

SMALL ROUND BLUE CELL LESION OF BONE

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DISCLOSURE

- No financial support or endorsement

OBJECTIVES

- Describe the more common small round cell lesions of bone
- Develop a differential diagnosis based on age, sex, location and appearance
- Discuss lesions that may mimic



BRIEF INTRODUCTION

- small round blue cell tumors is a descriptive name given to members of sarcoma with specific morphologic, biological, immunophenotype and clinical features
- encompasses several lesions



SMALL ROUND BLUE CELL LESIONS OF BONE

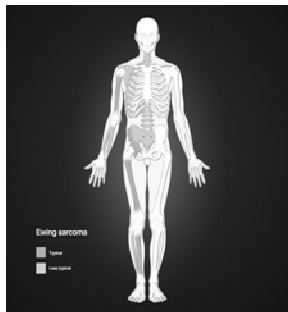
- EWING'S SARCOMA
- NEUROBLASTOMA
- EOSINOPHILIC GRANULOMA
- LEUKEMIA
- RETICULUM CELL SARCOMA
- MULTIPLE MYELOMA

EWING'S SARCOMA

- Epidemiology
 - M>F
 - 4-15 years
 - rare over the age of 30
 - second most common malignant bone tumor in children (after osteosarcoma)
- Clinical Presentation
 - pain usually most common symptom
 - fever and leukocytosis

LOCATION

- both long and flat bones are affected in Ewing sarcoma
- lower limb 45% (femur most common), pelvis 20%, upper limb 13%

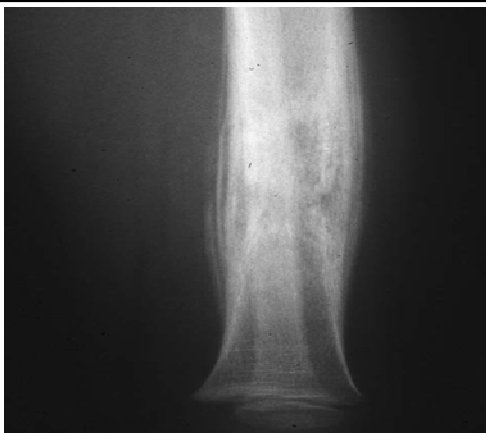


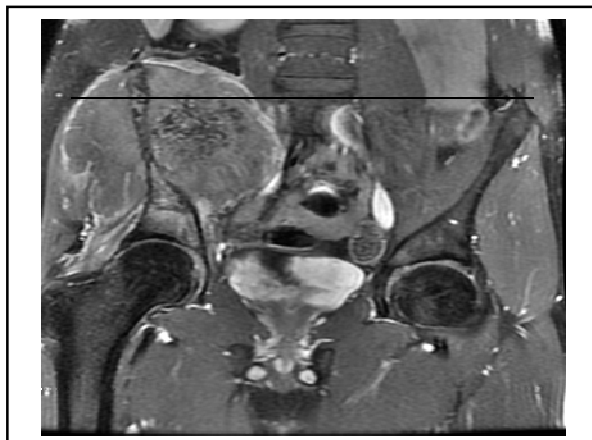
IMAGING FINDINGS

- Radiograph
 - poorly marginated, lytic, destructive lesion
 - permeative 76%, laminated periosteal reaction 57%
- "onion skin" is suggestive but NOT pathognomonic
- sclerosis CAN occur in up to 40%
- CT
 - used to evaluate bone destruction and extra-osseous involvement

IMAGING FINDINGS

- MRI
 - T1WI: low signal intensity
 - T1WI with contrast: can be heterogeneous but usually prominent enhancement
 - heterogeneously high signal, may see hair on end low signal striations





NEUROBLASTOMA

- Epidemiology
 - M>F
 - infants and very young children
- Clinical Presentation
 - pain or palpable mass

LOCATION

- adrenal glands are the number one primary site
- bone is the second most common site for metastasis after the liver
- most common posterior mediastinal mass in children

IMAGING FINDINGS

- Radiographs
 - nonspecific; often pressure on adjacent bones can cause remodelling of ribs and vertebral bodies.
 - often with calcifications
- CT
 - primary site is heterogeneous with calcifications
 - metastatic lesions tend to be lytic
 - look for localized invasion and remodeling

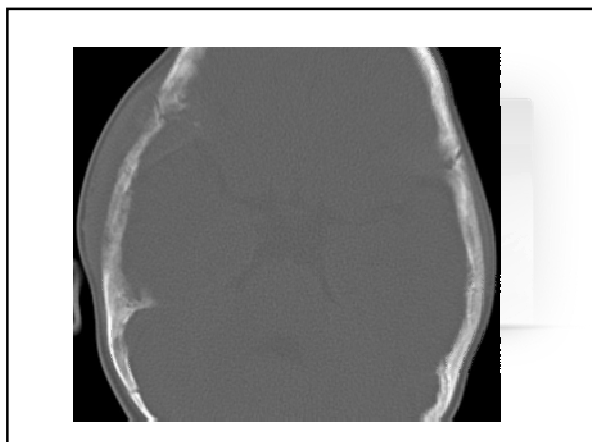
Table 3

International Neuroblastoma Staging System

Stage	Description
1	Localized tumor confined to the area of origin; complete gross excision with or without microscopic residual disease; identifiable ipsilateral and contralateral lymph nodes microscopically negative
2a	Unilateral tumor with incomplete gross excision; identifiable ipsilateral and contralateral lymph nodes microscopically negative
2b	Unilateral tumor with complete or incomplete gross excision; with positive ipsilateral regional lymph nodes; identifiable contralateral lymph nodes microscopically negative
3	Tumor infiltrating across the mid-line with or without regional lymph node involvement; or unilateral tumor with contralateral regional lymph node involvement; or mid-line tumor with bilateral regional lymph node involvement
4	Dissemination of tumor to bone, bone marrow, liver, distant lymph nodes, and/or other organs (except as defined for stage 4S)
4S	Localized primary tumor (as defined for stage 1 or 2) with dissemination limited to liver, skin, and/or < 10% of bone marrow, with age 0-1 year at diagnosis

From Brodeur GM et al(20)





- MRI: enhancing soft tissue masses with aggressive periosteal reaction of the involved region

EOSINOPHILIC GRANULOMA

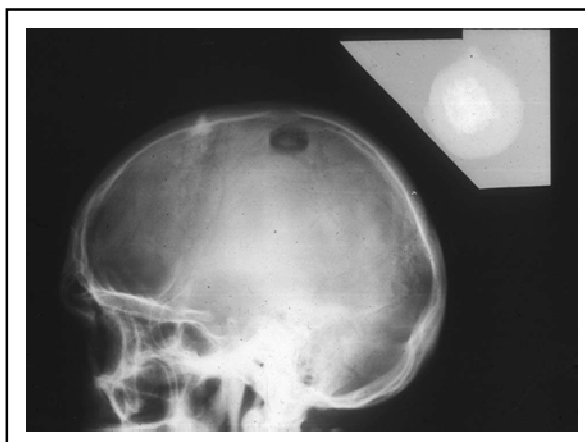
- Epidemiology
 - M>F 2:1
 - older children and young adults
- Clinical Presentation
 - may be asymptomatic or present with pain, swelling and tenderness around the lesion
- Location
 - Skull 49% , pelvis 23% and femur 17%

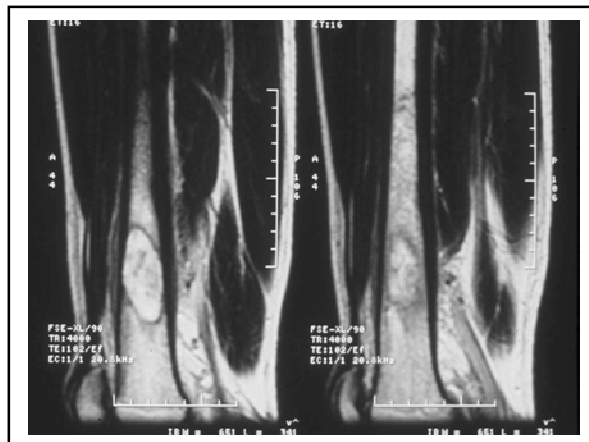
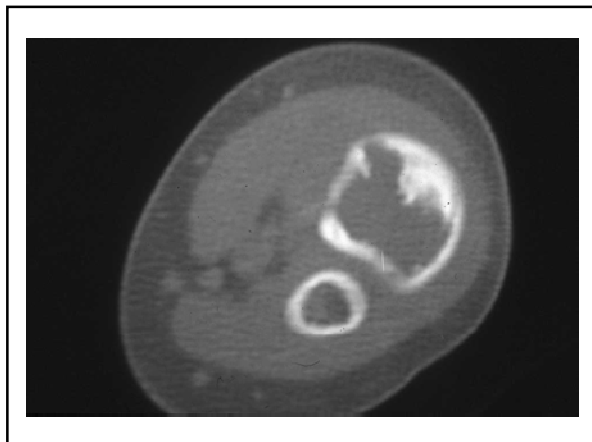
IMAGING FINDINGS

- Radiograph
 - solitary or multiple punched out lytic lesions
 - sharply margined
 - BEVELED EDGE
 - spine associated with vertebra plana
 - Long bones mainly involves the diaphysis

IMAGING FINDINGS

- CT
 - findings are similar to radiographs with cortical erosion +/- soft tissue involvement
- MRI
 - T1WI: low signal
 - TWI2: isointense to hyperintense
 - T1WI with contrast: often shows enhancement





LEUKEMIA

- General Considerations
 - leukemia: neoplastic disorder of white blood cells
 - may be myeloid or lymphoid in origin
 - may be acute or chronic

EPIDEMIOLOGY

- ALL: peak 2-10 years (most common childhood leukemia)
- AML: peak > 65 years (but constitutes 15-20% of childhood leukemia)
- CML: peak > 40 years (rare in childhood)
- CLL: 50-70 years

- Clinical Presentation
 - localized or diffuse bone
- Location
 - childhood leukemia: femur 24%, humerus 11%, ilium 17%, spine 14%
 - adult leukemia: axial skeleton predominates

IMAGING FINDINGS

- Radiographic
 - lesions may be so subtle that they are not recognizable on radiograph
 - compression fracture without significant trauma should raise suspicion
 - lucent metaphyseal lines "leukemic lines"
 - blastic or mixed lytic/sclerotic lesions are RARE



IMAGING FINDINGS

- CT
 - permeative bone destruction, lucent metaphyseal bands better seen
 - nonspecific in appearance
- MRI
 - T1WI: low signal
 - T2WI: variable
 - T1WI with contrast: avid enhancement



SARCOMA/PRIMARY LYMPHOMA OF BONE

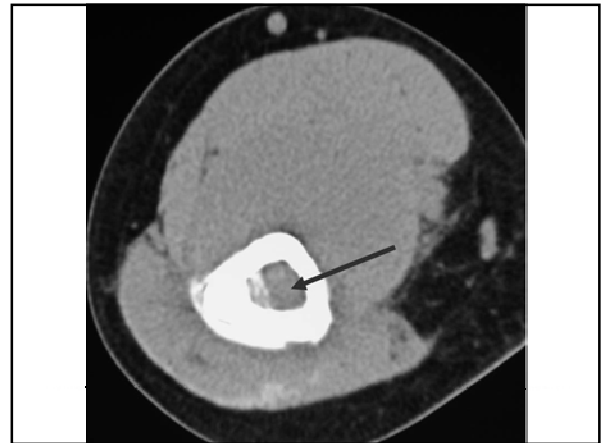
- Epidemiology
 - slight male predominance
 - vast majority are non-Hodgkin lymphoma
 - + 40 year old patients
- Clinical Presentation
 - bone pain common presenting symptom
 - can cause a swelling of the limb and limit movements of the arm or leg
 - symptoms of lymphoma like fever and weight loss are NOT common

LOCATION

- long bones 71%, flat bones 25%
- often a solitary lesion

IMAGING FINDINGS

- Radiographic
 - lytic lesions with wide zone of transition, permeative bone destruction and periosteal reaction
 - may contain sclerotic bone in 30%
- CT
 - helps to differentiate primary and secondary of bone
 - often demonstrates subtle cortical involvement
- MRI
 - T1WI: low signal
 - T2WI: high signal
 - T1WI with contrast: enhancing lesion



MULTIPLE MYELOMA

- Epidemiology
 - M>F 2:1
 - 70% of cases are diagnosed between the ages of 50-70
- Clinical Presentation
 - intermittent bone pain, anemia (usually normocytic/normocytic)
 - hypercalcemia
 - renal failure/proteinuria
 - pathological fractures

LOCATION

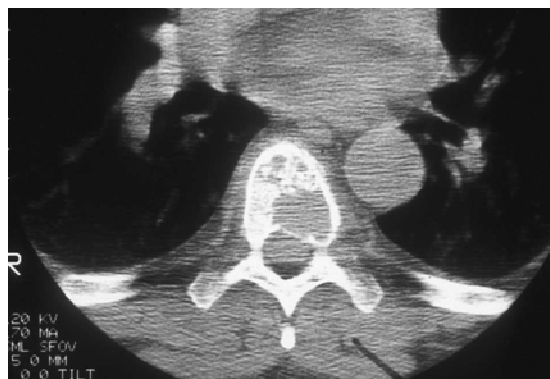
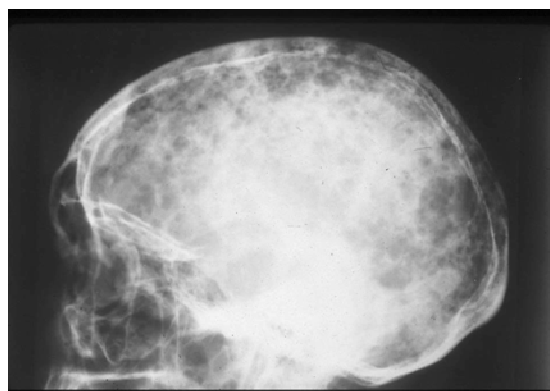
- osteoporosis is most common skeletal abnormality in this disease
- over 50% of solitary lesions are found in vertebrae
- if lesions are usually multiple usually found in vertebrae, ribs, skull, pelvis, and femur

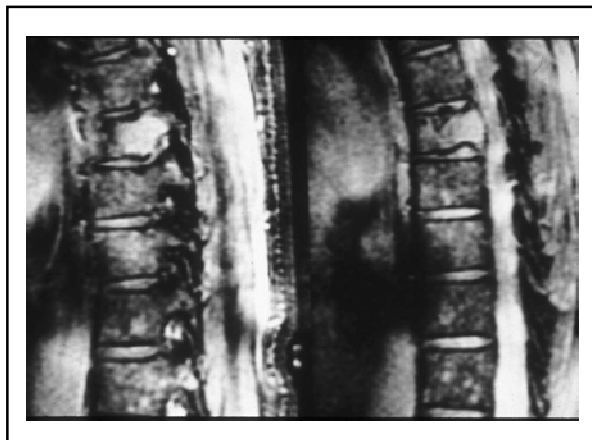
IMAGING FINDINGS

- Radiograph
 - majority of lesions are purely lytic, sharply defined/punched out with endosteal scalloping when abutting cortex
 - "punched out" lytic lesion
- CT
 - does not provide a large role in the diagnosis
 - helps to classify extra-osseous soft tissue component in patients with large disease burden
 - intramedullary soft tissue mass producing lytic lesions

IMAGING FINDINGS

- MRI
 - MRI is generally more sensitive in detecting multiple lesions compared to the standard plain film skeletal survey
 - T1WI: diffuse or focal: signal \leq muscle/disc
 - STIR: untreated disease has high signal intensity
 - T1WI C+ FS: untreated disease enhances with contrast





LESIONS THAT MAY MIMIC

- Osteomyelitis
 - bone destruction, intramedullary gas and fat-fluid level, periosteal reaction, sequestrum, involucrum
 - tendency to occur in metaphyses or metaphyseal equivalents (bone next to cartilage, e.g., calcaneal apophysis and acetabulum)
- Osteolytic osteosarcoma
 - 91% in metaphysis and 9% diaphysis
 - long bones 70-80%
 - permeative, destructive lesion, eccentrically located
- Metastasis

PUTTING EVERYTHING TOGETHER

LESION	AGE
NEUROBLASTOMA	USUALLY INFANTS
EOSINOPHILIC GRANULOMA	5-15 YEARS
ACUTE LEUKEMIA	5-15 YEARS
EWING'S SARCOMA	TEENAGER-EARLY 20'S
RETICULUM CELL SARCOMA	AVERAGE AGE 30'S
MUTIPLE MYELOMA	AVERAGE AGE 50-70
CHRONIC LEUKEMIA	AVERAGE AGE 60-70

LOCATION	
NEUROBLASTOMA	ADRENAL GLANDS, VARIABLE METASASIS
EOSINOPHILIC GRANULOMA	SKULL->PELVIS->FEMUR
LEUKEMIA	ADULT AXIAL SKELETON CHILDHOOD: FEMUR->HUMERUS->ILIUM
EWING'S SARCOMA	LOWER LIMB, METAPHYSEAL/DIAPHYSEAL
RETICULUM CELL SARCOMA	LONG BONES->FLAT BONES
MULTIPLE MYELOMA	50% SOLITARY LESIONS IN AXIAL SKELETON MULTIPLE: VERTEBRAE, RIBS, SKULL

YOU KNOW YOU'RE A RADIOLOGIST WHEN...

- You switch off all the room lights when watching TV or when you are at the computer
- The strawberry milkshake at McDonald's turns you off (it looks like a barium preparation for a swallow)
- Someone asks a favor from you in the middle of the night, you say, "Will it make much of a difference if I do it for you tomorrow morning, instead?"
- You refer to dust on your wedding photo as "artifacts"
- You always wonder what's that thing hanging around other doctor's necks, and then suddenly it hits you - it's a stethoscope!

THANK YOU



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