Atrium Health
Levine Cancer Institute
Musculoskeletal Institute

Recognition & Management of Soft Tissue and Bone Tumors

Colin J. Anderson, MD

5/22/21

Disclosures

- I have no financial disclosures to report

Outline

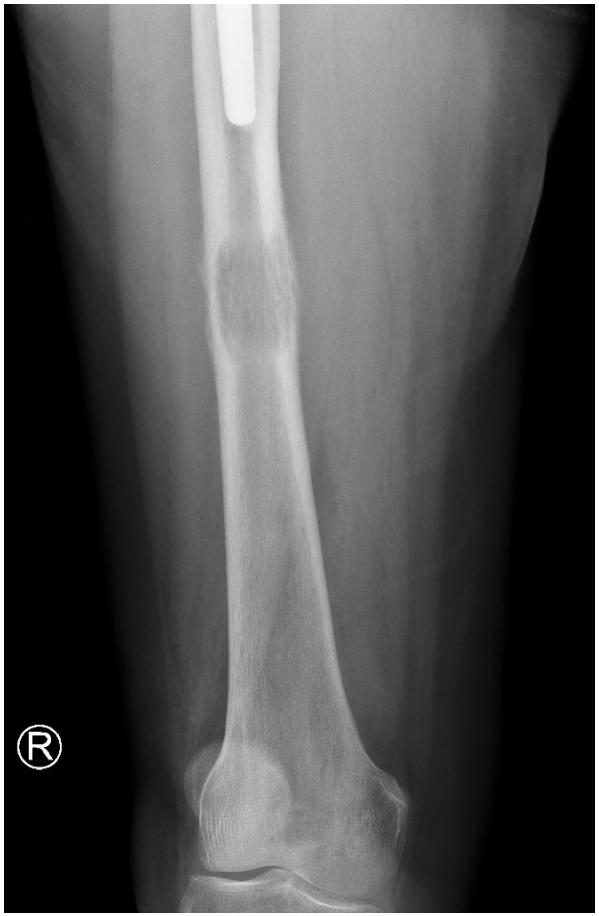
- Epidemiology
- Clinical Presentation
- Work up
- Management

Epidemiology

- Bone tumors
  - Primary bone tumors rare
    - Classified as benign or malignant
    - Benign bone tumors much more common
    - Bone sarcoma account for 0.2% of malignancies in adults
    - Bone sarcomas account for 6% of malignancies in children
    - About 5,000 new bone sarcomas a year in the US
  - Metastasis much more common than primary lesions

Metastasis

- Most common tumors that metastasize to bone
  - Breast
  - Lung
  - Kidney
  - Thyroid
  - Prostate
  - GI



Epidemiology

- Soft tissue lesions
  - Classified as benign or malignant
  - Benign much more common than malignant
  - About 10,000 new soft tissue sarcomas a year in the US
  - 30-50% of soft tissue sarcomas are inappropriately biopsied or excised prior to referral
    - The “whoops” procedure or “unplanned excision”

The Royal College of Surgeons of England

HUNTERIAN LECTURE

Ann R Coll Surg Engl 2006; **88**: 519–524
doi 10.1308/003588406X130651

Size matters for sarcomas!

ROBERT J GRIMER

Oncology Service, Royal Orthopaedic Hospital, Birmingham, UK

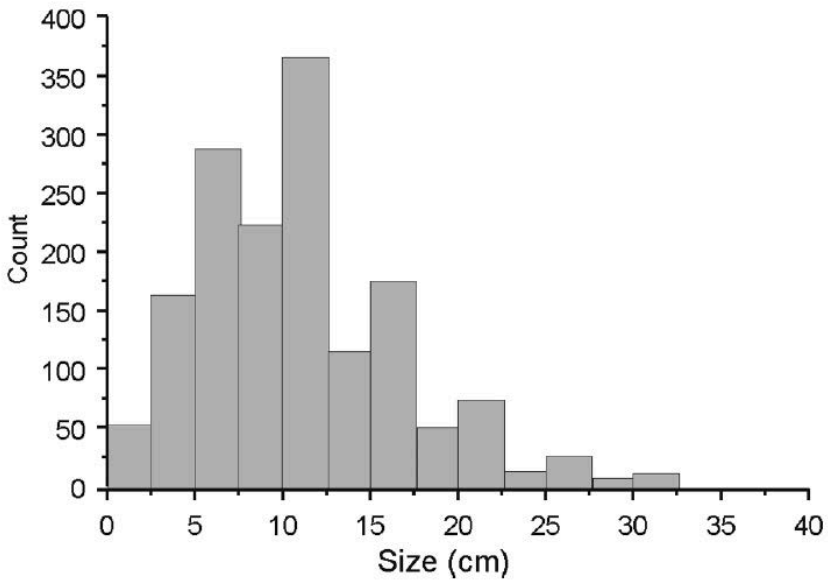


Figure 1 .Size of sarcomas at presentation (n = 1490).

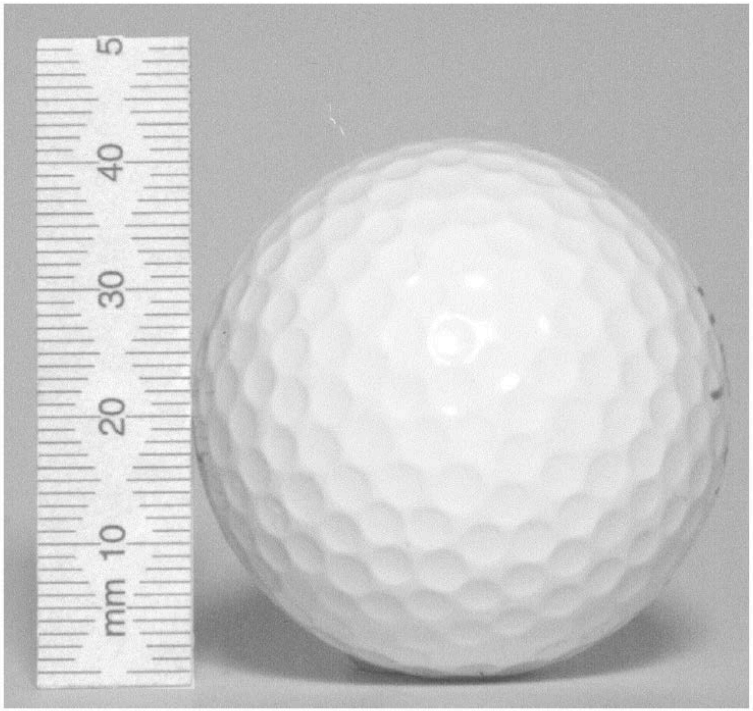


Figure 8 A golf ball measures 42 mm. A useful size to remember – any lump bigger than this should be considered malignant until proved otherwise.

Outline

- Epidemiology
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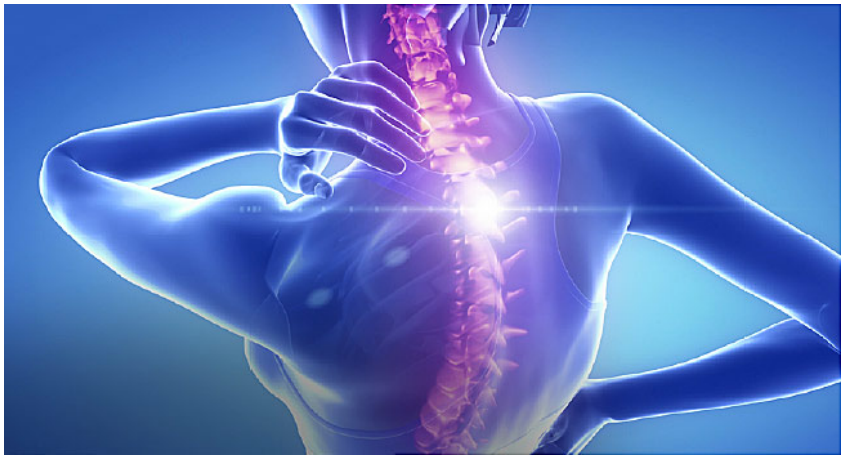
Clinical Presentation

- Bone lesions
  - Often incidental findings
  - Impending/completed pathologic fracture
- Soft tissue lesions
  - Mass or lump

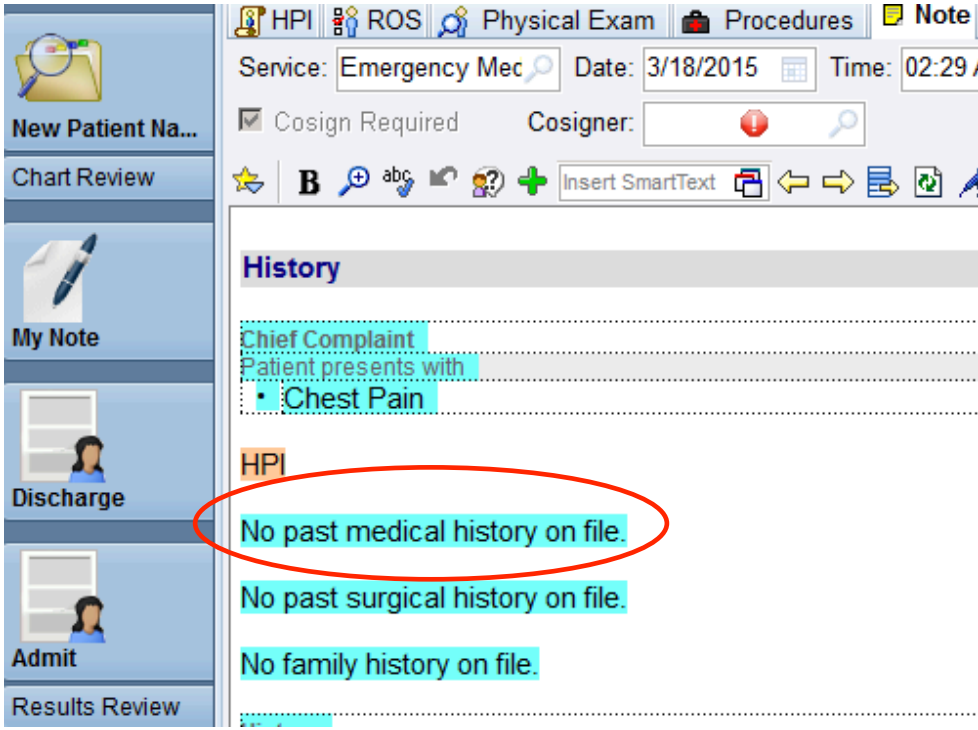
Obtain a History & Physical

- Age
  - Over 40? -> Metastatic disease
- History of trauma?
- Nature of pain
  - Improving? Worsening?
  - Chronicity?
  - Pain with weight bearing?
  - Night pain, awakens from sleep
  - Alleviating factors
- Growth over time
- ROS
  - Fevers, chills, weight loss, night sweats



History

- Past Medical History
  - HISTORY OF CANCER??
  - Do not discount “remote” history
- Social History
  - Carcinogenic exposures
  - Tobacco use
- Family History:
  - Family history of cancer



Physical Examination

- Size
- Location
- Consistency
- Depth
- Mobility
- Lymph Nodes

- Examination of other systems may identify primary
  - Breast, Thyroid, Abdomen, Lung, Prostate

Outline

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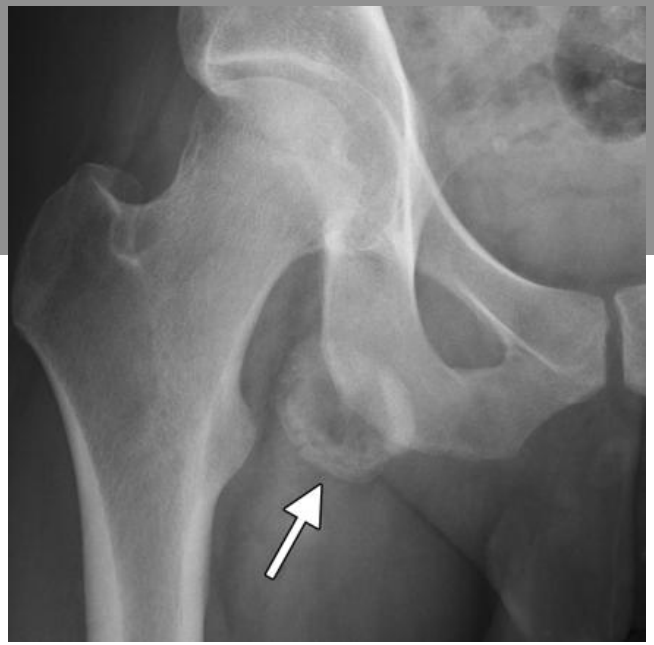
X-rays

- Extremely important!
  - Pain longer than 6 weeks
  - Pain refractory to conservative measures
  - Red flags
  - History of cancer
- Majority of benign bone lesions can be seen
- Malignant bone lesions often have more subtle findings – more likely to be missed
- Soft tissue calcifications can be informative



How to Read and X-ray

Enneking Questions

1) Where is the lesion?
2) What is the lesion doing to the bone?
3) What is the bone doing to the lesion?
4) Are there any clues that would provide information about the type of tissue within the lesion (e.g. matrix)?

Enneking Questions

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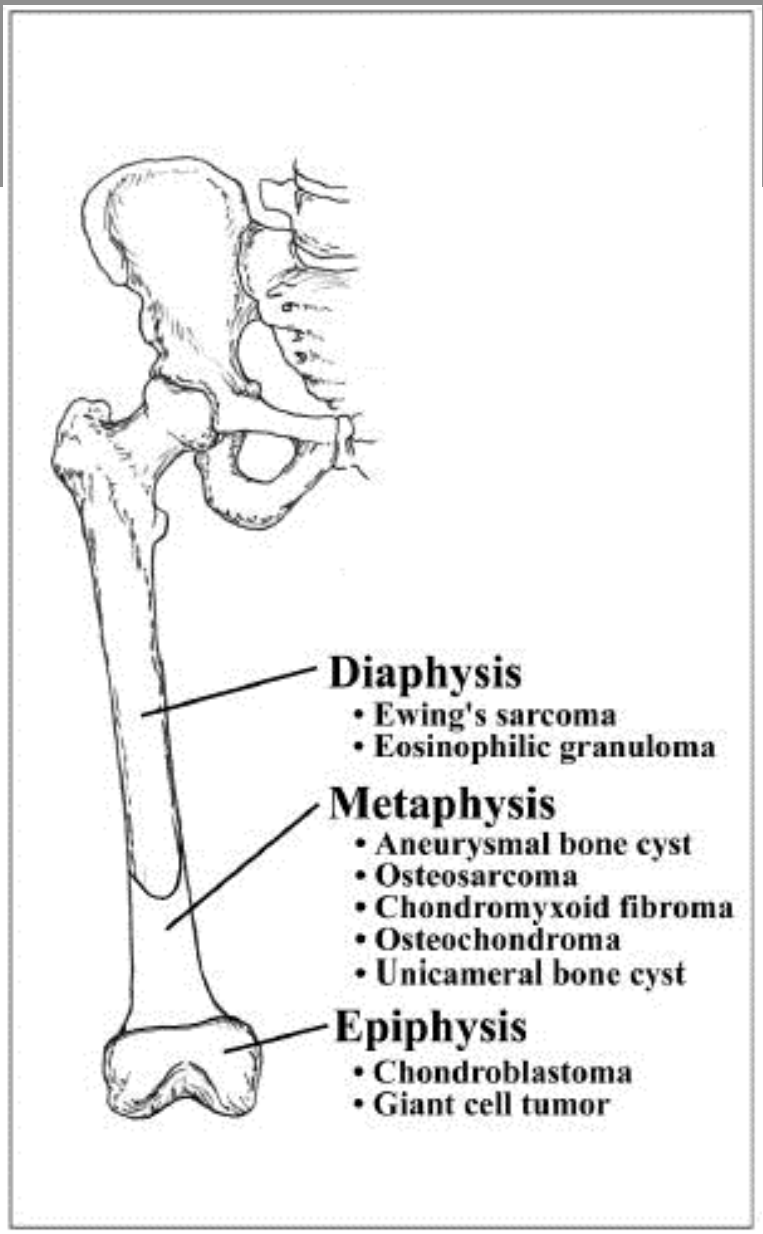
Enneking Questions

1) Where is the lesion?
   a) Epiphyseal, Metaphyseal, Diaphyseal
   b) Axial vs. Appendicular skeleton
   c) Central, Eccentric, Cortically-based, Juxtacortical, Peri-articular
   d) Multiple lesions?



Enneking Questions

1) Where is the lesion?
2) What is the lesion doing to the bone?
3) What is the bone doing to the lesion?
4) Are there any clues that would provide information about the type of tissue within the lesion (e.g. matrix)?

Enneking Questions

1. Where is the lesion?
2. What is the lesion doing to the bone?
   a) Size (>5 cm more likely bad)
   b) Expansion
   c) Endosteal scalloping
   d) Cortical Erosion/breakthrough
   e) Destructive changes
   f) Pathologic fracture
3. What is the bone doing to the lesion?
4. Are there any clues that would provide information about the type of tissue within the lesion (e.g. matrix)?

Expansion

- Generally implies slow growth
  - Think of Wolff's law
  - Benign lesions generally do not violate the cortex
- Mild
  - NOF, FD
- Moderate
  - UBC, ABC
  - Chondroid lesions
- Severe
  - ABC, GCT, Mets

Non-ossifying fibroma

Enchondroma

Giant cell tumor

Endosteal scalloping

- Erosion of inner surface of cortex due to medullary bone lesion
  - Can be benign (often seen in enchondroma) or malignant (mets, myeloma)

Cortical Erosion/Breakthrough

- More aggressive finding

Met

High Grade CS

Pathologic Fracture

UBC

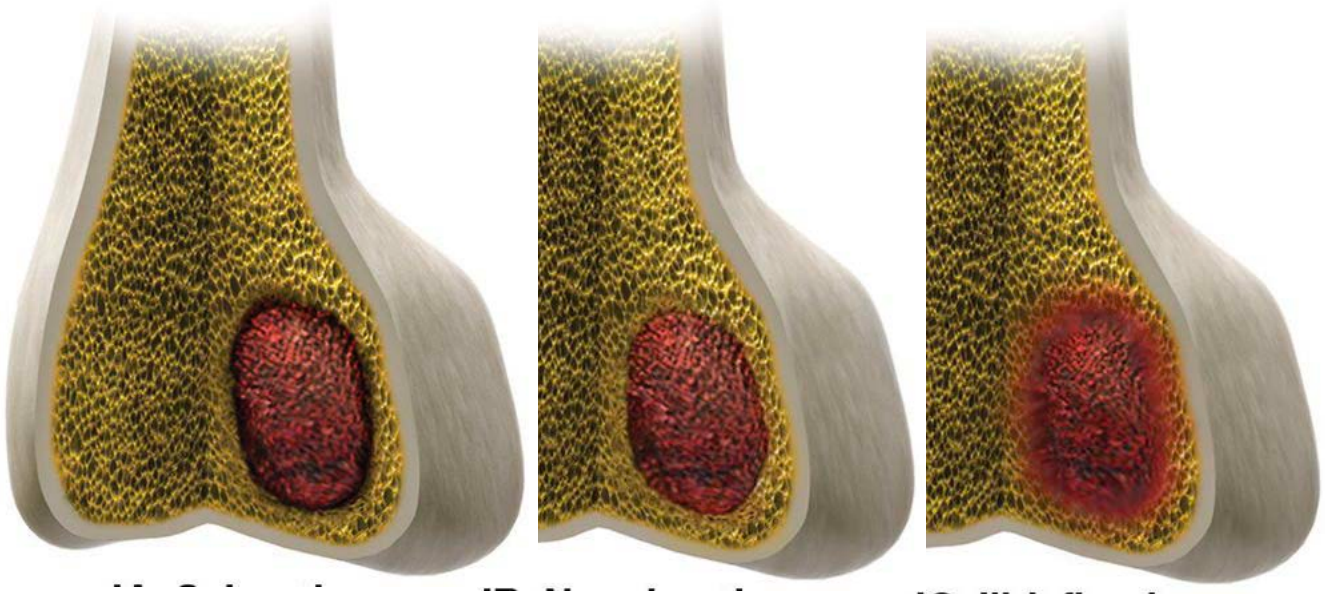
Prostate Ca Mets

Enneking Questions

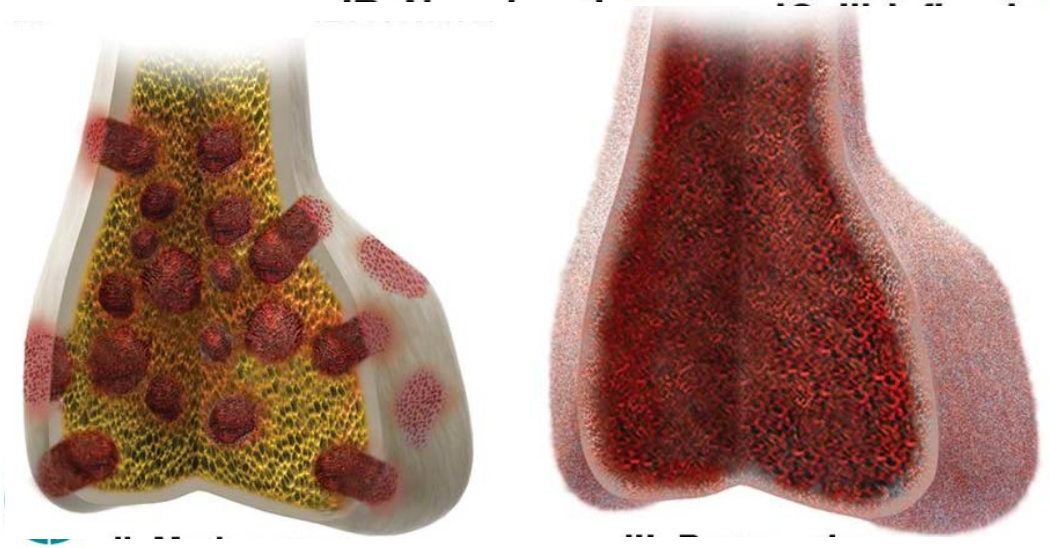
1. Where is the lesion?
2. What is the lesion doing to the bone?
3. What is the bone doing to the lesion?
   a) Margins
   b) Periosteal reaction
4. Are there any clues that would provide information about the type of tissue within the lesion (e.g. matrix)?

Lodwick Classification (Margins)

- Geographic
  - Sclerotic (IA)
  - Non-sclerotic (IB)
  - Ill-defined (IC)



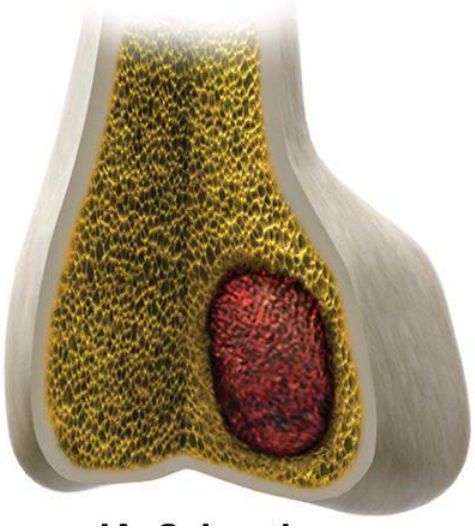
- Non-Geographic
  - Moth Eaten (II)
  - Permeative (III)



Geographic IA

- Narrow zone of transition
- Rim of reactive bone
- 99% benign

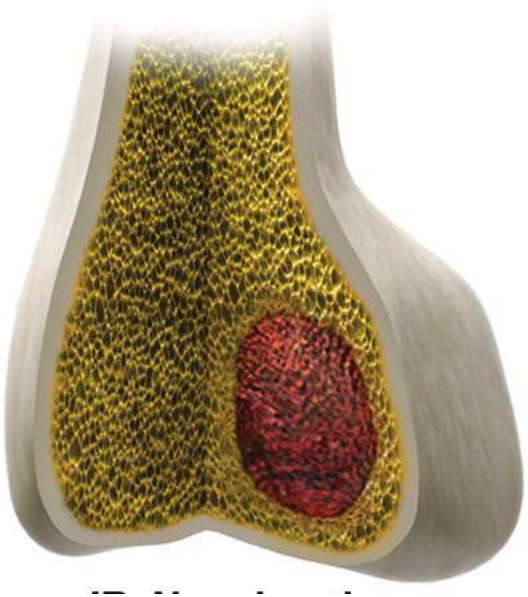
- Examples:
  - Non-ossifying Fibroma
  - Osteoid osteoma
  - LSMFT
  - Fibrous dysplasia
  - LCH, ABC, UBC
  - Brodie's abscess



Geographic IB

- Narrow zone of transition
- No rim of reactive bone
- Benign or aggressive

- Examples:
  - GCT, ABC
  - Osteoblastoma
  - Metastasis
  - Myeloma



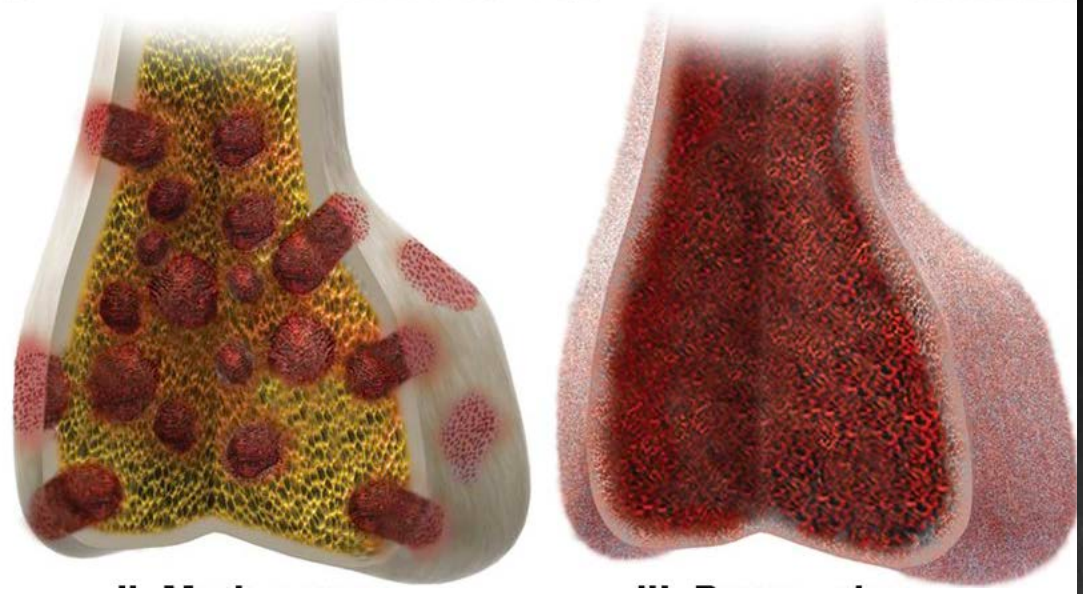
Geographic IC

- Wide zone of transition
- No rim of reactive bone
- Aggressive

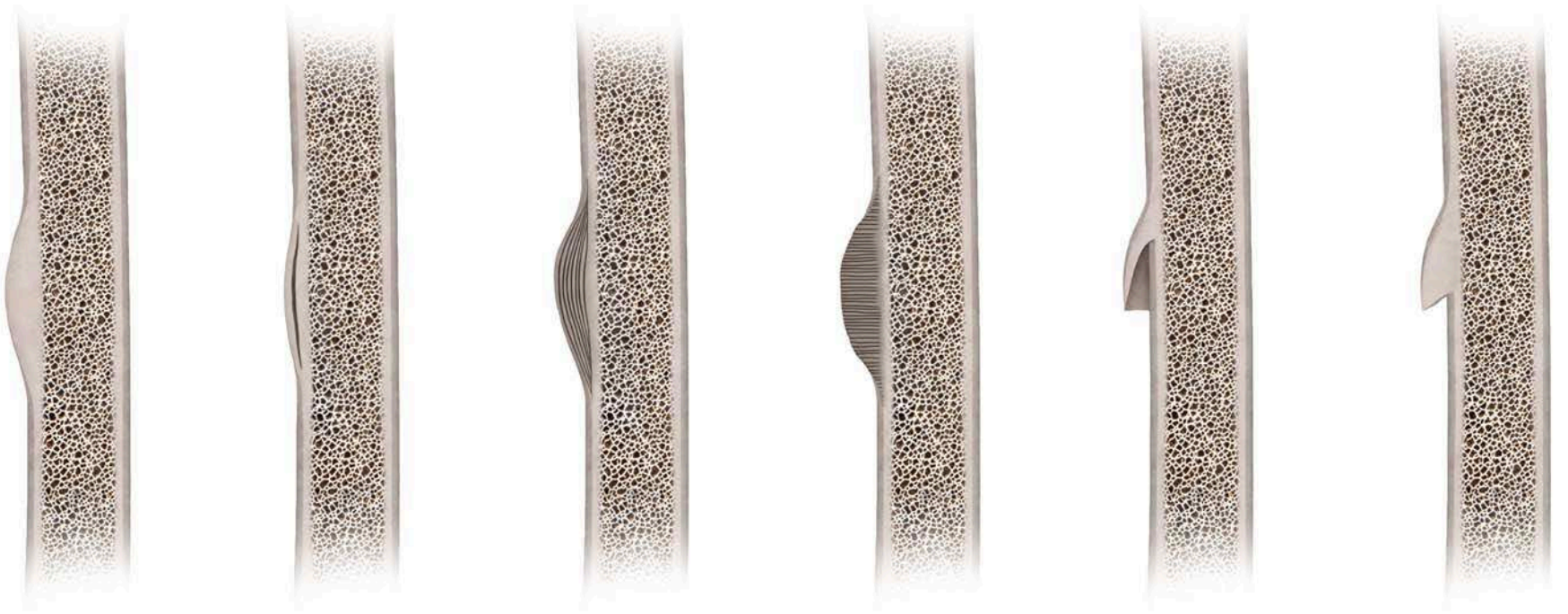
- Examples:
  - Osteosarcoma (early)
  - Chondrosarcoma (early)
  - GCT
  - Brown tumor
  - LCH
  - Osteomyelitis
  - Metastasis
  - Myeloma

Non-geographic margins (II & III)

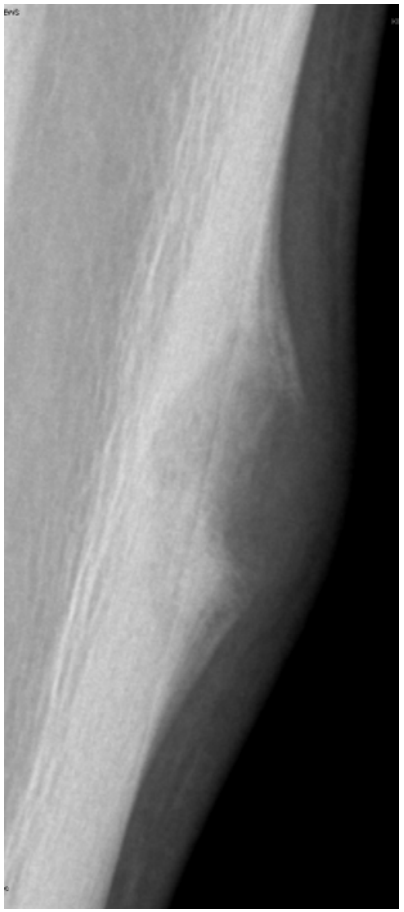
- Moth eaten (II)
- Permeative (III)
- Ill-defined areas of bone destruction
- AGGRESSIVE

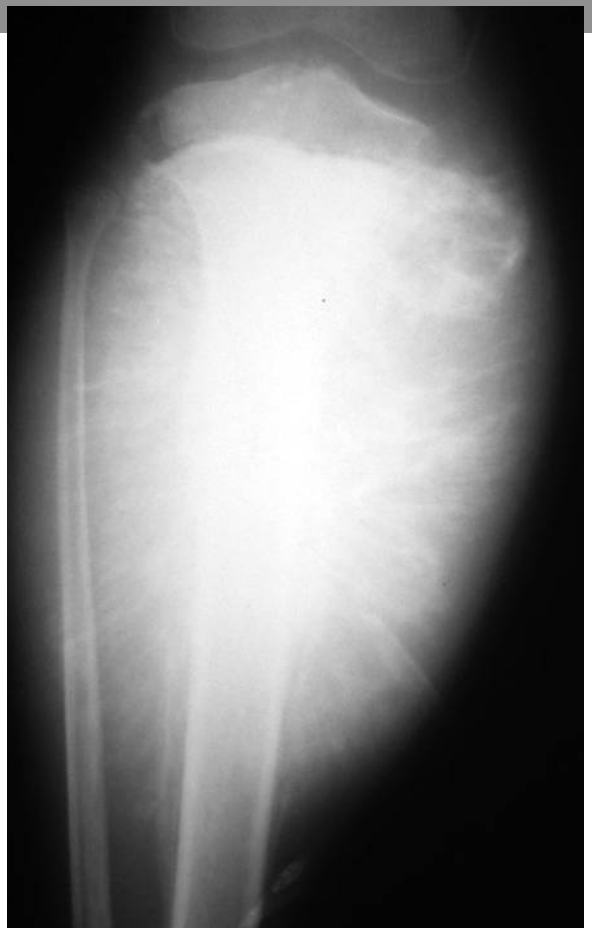


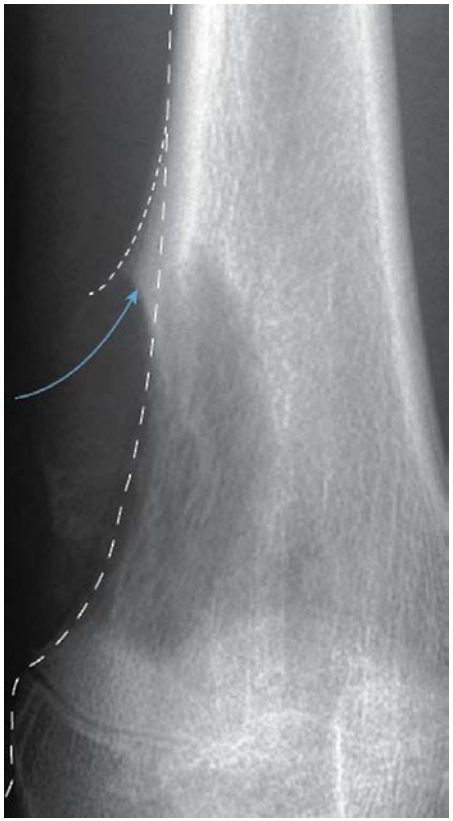
Periosteal reaction



Periosteal reaction





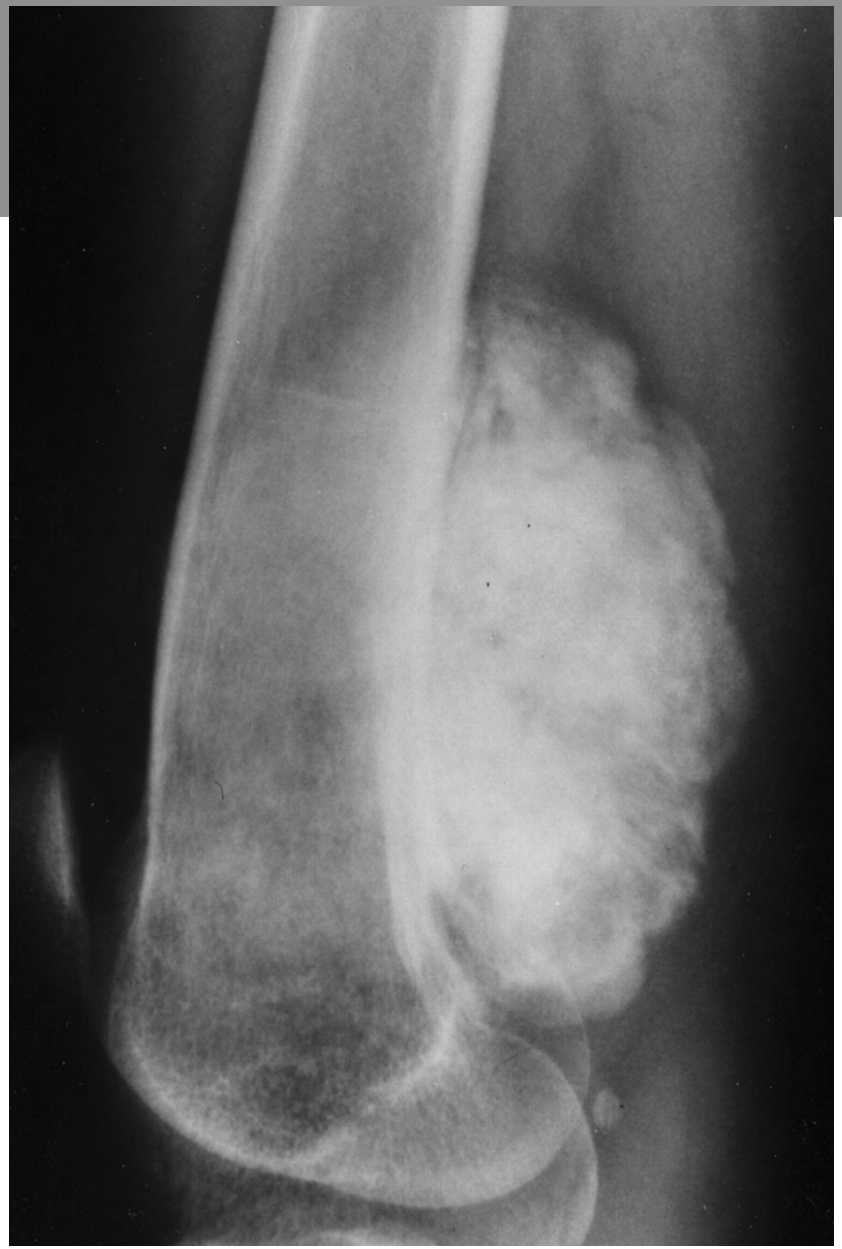


Enneking Questions

1. Where is the lesion?
2. What is the lesion doing to the bone?
3. What is the bone doing to the lesion?
4. Are there any clues that would provide information about the type of tissue within the lesion (e.g. matrix)?
   a) Osteoid
   b) Chondroid
   c) Fibrous

Osteoid

- Fluffy, cloud-like
- Ivory, dense



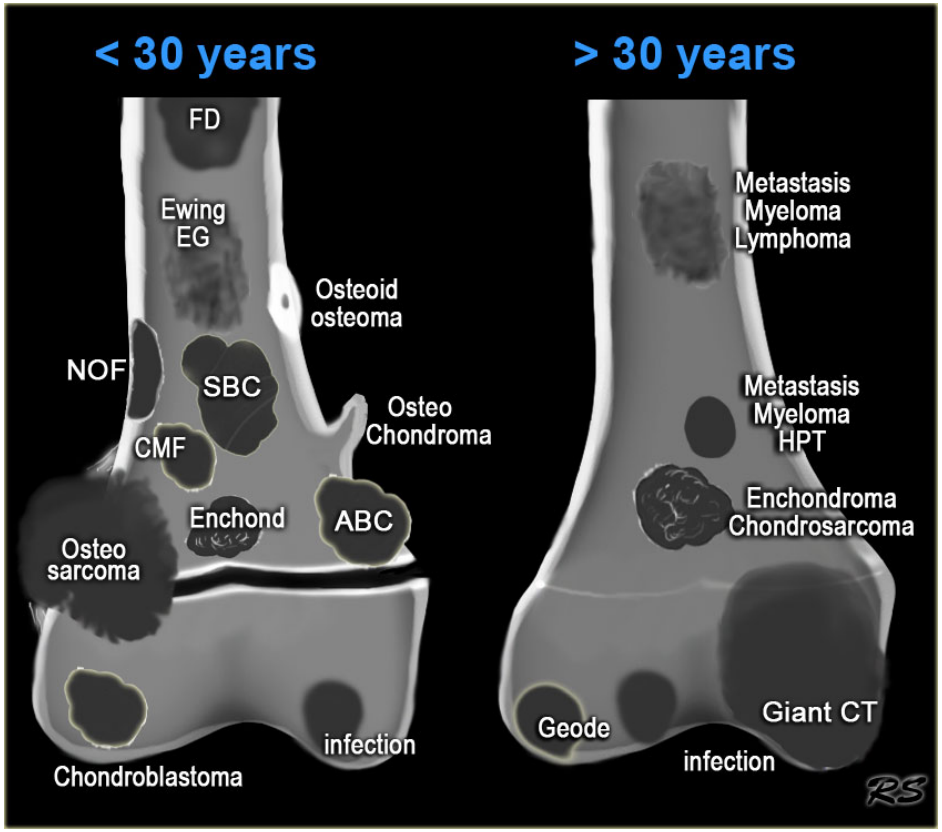
Chondroid

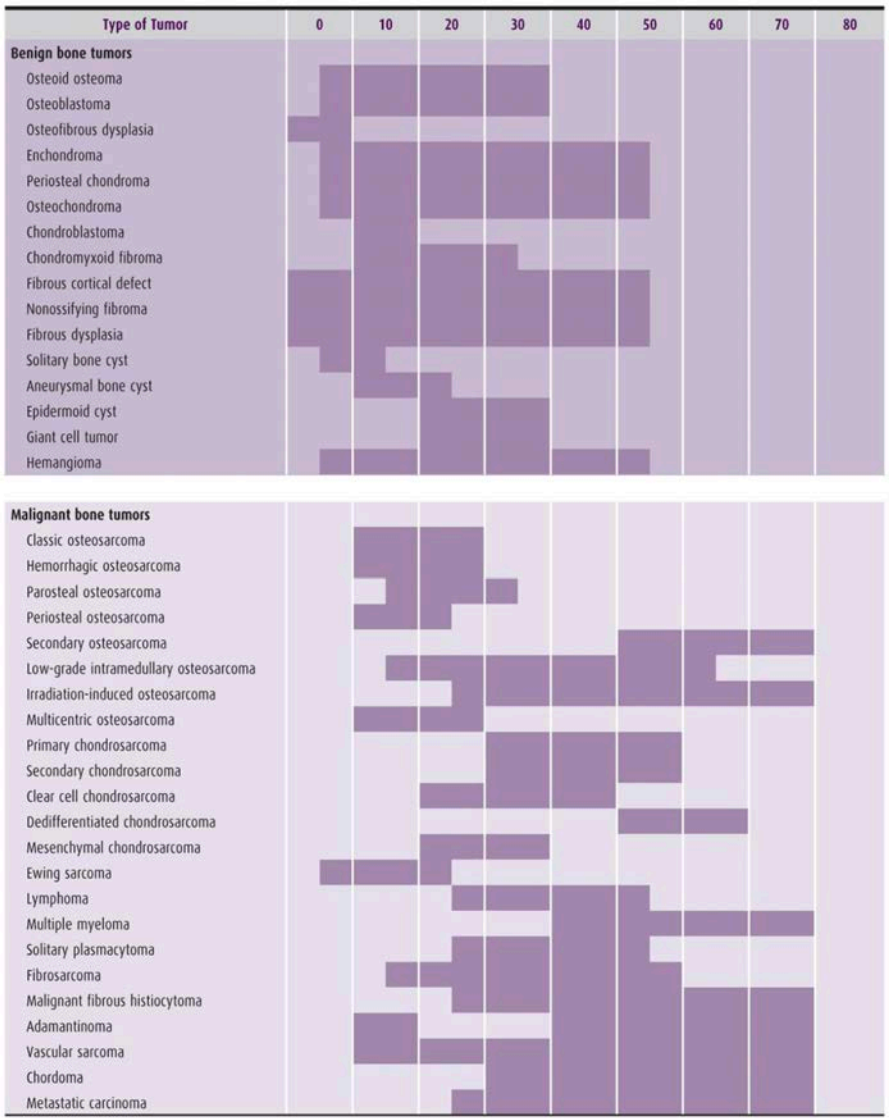
- Stippled
- Rings & arcs

Fibrous

- Ground glass

Age + Location + Radiography = > Diagnosis



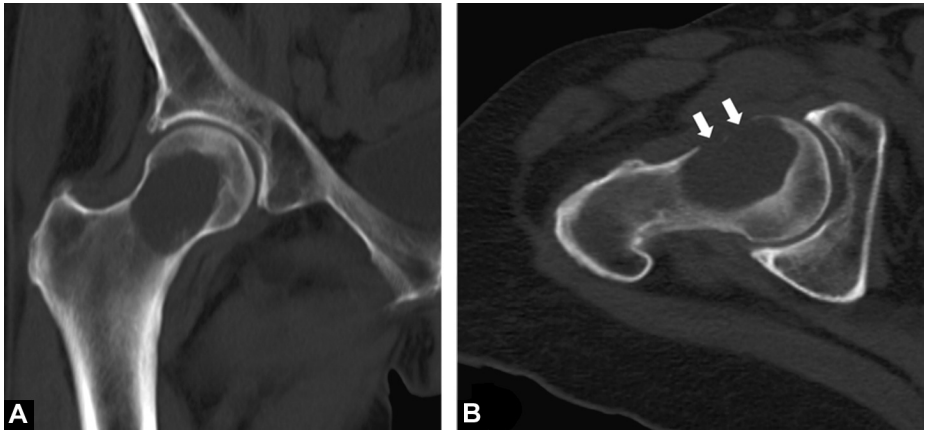


Work up

- If x-rays demonstrate anything concerning, okay to stop here and refer the patient
- Would not fault you for obtaining advanced imaging
  - Appreciate additional information, however sometimes the imaging study is insufficient
  - e.g. MRI w/o contrast

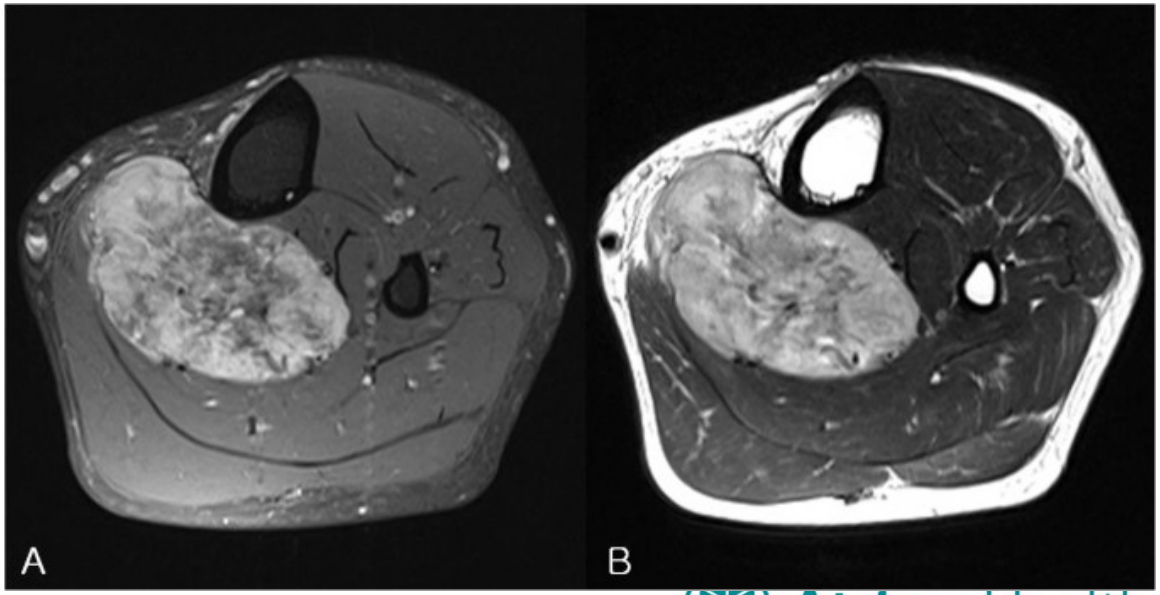
Advanced imaging

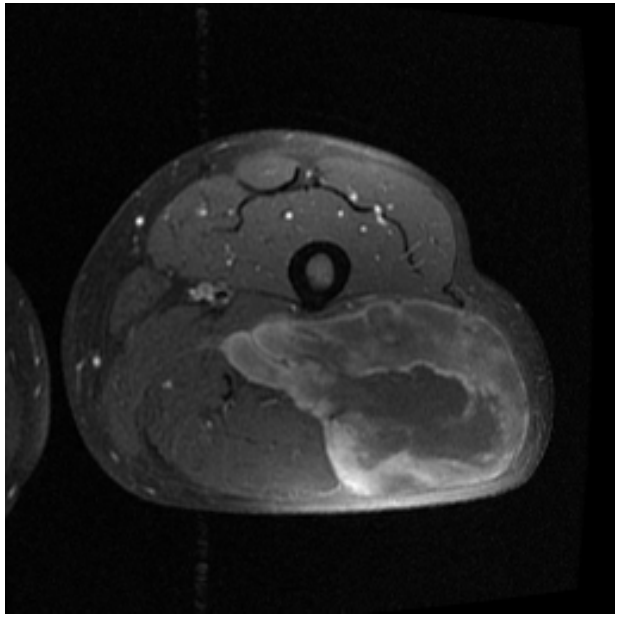
- CT Scan
  - Optimal visualization of bony anatomy
  - Especially useful for cartilaginous neoplasms
  - Demonstrates extra-osseous extension



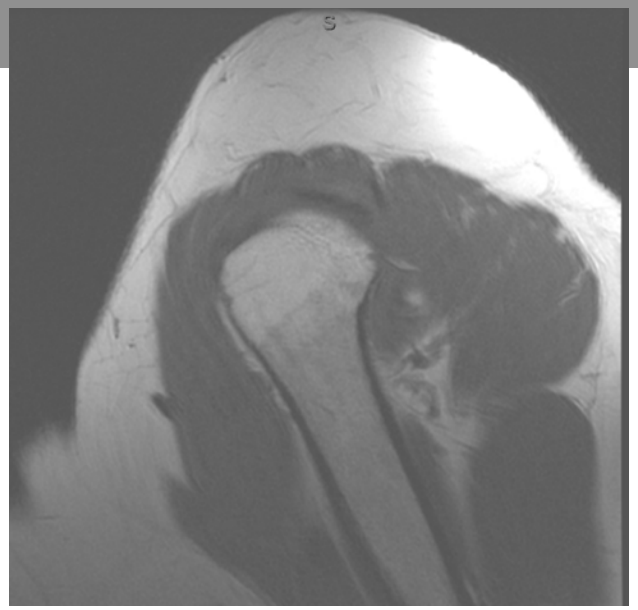
Advanced imaging

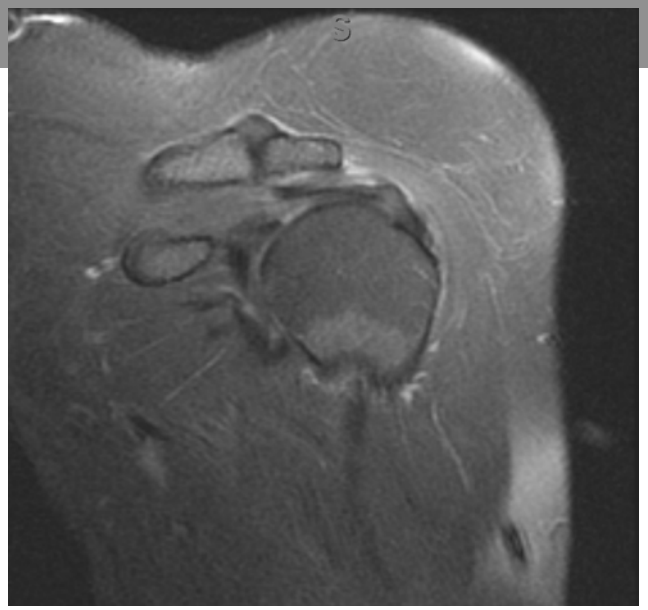
- MRI
  - Better evaluation of soft tissue masses
  - Relationship to neurovascular structures
  - MRI w/ & w/o contrast is test of choice for soft tissue masses

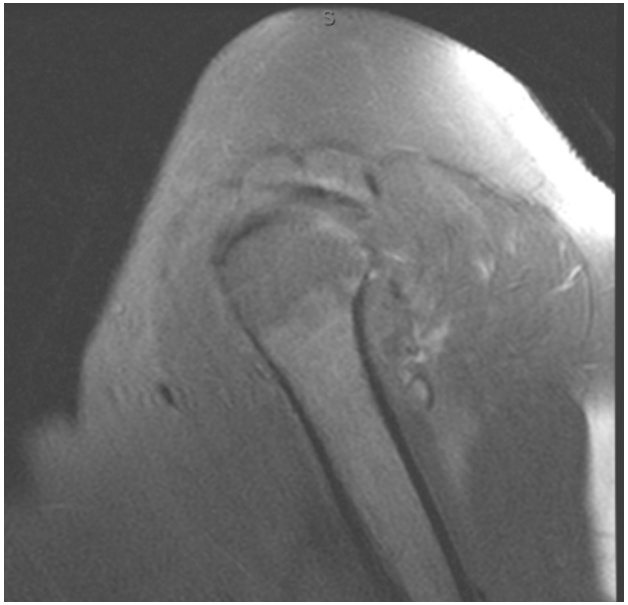


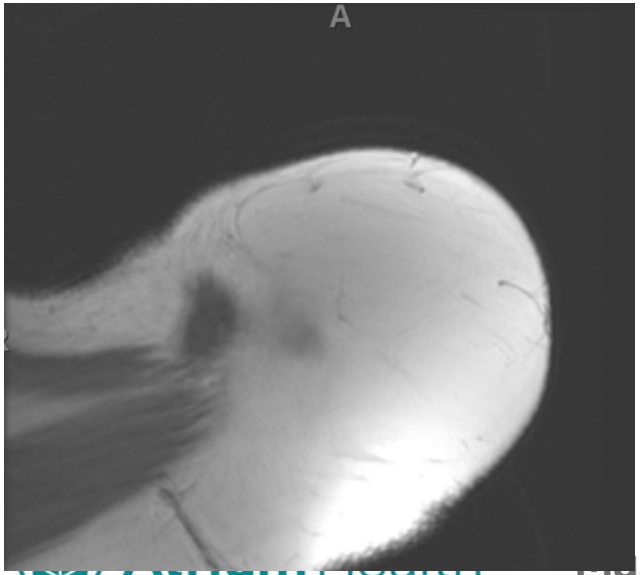


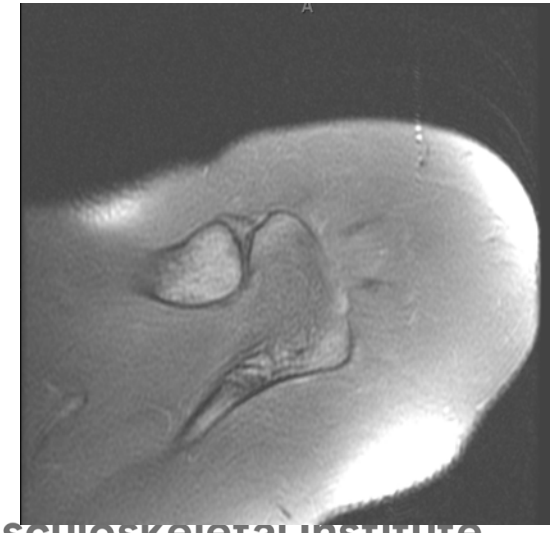
MRI of a lipoma





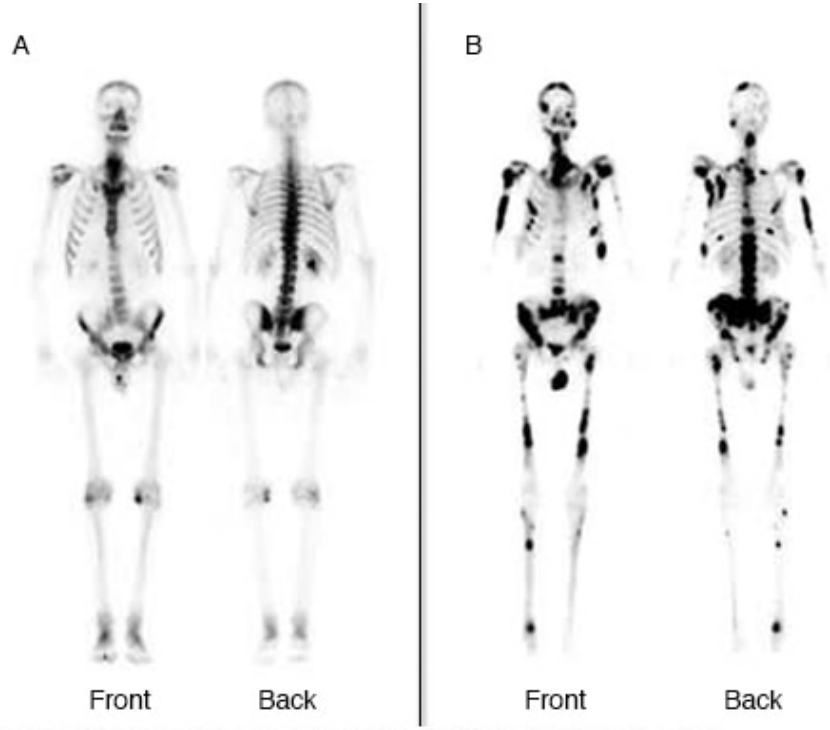






Advanced imaging

- Bone scan
  - Shows areas of bone turnover
  - Evaluate for unifocal vs. multifocal disease
  - Helpful for most bone tumors
  - Bone benign and malignant lesions can be seen
  - Multiple myeloma typically cold -> Skeletal survey

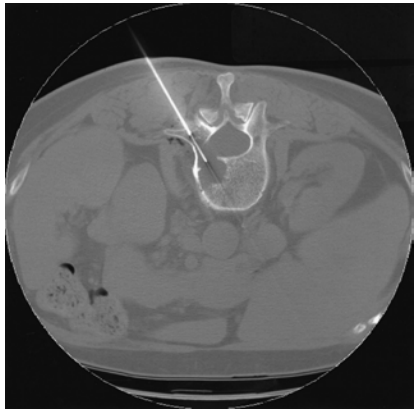


Advanced Imaging

- PET Scan
  - FDG tracer
  - Can replace bone scan
  - Increasingly utilized
  - Extended whole body vs. “eyes to thighs”

Biopsy

- Tissue biopsy is gold standard for diagnosis
- Indications:
  - Aggressive appearing bone or soft tissue lesions
  - Soft tissue lesions >5 cm +/- deep to fascia
  - Unclear diagnosis in symptomatic patient
  - Solitary bone lesion in patient with history of carcinoma
- When biopsy can be avoided
  - Asymptomatic, completely benign appearing bone lesions
  - Soft tissue lesions with diagnostic MRI (ie lipoma, hemangioma)
- Types
  - Fine needle aspiration
  - Core needle biopsy
  - Incisional biopsy
  - Excisional biopsy



Biopsy principles

- Incision
  - Longitudinal, not Transverse! Allows for extension if needed
- Approach
  - Do not expose NV structures -> contamination
  - Directly through muscle is ideal
- Closure
  - Obtain meticulous hemostasis
  - Make any drain hole in line with incision

- Inappropriate biopsy can alter treatment and affect outcomes

- Initiate oncologic referral if unsure!!

The Hazards of the Biopsy, Revisited

FOR THE MEMBERS OF THE MUSCULOSKELETAL TUMOR SOCIETY*

BY HENRY J. MANKIN, M.D.†, CAROLE J. MANKIN, M.S.L.S.†, AND MICHAEL A. SIMON, M.D.‡, BOSTON, MASSACHUSETTS

- Study to determine rates of complications, errors, morbidity related to inappropriate biopsies
  - 17.8% Diagnostic error
  - 19.3% Biopsy caused more complex surgery
  - 10.1% Change in patient outcome (Disability, loss of function, local recurrence, death)
  - 3.0% Unnecessary amputation

- Errors, complications, changes in course of outcome were 2-12x ($p < 0.001$) greater when biopsy was performed at referring institution

What not to do…

- “Whoops”

Outline

- Epidemiology
- Clinical Presentation
- Work up
- Management

Management Scenarios

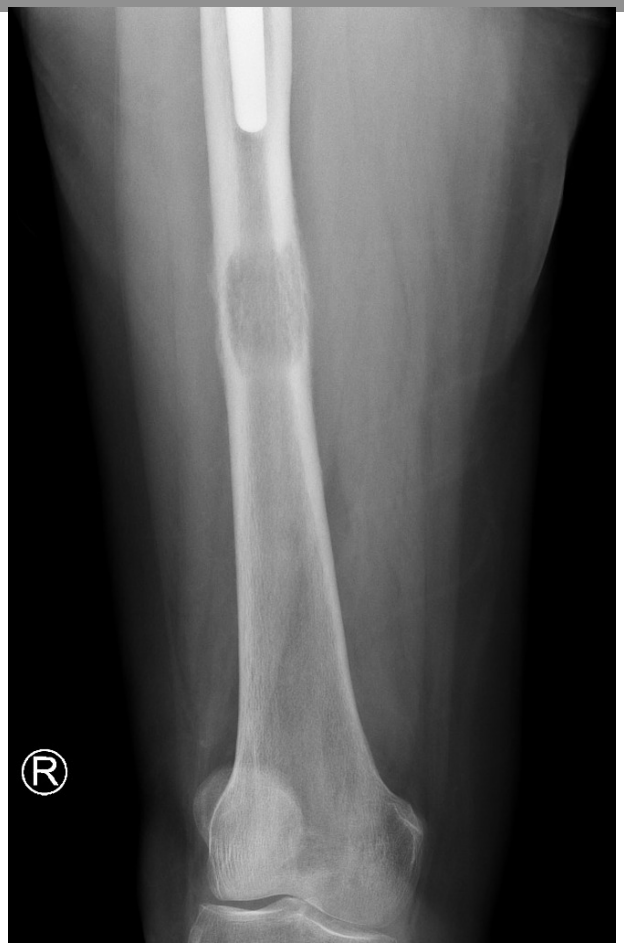
- Benign appearing bone lesion
- Concerning bone lesion
- Small superficial soft tissue lesion
- Concerning soft tissue lesion

Management

- Benign bone lesion
  - Often incidental
  - Well circumscribed w/ rim of reactive bone is >95% benign
- Obtain thorough H&P
- We will gladly review imaging and let you know if referral is indicated
- Please try not to scare them

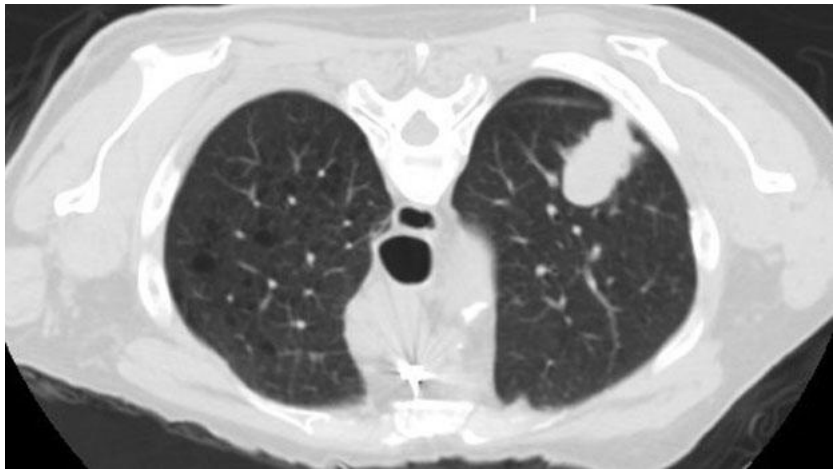
Management

- Concerning bone lesion
  - Obtain thorough H&P
  - In adult -> think met!
    - Consider work up for primary of unknown origin
  - In child, may be benign or malignant
  - Urgent referral
  - Feel free to call us



Work for primary of unknown origin

- CT C/A/P
  - Captures location of most common malignancies that metastasize to bone:
    - Breast, Lung, Kidney, Thyroid, Prostate, GI
- Bone Scan
- Labs
  - Patient > 40: CBC w/diff, CMP, ESR, CRP, SPEP/UPEP, (PSA, Thyroid studies)
  - Patient < 40: CBC w/diff, BMP, ESR, CRP, (Alk Phos, LDH)



Case

CC: Left hip pain

HPI: 48 yo M previously healthy w/ L intermittent hip pain since October. Went on hike on Thanksgiving and pain became constant. Previously very active (runs >25 miles/week). X-rays obtained in December - reportedly normal. MRI January with bilateral proximal femur lesions. Sent to oncologist for multiple myeloma workup that was negative. Sought 2nd opinion w/ orthopedist who placed urgent referral to our clinic.

PMHx: GERD

PSHx: None

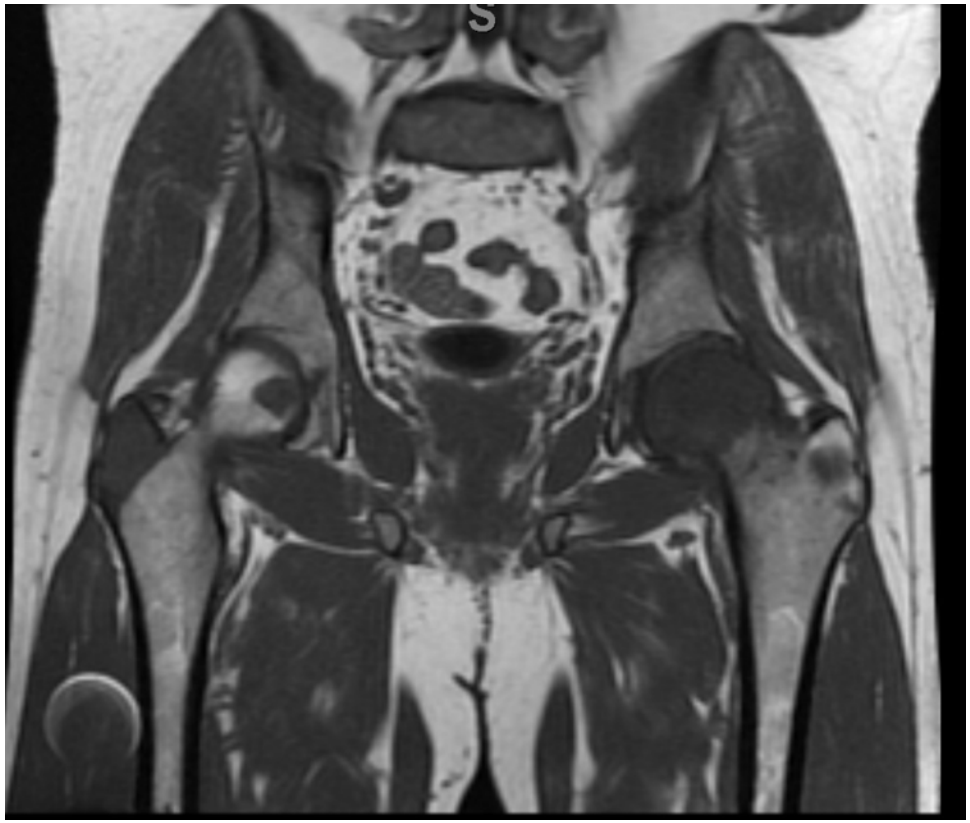
Meds: None

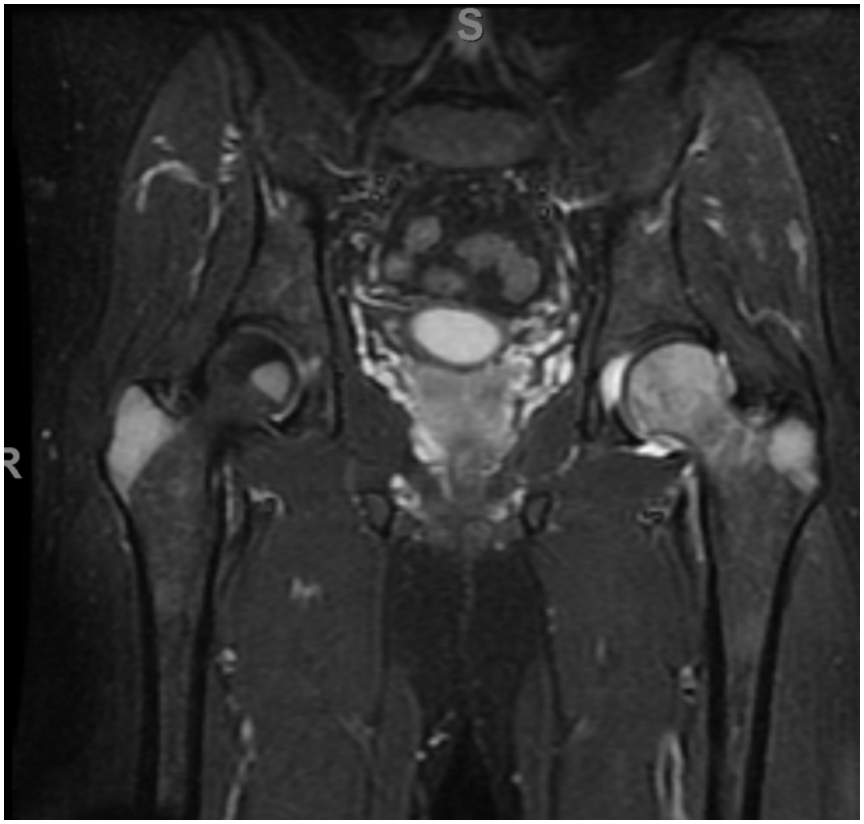
Exam: TTP over left GT. L groin pain with flexion/IR. No pain in R hip.

X-ray 12/29/20

X-ray in clinic 3/11/21

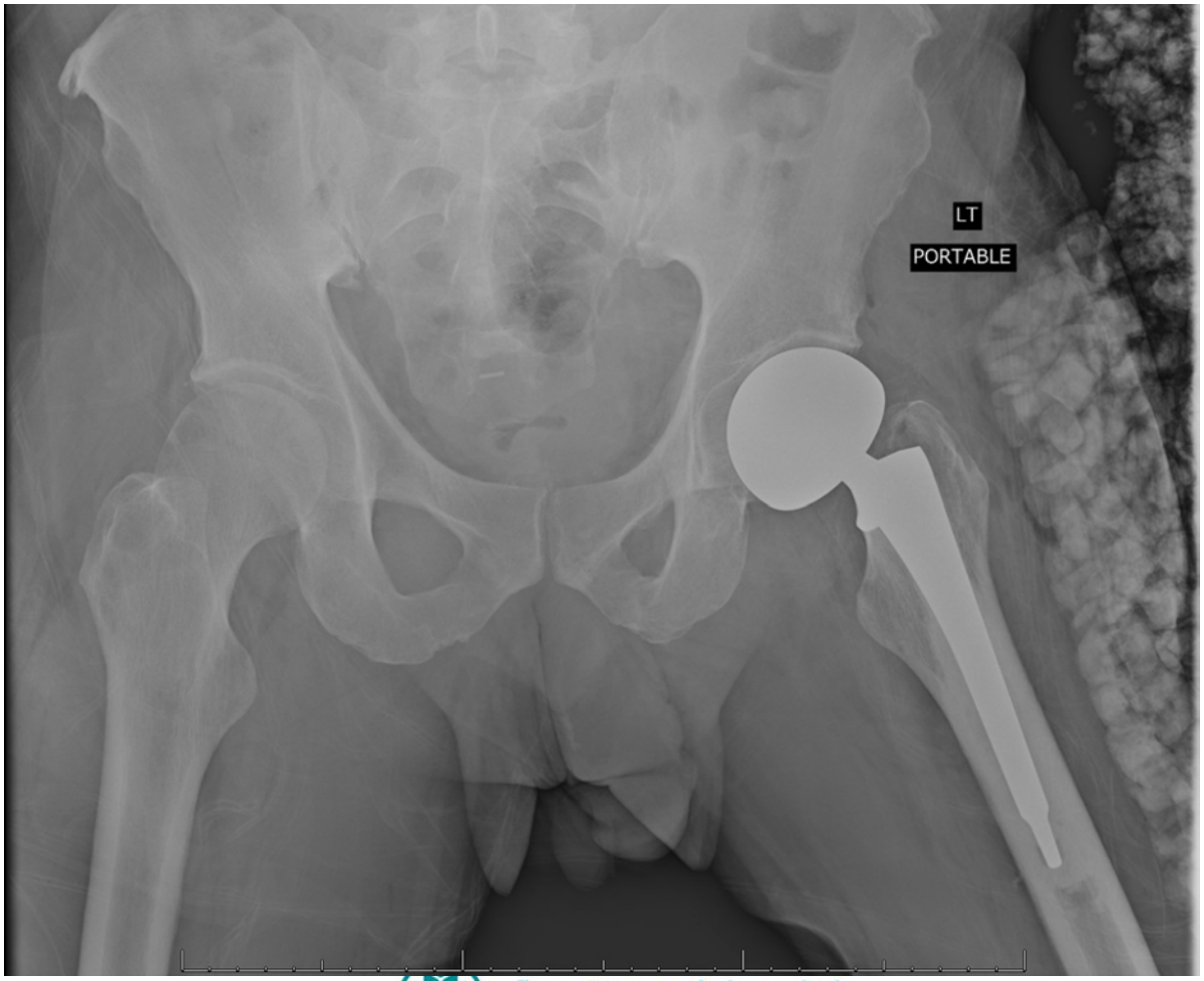
MRI





Surgery

To OR for incisional biopsy, L hip hemiarthroplasty



Pathology

Case Number: I21-1265

Date of Service:	3/19/2021
Date Received:	3/19/2021
Date Resulted:	3/31/2021
Ordering Physician:	COLIN J ANDERSON

Final Pathologic Diagnosis

LEFT FEMORAL HEAD, FLOW CYTOMETRIC ANALYSIS:

B-CELL MALIGNANT LYMPHOMA WITH A NONSPECIFIC IMMUNOPHENOTYPE.

Management

- Small superficial soft tissue mass
  - Obtain thorough H&P
  - Consider axial imaging prior to any biopsy/excision
  - Remember principles of biopsy
  - We are available to discuss

Case

- CC: Left shoulder mass

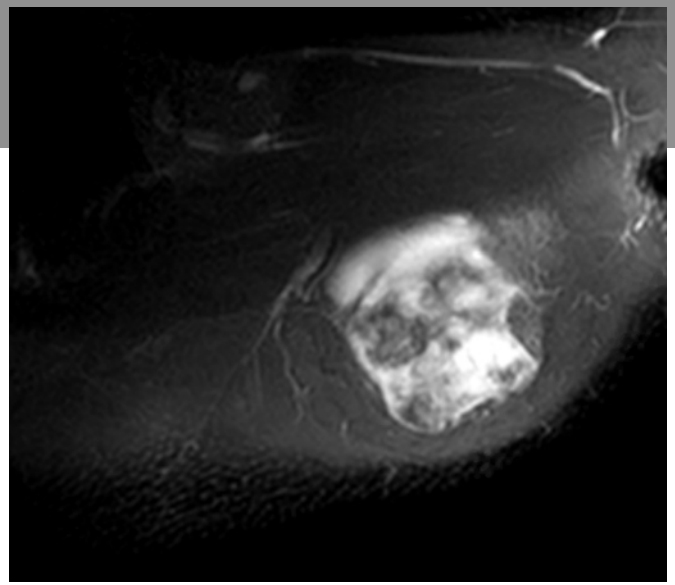
- HPI: RB is a 69 yo M with a five-year history of left posterior shoulder mass. Previously told by three separate providers that it was a lipoma and not to worry about it. Recently growing larger.

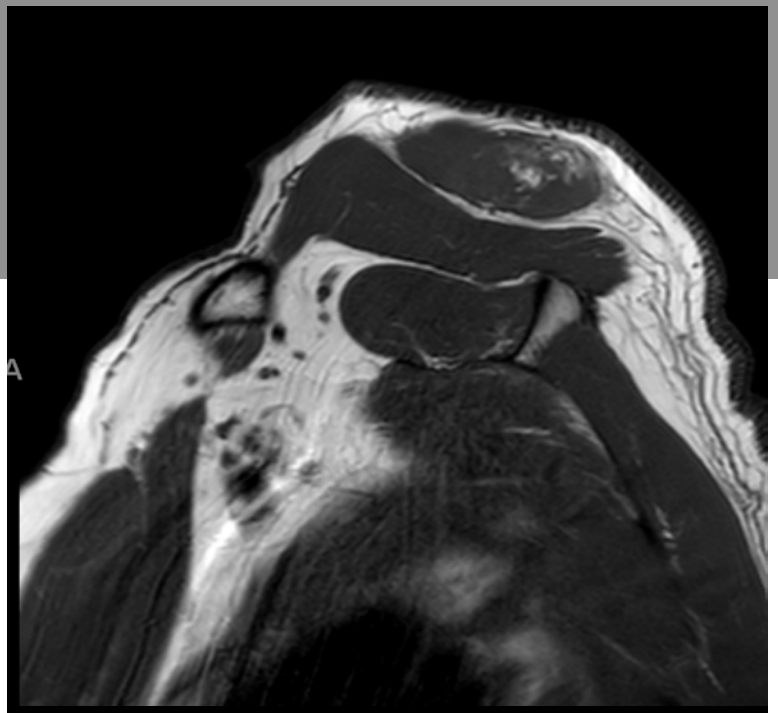
- PMHx: None
- PSurgHx: None
- Meds: None
- Social History: Works as truck driver, no tobacco/EtOH

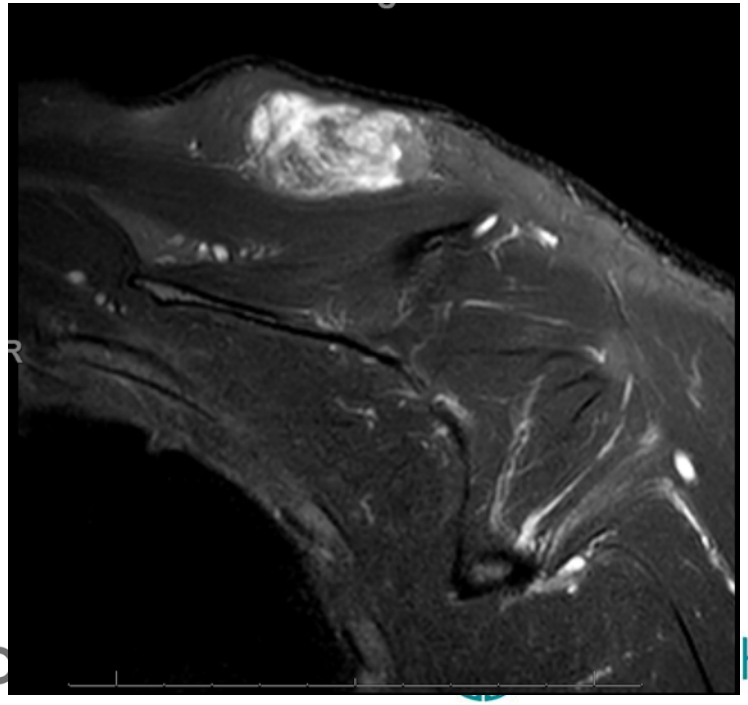
Exam

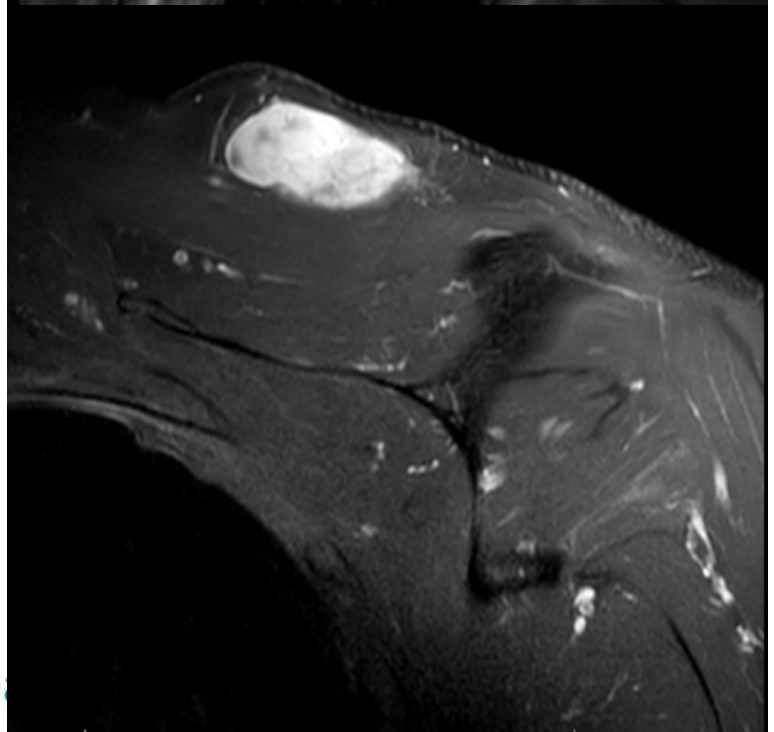
- Soft, rubbery mass approximately 5 x 5 x 4 cm in size arising from posterior superior shoulder overlying trapezius, mobile relative to fascia, non-tender to palpation

MRI









Core needle biopsy

Histology

Surgical Pathology Report

Case Number: S21-25143

Date of Service:	4/19/2021
Date Received:	4/19/2021
Date Resulted:	4/21/2021
Ordering Physician:	COLIN J ANDERSON

Final Pathologic Diagnosis

SOFT TISSUE, ADJACENT TO LEFT SHOULDER, CORE BIOPSY:

LOW-GRADE MYXOID LESION (SEE COMMENT).

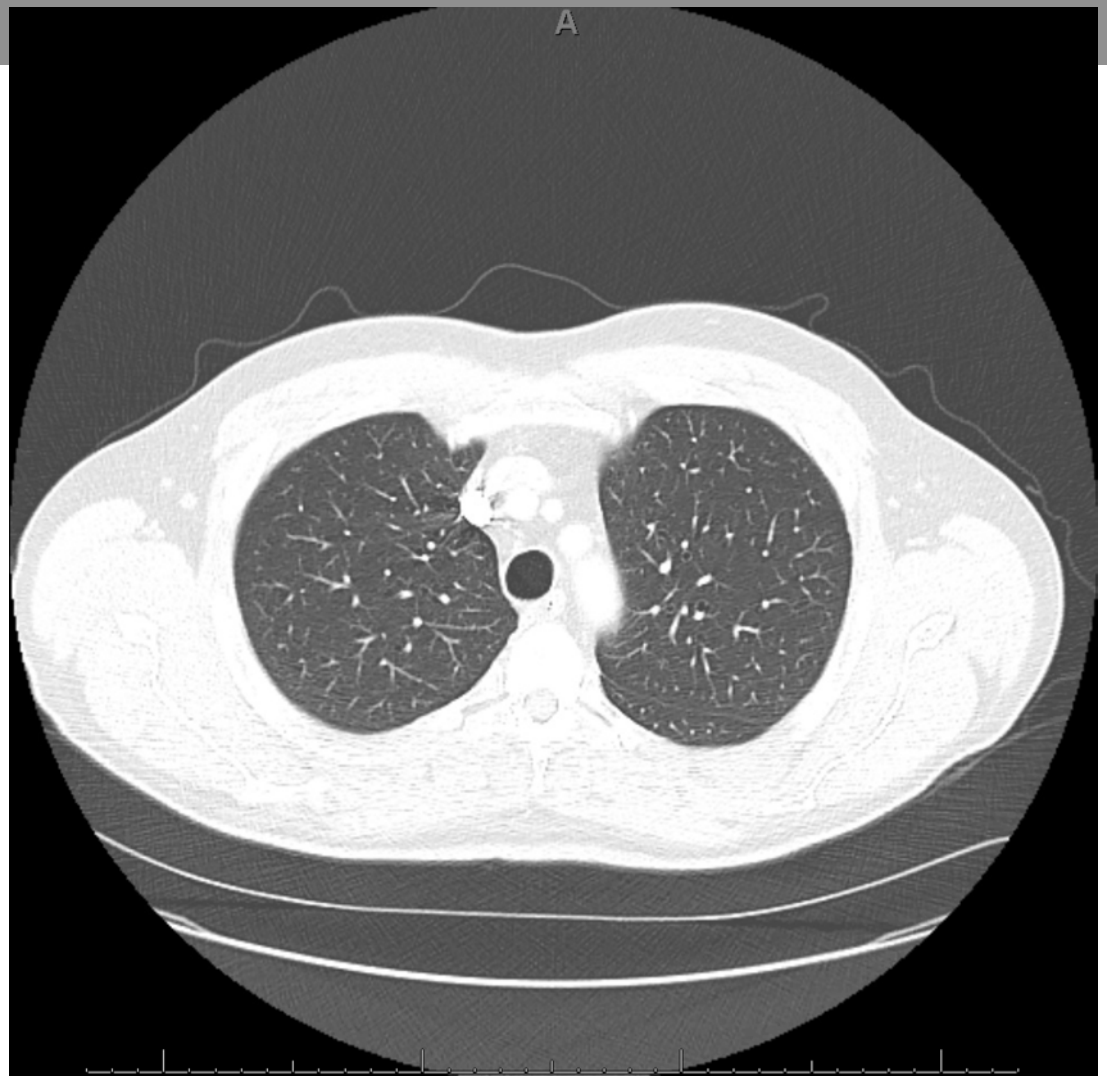
Comment

The biopsy contains fragments of loose fibrous tissue with a low-grade myxoid lesion populated by bland spindled cells. Focal nuclear hyperchromasia is seen. An immunostain for CD34 highlights spindled cells. An S-100 immunostain is negative.

The findings in the biopsy would invoke low-grade myxoid neoplasms, both benign (myxoid variant of spindle cell lipoma) and malignant in the differential diagnosis.

Staging Chest CT

- No evidence of metastasis



Surgery

- Wide excision of mass

Final pathology

- Low grade myxoid sarcoma
  - Negative margins

- Plan:
  - Wide excision was curative
  - No indication for radiation or chemotherapy for low grade lesions
  - Will proceed with surveillance including routine examination and chest imaging

- Take home lessons:
  - Not everything is a lipoma
  - Get advanced imaging!

Management

- Concerning soft tissue mass
  - Obtain thorough H&P
  - >5 cm, deep
  - Obtain axial imaging
  - Exercise caution with biopsy or treatment
  - Urgent referral

Case

- 89 yo M with 8 cm deep left ulnar wrist mass
  - Underwent excisional biopsy
  - Path demonstrated sarcoma
  - Quickly grew back

Case

- To surgery for tumor bed resection followed by post-op RT

Take Home Messages

- Any mass larger than golf ball is malignant until proven otherwise
- Not everything is a lipoma
- Be on the lookout for red flags!
- It's okay to order x-rays or more imaging!
- We're happy to review cases with you

Atrium Health
Levine Cancer Institute

We ask that you please **do not** share the Levine Cancer Institute (LCI) New Patient (NP) referral number with patients as it is not intended for patient use. Please have patients call **980-442-2000** if they need assistance.

LCI New Patient Referral Center

Hours:
Monday through Friday, 8 a.m. to 5 p.m.
Phone: 980-442-2900
Fax: 704-446-4396
Email:
LCIReferralCoordination@AtriumHealth.org

- Practices can submit referrals to Levine Cancer Institute via phone, fax or email.
- Referring practices are responsible for obtaining prior authorization before submitting referral.
- LCI New Patient Referral Coordinators will be responsible for conducting a Real Time Eligibility Check before scheduling the appointment.

1. Referring physician, nurse practitioner or physician assistant orders referral to Levine Cancer Institute.
2. Referring Office Referral Coordinator formally submits referral to LCI New Patient Referral Center via phone, fax or email. If the referral is called in or sent via email, referring practice must fax patient records same day to ensure accuracy of the scheduled appointment/location.
3. LCI NP Referral Coordinator will use section-specific referral guidelines to determine the most appropriate appointment date/location.
4. If the referral is called in, the LCI NP Referral Coordinator will make every effort to schedule the appointment while on the phone. If further clinical evaluation is necessary, the referral will be passed along to the appropriate Referral Coordinator to schedule within 24 to 48 hours.
5. Once the appointment has been scheduled, the LCI Referral Coordinator will contact the patient to inform them of the date, time and location.
6. Lastly, the LCI Referral Coordinator will contact referring practice to inform them of the patient appointment date/time. If the patient contacts the referring office to reschedule the appointment, please direct them to call 980-442-2000.

***For Urgent referrals, call Dr. Kneisl, Dr. Patt, or Dr. Anderson

Questions?