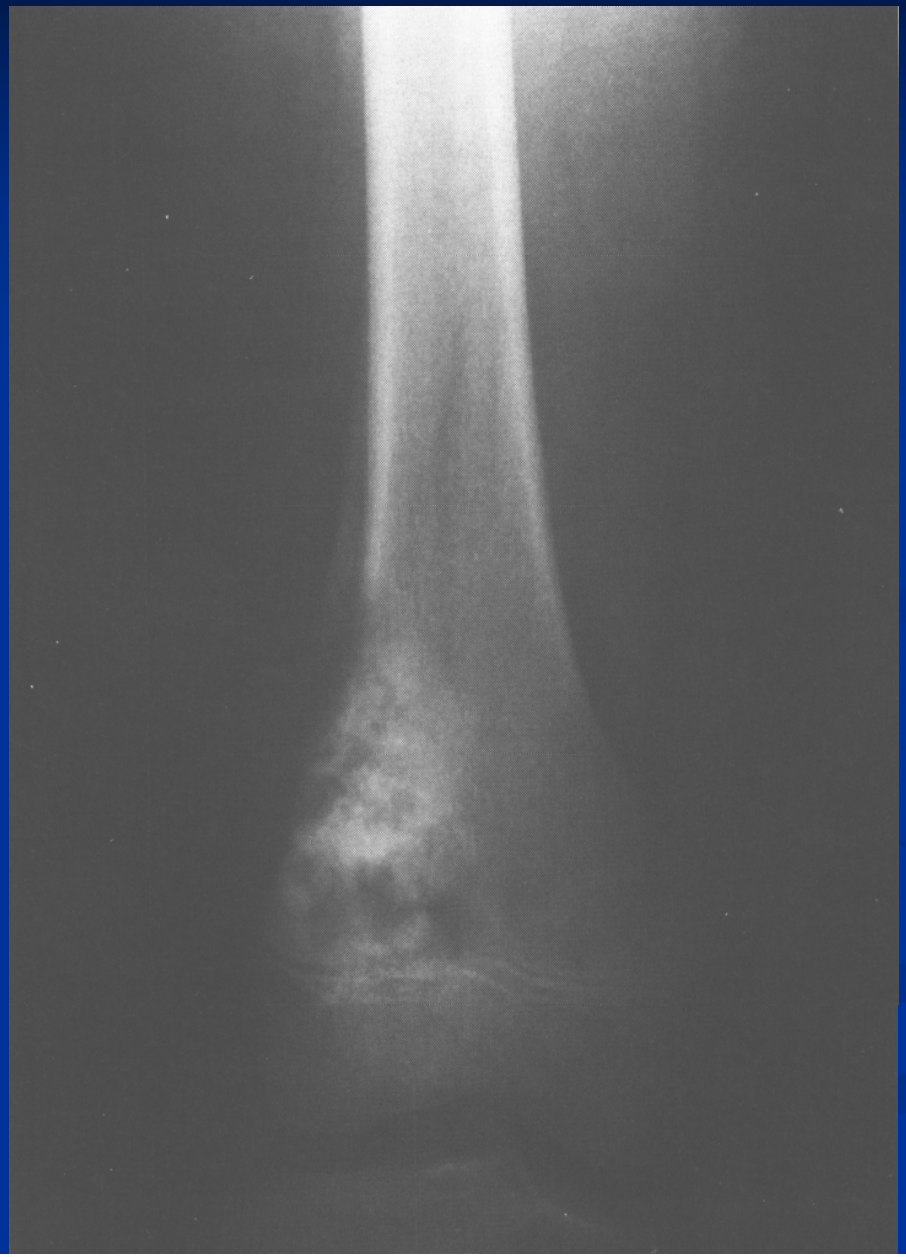
Unknown #14

Unknown #14

- Cortical based, Geographic Lesion in Tibia
- Extensive Sclerotic Margin
- Tibial bowing

Osteofibrous Dysplasia

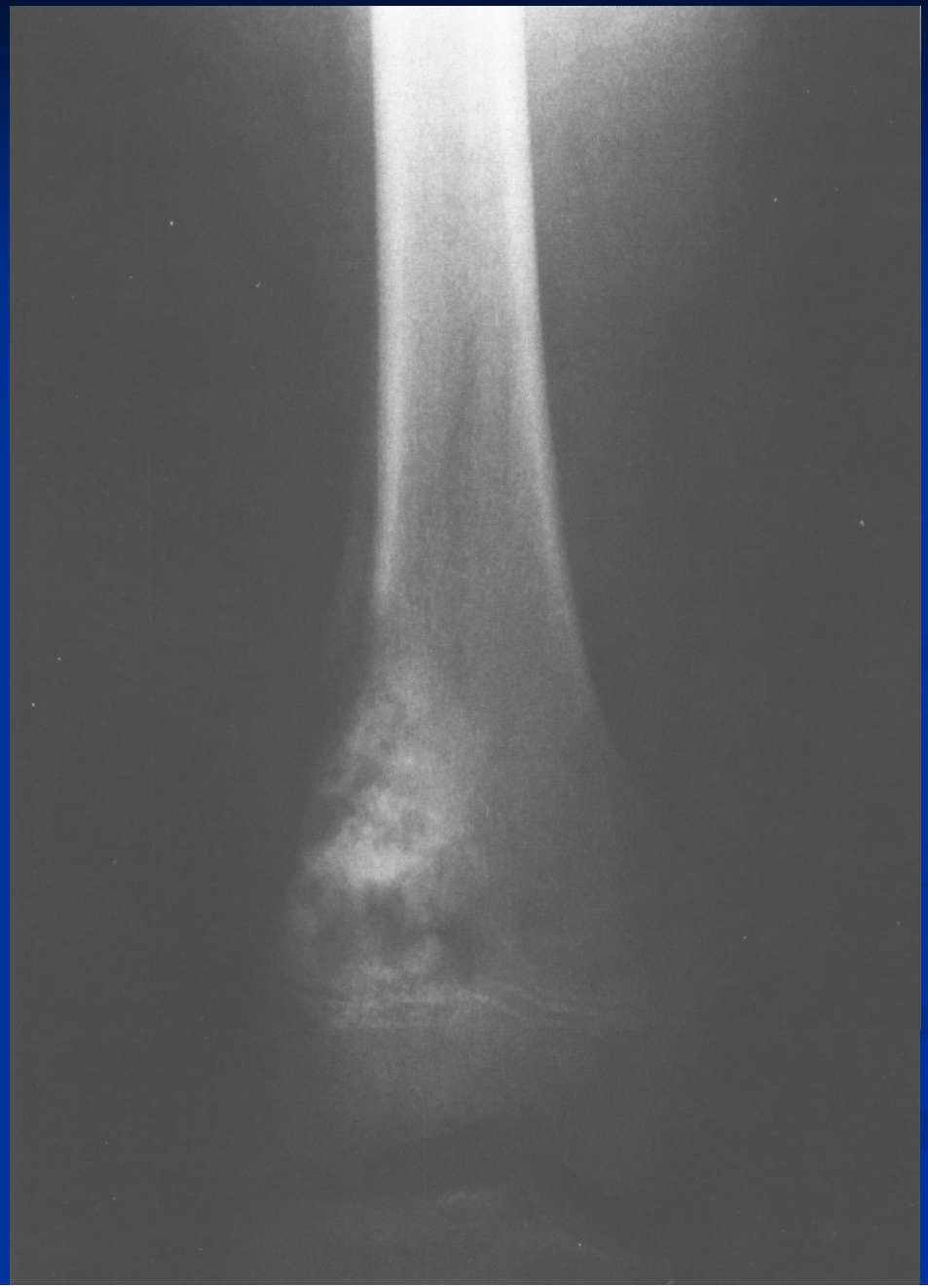
Unknown #15



Unknown #15

- Permeative/Moth Eaten Lesion (Malignant)
- Eccentric, Metaphyseal
- Ossification Present within Neoplasm
- Codman's Triangle
- Skeletally Immature; Spares Growth Plate
- Cortical Destruction
- Appears Malignant and is Producing Osteoid

Osteosarcoma



Unknown #16

Osteofibrous Dysplasia