

William Herring, M.D. © 2002

Bone Tumors Clues and Cues

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Clues by Appearance of Lesion

Patterns of Bone Destruction

- Geographic
- Moth-eaten
- Permeative

Geographic Bone Destruction

- Destructive lesion with sharply defined border
- Implies a less-aggressive, more slow-growing, benign process
- Narrow transition zone

Patterns of Bone Destruction

- Geographic
- Moth-eaten
- Permeative



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Non-ossifying fibroma

Geographic Lesions

Examples

- Non-ossifying fibroma
- Chondromyxoid fibroma
- Eosinophilic granuloma

Moth-eaten Appearance

- Areas of destruction with ragged borders
- Implies more rapid growth
 - Probably a malignancy

Patterns of Bone Destruction

- Geographic
- Moth-eaten
- Permeative



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Multiple Myeloma

Moth-eaten Appearance

Examples

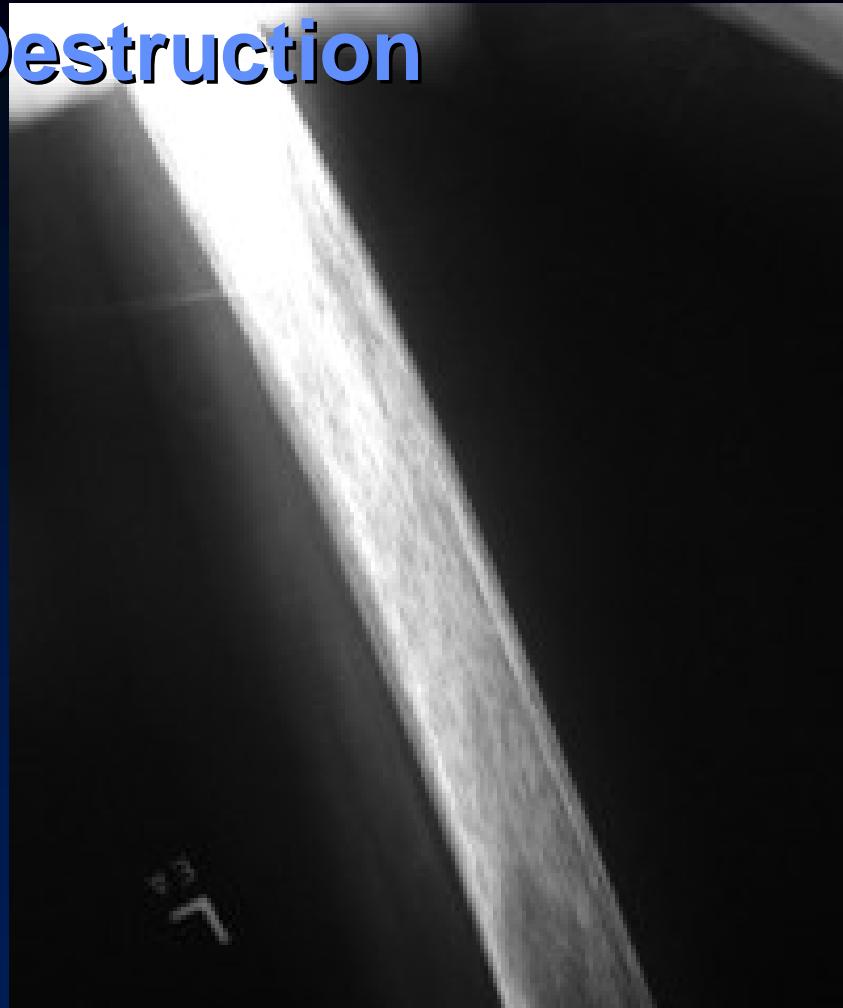
- Myeloma
- Metastases
- Lymphoma
- Ewing's sarcoma

Permeative Pattern

- Ill-defined lesion with multiple “worm-holes”
- Spreads through marrow space
- Wide transition zone
- Implies an aggressive malignancy
 - Round-cell lesions

Patterns of Bone Destruction

- Geographic
- Moth-eaten
- Permeative



Leukemia

Permeative Pattern

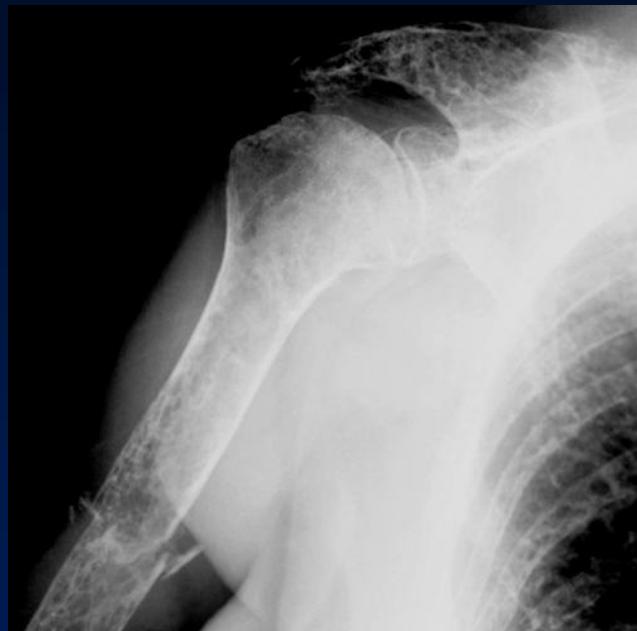
Round cell lesions

- Lymphoma, leukemia
- Ewing's Sarcoma
- Myeloma
- Osteomyelitis
- Neuroblastoma

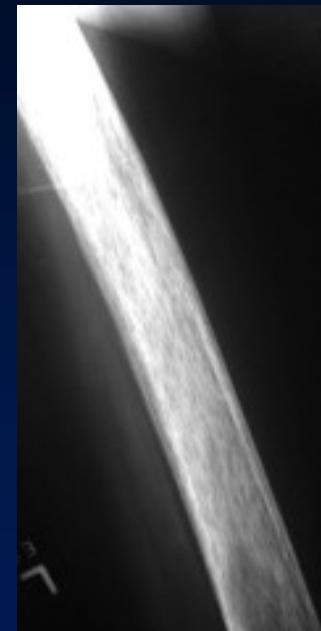
Patterns of Destruction



Geographic



Moth-eaten



Permeative

Less malignant

More malignant

Periosteal Reactions

- Benign
 - None
 - Solid
- More aggressive or malignant
 - Lamellated or onion-skinning
 - Sunburst
 - Codman's triangle

Periosteal Reactions

- Benign
 - None
 - Solid
- Aggressive/malignant
 - Onion-skinning
 - Sunburst
 - Codman's triangle



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Non-ossifying fibroma

Periosteal Reactions

- Benign
 - None
 - Solid
- Aggressive/malignant
 - Onion-skinning
 - Sunburst
 - Codman's triangle



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Chronic osteomyelitis

Periosteal Reactions

- Benign
 - None
 - Solid
- Aggressive/malignant
 - Onion-skinning
 - Sunburst
 - Codman's triangle

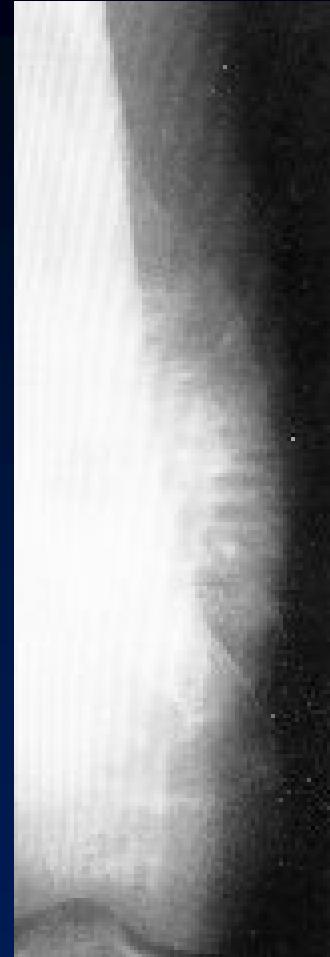


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Ewing's sarcoma

Periosteal Reactions

- Benign
 - None
 - Solid
- Aggressive/malignant
 - Onion-skinning
 - Sunburst
 - Codman's triangle



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Osteosarcoma

Periosteal Reactions

- Benign
 - None
 - Solid
- Aggressive/malignant
 - Onion-skinning
 - Sunburst
 - Codman's triangle



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Ewing's-Codman's
triangle

Periosteal Reactions



Solid

Less malignant



Lamellated



Sunburst

Codman's

More malignant



Tumor Matrix

- Osteoblastic
 - Fluffy, cotton-like or cloud-like densities
 - ▲ Osteosarcoma
- Cartilaginous
 - Comma-shaped, punctate, annular, popcorn-like
 - ▲ Enchondroma, chondrosarcoma, chondromyxoid fibroma

Tumor matrix

- Osteoblastic
- Cartilaginous



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Osteosarcoma

Tumor matrix

- Osteoblastic
- Cartilaginous



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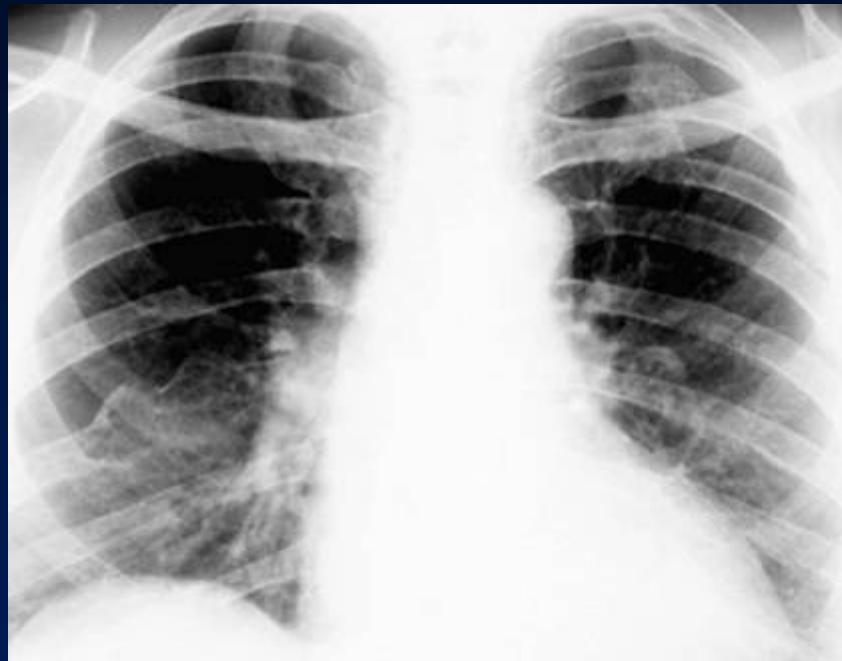
Chondrosarcoma

Expansile Lesions of Bone

- Multiple myeloma
- Mets
- Aneurysmal bone cyst
- Fibrous dysplasia
- Brown tumor
- Enchondroma
- Lymphoma

Expansile lesions

- Multiple myeloma
- Mets
- Aneurysmal bone cyst
- Fibrous dysplasia
- Brown tumor
- Enchondroma
- Lymphoma



Multiple Myeloma

Expansile lesions

- Multiple myeloma
- Mets
- Aneurysmal bone cyst
- Fibrous dysplasia
- Brown tumor
- Enchondroma
- Lymphoma



Renal Cell Carcinoma

Expansile lesions

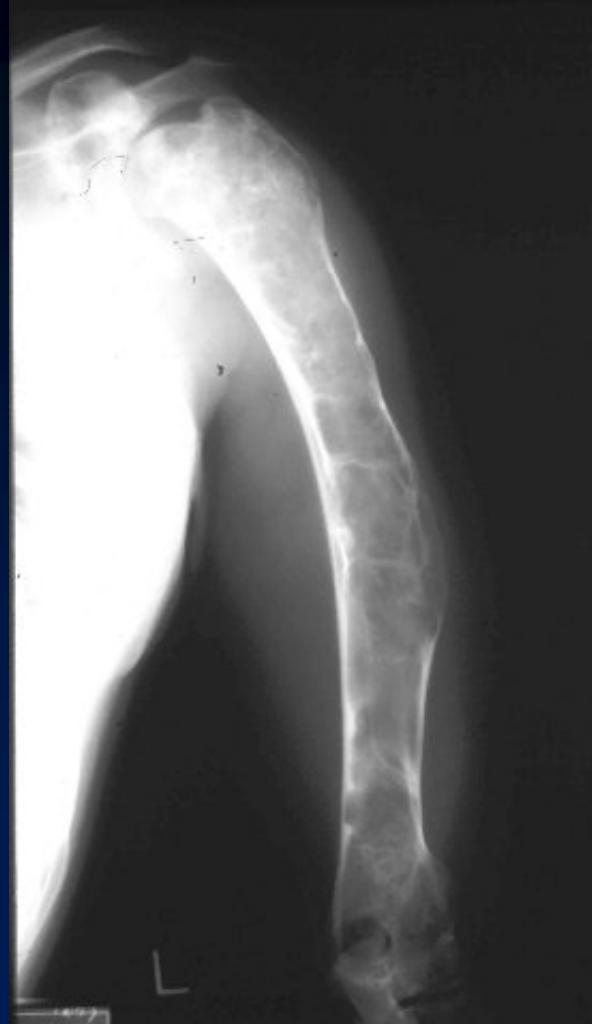
- Multiple myeloma
- Mets
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- Brown tumor
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- Lymphoma



Aneurysmal Bone Cyst

Expansile lesions

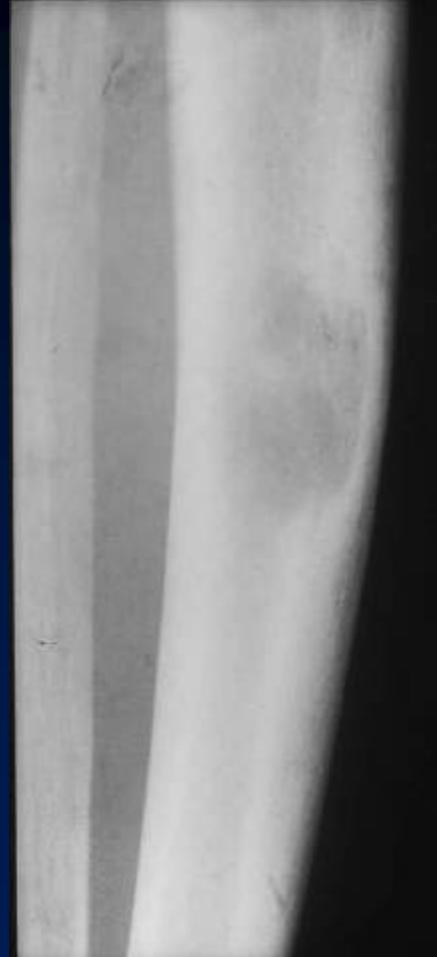
- Multiple myeloma
- Mets
- Aneurysmal bone cyst
- Fibrous dysplasia
- Brown tumor
- Enchondroma
- Lymphoma



Fibrous Dysplasia

Expansile lesions

- Multiple myeloma
- Mets
- Aneurysmal bone cyst
- Fibrous dysplasia
- Brown tumor
- Enchondroma
- Lymphoma



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Brown Tumor

Expansile lesions

- Multiple myeloma
- Mets
- Aneurysmal bone cyst
- Fibrous dysplasia
- Brown tumor
- Enchondroma
- Lymphoma

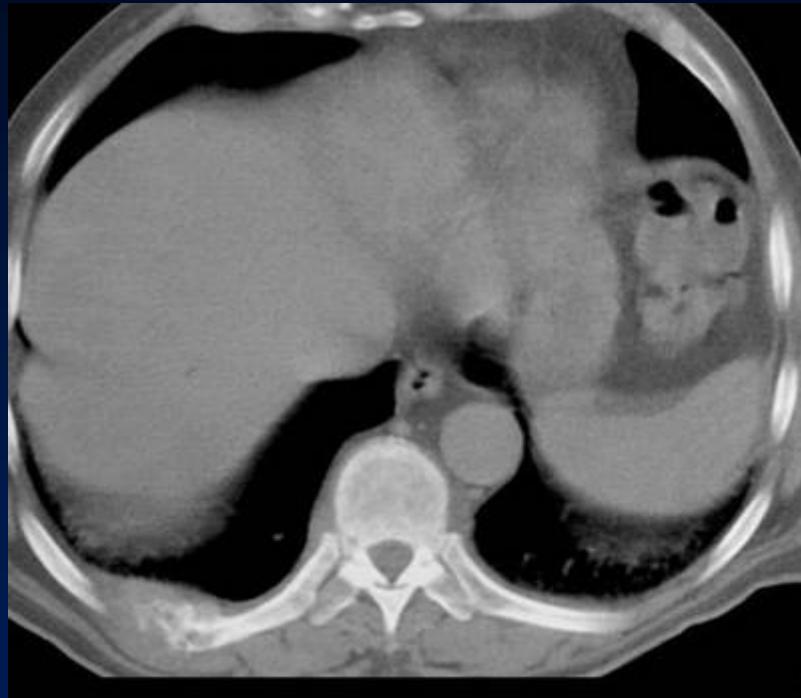


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Enchondroma

Expansile lesions

- Multiple myeloma
- Mets
- Aneurysmal bone cyst
- Fibrous dysplasia
- Brown tumor
- Enchondroma
- Lymphoma



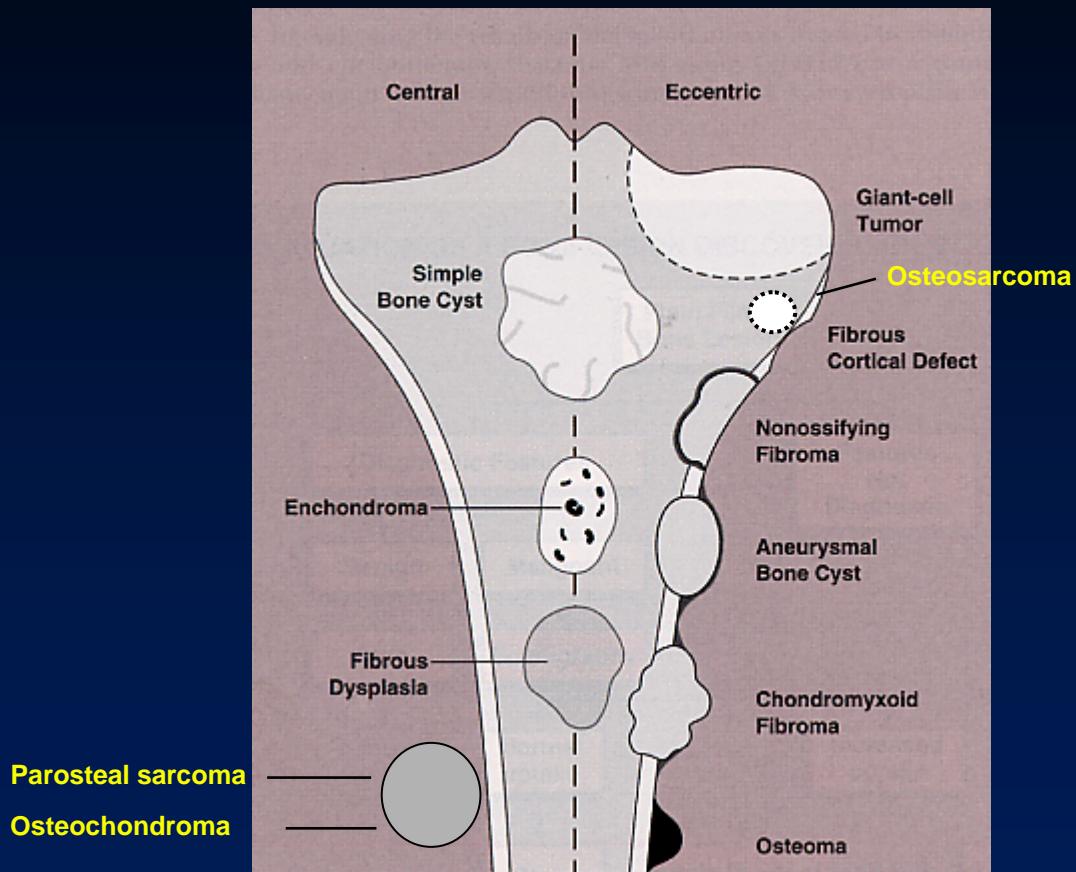
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Lymphoma

Clues by Location of Lesion

In the Transverse Plane

- Central
 - Enchondroma
- Eccentric
 - GCT, osteosarcoma, chondromyxoid fibroma
- Cortical
 - Non-ossifying fibroma, osteoid osteoma
- Parosteal
 - Parosteal osteosarcoma, osteochondroma



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In The Transverse Plane

In the Longitudinal Plane

- Epiphyseal
 - GCT, chondroblastoma
- Metaphyseal
 - Osteomyelitis, osteo- and chondrosarcoma
- Diaphyseal
 - Round cell lesions, ABC, enchondroma

Tumor Types

Characteristic Locations

- Simple bone cyst
 - Proximal humerus
- Chondroblastoma
 - Epiphyses
- Giant Cell tumor
 - Epiphyses

Characteristic locations

- Simple bone cyst
 - Proximal humerus
- Chondroblastoma
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- Giant Cell tumor
 - Epiphyses



Characteristic locations

- Simple bone cyst
 - Proximal humerus
- Chondroblastoma
 - Epiphyses
- Giant Cell tumor
 - Epiphyses



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Chondroblastoma

Characteristic locations

- Simple bone cyst
 - Proximal humerus
- Chondroblastoma
 - Epiphyses
- Giant Cell tumor
 - Epiphyses



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Giant Cell Tumor

Tumor Types

Characteristic Locations

- Adamantinoma
 - Tibia
- Chordoma
 - Sacrum, clivus
- Osteoblastoma
 - Spine, posterior

Characteristic locations

- Adamantinoma
 - Tibia
- Chordoma
 - Sacrum, clivus
- Osteoblastoma
 - Spine, posterior



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Adamantinoma

Characteristic locations

- Adamantinoma
 - Tibia
- Chordoma
 - Sacrum, clivus
- Osteoblastoma
 - Spine, posterior



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Chordoma

Characteristic locations

- Adamantinoma
 - Tibia
- Chordoma
 - Sacrum, clivus
- Osteoblastoma
 - Spine, posterior



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Osteoblastoma

Tumor Types

Characteristic Locations

- Parosteal sarcoma
 - Distal femur
- Periosteal sarcoma
 - Tibia

Characteristic locations

- Parosteal sarcoma
 - Distal femur
- Periosteal sarcoma
 - Tibia



Parosteal sarcoma

Characteristic locations

- Parosteal sarcoma
 - Distal femur
- Periosteal sarcoma
 - Tibia



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Characteristic Tumors

By Body Site

Pelvic Lesions

- Chondrosarcoma
- Solitary plasmacytoma
- Chordoma

Pelvic lesions

- Chondrosarcoma
- Solitary plasmacytoma
- Chordoma



Pelvic lesions

- Chondrosarcoma
- Solitary plasmacytoma
- Chordoma



Plasmacytoma

Pelvic lesions

- Chondrosarcoma
- Solitary plasmacytoma
- Chordoma



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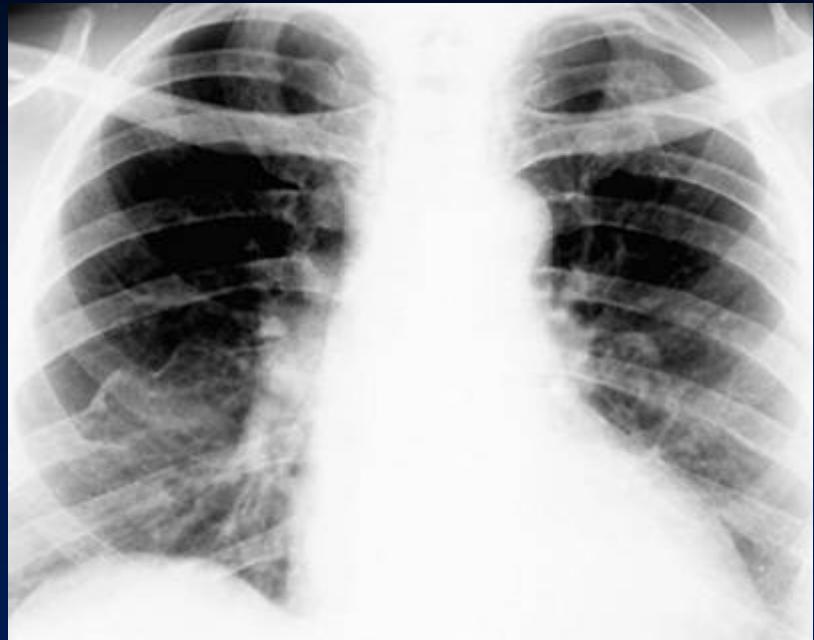
Chordoma

Expansile Rib Lesions

- Plasmacytoma
- Metastases
- Chondrosarcoma
- Eosinophilic granuloma
- Neurofibromatosis
- Fibrous dysplasia

Expansile rib lesions

- Plasmacytoma
- Metastases
- Chondrosarcoma
- Eosinophilic granuloma
- Neurofibromatosis
- Fibrous dysplasia



Expansile rib lesions

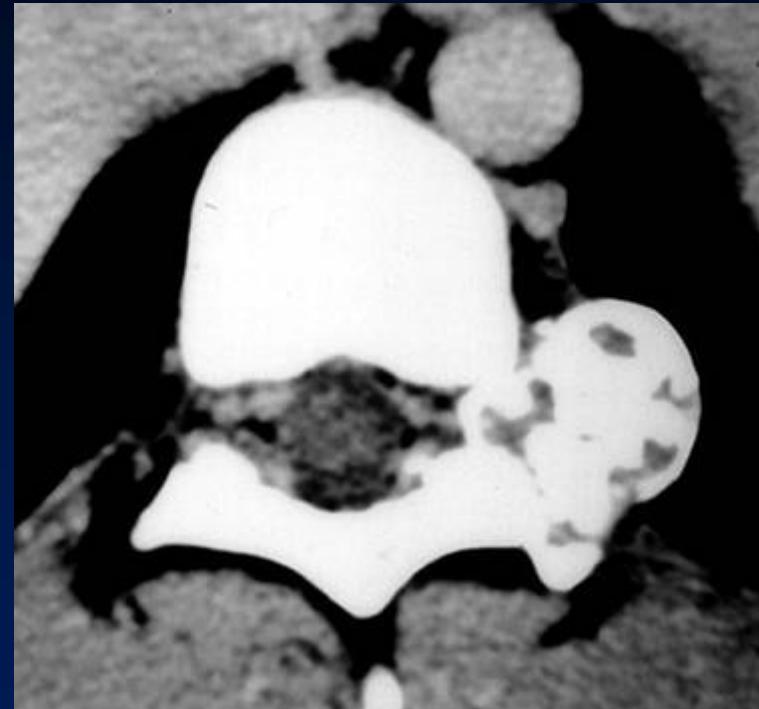
- Plasmacytoma
- Metastases
- Chondrosarcoma
- Eosinophilic granuloma
- Neurofibromatosis
- Fibrous dysplasia



Thyroid Carcinoma

Expansile rib lesions

- Plasmacytoma
- Metastases
- Chondrosarcoma
- Eosinophilic granuloma
- Neurofibromatosis
- Fibrous dysplasia



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Expansile rib lesions

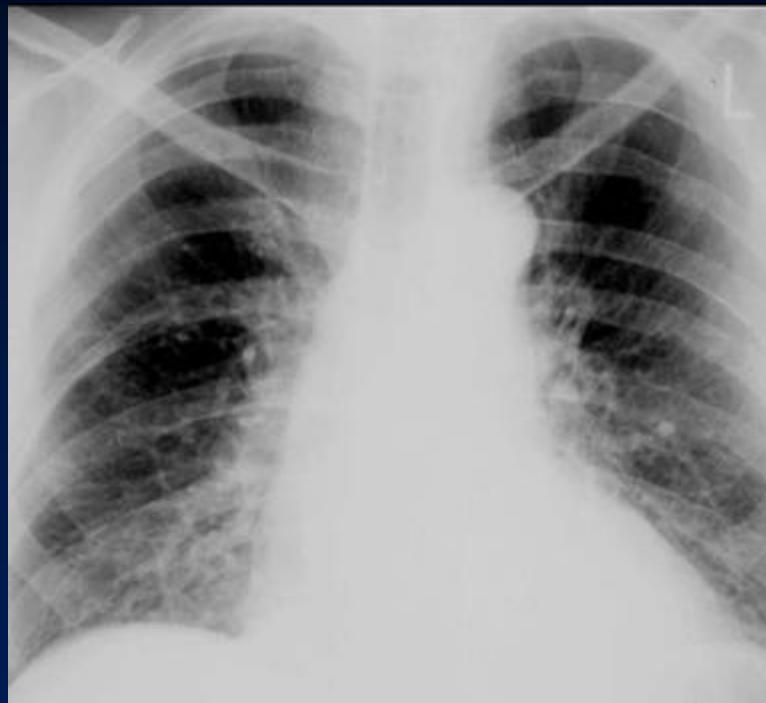
- Plasmacytoma
- Metastases
- Chondrosarcoma
- Eosinophilic granuloma
- Neurofibromatosis
- Fibrous dysplasia



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Expansile rib lesions

- Plasmacytoma
- Metastases
- Chondrosarcoma
- Eosinophilic granuloma
- Neurofibromatosis
- Fibrous dysplasia



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Expansile rib lesions

- Plasmacytoma
- Metastases
- Chondrosarcoma
- Eosinophilic granuloma
- Neurofibromatosis
- Fibrous dysplasia



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Lesions of the Spine

- Osteoblastoma
 - Expansile, with punctate densities within
- Chordoma
- ABC
- Metastatic disease

Spine lesions

- Osteoblastoma
- Chordoma
- ABC
- Metastatic disease

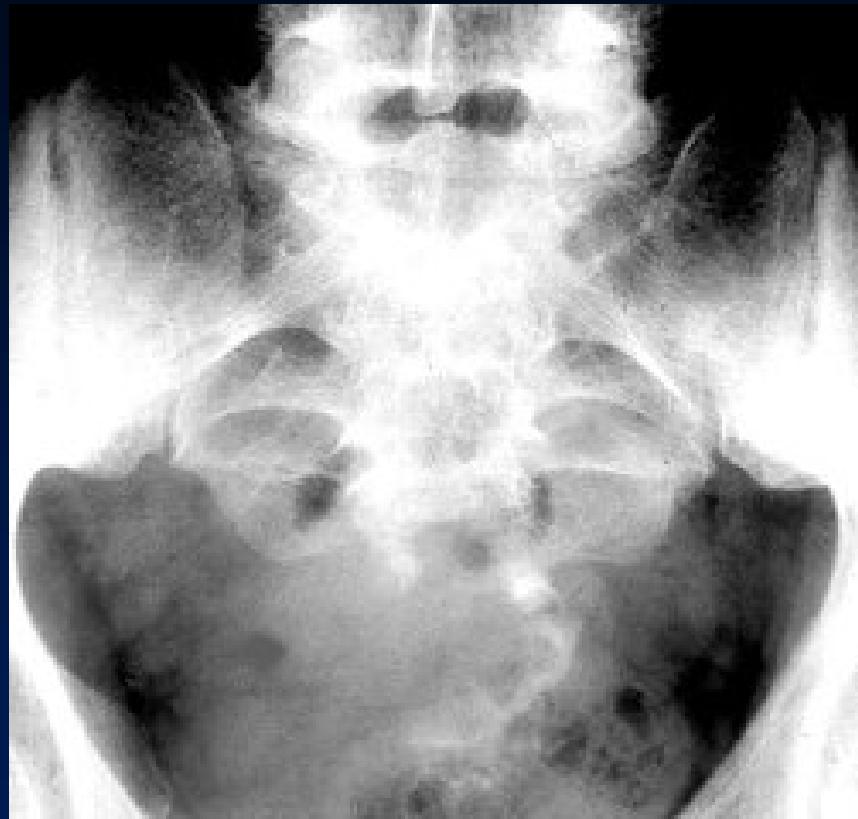


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Osteoblastoma

Spine lesions

- Osteoblastoma
- Chordoma
- ABC
- Metastatic disease



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Chordoma

Spine lesions

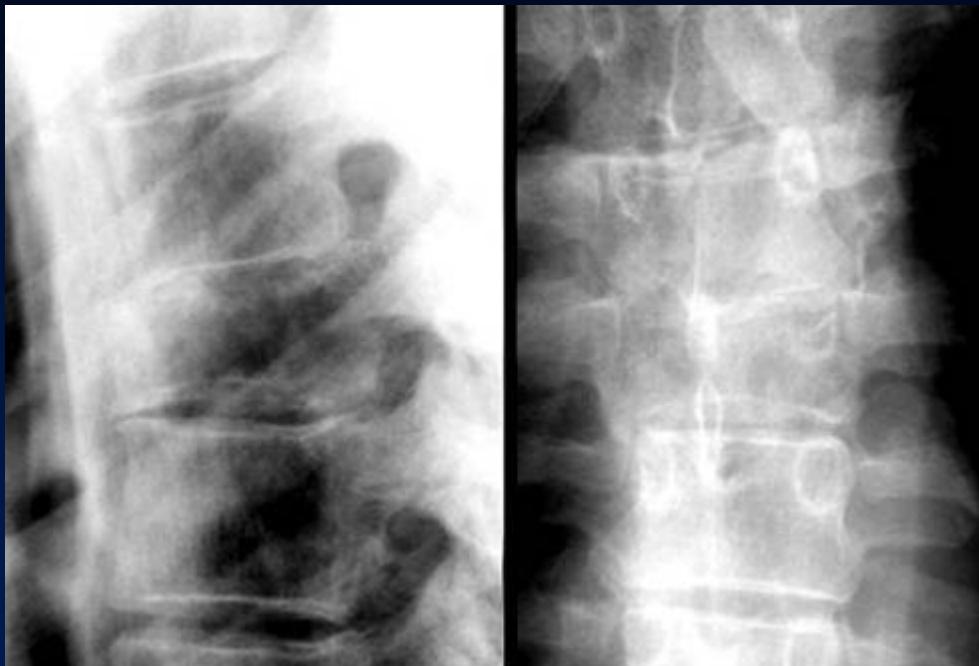
- Osteoblastoma
- Chordoma
- ABC
- Metastatic disease



Aneurysmal bone cyst

Spine lesions

- Osteoblastoma
- Chordoma
- ABC
- Metastatic disease



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Metastatic Breast Carcinoma

Clues by Density Of Lesion

Sclerotic Cortical Lesions

- Osteoid osteoma
- Brodie's abscess
- Stress fracture

Sclerotic cortical lesions

- Osteoid osteoma
- Brodie's abscess
- Stress fracture



Osteoid Osteoma

Sclerotic cortical lesions

- Osteoid osteoma
- Brodie's abscess
- Stress fracture

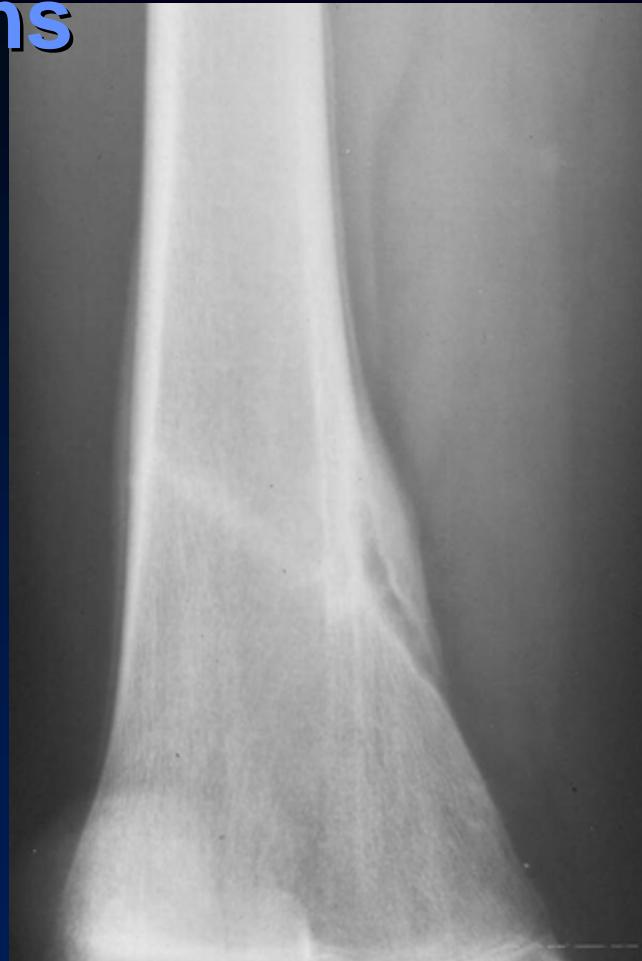


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Brodie's abscess

Sclerotic cortical lesions

- Osteoid osteoma
- Brodie's abscess
- Stress fracture



Healing Stress Fracture

Sclerotic Cortical Lesions



Osteoid Osteoma



Brodie's abscess



Healing Stress
Fracture

Lytic Lesions in Children

- Eosinophilic granuloma
- Neuroblastoma
- Leukemia

Lytic Lesions in Children

- Eosinophilic granuloma
- Neuroblastoma
- Leukemia



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Eosinophilic granuloma

Lytic Lesions in Children

- Eosinophilic granuloma
- Neuroblastoma
- Leukemia

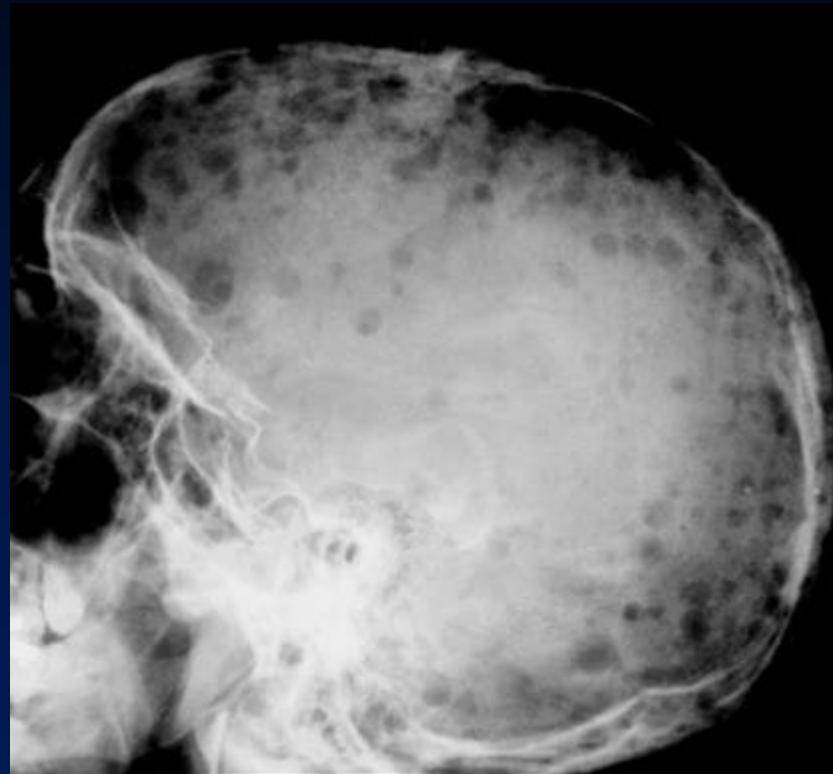


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Neuroblastoma

Lytic Lesions in Children

- Eosinophilic granuloma
- Neuroblastoma
- Leukemia



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Leukemia

Lytic Lesions in Adults

- Metastatic lesions
 - Lung
 - Renal
 - Thyroid
- Multiple myeloma
- Primary bone tumor

Lytic Lesions in Adults

- **Mets**
- **Myeloma**
- **Primary bone tumor**



Met from Thyroid Carcinoma

Lytic Lesions in Adults

- Mets
- Myeloma
- Primary bone tumor



Multiple myeloma

Lytic Lesions in Adults

- **Mets**
- **Myeloma**
- **Primary bone tumor**



Chondrosarcoma

Blastic Lesions in Children

- Medulloblastoma
- Lymphoma

Blastic Lesions in Children

- Medulloblastoma
- Lymphoma



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Medulloblastoma

Blastic Lesions in Children

- Medulloblastoma
- Lymphoma



Lymphoma

Blastic Lesions in Adults

- Metastatic disease
 - Breast – female
 - Prostate – male
- Lymphoma
- Paget's disease
- Etcetera-mastocytosis, fluorosis

Blastic Lesions in Adults

- Mets
- Lymphoma
- Paget's



Prostate Mets

Blastic Lesions in Adults

- Mets
- Lymphoma
- Paget's



Breast Mets

Blastic Lesions in Adults

- Mets
- Lymphoma
- Paget's



Lymphoma

Blastic Lesions in Adults

- Mets
- Lymphoma
- Paget's



Paget's of Spine

Other Clues

Benign Lesions Without Sclerotic Borders

- Giant Cell tumor
- Brown tumor
- Osteolytic phase of Paget's Disease

Benign Lesions without Sclerotic Borders

- Giant cell tumor
- Brown tumor
- Osteolytic Paget's

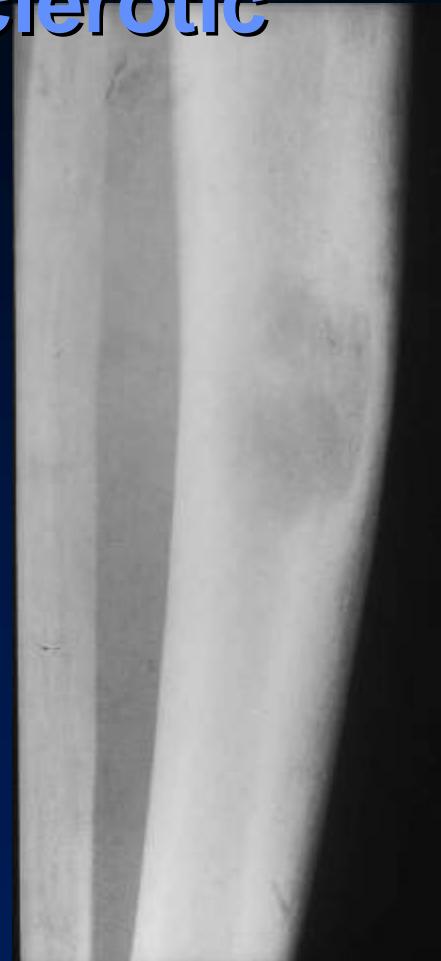


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Giant Cell Tumor

Benign Lesions without Sclerotic Borders

- Giant cell tumor
- Brown tumor
- Osteolytic Paget's



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Brown Tumor

Benign Lesions without Sclerotic Borders

- Giant cell tumor
- Brown tumor
- Osteolytic Paget's



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Osteolytic Paget's

Soft Tissue Extension

- **Usually implies malignancy**
 - More likely to form discrete soft tissue mass
- **Benign conditions with soft tissue extension**
 - Osteomyelitis
 - ▲ Usually infiltration of fat



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Osteosarcoma

Multiple Lesions

- More often benign
- Malignancies with multiple lesions
 - Metastatic disease
 - Multiple myeloma
 - Lymphoma
 - Ewing's sarcoma (rarely)
 - Osteosarcoma (rarely)

Multiple lesions

- Metastatic
- Multiple myeloma
- Lymphoma

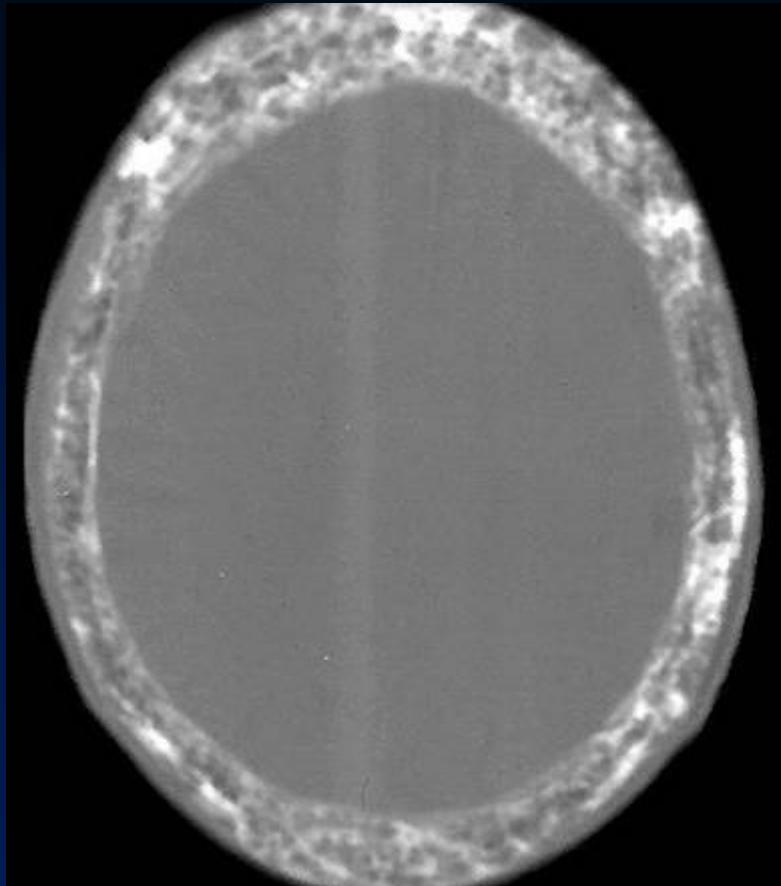


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Mets from Ca of Prostate

Multiple lesions

- Metastatic
- Multiple myeloma
- Lymphoma



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Multiple Myeloma

Multiple lesions

- Metastatic
- Multiple myeloma
- Lymphoma



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Lymphoma

Multiple lesions

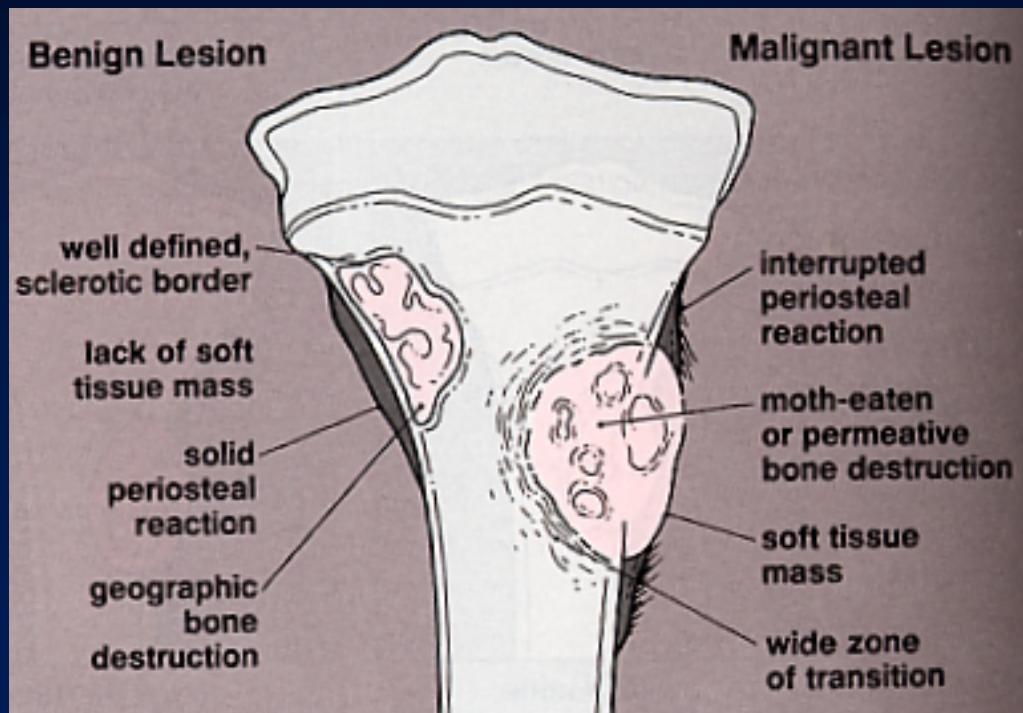
- Metastatic
- Multiple myeloma
- Lymphoma
- Osteosarcomatosis



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Osteosarcomatosis

Benign vs. Malignant



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The End