AMSER RadPath Case of the Month

26-year-old female with knee pain

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Patient Presentation

- The patient initially presented to her PCP for knee pain after feeling a popping sensation while exercising
- She had been having general discomfort in her knee for over a year
- Past medical history is remarkable for ER/PR+ Ductal Carcinoma in situ found incidentally on
  partial mastectomy for a large fibroadenoma at the age of 23
- Family history is remarkable for breast and colon cancer

What Imaging Should We Order?

Select the applicable ACR Appropriateness Criteria

American College of Radiology
ACR Appropriateness Criteria®
Chronic Knee Pain

Variant 1: **Adult or child greater than or equal to 5 years of age. Chronic knee pain. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
Radiography knee	Usually Appropriate	☢
Image-guided aspiration knee	Usually Not Appropriate	Varies
CT arthrography knee	Usually Not Appropriate	☢
CT knee with IV contrast	Usually Not Appropriate	☢
CT knee without and with IV contrast	Usually Not Appropriate	☢
CT knee without IV contrast	Usually Not Appropriate	☢
MR arthrography knee	Usually Not Appropriate	O
MRI knee without and with IV contrast	Usually Not Appropriate	O
MRI knee without IV contrast	Usually Not Appropriate	O
Bone scan knee	Usually Not Appropriate	☢☢☢
US knee	Usually Not Appropriate	O
Radiography hip ipsilateral	Usually Not Appropriate	☢☢☢

This imaging modality was ordered by the PCP

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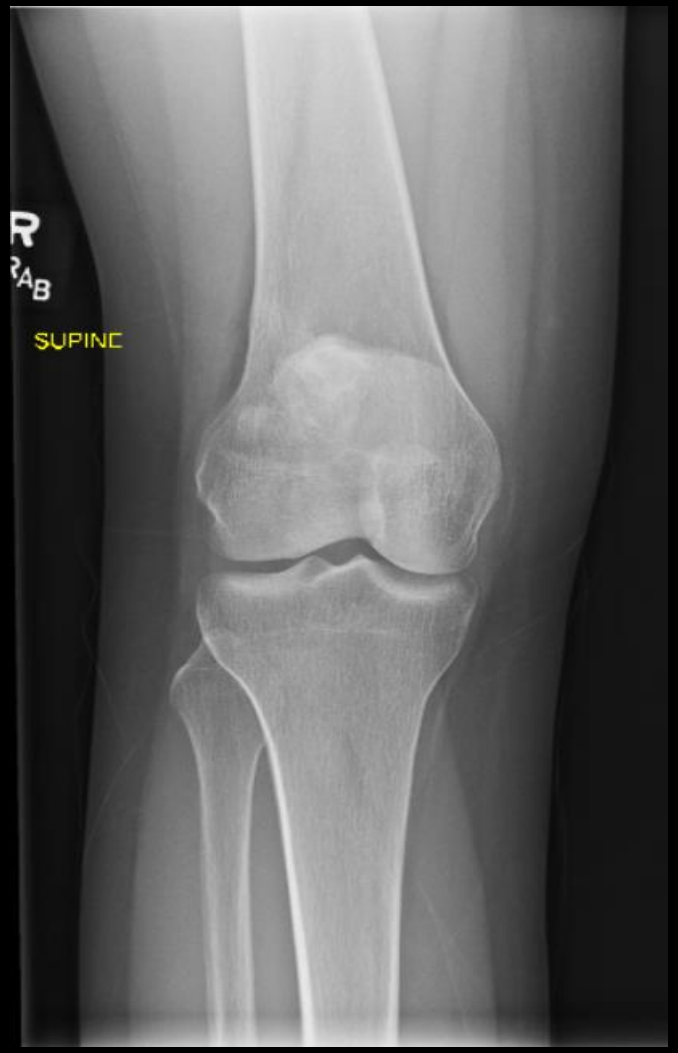
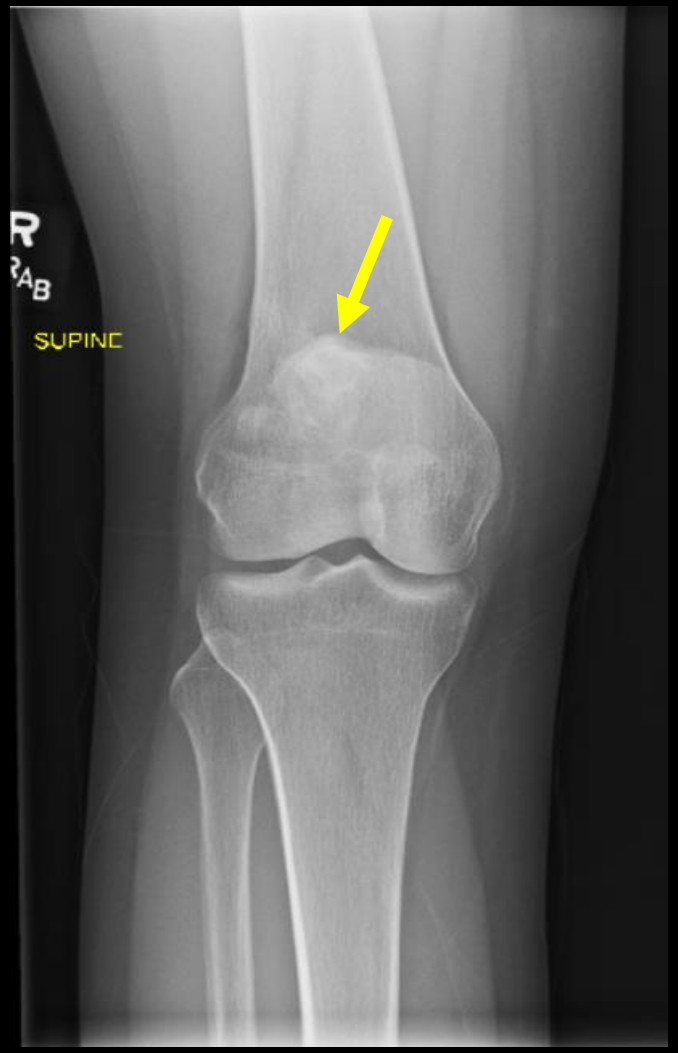
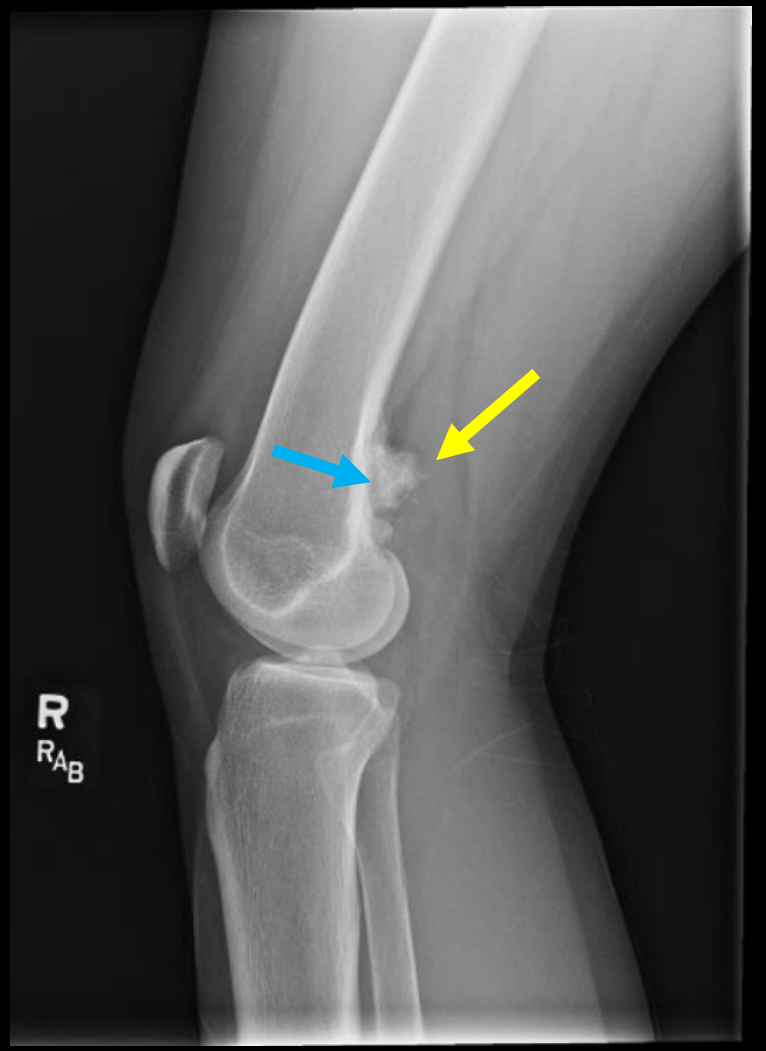
Findings (unlabeled)



Findings: (labeled)



- Posterior ossified mass projecting over distal femur (yellow arrow)
- Highlights importance of lateral X-ray



- Osseous mass with irregular margins arising from the posterior aspect of the distal femoral metaphysis (yellow arrow)
- Thin radiolucent line (string sign) separating portion of the mass from cortex (blue arrow).

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What Follow-Up Imaging Should We Order?

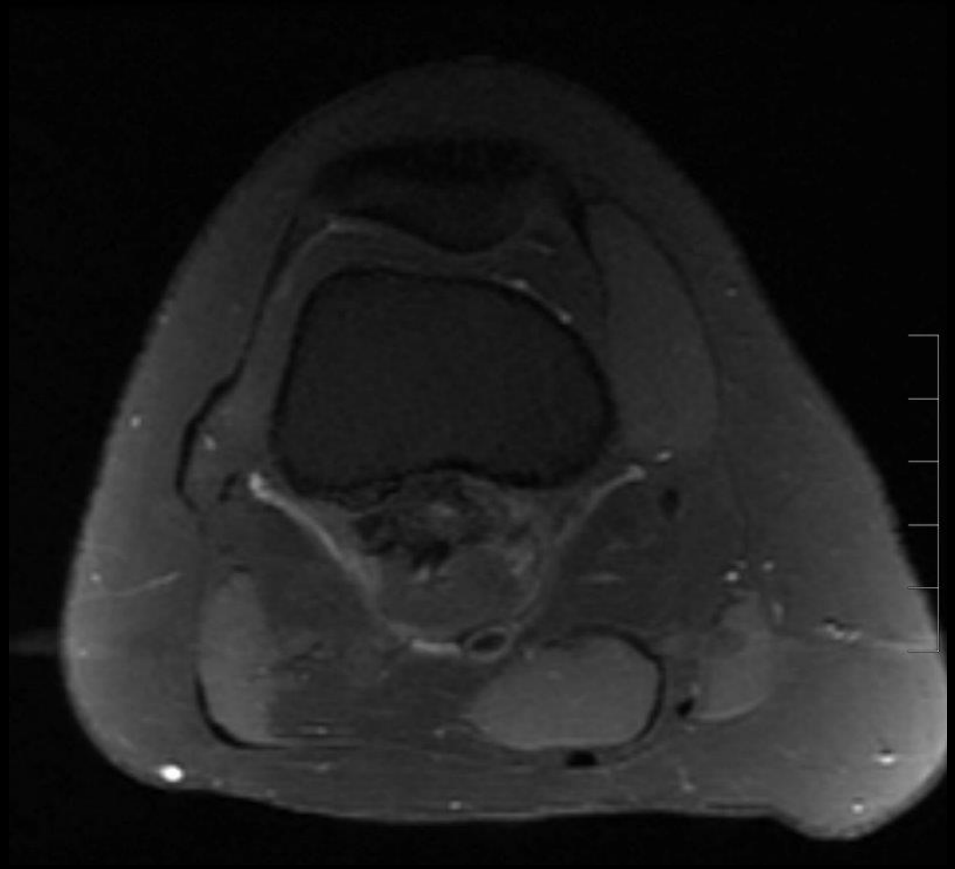
Select the applicable ACR Appropriateness Criteria

Variant 5: **Suspect primary bone tumor. Lesion on radiographs. Indeterminate or aggressive appearance for malignancy. Next imaging study.**

Procedure	Appropriateness Category	Relative Radiation Level
MRI area of interest without and with IV contrast	Usually Appropriate	O
MRI area of interest without IV contrast	May Be Appropriate	O
CT area of interest without and with IV contrast	May Be Appropriate (Disagreement)	Varies
CT area of interest without IV contrast	May Be Appropriate	Varies
FDG-PET/CT whole body	May Be Appropriate	☢☢☢☢
Bone scan whole body with SPECT or SPECT/CT area of interest	May Be Appropriate	☢☢☢
Bone scan whole body	Usually Not Appropriate	☢☢☢
CT area of interest with IV contrast	Usually Not Appropriate	Varies
Radiography skeletal survey	Usually Not Appropriate	☢☢☢
US area of interest	Usually Not Appropriate	O

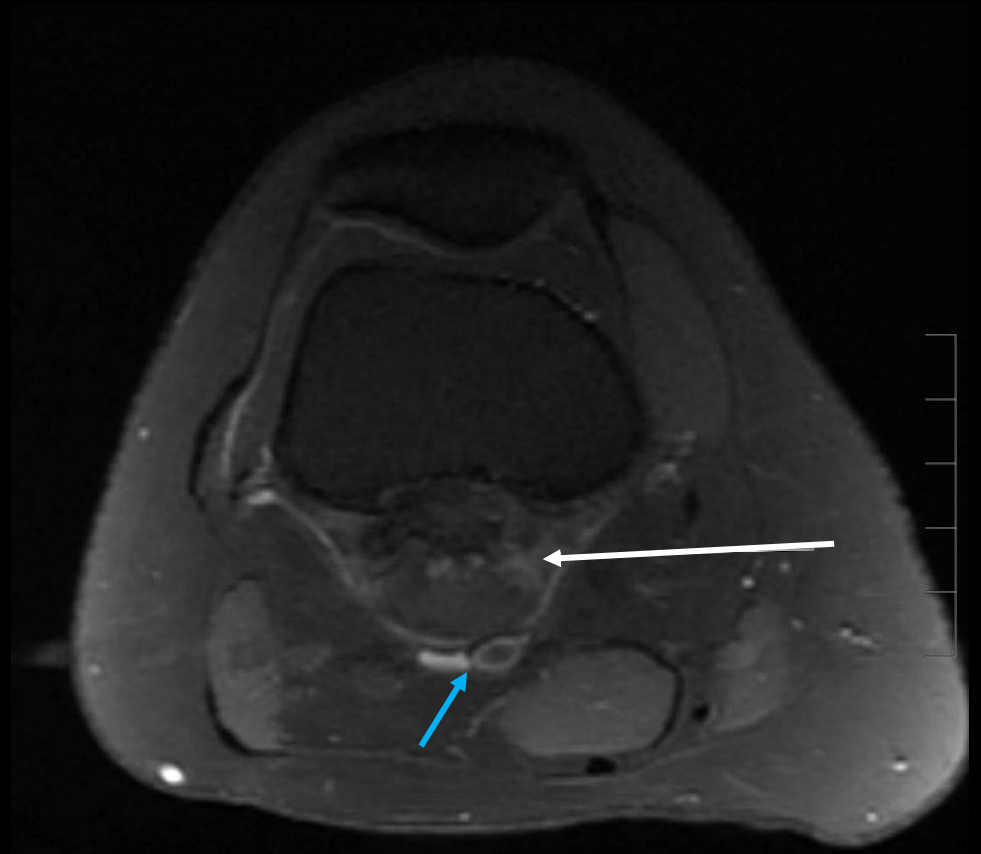
Both imaging modalities were ordered by the Surgeon

Findings (unlabeled)



Findings: (labeled)

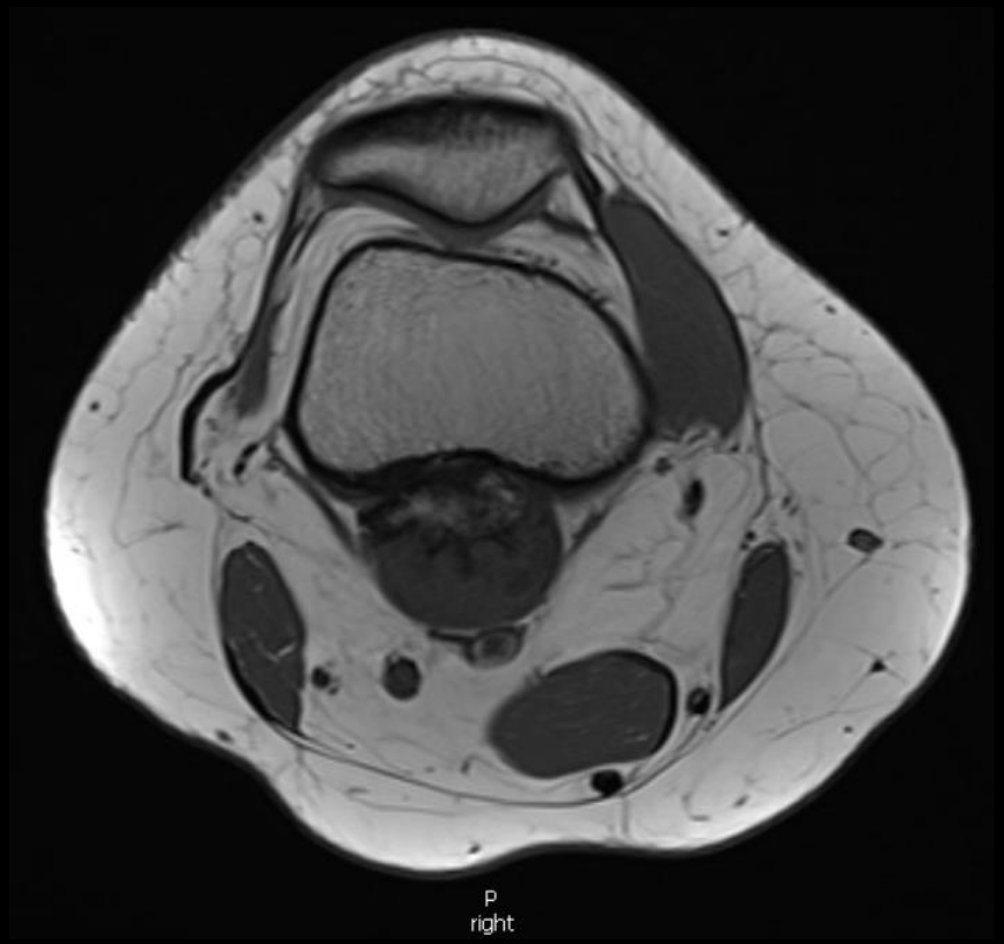
Axial T2 Fat Saturated

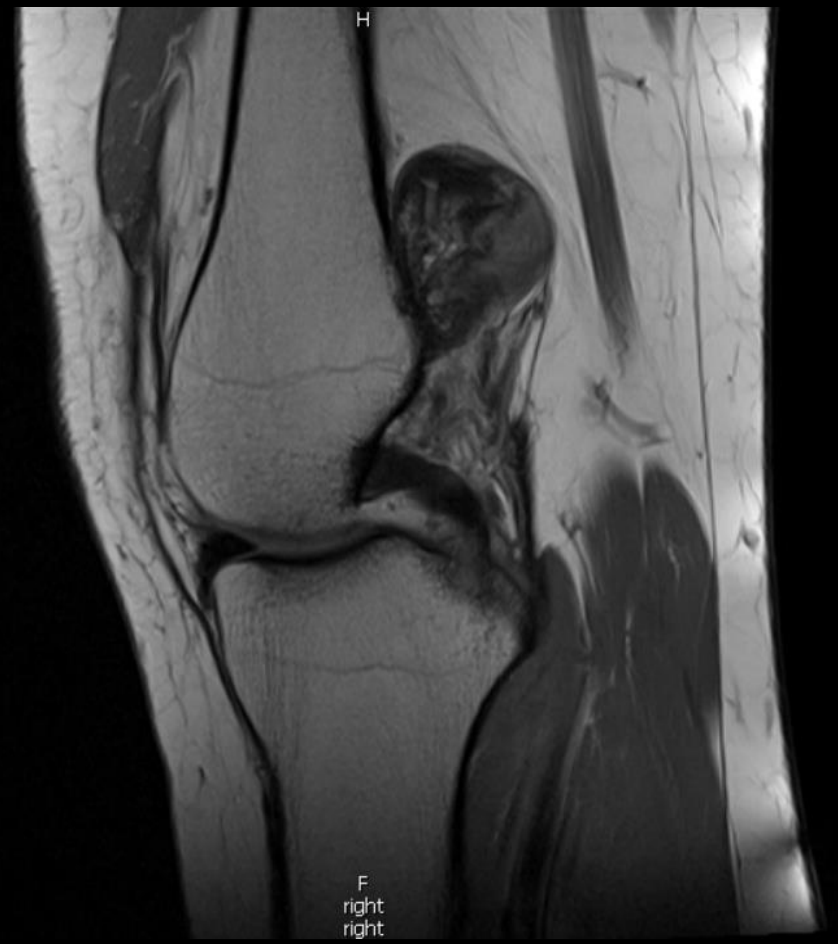


- Heterogeneous juxtacortical mass with ossification and soft tissue (white arrow)
- Mass demonstrating enhancement with medullary extension at the inferior aspect (yellow arrow)
- Mass abuts the popliteal artery and vein (blue arrow) without evidence of encasement

Sagittal T1 Fat Saturated Post Contrast

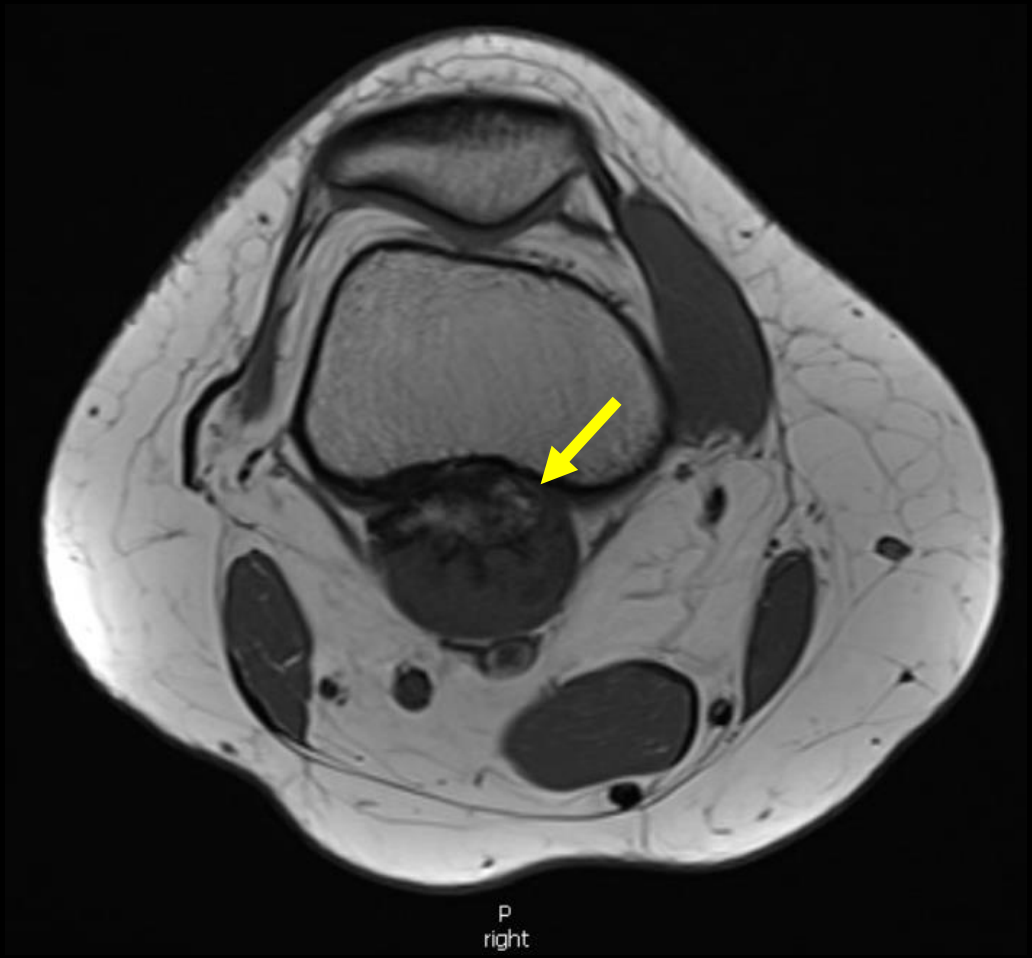
Findings (unlabeled)





Findings (labeled)

Axial T1



- mass demonstrating hyperintense osseous component as well as soft tissue component along posterior distal femur just above intercondylar notch (yellow arrow)

Sagittal Proton Density

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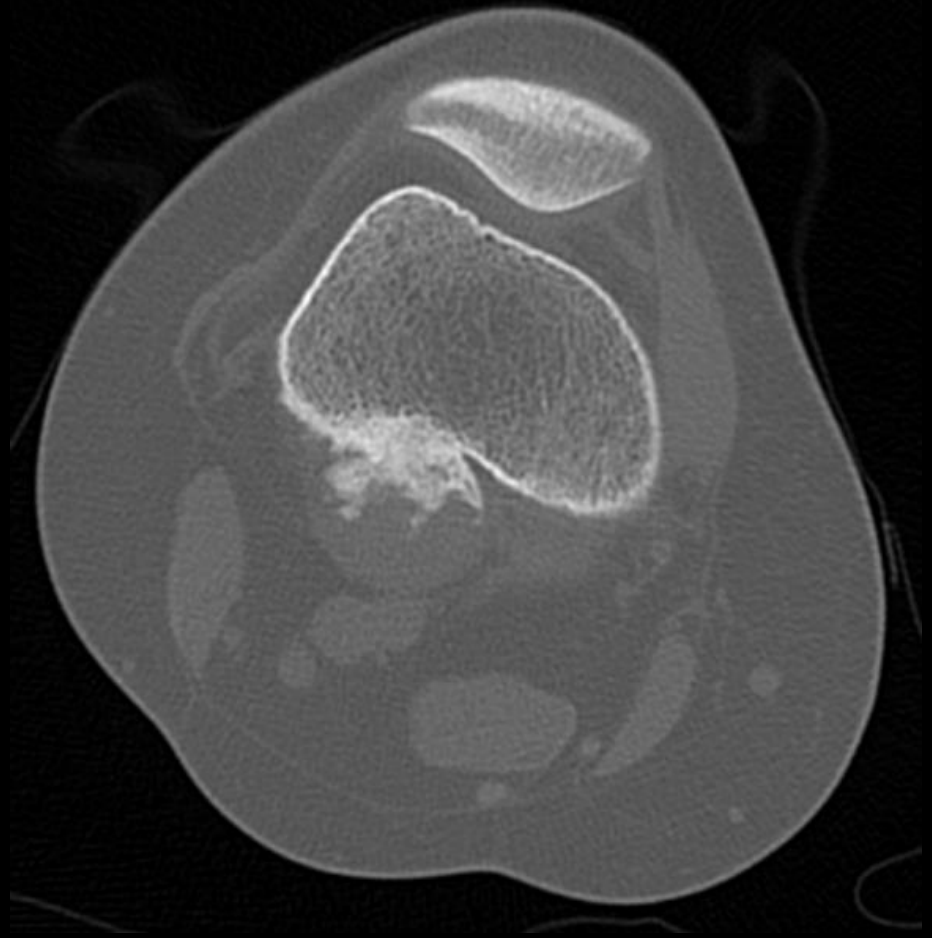
Findings (unlabeled)

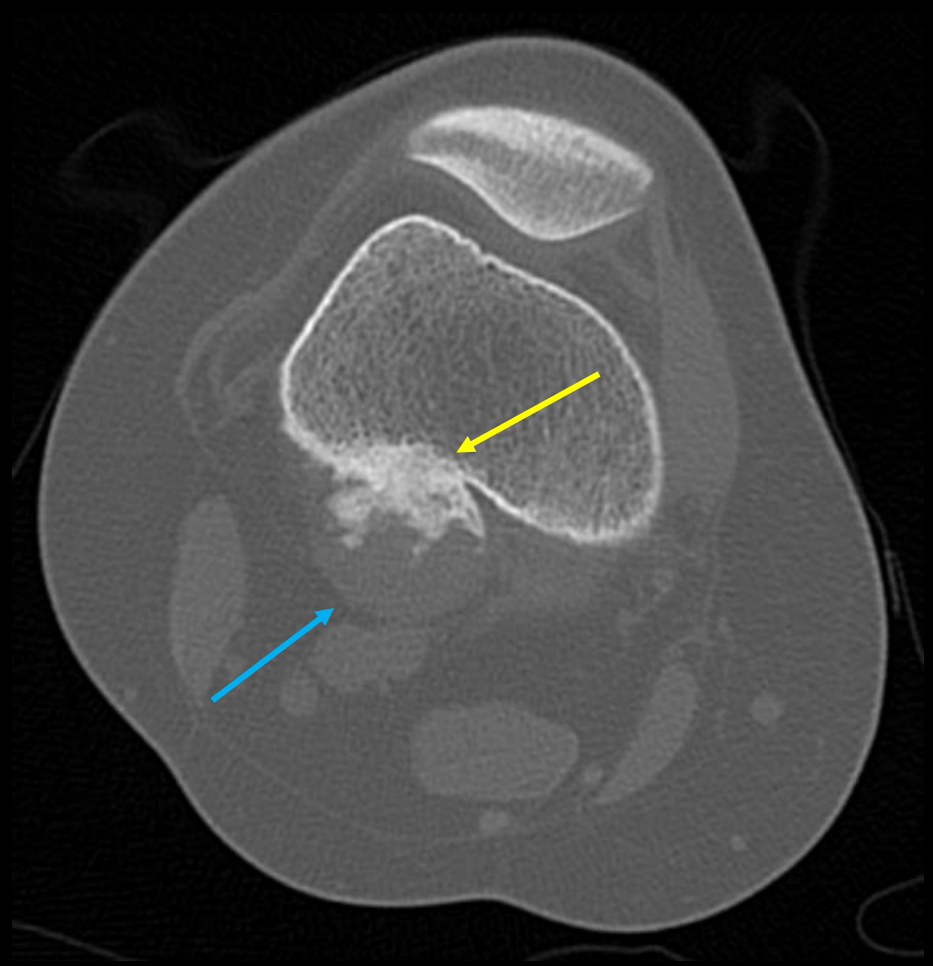
Axial CT



Sagittal CT

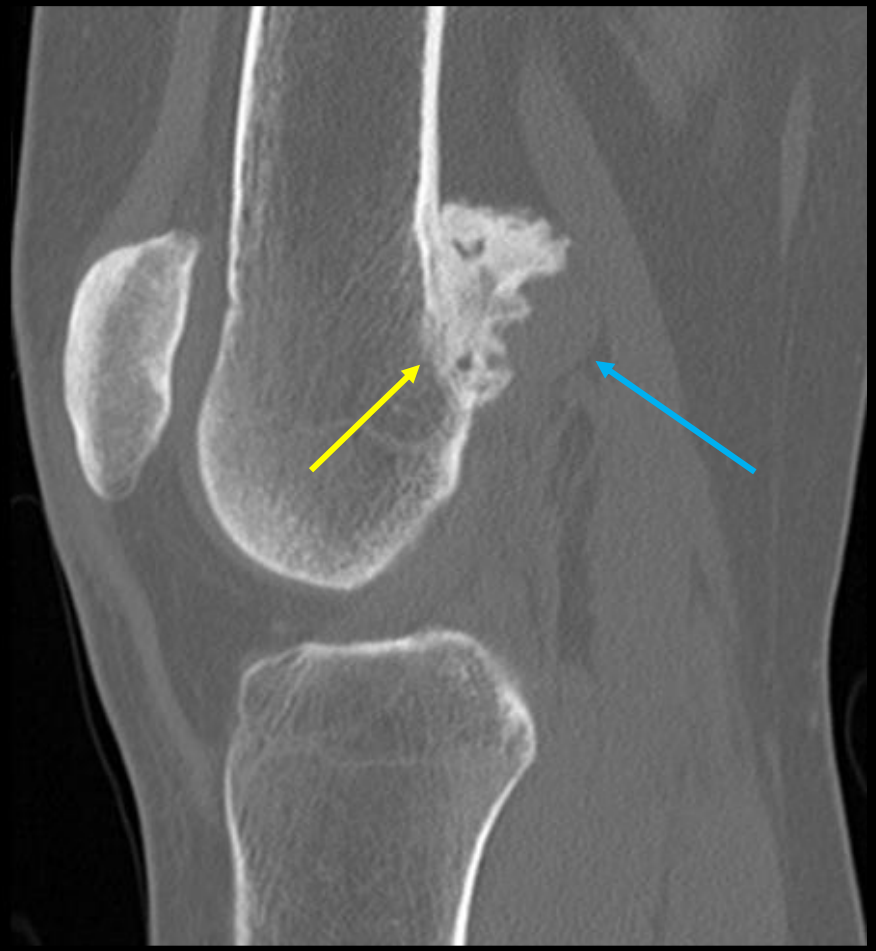
Findings (labeled)

Axial CT



- Hyperdense osseous mass seen arising from the bone and involving the medullary space (yellow arrow).
- Mass lacks corticomedullary continuity, distinguishing it from osteochondroma
- Mass has both bone and soft tissue component (blue arrow)

Sagittal CT



Differential Diagnosis

Based on age and location (metaphysis of femur)

- Benign
  - Parosteal Lipoma
  - Cortical Desmoid
  - Myositis Ossificans
  - Chondroblastoma
  - Osteochondroma
- Malignant
  - Osteosarcoma
    - Parosteal
    - Periosteal
  - Lymphoma
  - Metastasis

The patient was taken to the operating room for surgical excision and the mass was taken to pathology for analysis

Gross Pathology

- Well-circumscribed solid, partially ossified fibrous mass attached to the cortex measuring (cm) 3.5x3.0x2.4
- AJCC Pathologic Stage pT1

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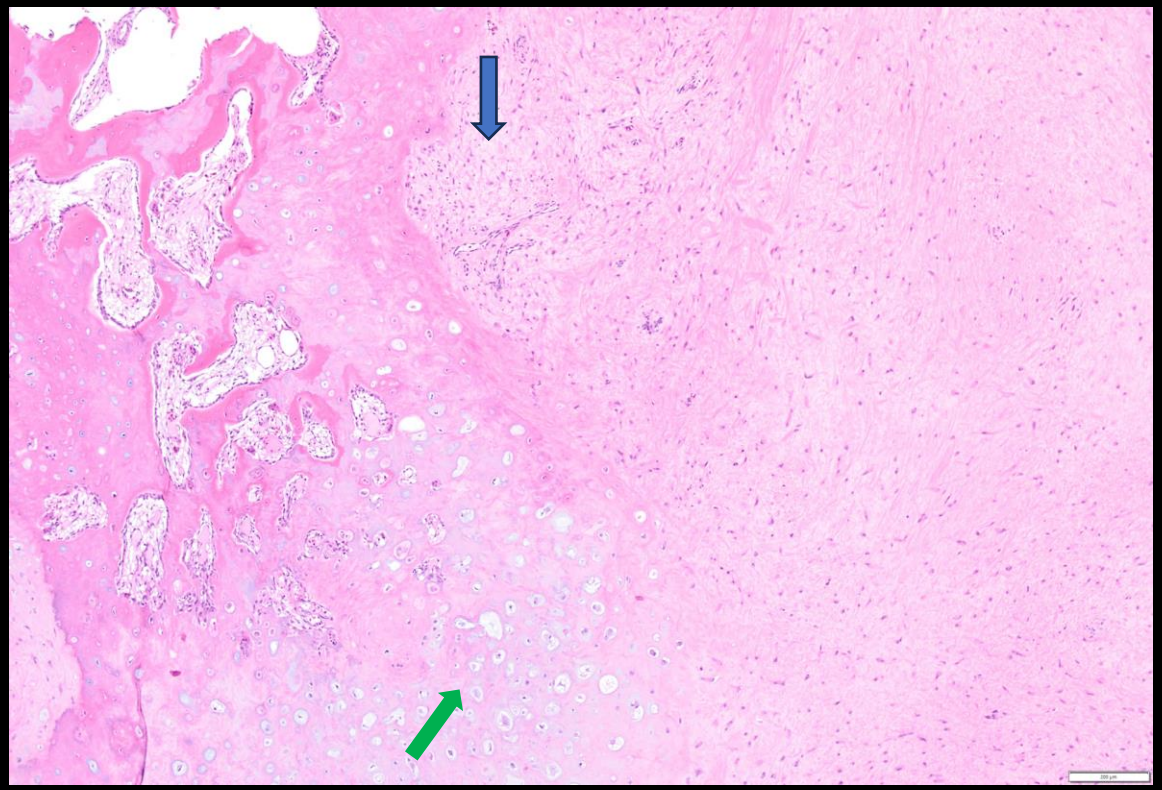
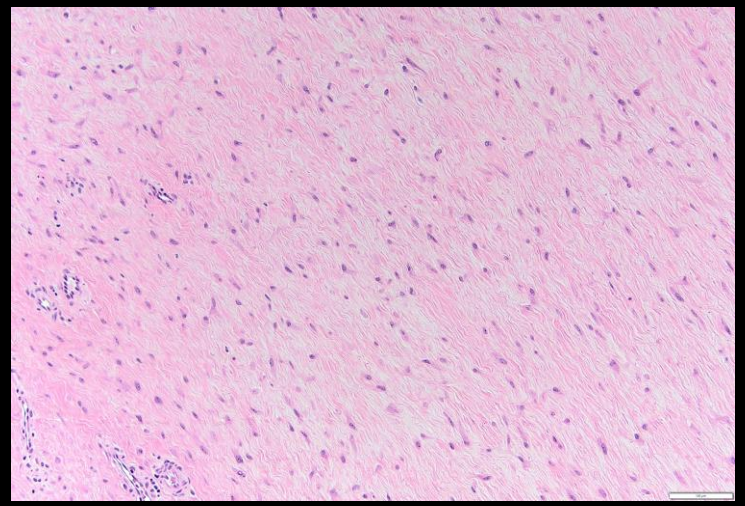
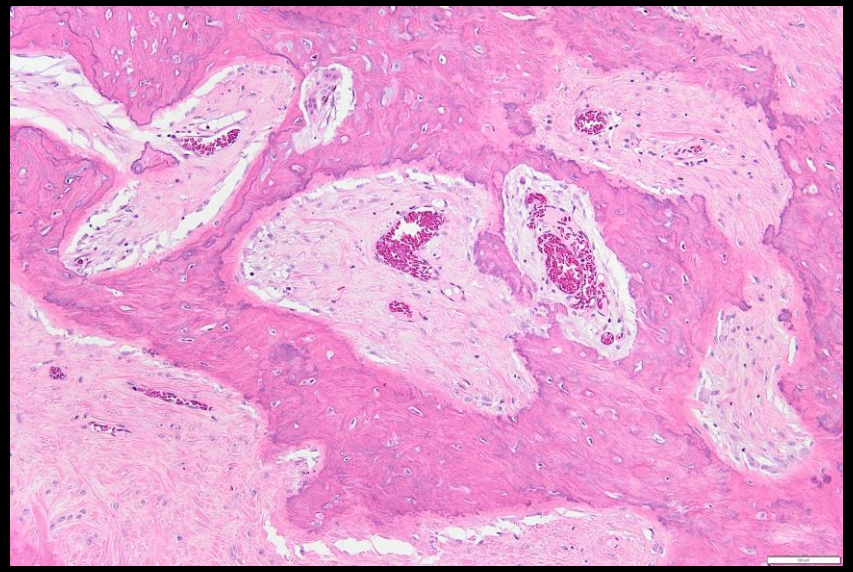
Pathology



low grade lesion composed of osseous trabeculae (Green Arrow) surrounded by atypical spindle cells with moderate cellularity (Blue Arrow)



Atypical spindle cell proliferation



Abnormal spindle cells infiltrating the osseous matrix

*Positive for MDM2 amplification on FISH analysis

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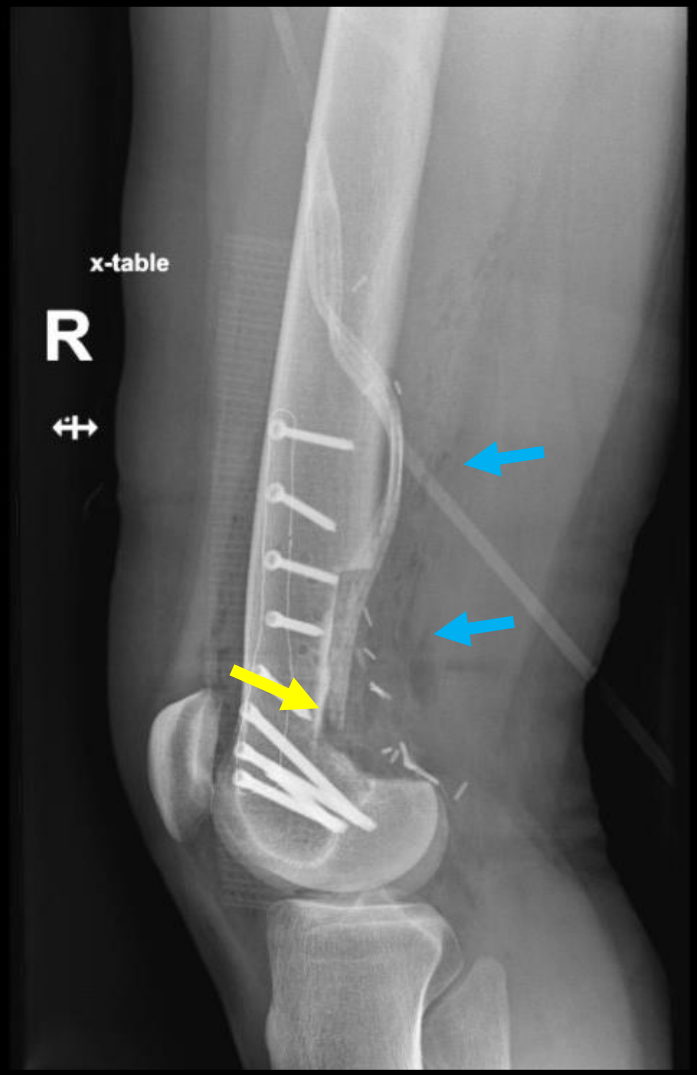
Final Dx:

Parosteal Osteosarcoma

Case Discussion

- Osteosarcoma is a malignant osteoid-producing tumor and the most common non-hematological primary bone malignancy
  - Can also occur secondary to Paget's Disease, prior exposure to radiation, or as a histological variant of chondrosarcoma
  - 3 classifications exist: Central (most common), Intracortical, or Juxtacortical (Surface)
- Epidemiology
  - Bimodal distribution with highest prevalence in 10-20 years of age
    - Associated with retinoblastoma, Li-Fraumeni Syndrome, Rothmund-Thompson Syndrome, Bloom Syndrome, and Werner Syndrome
  - Prevalence in patients >40 y/o mostly occurs secondarily from other etiologies such as Paget's disease
- Clinical Presentation
  - Pain and/or palpable soft tissue mass with/without pathologic fracture
- Parosteal Osteosarcoma is the most common type of juxtacortical osteosarcoma
  - Most common in the 3rd decade of life with a slight predominance in females
  - Located primarily in the metaphysis of long bones
    - Posterior aspect of distal femur (most common), distal tibia and humerus
- Pathology
  - Lobulated exophytic mass with a gritty texture on gross specimen
  - Microscopically, tumor is usually hypocellular with bony trabeculae
    - Cellular atypia present in 20% of cases, representing a more aggressive tumor
    - MDM2 and CDK4 stains can help differentiate between benign fibro-osseous lesions and osteosarcoma

Case Discussion



- Postoperative X-rays show extent of surgery with several screws and a drain, all in proper positioning
- The mass was successfully excised with negative margins
- Sharp surgical margins where mass was resected along with a portion of the medullary space (yellow arrow)
- Note the soft tissue emphysema from surgery (blue arrows)

Case Discussion

- Imaging
  - Plain Film
    - Lobulated exophytic, cauliflower-like mass with central calcifications/ossification and cortical thickening adjacent to the cortical surface of the bone
    - String sign--> thin radiolucent line separating the tumor from the cortex (30% of cases)
    - In contrast to most osteosarcomas, periosteal reaction is usually absent
  - MRI
    - Low signal intensity on both T1 and T2
    - High T2 signal may represent an aggressive phenotype, however necrosis, hemorrhage, or fluid (all common) may present with high T2 intensity
    - Pathology is crucial in diagnosis
  - Treatment and Prognosis
    - Parosteal Osteosarcoma is a low-grade tumor treated with surgical resection
    - Tumors are usually large and may require joint replacement or bone grafting

References:

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