AMSER Case of the Month January 2025

A 78-year-old male presents to the ER with right groin and right knee pain

Majd Abuaita, OMS4

Alabama College of Osteopathic Medicine

Deborah Brahee, MD

Cleveland Clinic

Patient Presentation

HPI: 78-year-old male presents to the ED with right groin and knee pain after working out at his home gym a few days prior. His pain began 2 hours after his workout. Pain worse with walking/standing.

PMHx: Afib (on Eliquis), COPD, HF, HIV (on Biktarvy), HTN

PSHx: None

Social History: Currently smokes 1/2 ppd

Vitals: BP 158/74, otherwise unremarkable

Physical Examination:

No bruising noted in groin or knee region

Tender to palpation at R groin & diffuse R knee, inferior inguinal ligament;
no palpable hernia with/without Valsalva

Weak with R lower extremity ROM

Pertinent Labs:

CBC, BMP, CRP, ESR, hA1C within normal limits; UA with hematuria

What Imaging Should We Order?

ACR Appropriateness Criteria

This imaging modality was ordered by the ER provider

Acute Hip Pain-Suspected Fracture

Variant 1: **Acute hip pain. Fall or minor trauma. Suspect fracture. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
Radiography hip	Usually Appropriate	☢☢☢
Radiography pelvis	Usually Appropriate	☢☢
Radiography pelvis and hips	Usually Appropriate	☢☢☢
CT pelvis and hips with IV contrast	Usually Not Appropriate	☢☢☢
CT pelvis and hips without and with IV contrast	Usually Not Appropriate	☢☢☢☢
CT pelvis and hips without IV contrast	Usually Not Appropriate	☢☢☢
MRI pelvis and affected hip without and with IV contrast	Usually Not Appropriate	O
MRI pelvis and affected hip without IV contrast	Usually Not Appropriate	O
Bone scan hips	Usually Not Appropriate	☢☢☢
US hip	Usually Not Appropriate	O

ACR Appropriateness Criteria

Variant 2: **Suspected groin hernia such as inguinal or femoral. Initial imaging.**

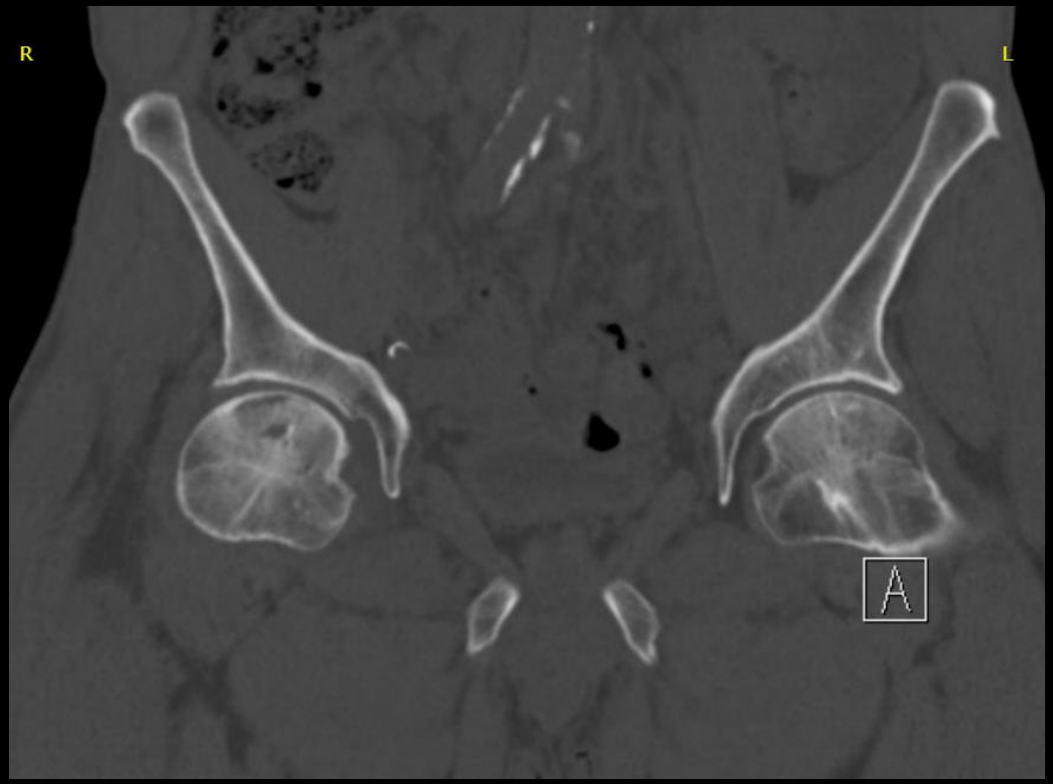
Procedure	Appropriateness Category	Level
US pelvis	Usually Appropriate	
MRI pelvis without and with IV contrast	Usually Appropriate	O
CT abdomen and pelvis with IV contrast	Usually Appropriate	☢☢☢
CT abdomen and pelvis without IV contrast	Usually Appropriate	☢☢☢
CT pelvis with IV contrast	Usually Appropriate	☢☢☢
CT pelvis without IV contrast	Usually Appropriate	☢☢☢
MRI pelvis without IV contrast	May Be Appropriate	O
Radiography abdomen and pelvis	Usually Not Appropriate	☢☢
Fluoroscopy small bowel follow-through	Usually Not Appropriate	☢☢☢
CT abdomen and pelvis without and with IV contrast	Usually Not Appropriate	☢☢☢☢
CT pelvis without and with IV contrast	Usually Not Appropriate	☢☢☢☢

This imaging modality was ordered by the ER provider

Findings (Unlabeled)

X-ray Hip and Pelvis

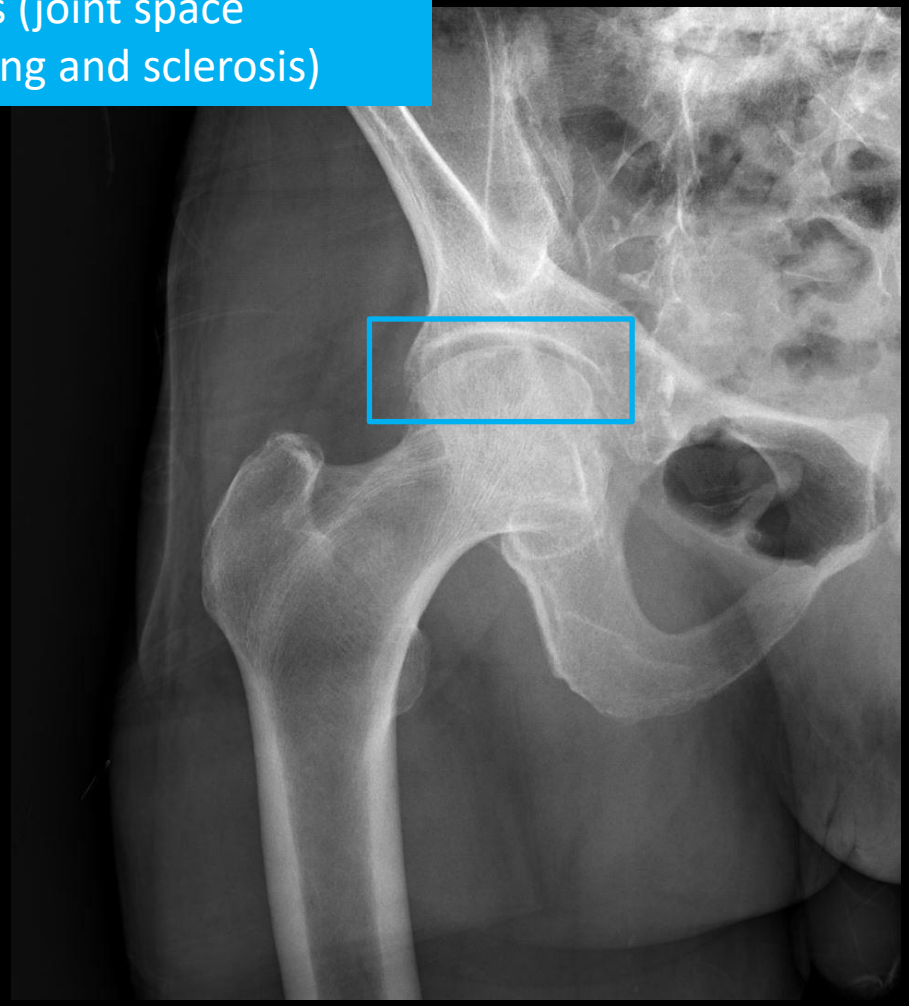
Findings (Unlabeled)



CT Hips without contrast

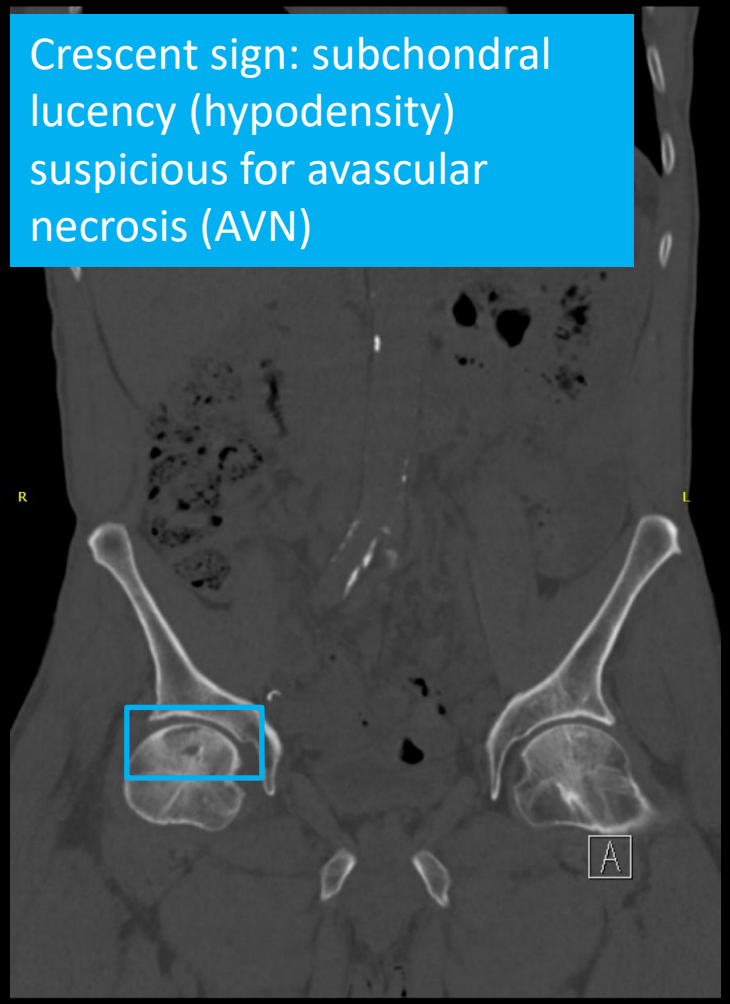
Subchondral lucency with adjacent degenerative changes (joint space narrowing and sclerosis)

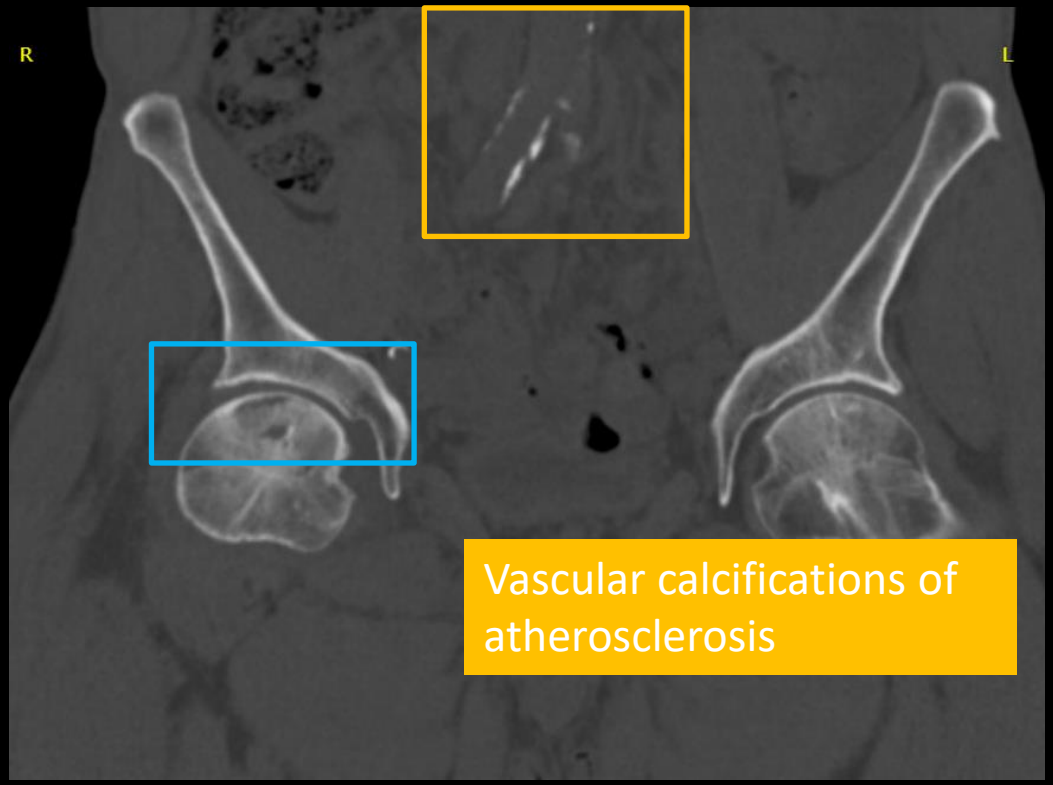
Findings (Labeled)



X-ray Hip and Pelvis

Findings (Labeled)





CT Hips without contrast

What Imaging Should We Order?

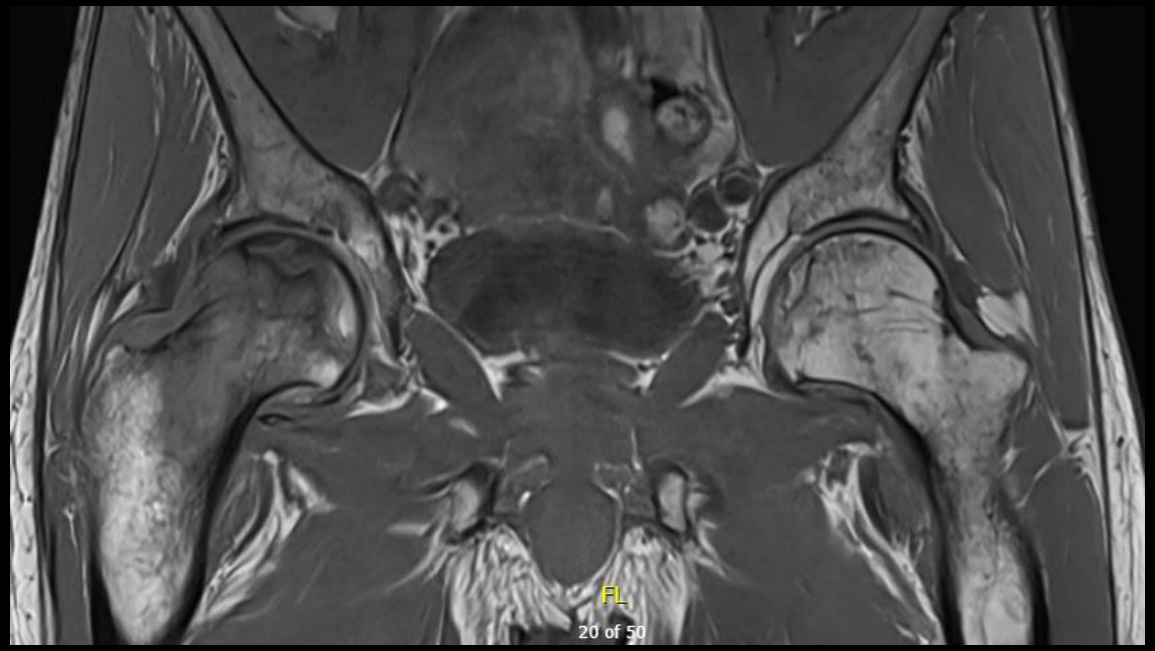
ACR Appropriateness Criteria

This imaging modality was ordered by ortho

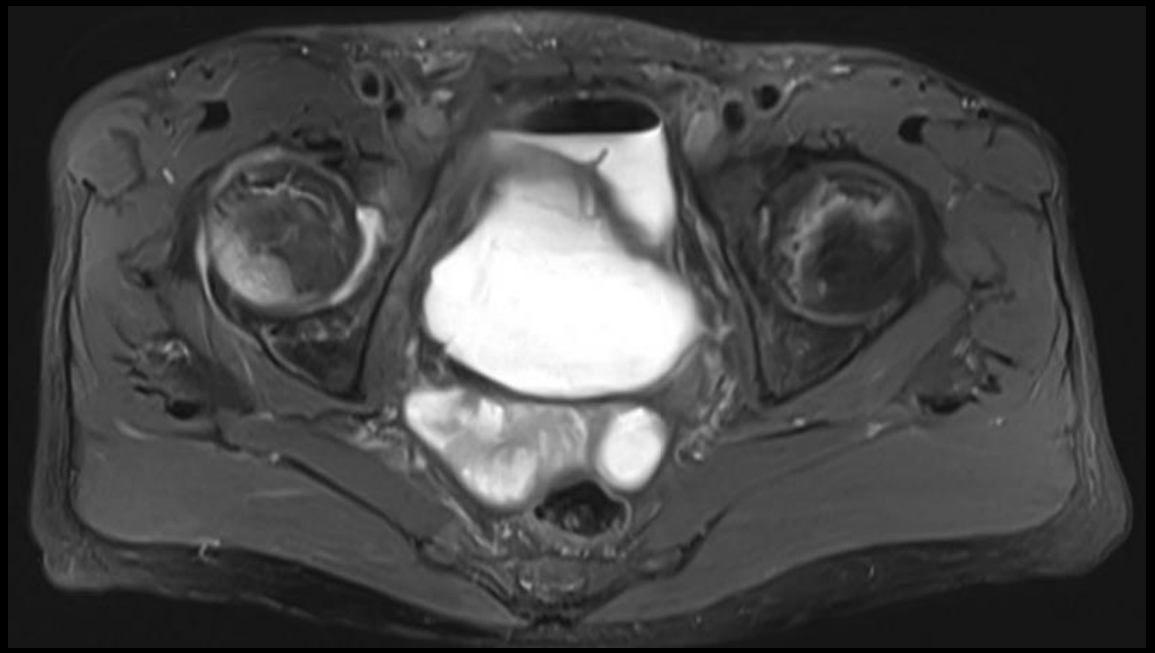
Variant 2: **Clinically suspected osteonecrosis. Normal radiographs or radiographs that show findings suspicious for osteonecrosis. Next imaging study.**

Procedure	Appropriateness Category	Relative Radiation Level
MRI area of interest without IV contrast	Usually Appropriate	O
MRI area of interest without and with IV contrast	May Be Appropriate	O
CT area of interest without IV contrast	May Be Appropriate (Disagreement)	Varies
Bone scan area of interest	Usually Not Appropriate	☢☢☢
CT area of interest with IV contrast	Usually Not Appropriate	Varies
CT area of interest without and with IV contrast	Usually Not Appropriate	Varies

Findings (Unlabeled)



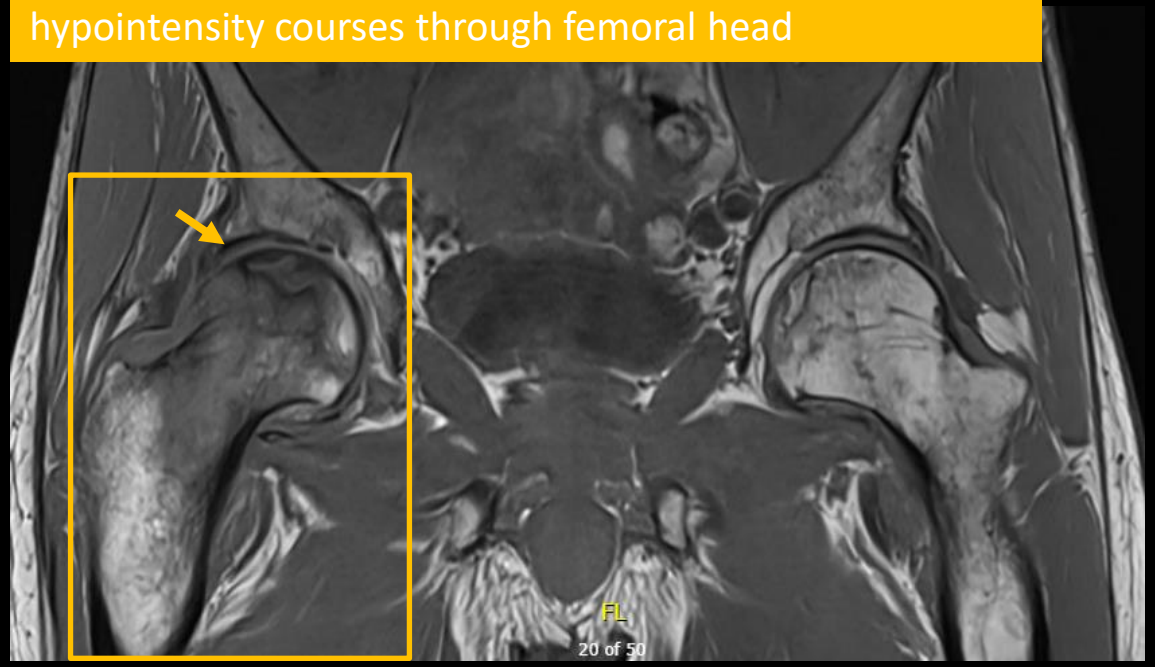
Coronal T1 weighted MRI of hips without contrast



Axial T2 weighted MRI of hips without contrast

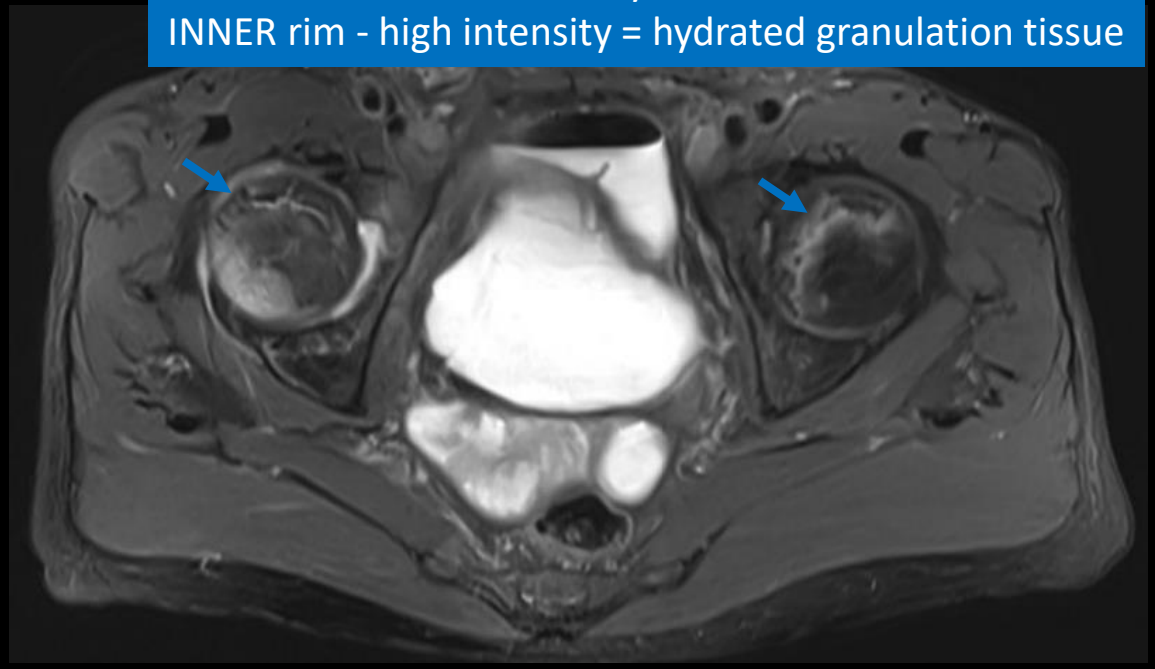
Findings (Labeled)

Bone marrow edema (decreased signal of femoral head/neck), curvilinear/serpiginous signal (arrow) hypointensity courses through femoral head



Coronal T1 weighted MRI of hips without contrast

Bilateral Double line sign:
OUTER rim - lower intensity = sclerosis
INNER rim - high intensity = hydrated granulation tissue



Axial T2 weighted MRI of hips without contrast

AMSER

Final Dx:

Osteonecrosis of the Femoral Head(s)

Secondary finding of non-obstructive renal calculi (not shown) likely explain hematuria

Osteonecrosis of the Femoral Head

Etiology: multiple.
Most common: glucocorticoid use* and alcoholism (> 80% of atraumatic cases); smoking; HIV; trauma (medial femoral circumflex artery); inherited diseases such as Sickle Cell and Gaucher Disease; primary idiopathic osteonecrosis AKA Legg-Calve-Perthes in the pediatric population (5 – 12-year-olds)

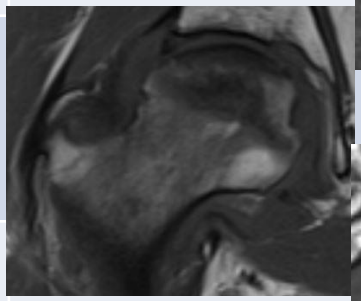
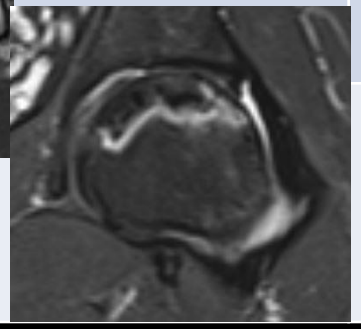
Pathogenesis: Interruption of blood flow within bone --> surrounding hyperemia + impaired angiogenesis --> failed repair --> demineralization of bone --> trabecular thinning --> collapse

Clinical signs and symptoms: Groin pain is most common in patients with femoral head disease; weight bearing or **motion inducing** pain; rest pain and nocturnal pain also common in 67% and 33% of patients, respectively. Most patients are asymptomatic initially/in earlier stages*

Diagnosis: Clinical symptoms + positive radiographic findings; MRI without contrast is gold standard, but not required

Treatment: Conservative management with PT, analgesia, anti-inflammatory therapy; surgical management (i.e. bone reshaping or grafting)

Osteonecrosis Radiographic Findings

Imaging Modality	Key Findings	Image Example	Sensitivity	Specificity
X-ray	Early: Normal* Late: subchondral lucency/fracture (Crescent sign) + joint space narrowing + surrounding sclerosis		30 - 60%	70 – 80%
CT	Early: subchondral lucency		70 - 80%	70 - 80%
MRI T1-weighted	Early: hypointense signal in femoral head (due to LOSS of fat signal secondary to edema and sclerosis)		71- 100%	94 - 100%
MRI T2-weighted	Early: hyperintense signal in femoral head AKA "Double Line" sign (pathognomonic for osteonecrosis)		71- 100%	94 - 100%

Osteonecrosis Staging: Ficat and Arlet Classification (most common)

Stage	Clinical Symptoms	Radiographic Finding
0	None	No radiographical findings on X-ray or MRI
I	Pain, especially in groin	X-ray: normal or mild osteopenia MRI: edema (hypointense signal on T1 weighted)
II	Pain + stiffness	X-ray: Mixed osteopenia/sclerosis and/or subchondral cysts MRI: geographic defect
III	Pain + stiffness +/- radiation to knee +/- limp	X-ray: + Crescent sign (subchondral lucency) MRI: + Crescent sign
IV	Pain + limp	X-ray: Secondary degenerative changes (joint space narrowing/osteoarthritis with articular collapse)

References:

- American College of Radiology. ACR Appropriateness Criteria®. Available at https://acsearch.acr.org/list. Accessed June 2024.
- Osteonecrosis of the Femoral Head: https://radiopaedia.org/articles/osteonecrosis-of-the-femoral-head?lang=us
- Ficat and Arlet Classification: https://radiopaedia.org/articles/ficat-and-arlet-classification-of-osteonecrosis-of-the-femoral-head
- Osteonecrosis of the Femoral Head: https://www.uptodate.com/contents/clinical-manifestations-and-diagnosis-of-osteonecrosis-avascular-necrosis-of-bone
- Osteonecrosis of the Femoral Head: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9076447/#:~:text=Osteonecrosis%20is%20a%20progressive%20disorder%20in%20which%20lack,and%20can%20ultimately%20necessitate%20total%20hip%20arthroplasty%20%28THA%29.
- Double Line Sign: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6440034/
- Perthes Disease Image: https://radiologyassistant.nl/pediatrics/hip/hip-pathology-in-children