Rad Path Conference
Cartilage Forming Tumors and More

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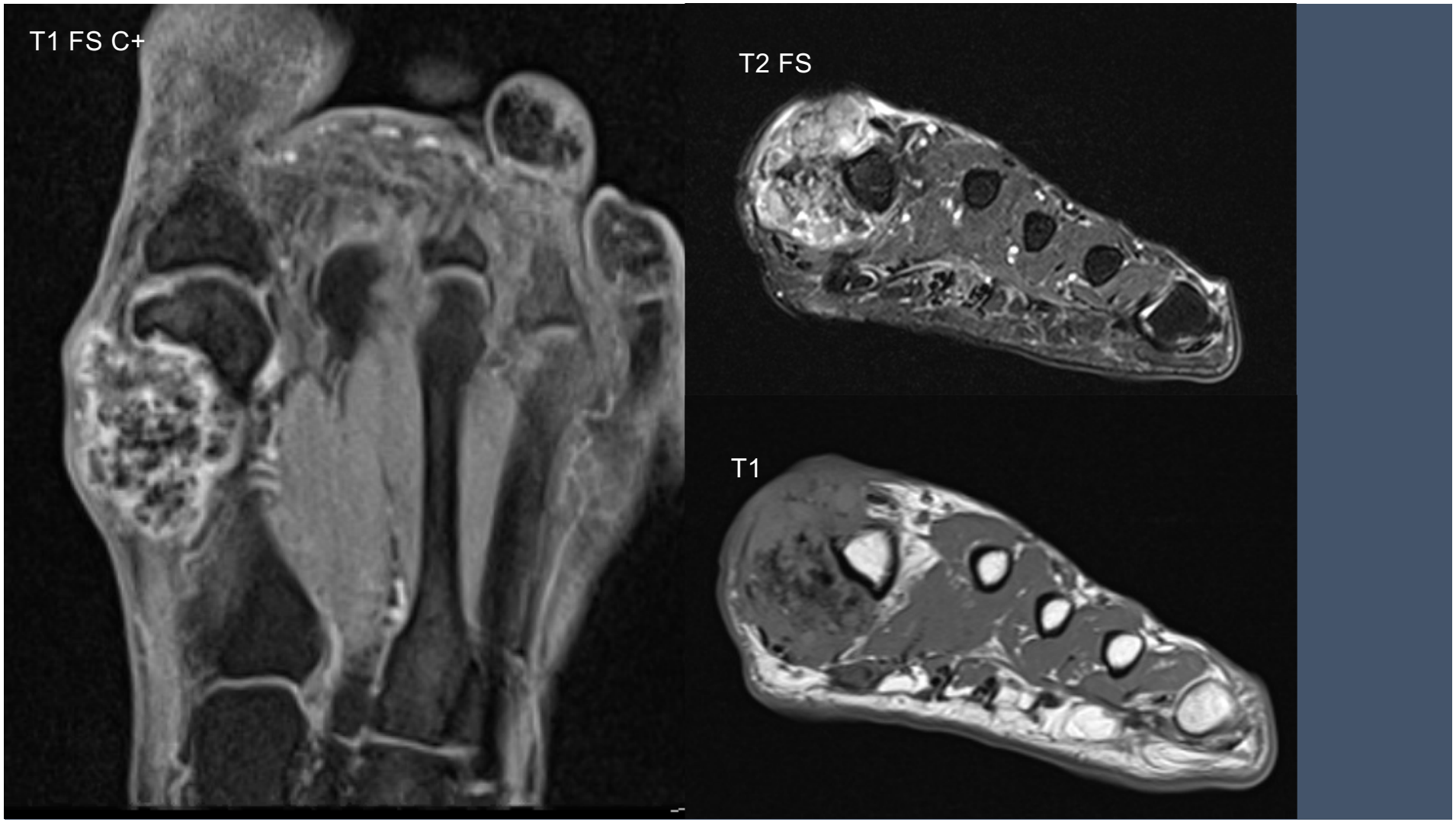
BRIGHAM HEALTH
BWH BRIGHAM AND WOMEN'S HOSPITAL
MAGNET RECOGNIZED
HARVARD MEDICAL SCHOOL TEACHING HOSPITAL

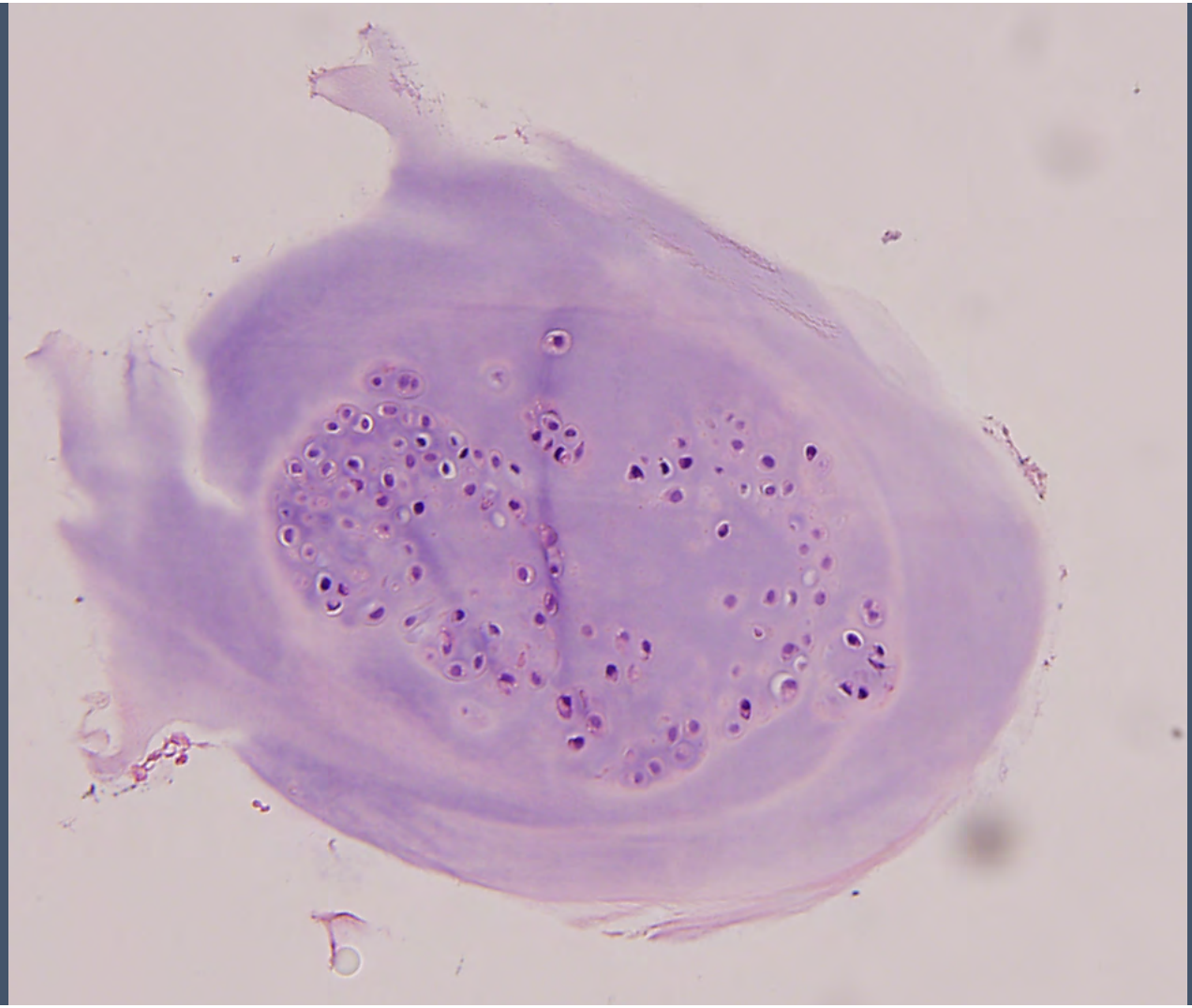
CASE 1

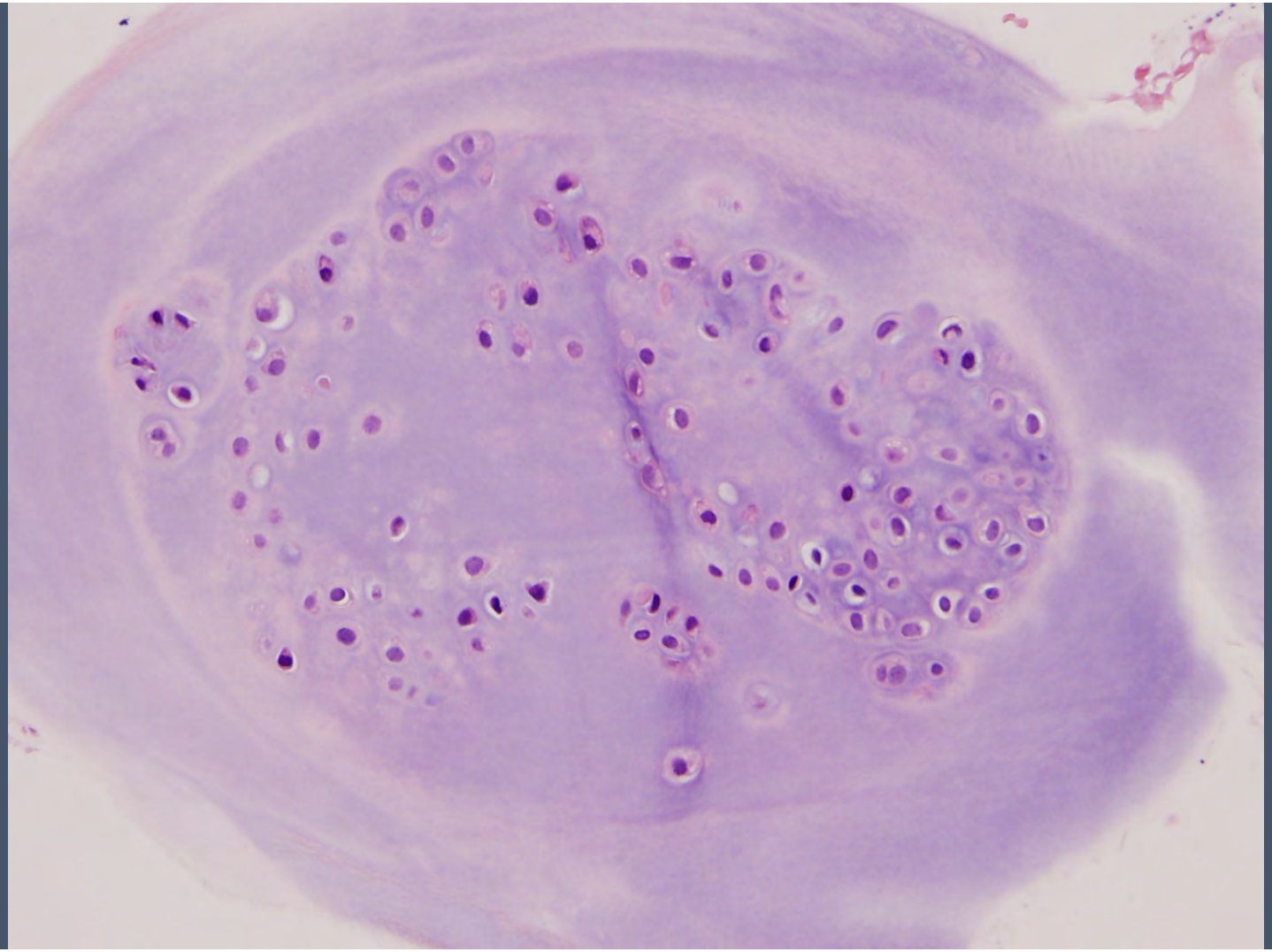
60F with lump on left great toe


MS


T1 FS C+
T2 FS
T1

PATHOLOGY





Periosteal Chondroma

- Benign chondroid tumor originating at the periosteal surface
- Imaging:
  - Soft tissue mass with chondroid matrix calcification causing cortical erosion
  - MRI findings: lobulated lesion with high signal intensity on T2W and peripheral and septal enhancement
  - Consider periosteal chondrosarcoma if lesion > 2.5cm
- Treatment
  - Wide excision whenever possible since major differential includes periosteal chondrosarcoma and periosteal osteosarcoma.

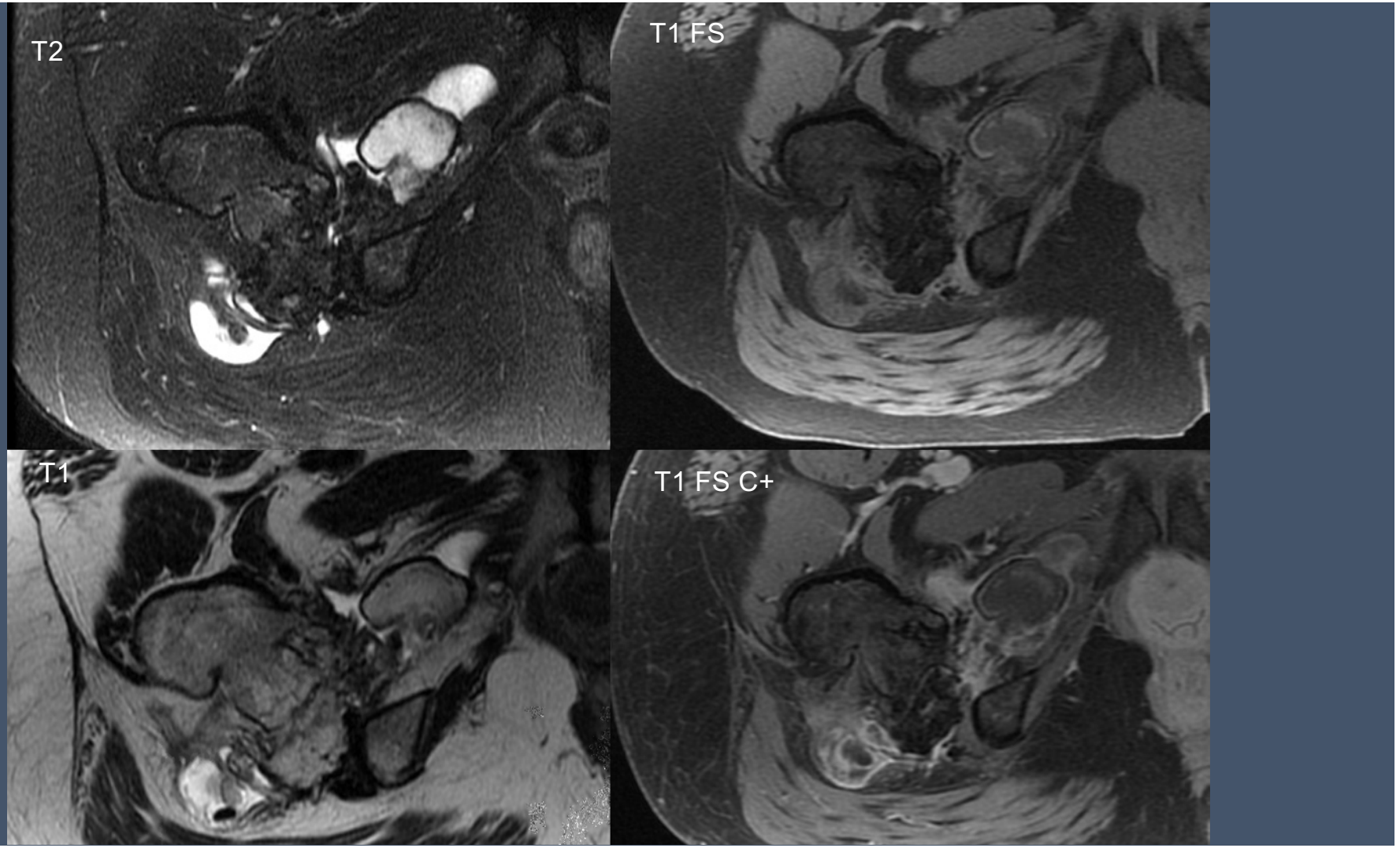
CASE 2

52F with right hip pain for years

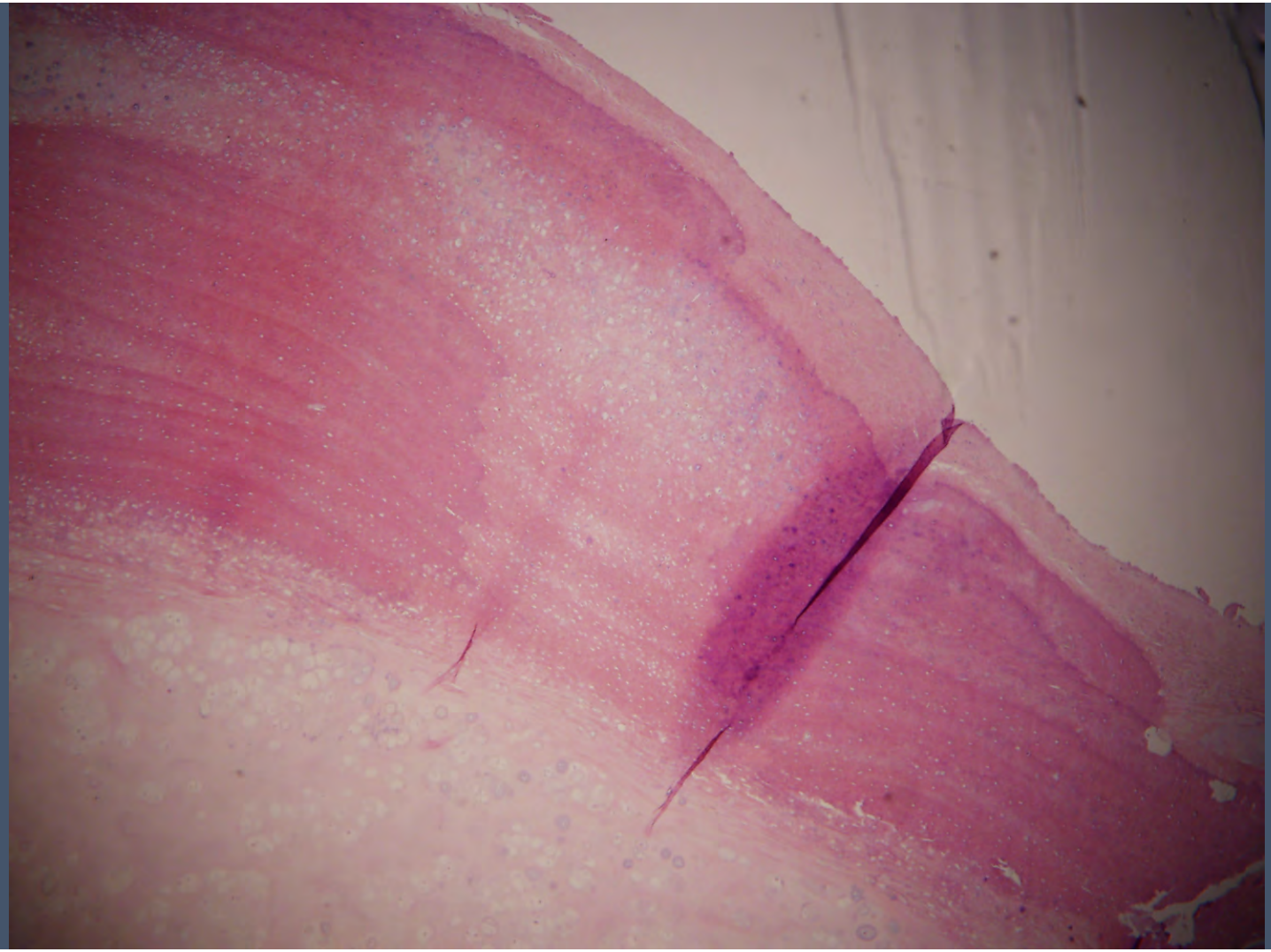

?
5 cm

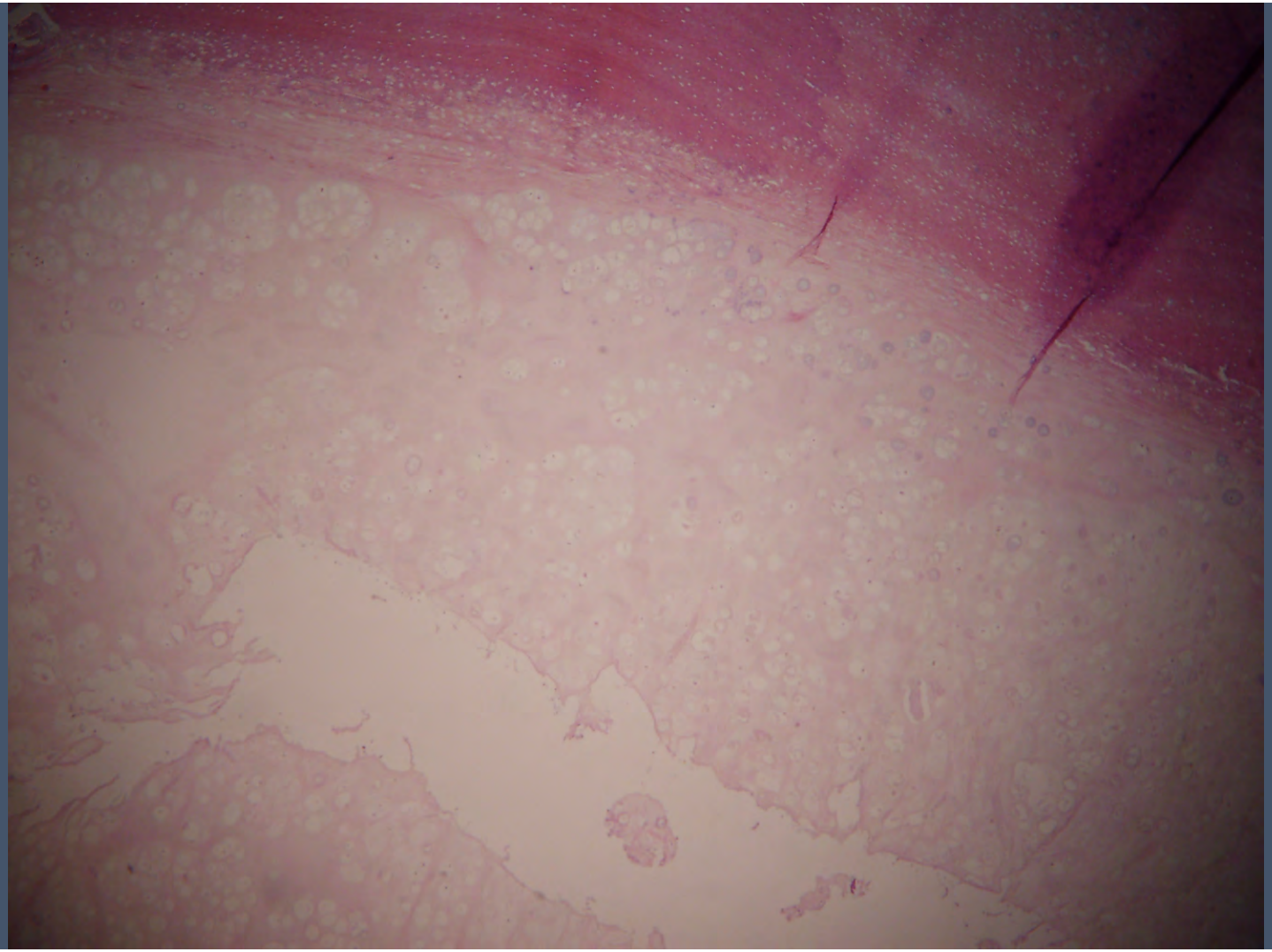

Axial

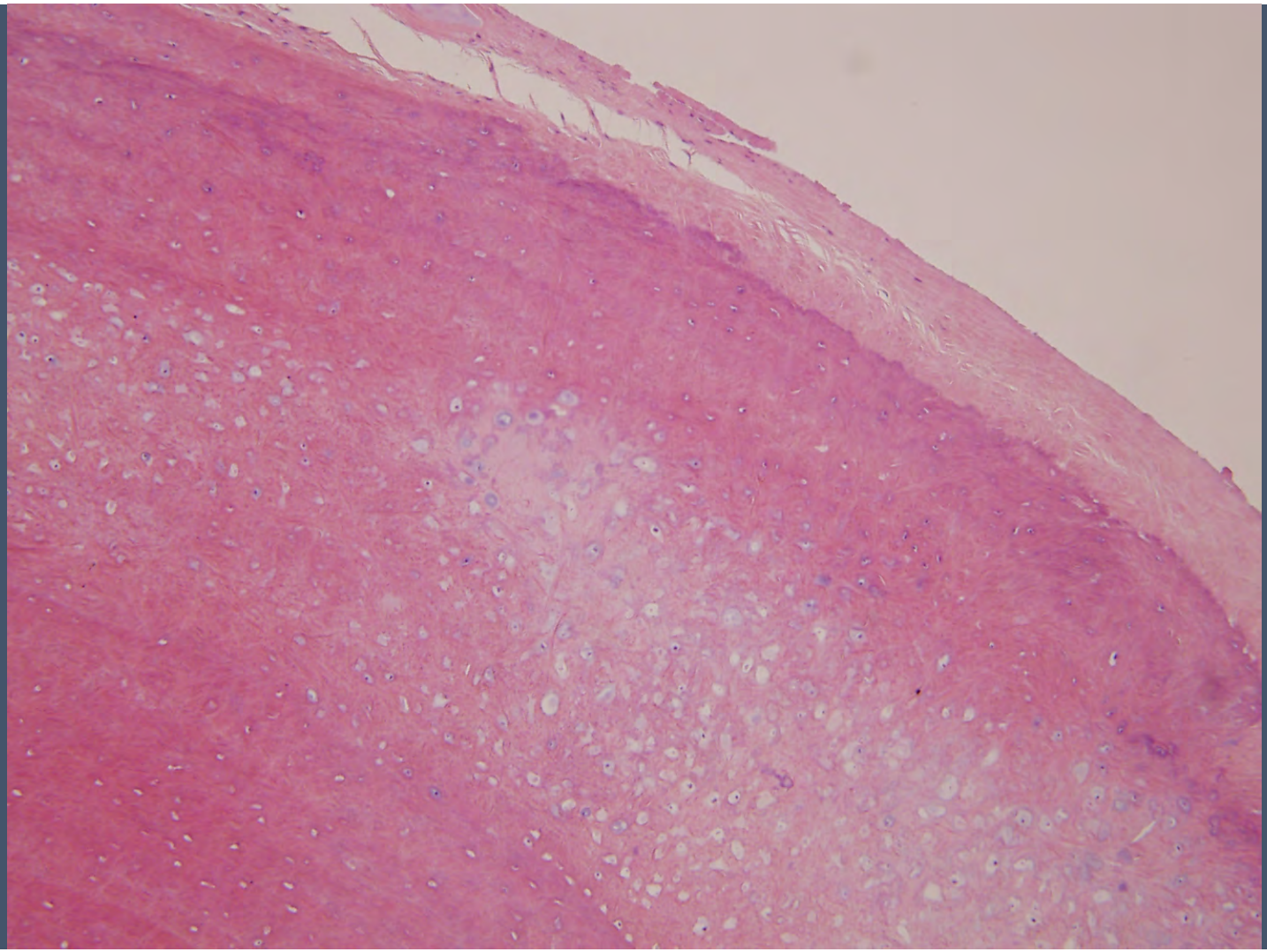

Sagittal
Spin: -101
Tilt: 0


T2
T1 FS
T1
T1 FS C+

PATHOLOGY







Osteochondroma/Exostosis

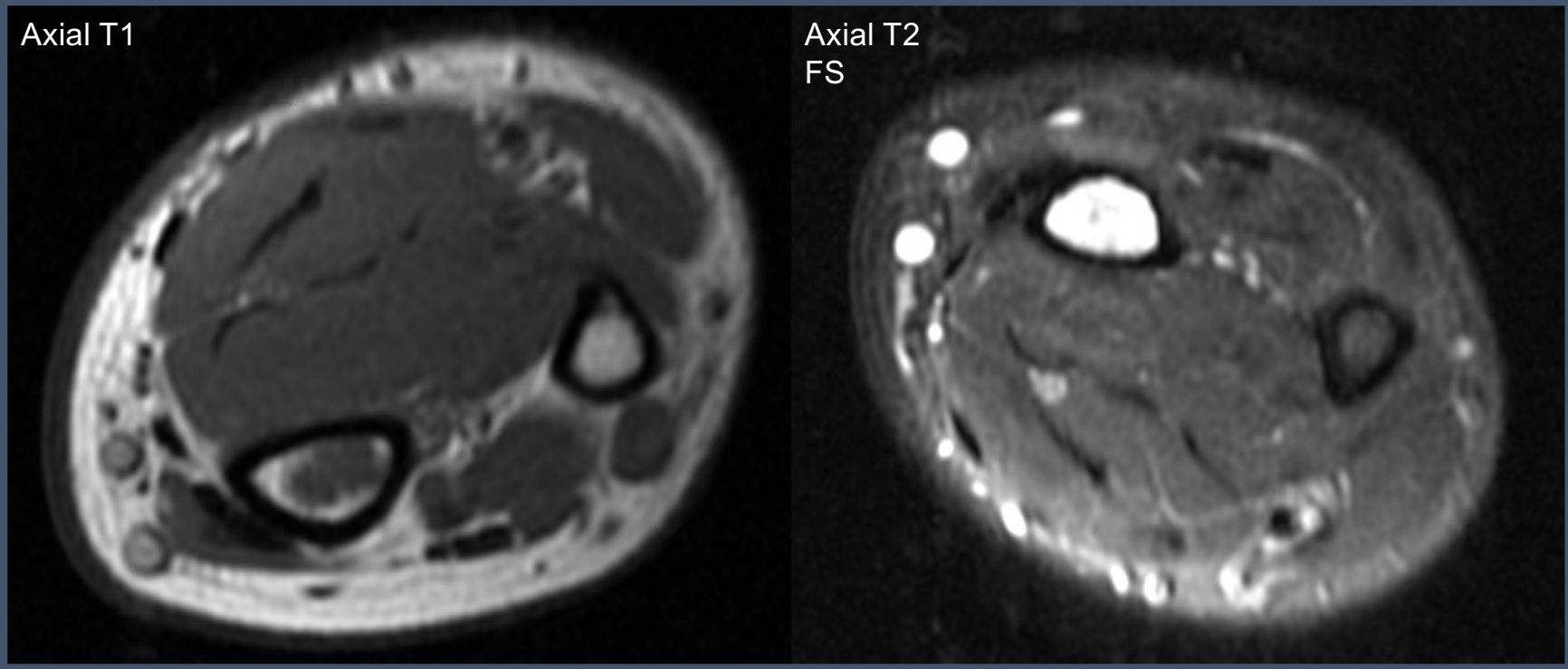
- Bony lesion arising from surface of bone demonstrating cortical and marrow continuity covered by a cartilaginous cap
  - Result from displaced growth plate cartilage, which causes lateral bone growth from the metaphyseal region.
- Most common bone tumor ~3% of the population
- Malignant degeneration of the cartilage cap to chondrosarcoma in <1% of cases
- Hereditary Multiple Exostosis (AD)
  - Higher incidence of malignant degeneration.
- Treatment
  - Asymptomatic: conservative management
  - Symptomatic, mechanical complications (bursa formation, nerve irritation, impingement, etc.), or concern for malignant degeneration: marginal or wide resection

Osteochondroma Imaging

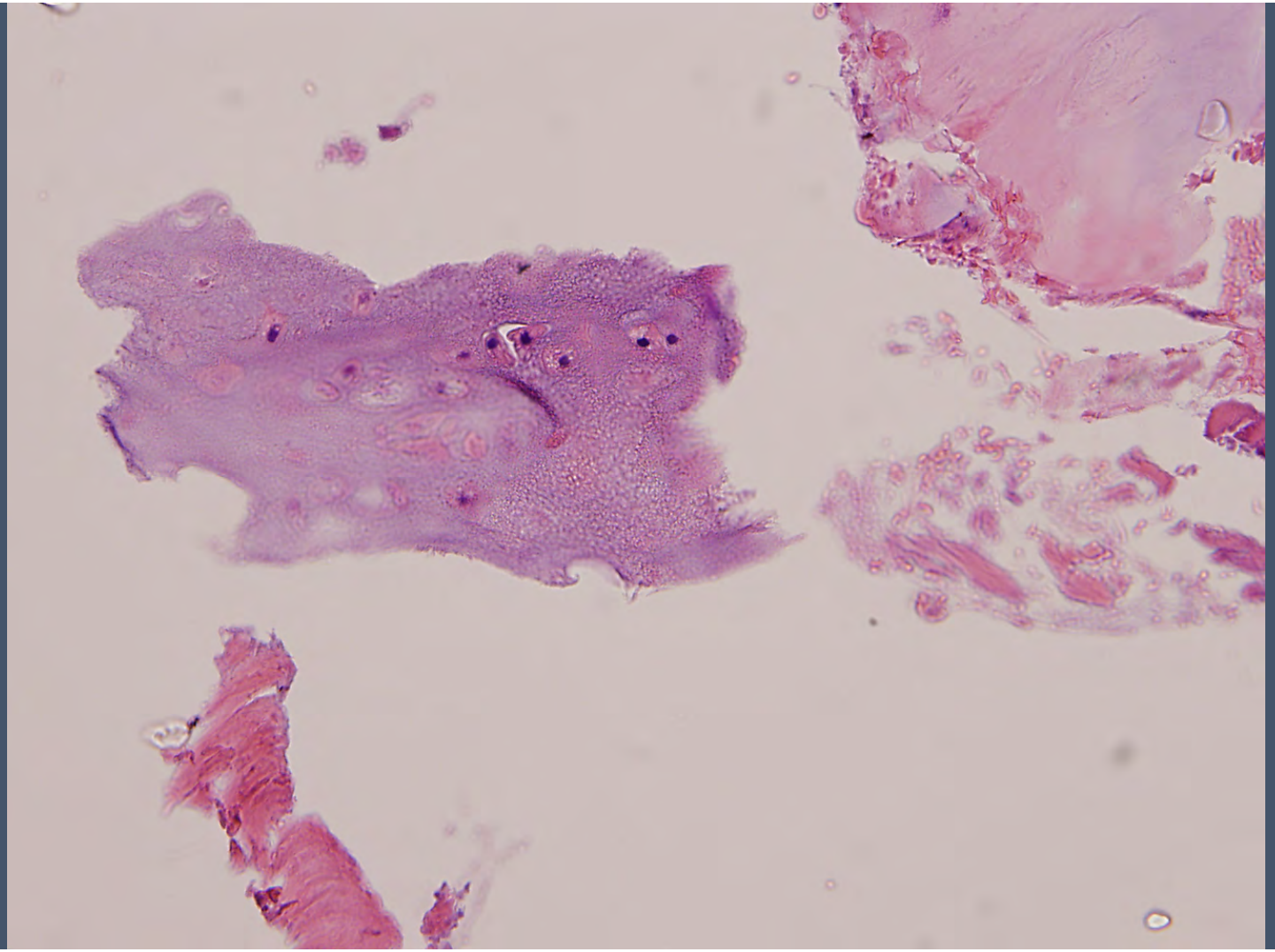
- Bony lesion arising from surface of bone with cortical and marrow continuity
- Cartilage cap (source of growth) covers the exostosis.
  - Generally < 1 cm thick in adults.
  - Chondroid matrix may be seen within the cartilaginous cap.
  - Low-intermediate SI on T1W images and high SI on T2W images
- Bone scan: mildly increased uptake
- Consider malignant degeneration of the cartilage if:
  - Lesion growth following skeletal maturation
  - New pain, not related to other exostosis complication
  - Change in character of calcified matrix (snowstorm appearance), osseous destruction, or soft tissue mass
  - Cartilage cap > 1 cm in thickness

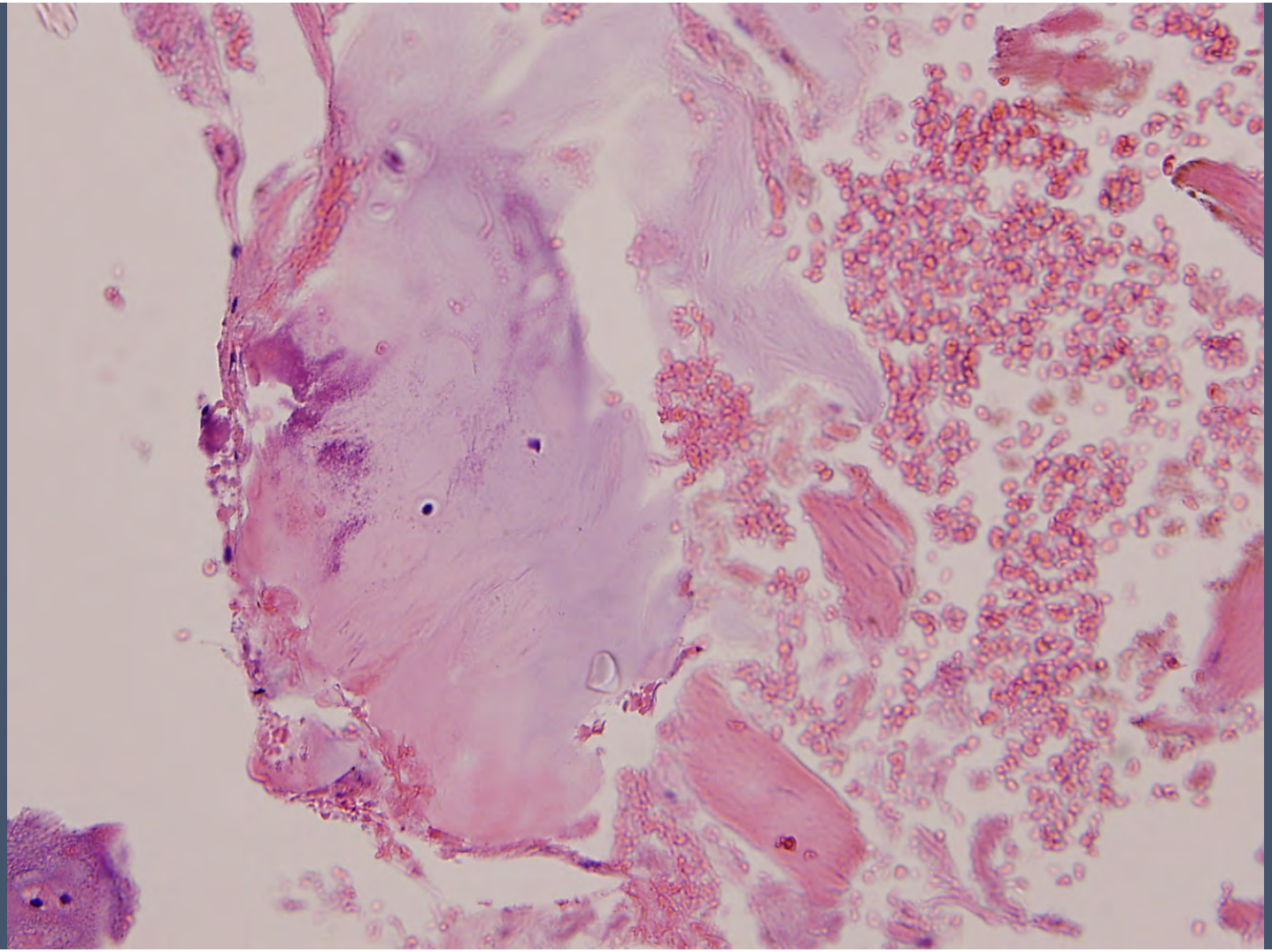
CASE 3

41M with tingling in his left arm


Axial T1
Axial T2
FS

PATHOLOGY





Enchondroma

- Benign tumor of hyaline cartilage originating in medullary bone
  - Residual benign cartilaginous rests that are displaced from the growth plate.
- Second most common benign bone tumor
- Most common tumor of phalanges of hand
- Frequently discovered incidentally on radiographs, they are usually asymptomatic in the absence of pathologic fracture or malignant transformation.
- Treatment:
  - Incidentally noted: observation
  - Large enchondromas ± clinical symptoms: marginal or wide resection

Enchondroma Imaging

- Discrete geographic lesion with lobulated margins.
- Mildly expanded bony margins and cortical thinning.
  - Lesions in the small tubular bone may present with a pathologic fracture.
- Chondroid matrix: stippled (punctate), curvilinear (arcs and rings), or flocculent calcification
- MRI findings: Lobulated lesion with high signal on T2W MR images and peripheral, septal enhancement.
- Bone Scan: increased uptake in 30%
- Major differential consideration at sites other than the hands and feet is low-grade chondrosarcoma (can be indistinguishable from enchondroma on all imaging studies).
- Consider malignant degeneration if: pain, deep endosteal scalloping (> 2/3 cortical thickness), cortical breakthrough, soft-tissue mass, bone marrow edema.

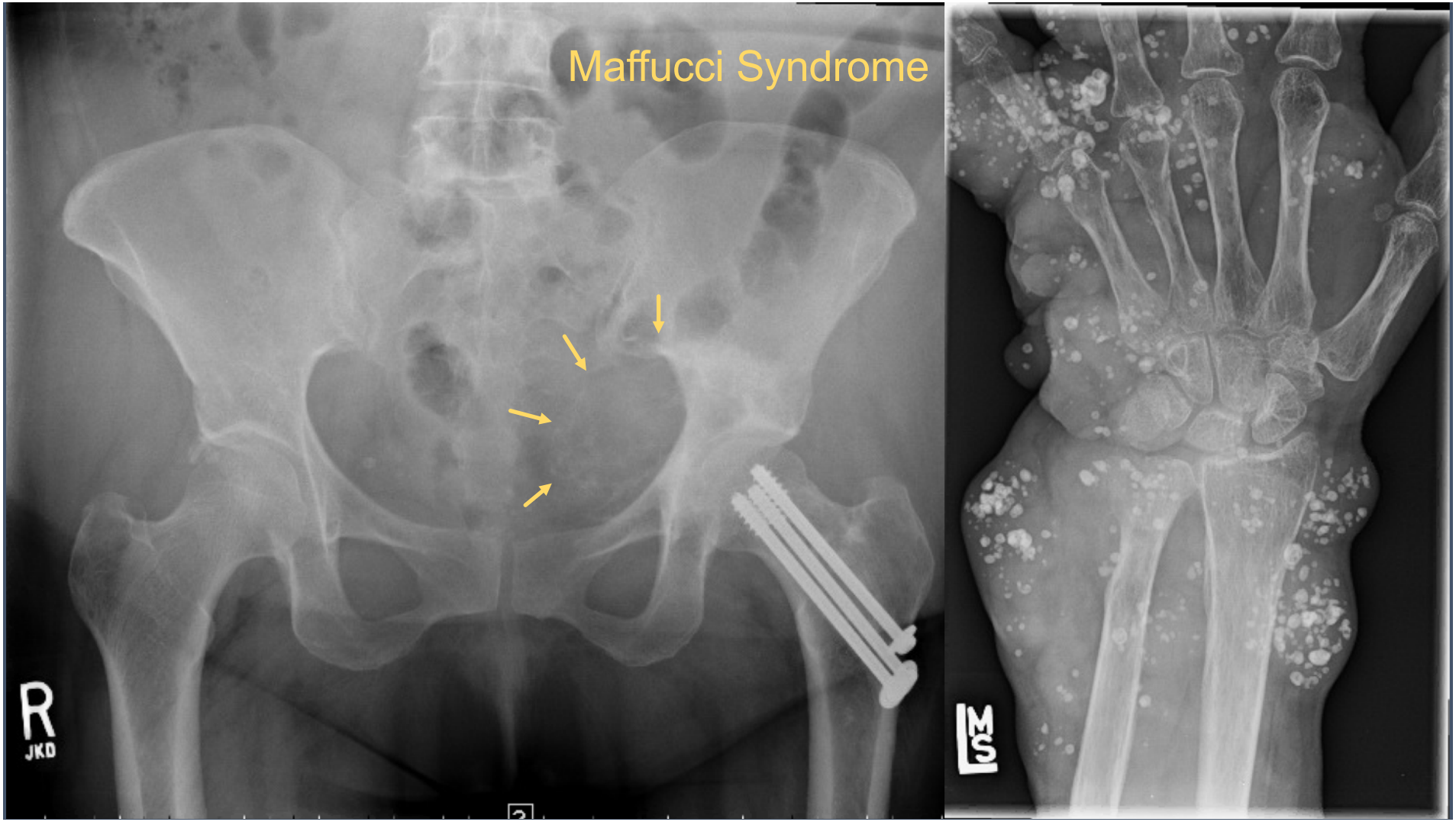
Multiple enchondromatosis

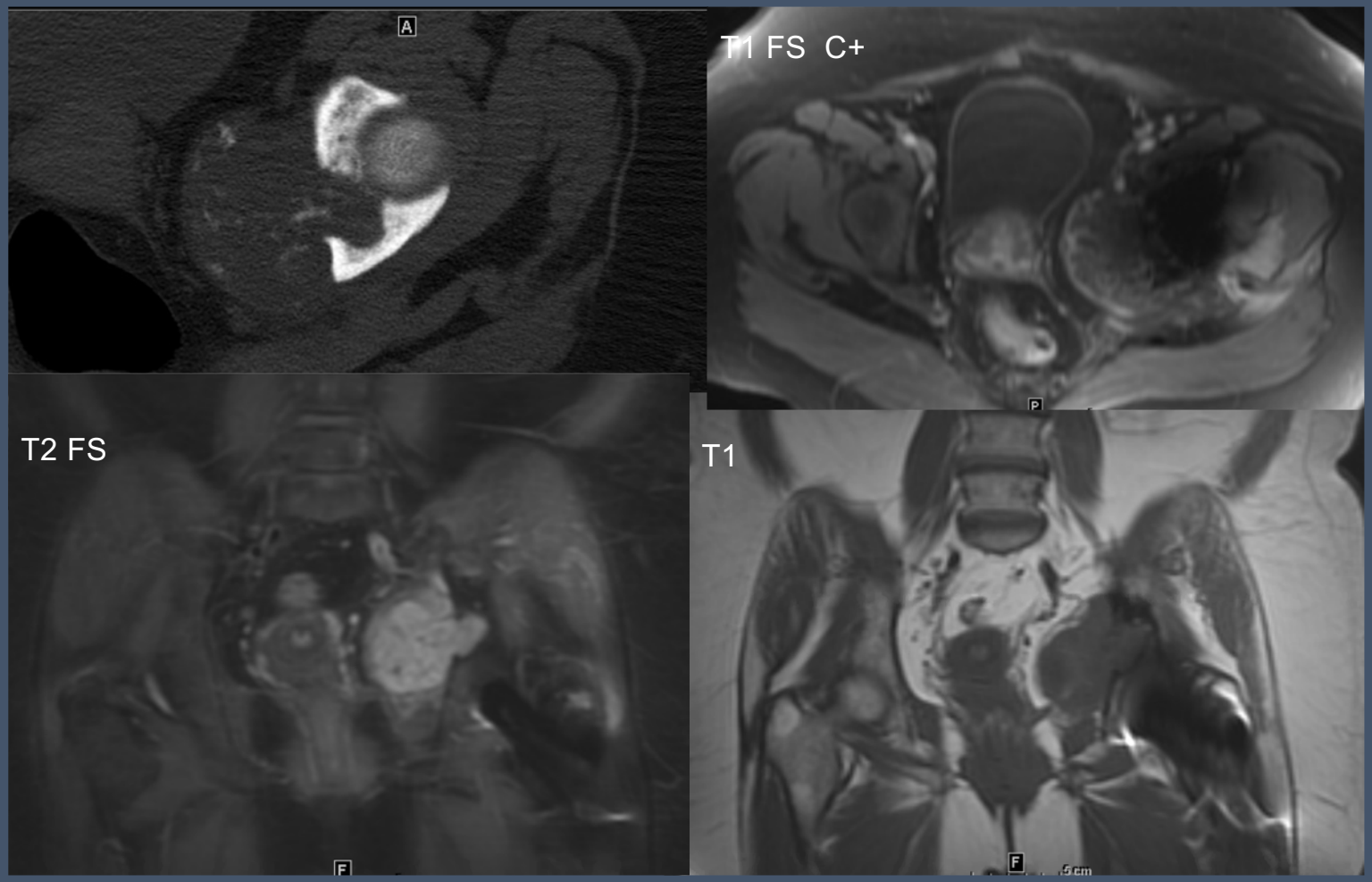
Ollier Disease: Multiple enchondromas.

Maffucci Syndrome: Multiple enchondromas plus venous malformations (phleboliths).

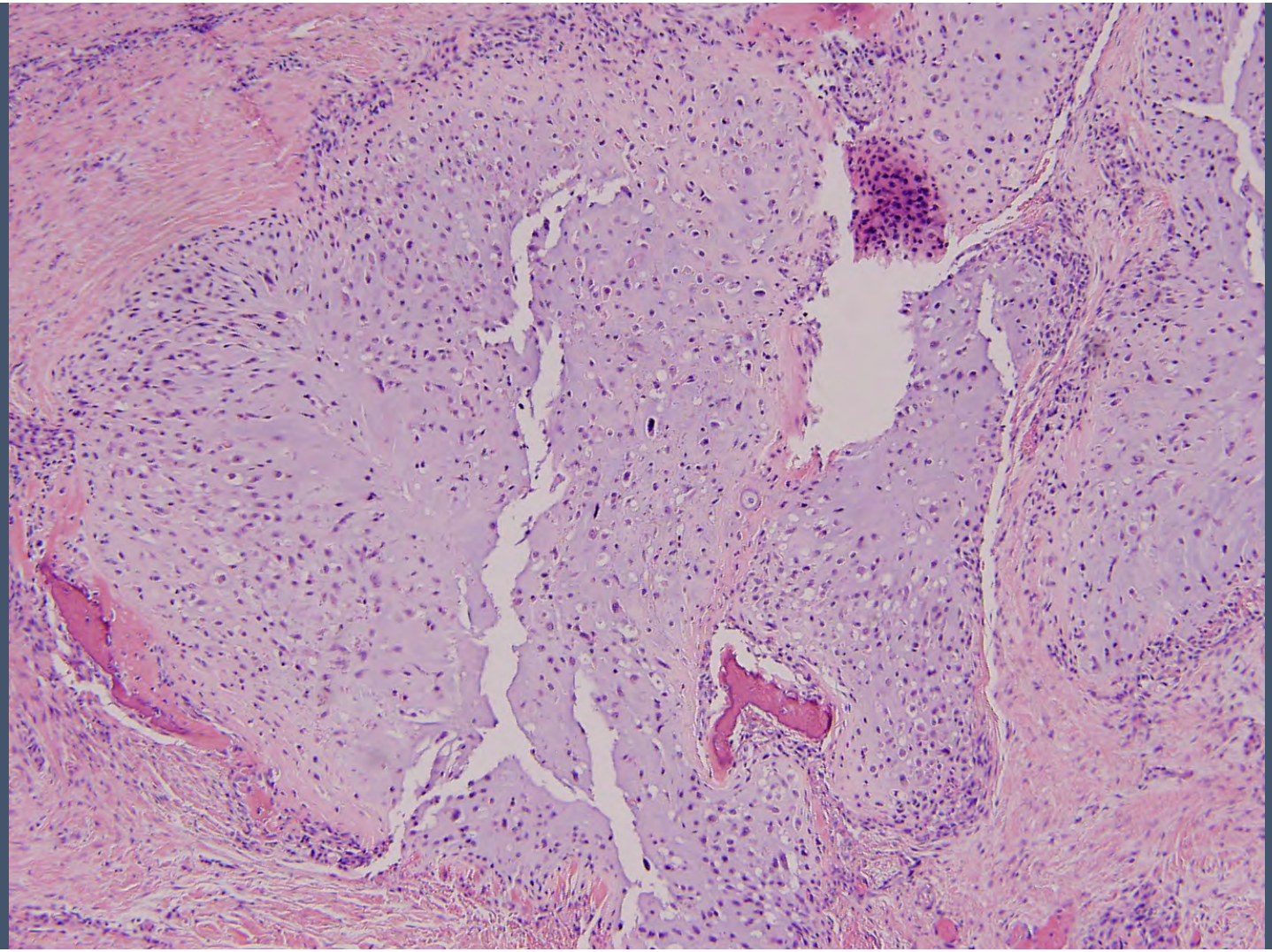
CASE 4

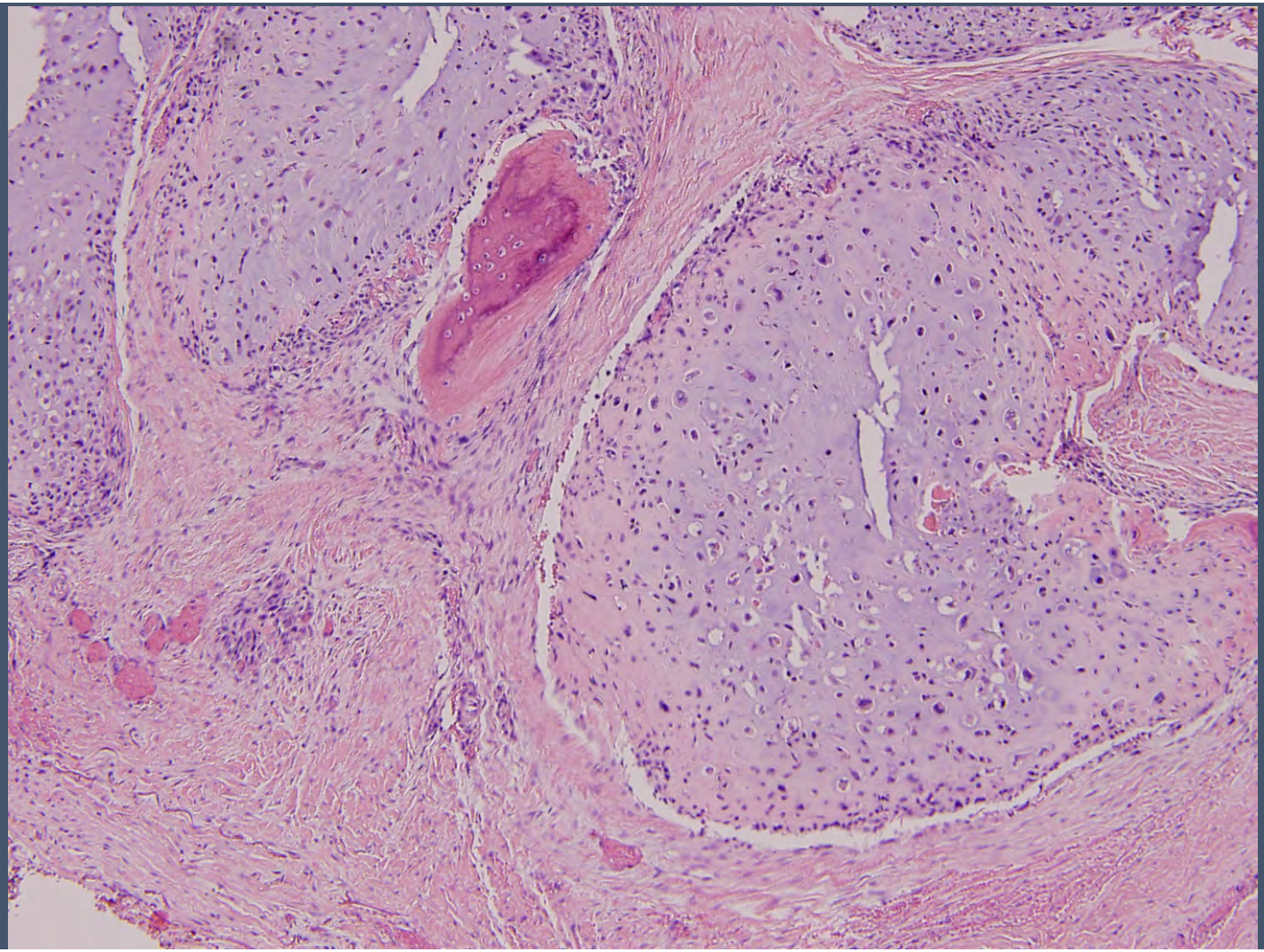
52F with left hip pain

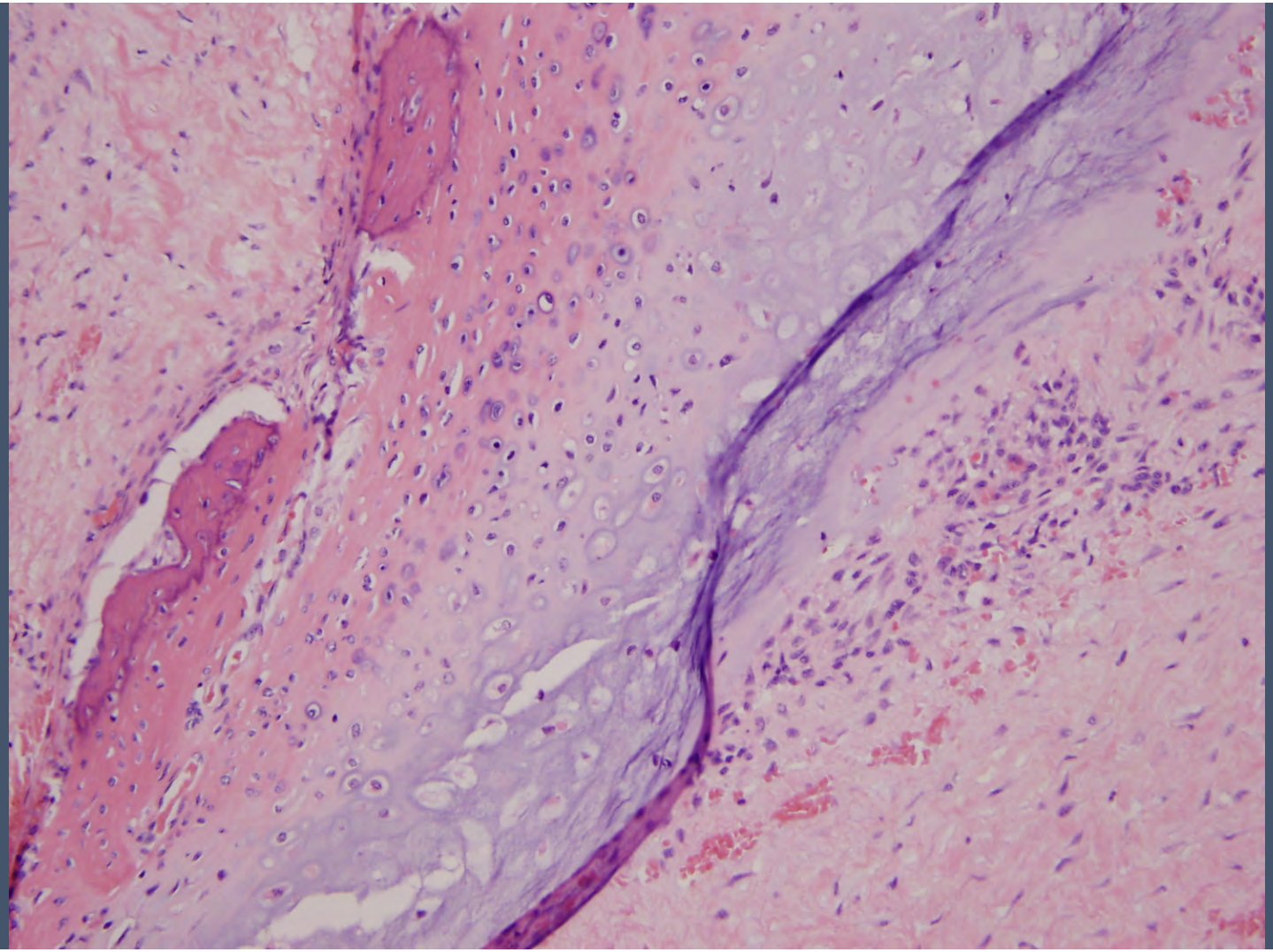

Maffucci Syndrome
R
JKD
MS


A
T1 FS C+
P
T2 FS
F
T1
F

PATHOLOGY







Chondrosarcoma

- Malignant hyaline cartilage tumor
- Third most common primary malignant bone tumor
- Peak incidence: 50-70 years of age
- Primary CS: originates centrally in previously normal bone
- Secondary CS (most common): originates in cartilaginous precursor
  - Enchondroma: Rate of degeneration of solitary enchondroma unknown
    - Rate of degeneration in Ollier ~ 25%
    - Rate of degeneration in Maffucci ~ 25%
  - Osteochondroma: Rate of degeneration of solitary lesion < 1%
    - Rate of degeneration in Multiple Hereditary exostosis ~ 3%
- Treatment: Wide excision

Chondrosarcoma Imaging

Intramedullary CS (primary or secondary)

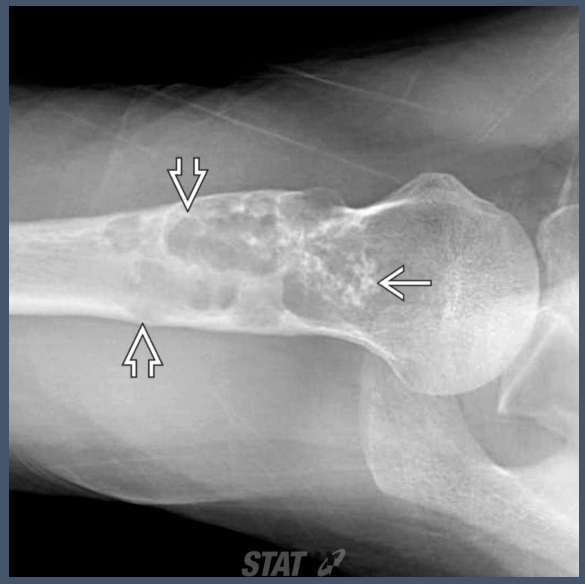
- Lytic lesion arising centrally in metaphysis or diaphysis, endosteal scalloping 2/3 width of cortex (75% of CS), cortical breakthrough, soft tissue mass, ± chondroid matrix.
- Lobulated mass with high signal on T2WI (appearance of cartilage)
- Peripheral and septal enhancement

Exophytic CS (secondary)

- Underlying osteochondroma with cartilage cap > 1 cm thick

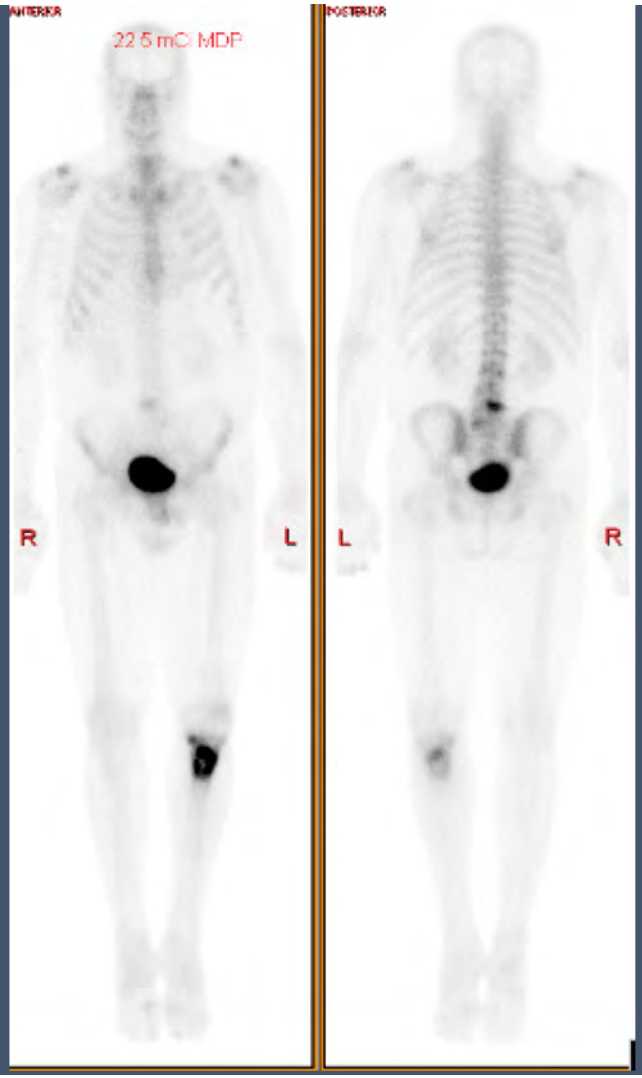
Difficult to distinguish between benign and low-grade malignant cartilaginous tumors based on imaging. Consider malignant degeneration if:

- New-onset nonmechanical pain
- Lesion growth after growth plate closure



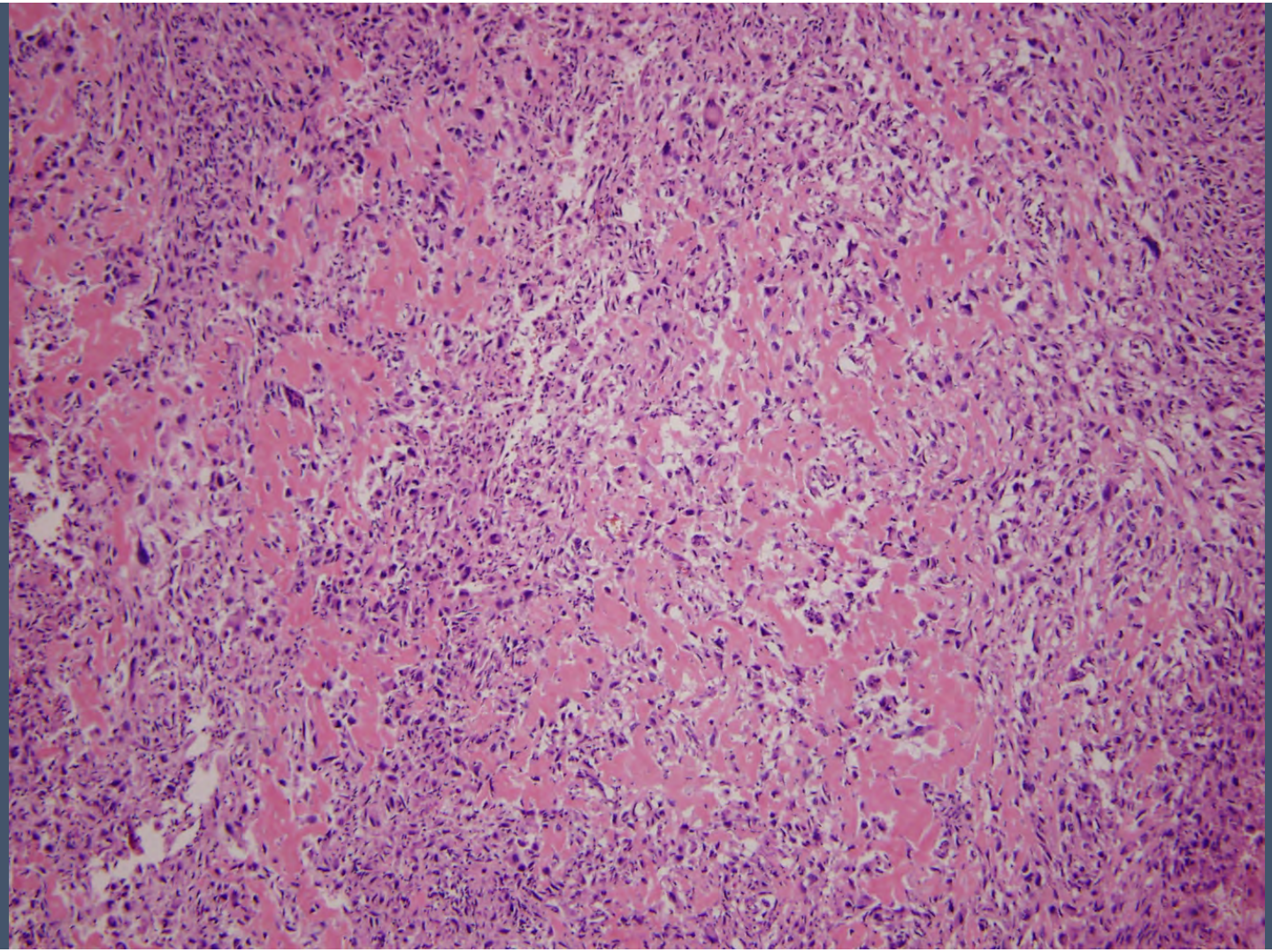
CASE 5

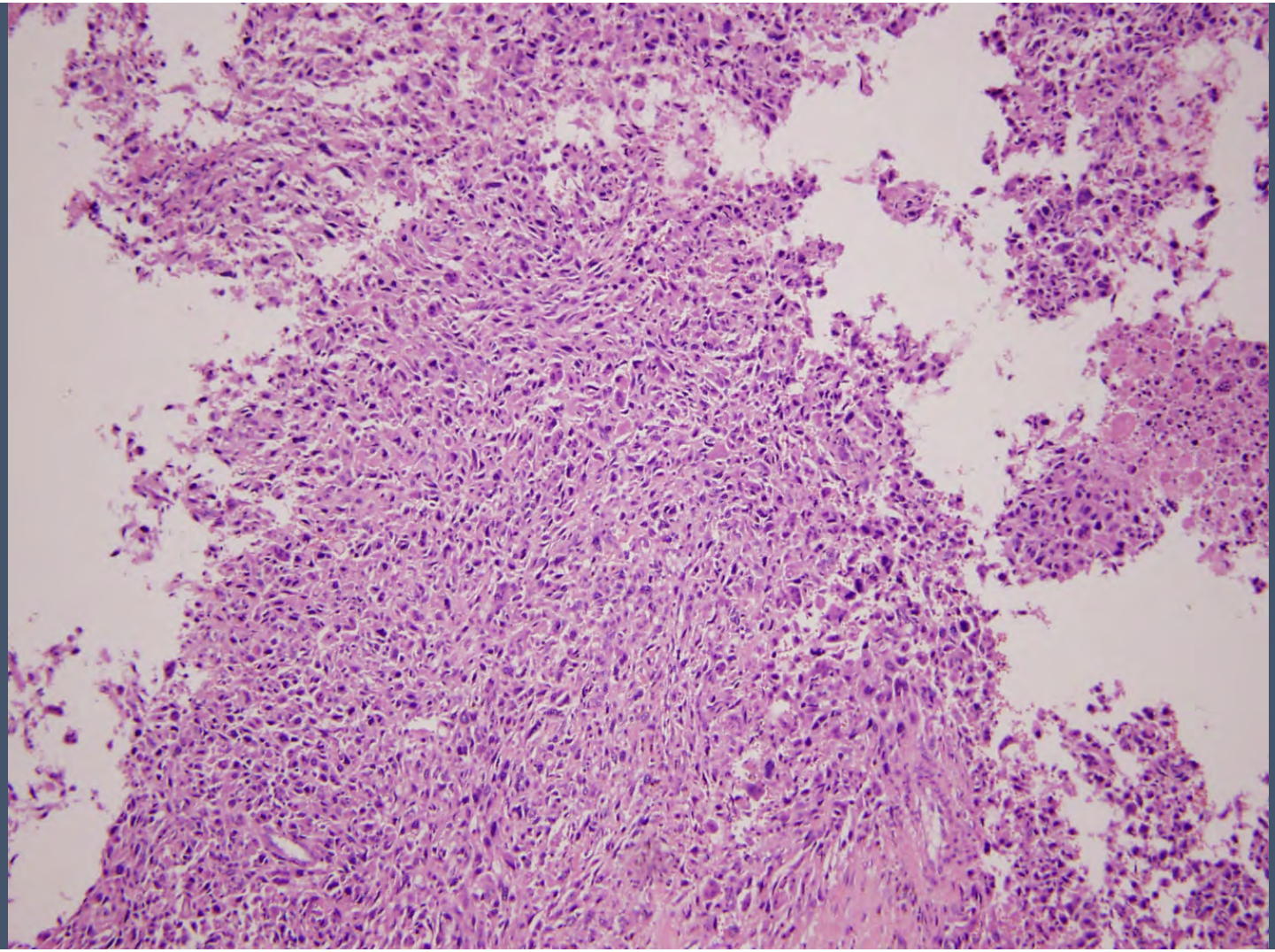
60M with left knee pain

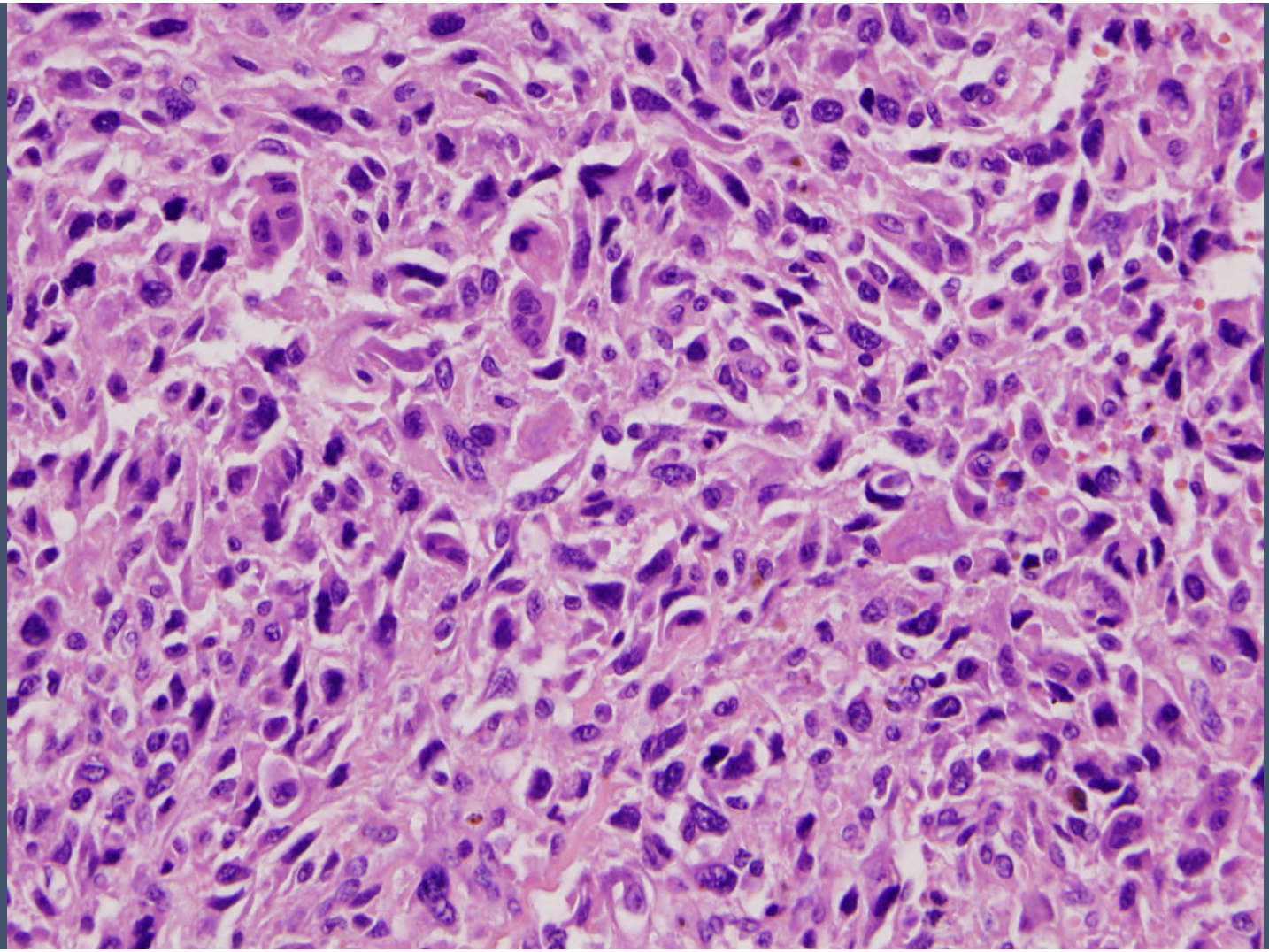

ANTERIOR
22.5 mCi MDP
R
L
POSTERIOR
L
R


T2 FS
T1
T1 FS
C+

PATHOLOGY







Conventional Osteosarcoma

- Malignant osteoid-producing tumor originating in intramedullary space.
- Most common primary malignant bone tumor in children/adolescents
  - 75% occur in patients < 25 years of age
- Second most common malignant bone tumor overall (multiple myeloma most common)

Metastases are found in 5% to 10% of patients at clinical presentation.

- Treatment
  - Induction chemotherapy
  - Wide surgical excision
  - Adjuvant chemotherapy
- Local recurrence and systemic disease usually occur within 2 years after initial diagnosis.
  - Relapses: 80% in the lung and 20% in bone

Conventional OS Imaging

- Occurs at the sites of most rapid growth
  - Distal femur > proximal tibia > proximal humerus
- Permeative lesion with wide zone of transition
- Cortical breakthrough with soft-tissue mass
- Aggressive periosteal reaction: Codman triangle, hair-on-end, or sunburst appearance
- Osteoid matrix (ex. cloud-like) in 90% of the cases, pathognomonic if present in the soft-tissue mass
- Density ranges from intensely sclerotic to lytic (80% of OS in adults older than age 60)
- Enhancement of soft tissue mass

References

- Helms et al. *Muculoskeletal MRI*. 2nd ed.
- Manaster BJ et al. *Musculoskeletal Imaging: The Requisites.* 4th ed.
- Mandell J. *Core Radiology*.
- Reeder et al. *Reeder and Felson's Gamuts in Radiology*. 4th ed