

RADY 412 Segond Fracture

Shawn Ahuja, 08/17/22

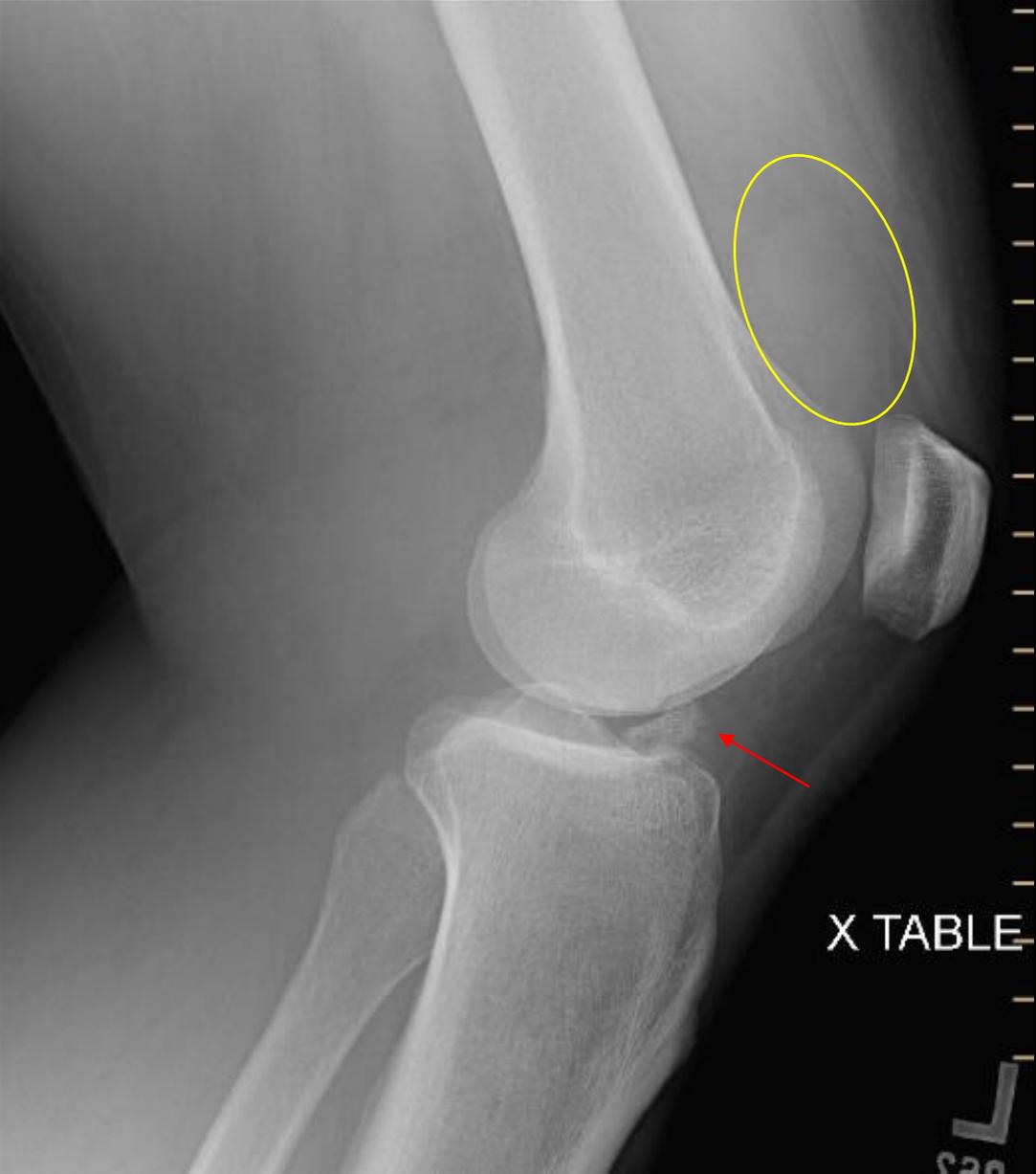
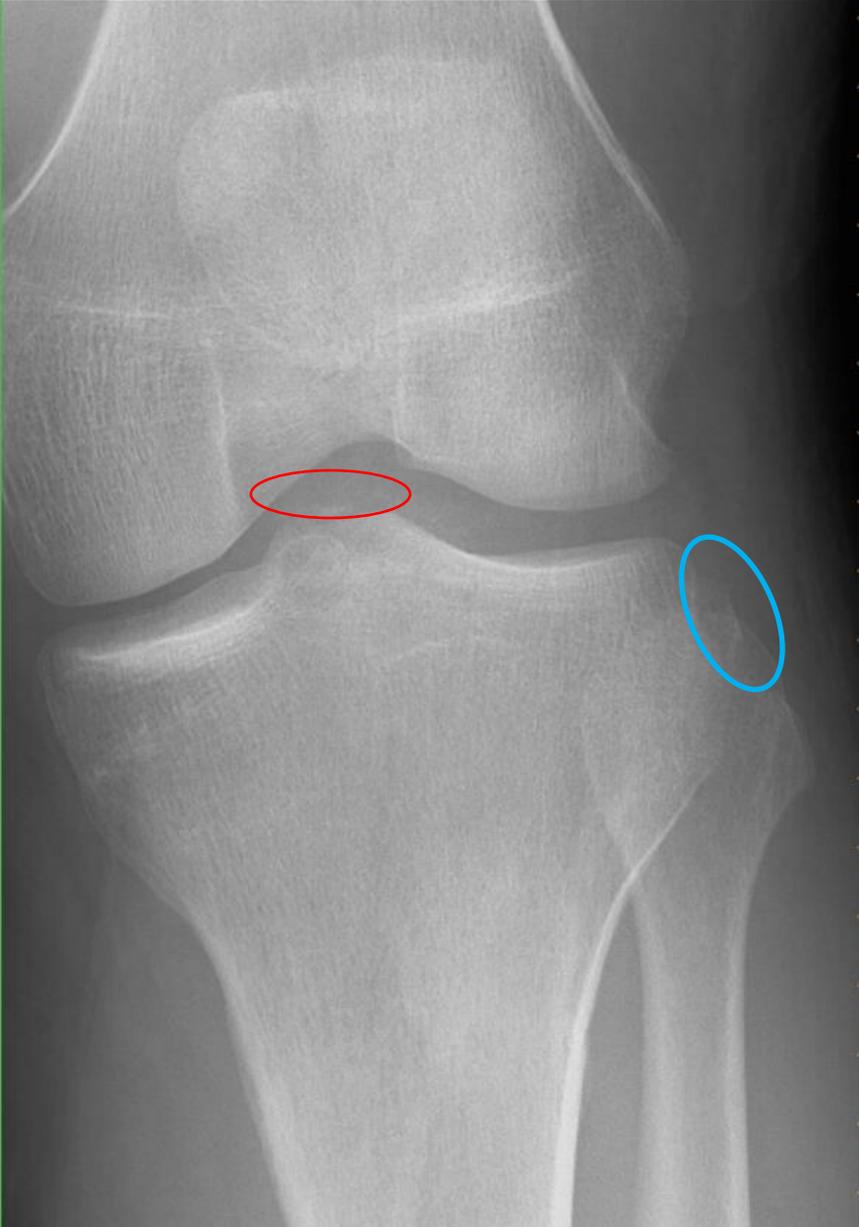
Focused patient history and workup

- 43 y/o male with noncontributory PMHx presenting to the ED with left knee pain.
- Patient was riding a scooter two days ago and attempted to brake by sticking out his left foot.
- Reports constant knee pain with ambulation since the incident with a few episodes of knee buckling.
- PE is significant for left knee swelling, + anterior drawer, but is otherwise normal.
- ROS, vitals, labs are otherwise normal. Denies pain at any other joint.

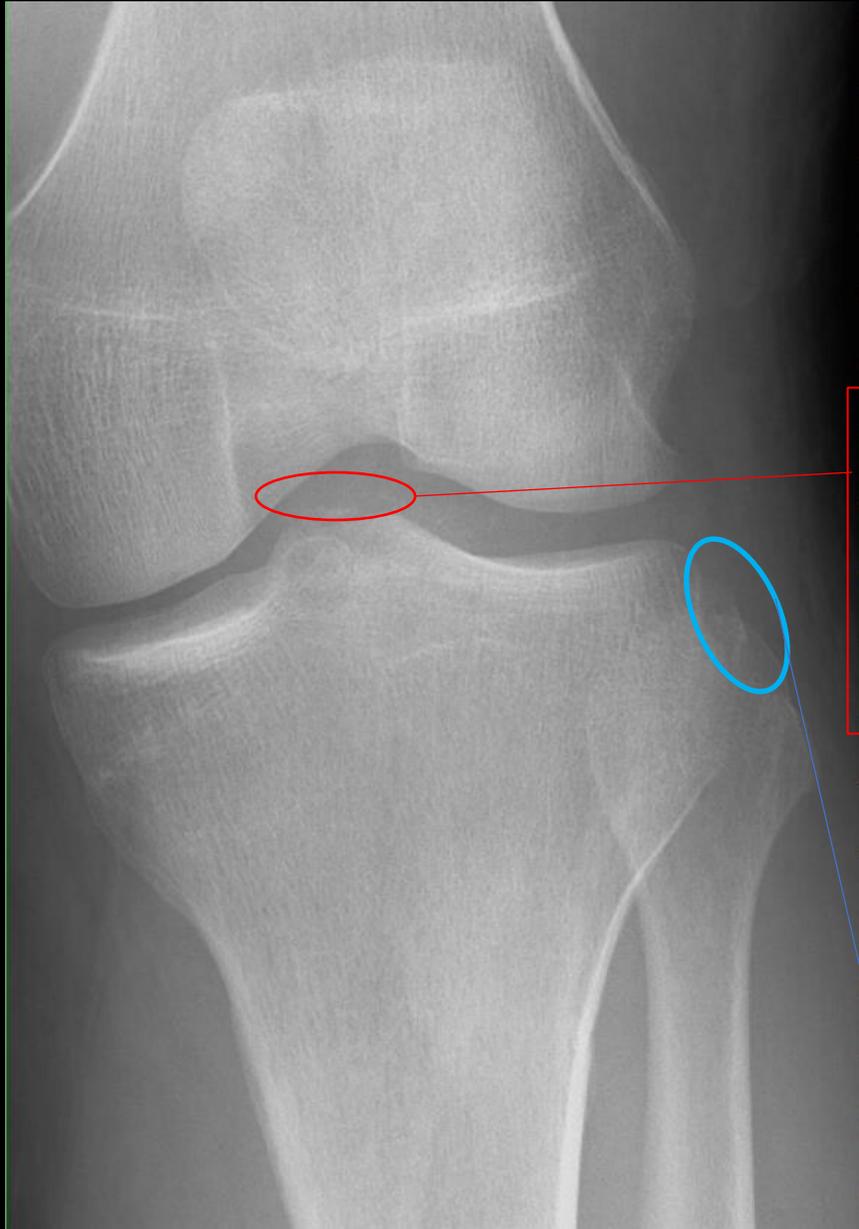
List of imaging studies

- X-Ray of the Knee (AP and cross table lateral views)
- Knee MRI (Coronal and Sagittal PD Fat Sat, different patient)

X-Ray (Knee, AP and Lateral)

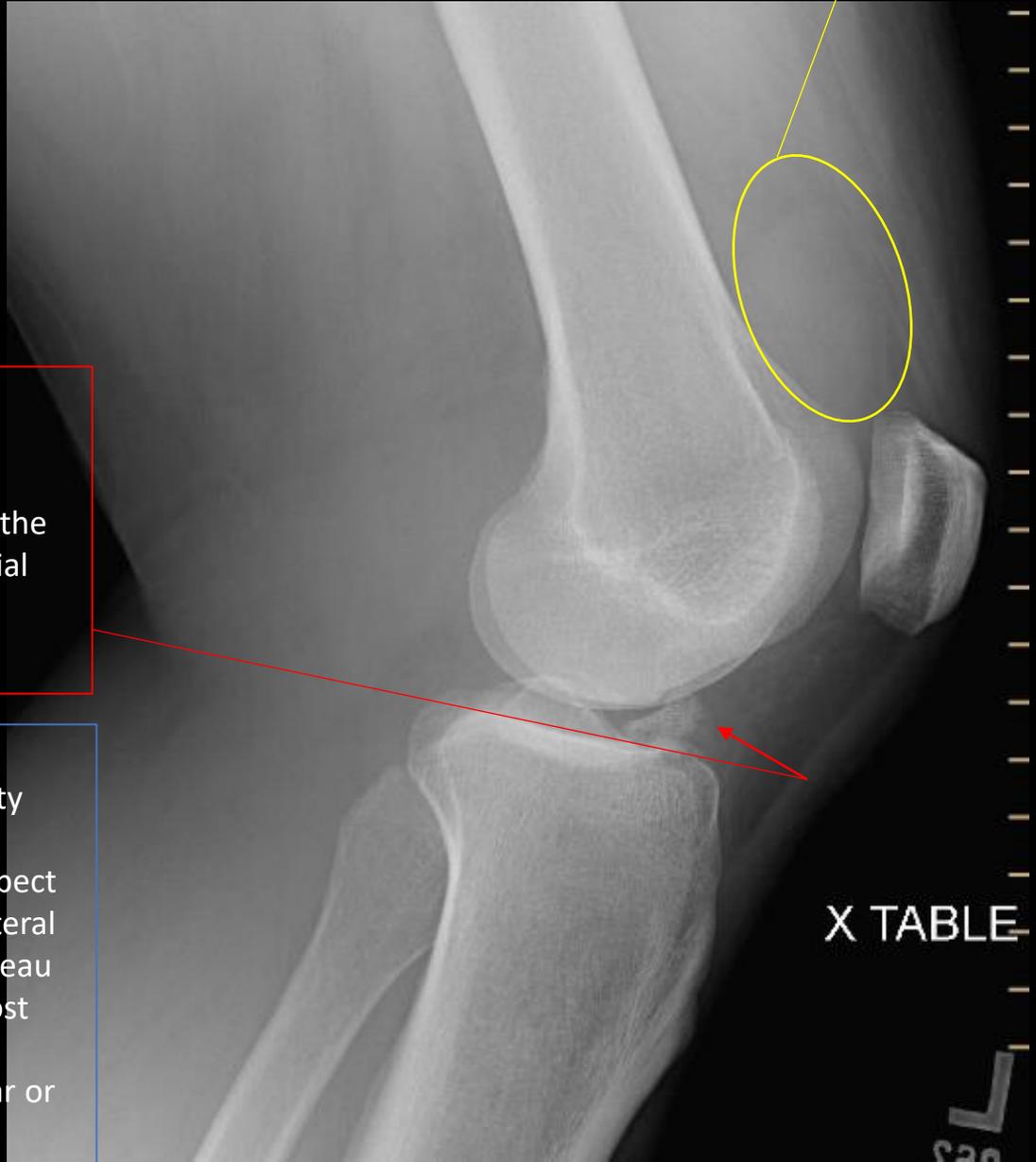


X-Ray (Knee, AP and Lateral)



Osseous fragment projects superior to the anterior tibial spine

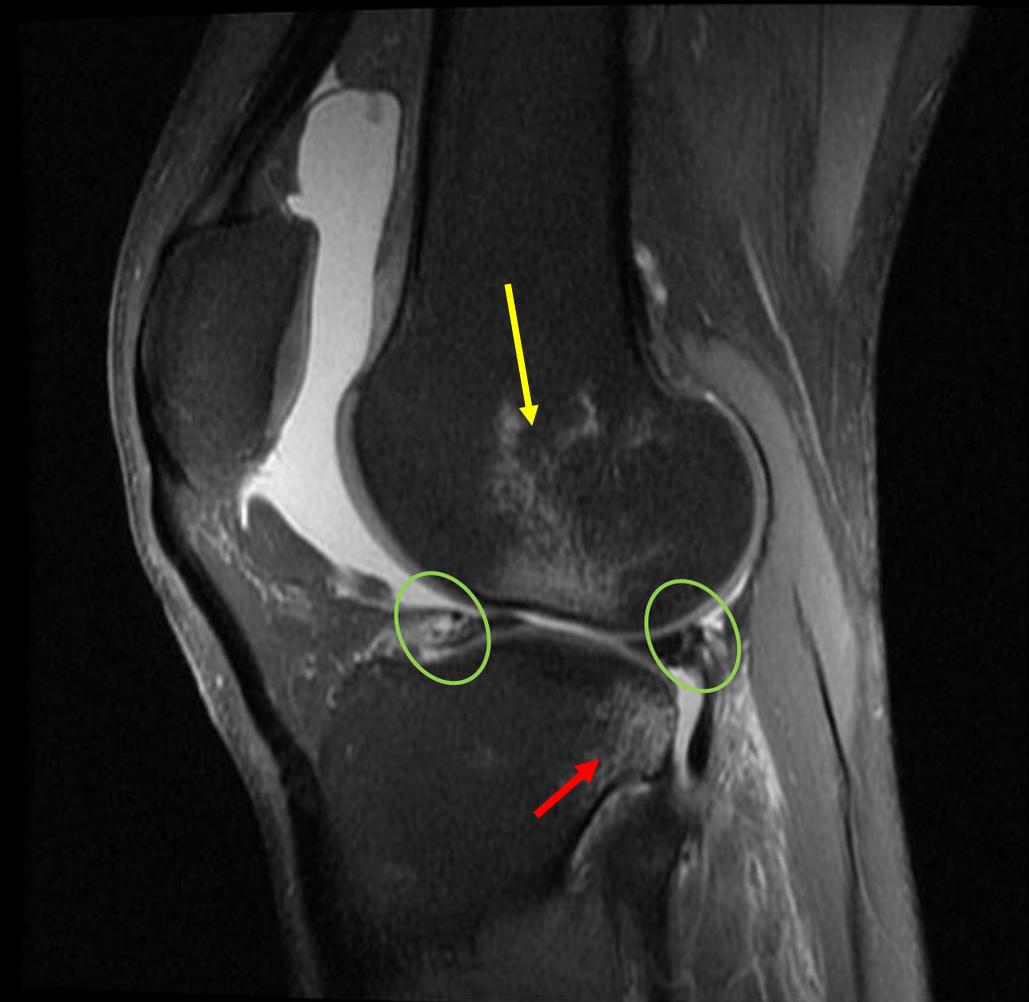
Cortical irregularity along the lateral aspect of the lateral tibial plateau that almost looks curivlinear or elliptical.



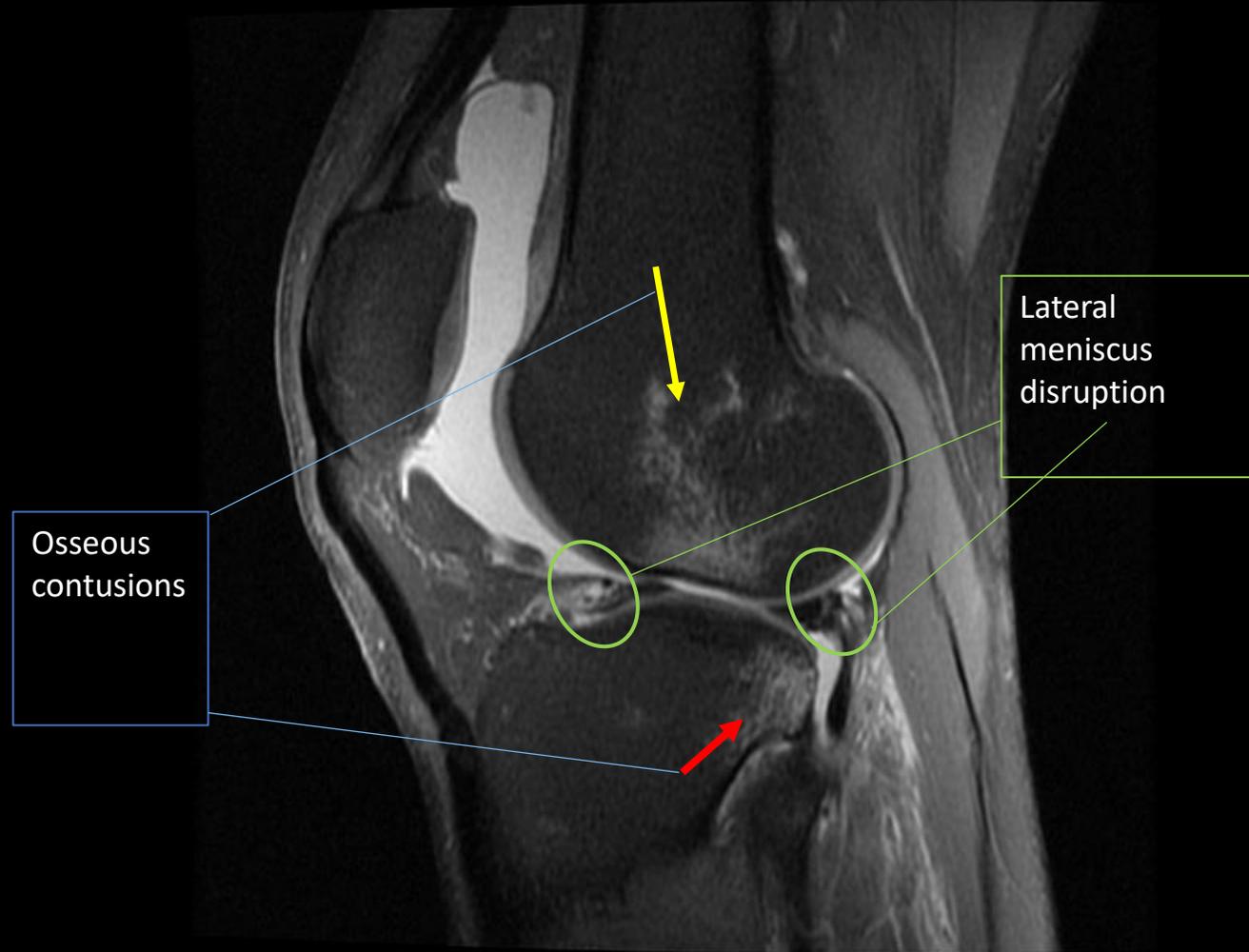
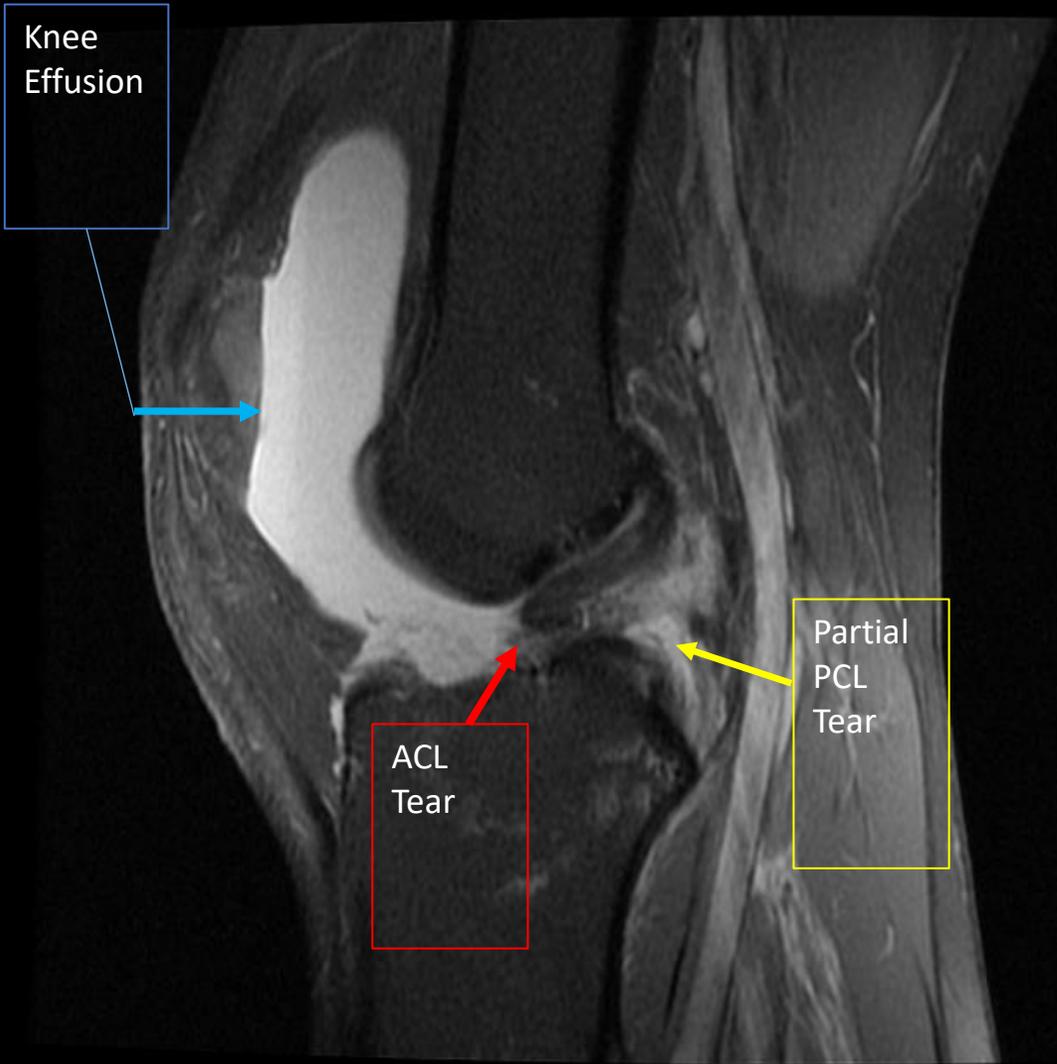
Moderate knee effusion

X TABLE

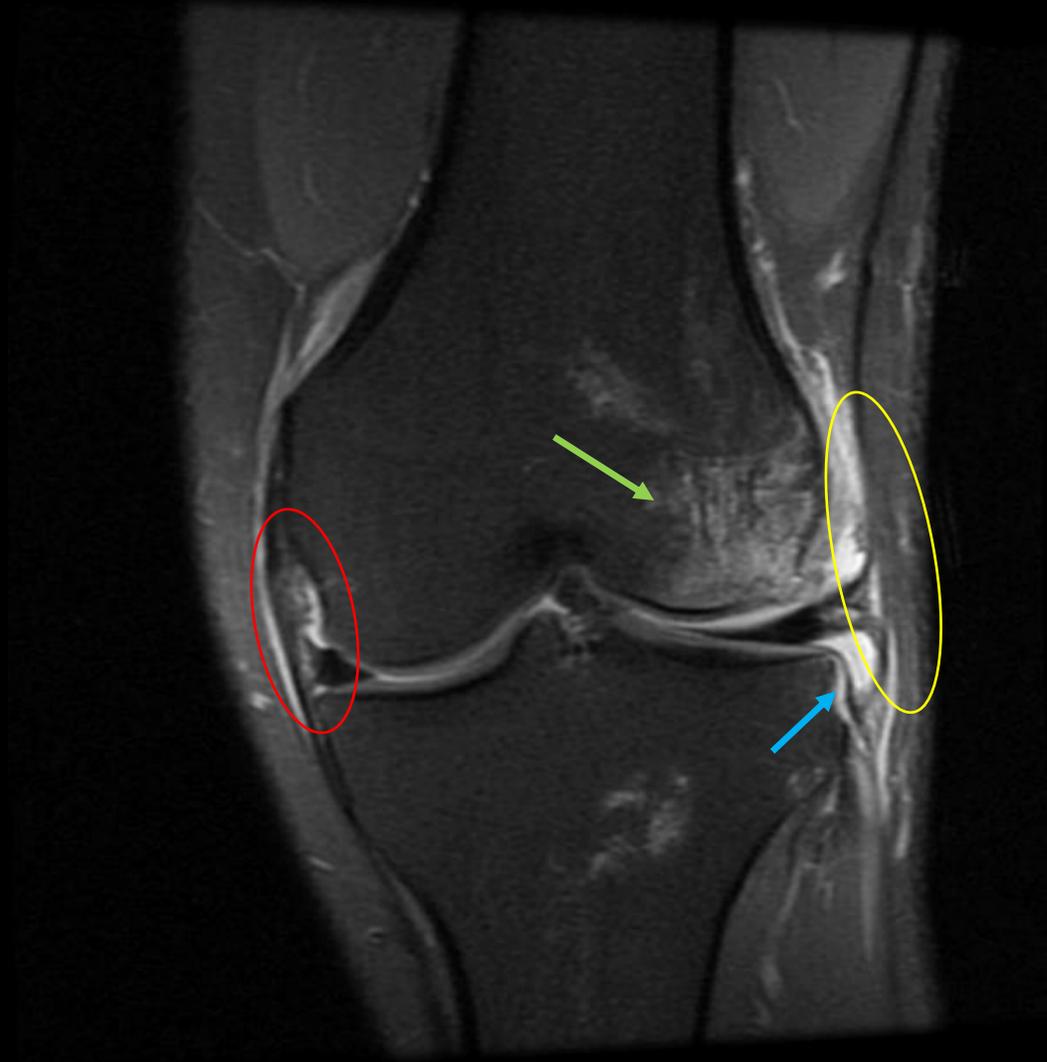
MRI (Sagittal PD Fat Sat)



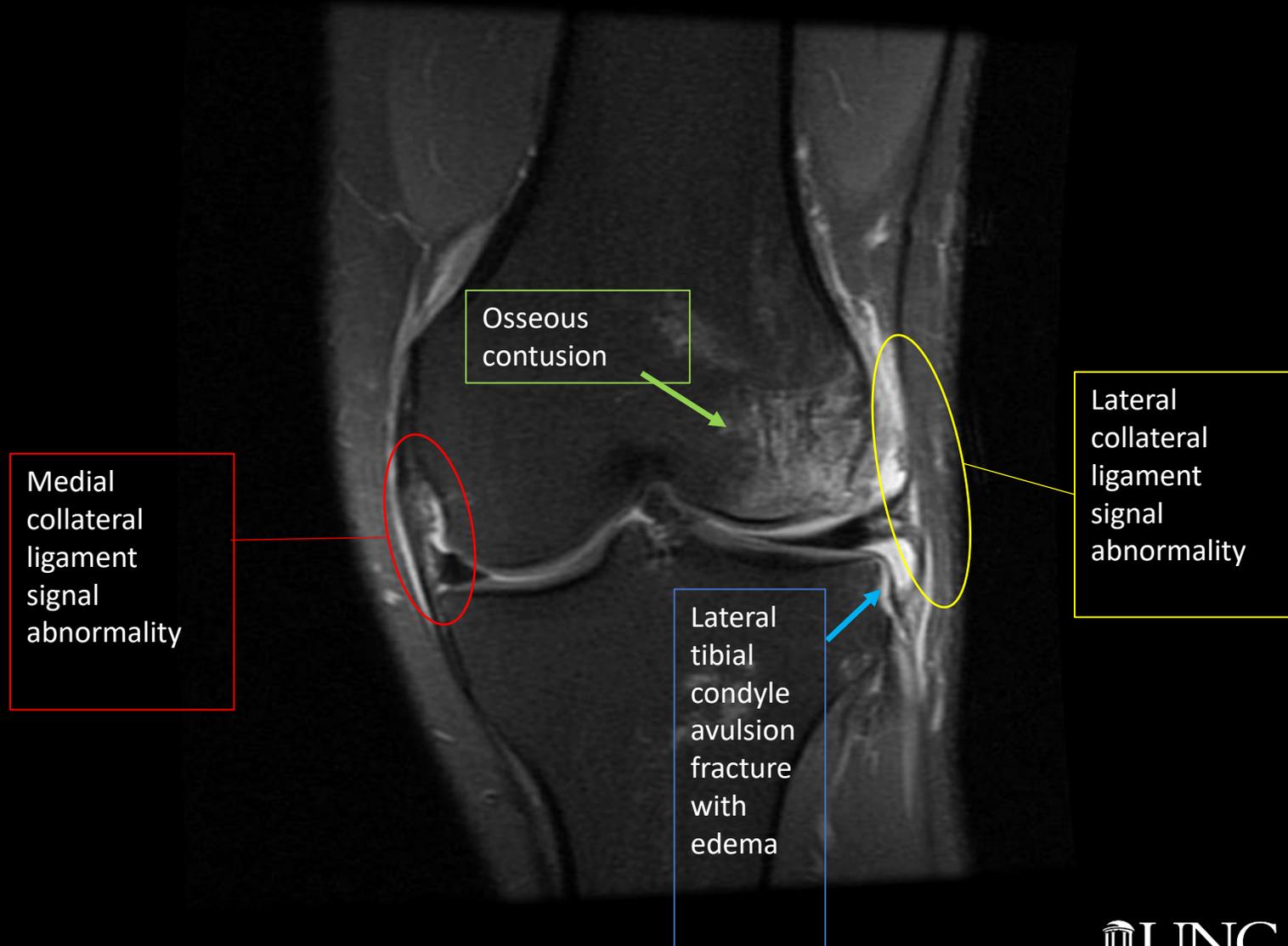
MRI (Sagittal PD Fat Sat)



MRI (Coronal PD fat sat)

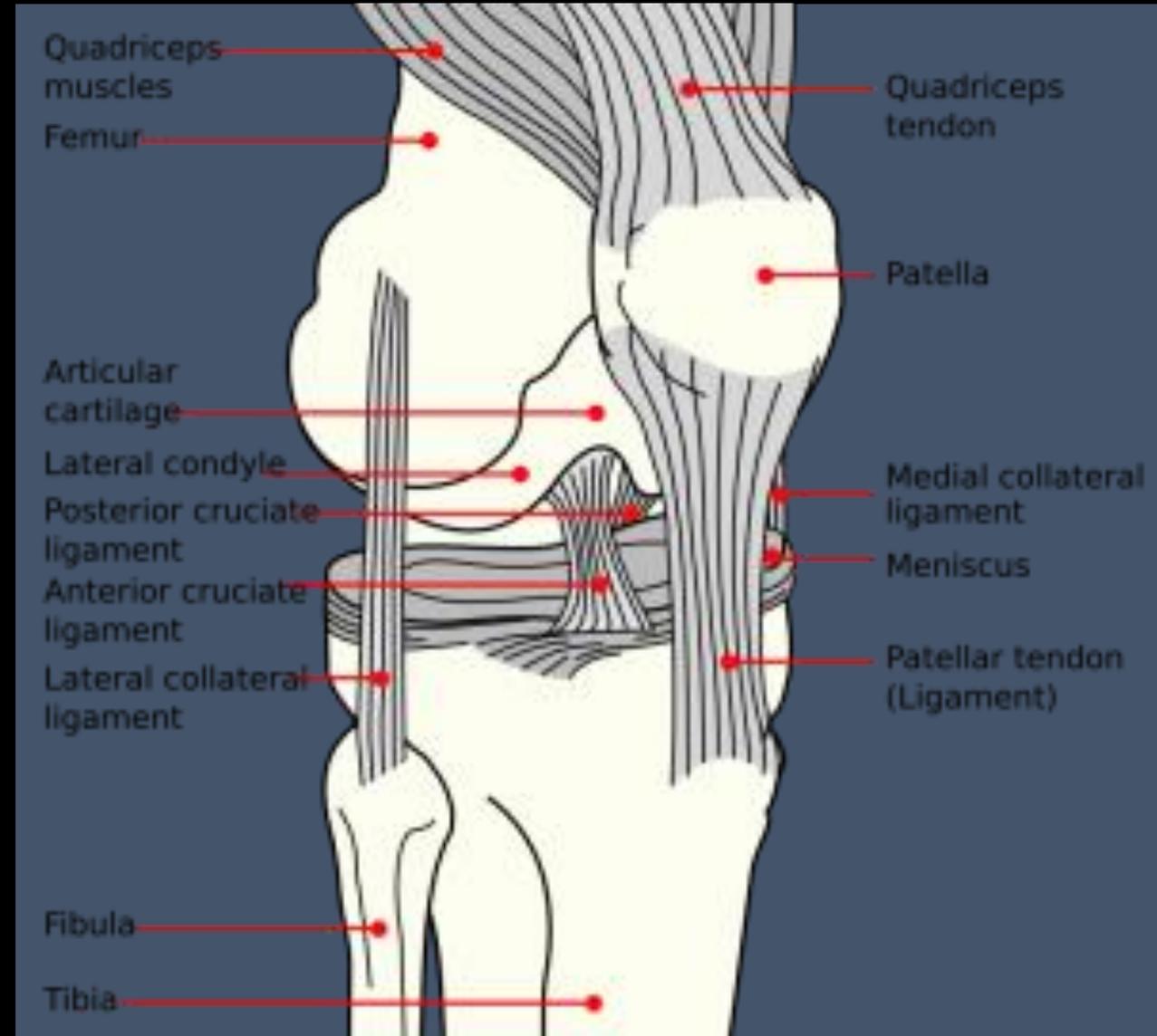


MRI (Coronal PD fat sat)



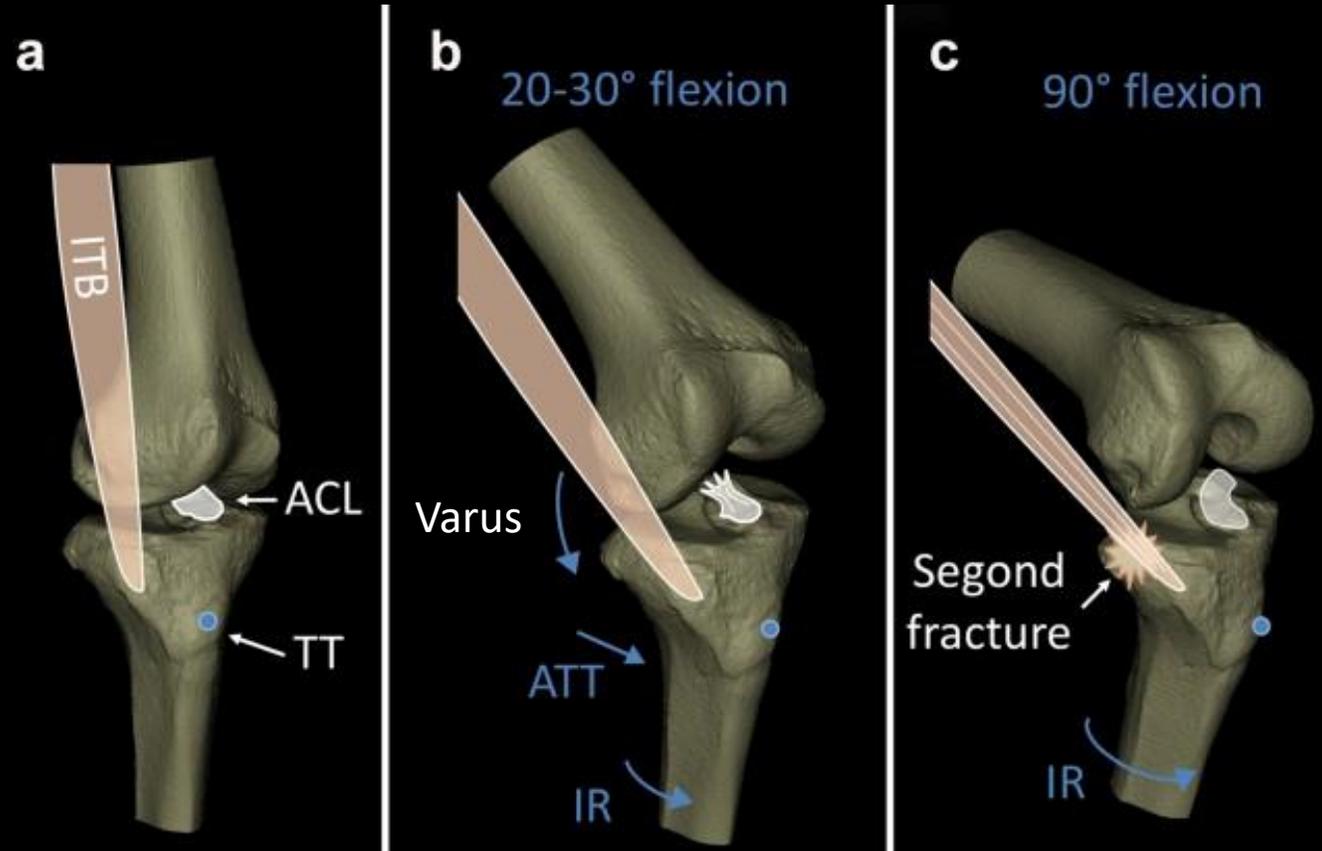
Segond Fracture: Overview

- Avulsion fracture of the lateral aspect of the tibial plateau.¹
 - Thought to be due to avulsion of the anterior lateral ligament² vs IT band fibers³



Segond Fracture: Mechanism of injury

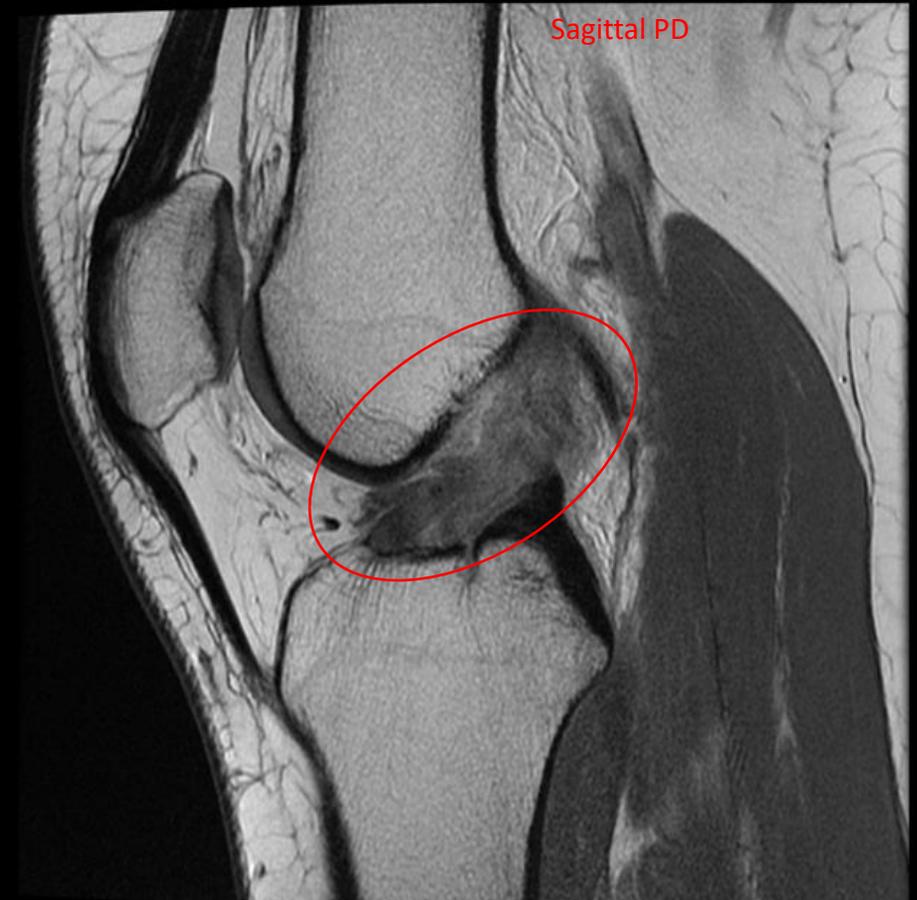
- Typical MOI involves internal rotation and varus stress.¹
 - Typically in the context of a fall or sports like soccer, basketball, baseball, and skiing



Second Fracture Associations

Necessitates a MRI due to the frequently associated soft tissue injuries^{4,5}:

- **ACL tear** (most common associated injury at 75-100% of cases)
- **Meniscal tear**; medial or lateral (66-75% of cases)
- More rarely: avulsion of the ACL, the fibular attachment of biceps femoris, or of the fibular collateral ligament



ACL Tear

Second Fracture Associations

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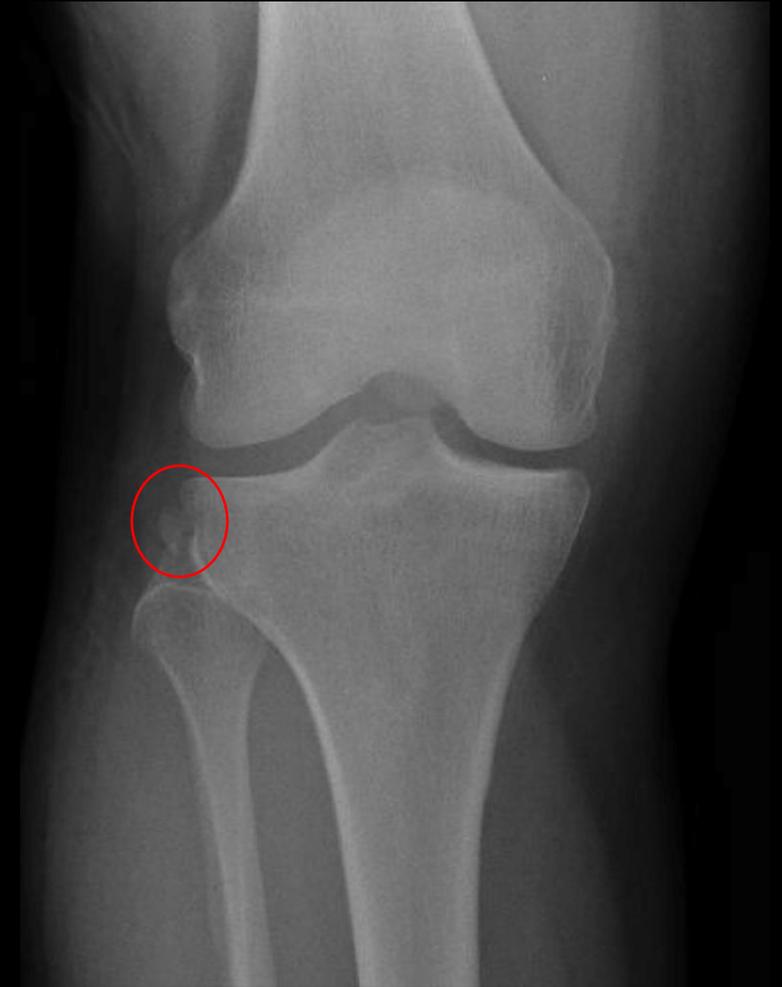
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Horizontal tear of posterior horn of medial meniscus

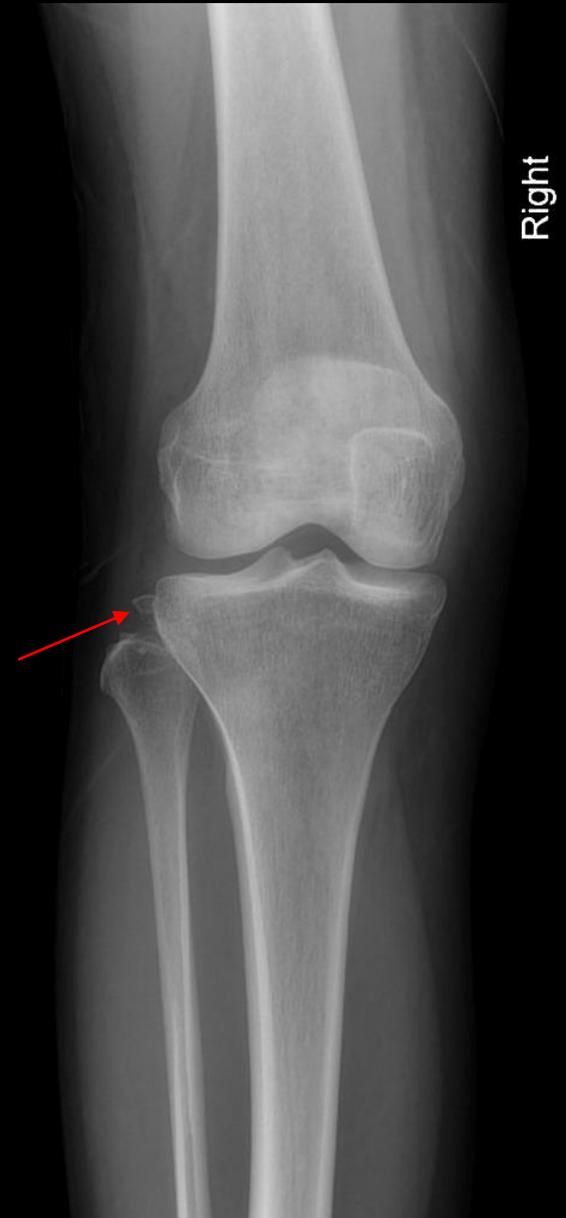
Second Fracture: Imaging findings

- Curvilinear/elliptical bone fragment parallel to the lateral tibial plateau. This is known as the “**Lateral Capsular sign.**”⁵
- Best appreciated on an AP view of the knee.



DDx: Other Osseous Fragments Associated with Knee Injury

- Avulsion fracture of the proximal fibula instead of lateral tibial plateau. (trace the cortex.)
- This is known as the “**arcuate sign.**”⁶
- The arcuate ligament complex is implicated often resulting in injuries to the **cruciate ligaments**, **menisci**, and **popliteus**.⁷
 - PCL injury > ACL injury in contrast to Segond fracture



DDx: Other Osseous Fragments Associated with Knee Injury

- Avulsion fracture of now the medial tibial plateau with a similar elliptical appearance.⁸
- Consistent with a **“Reverse Segond Fracture.”**⁵
- As the name implies, the MOI is reversed (external rotation under valgus) as are the soft tissue findings (predominantly medial menisci and PCL tears.)
- Still necessitates a MRI!



DDx: Other Osseous Fragments Associated with Knee Injury

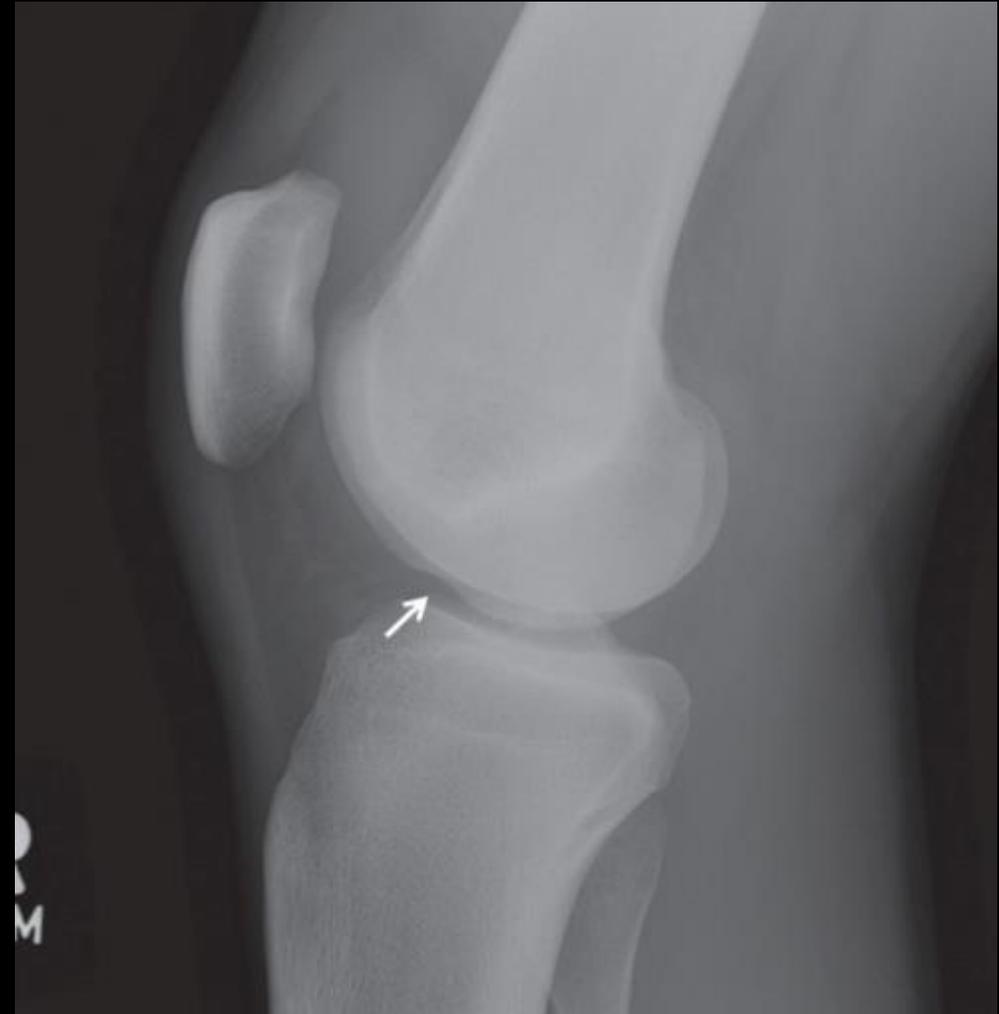
- Linear calcification near the proximal portion of the MCL.
- Consistent with a **Pellegrini-Stieda lesion**.⁹
- MOI is due to avulsion of the medial femoral condyle by the MCL (**Stieda fracture**) with resultant calcification.
 - Sequela of a remote injury



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DDx: Additional Radiographic Signs of ACL injury

- Moderate sized knee effusion with a deep lateral sulcus terminalis. (arrow)
- Also known as the “lateral femoral notch sign.”
 - Suggests an osteochondral impaction of the lateral femoral condyle onto the the posterior lateral tibial plateau in a pivot shift MOI.¹¹
- Depression greater than 2 mm confers a 100% specificity and 3% sensitivity for ACL injury.¹²



Patient treatment and outcome

- While the fracture may be small, the shown ligamentous injuries can result in anterior instability if not surgically corrected.
- Meniscal tears require arthroscopy while ACL tears require reconstruction with a graft.¹⁰
- Healing of the Segond fracture may demonstrate a bone excrescence below the lateral tibial plateau.¹

ACR appropriateness criteria

Scenario	Procedure	Adult RRL	Peds RRL	Appropriateness Category
Knee trauma, fall or twisting, focal tenderness, initial imaging	Radiography knee	<0.1 mSv ⊕	<0.03 mSv [ped] ⊕	Usually appropriate
	US knee	0 mSv ○	0 mSv [ped] ○	Usually not appropriate
	MR arthrography knee	0 mSv ○	0 mSv [ped] ○	Usually not appropriate
	MRA knee without IV contrast	0 mSv ○	0 mSv [ped] ○	Usually not appropriate
	MRA knee without and with IV contrast	0 mSv ○	0 mSv [ped] ○	Usually not appropriate
	CT knee with IV contrast	<0.1 mSv ⊕	0.03-0.3 mSv [ped]..	Usually not appropriate
	MRI knee without IV contrast	0 mSv ○	0 mSv [ped] ○	Usually not appropriate
	MRI knee without and with IV contrast	0 mSv ○	0 mSv [ped] ○	Usually not appropriate
	CT knee without IV contrast	<0.1 mSv ⊕	0.03-0.3 mSv [ped]..	Usually not appropriate
	CT knee without and with IV contrast	<0.1 mSv ⊕	0.03-0.3 mSv [ped]..	Usually not appropriate

ACR appropriateness criteria

Scenario	Procedure	Adult RRL	Peds RRL	Appropriateness Category	
Knee trauma, fall or twisting, internal derangement suspected, no fracture on xray, next imaging study	Bone scan with SPECT or SPECT/CT knee	1-10 mSv ⊕⊕⊕	3-10 mSv [ped] ⊕⊕⊕⊕	Usually not appropriate	●
	MRI knee without IV contrast	0 mSv ○	0 mSv [ped] ○	Usually appropriate	●
	CT knee without IV contrast	<0.1 mSv ⊕	0.03-0.3 mSv [ped]..	May be appropriate	●
	US knee	0 mSv ○	0 mSv [ped] ○	Usually not appropriate	●
	MR arthrography knee	0 mSv ○	0 mSv [ped] ○	Usually not appropriate	●
	MRA knee without IV contrast	0 mSv ○	0 mSv [ped] ○	Usually not appropriate	●
	MRA knee without and with IV contrast	0 mSv ○	0 mSv [ped] ○	Usually not appropriate	●
	CT knee with IV contrast	<0.1 mSv ⊕	0.03-0.3 mSv [ped]..	Usually not appropriate	●
	MRI knee without and with IV contrast	0 mSv ○	0 mSv [ped] ○	Usually not appropriate	●
CT knee without and with IV contrast	<0.1 mSv ⊕	0.03-0.3 mSv [ped]..	Usually not appropriate	●	

UNC Top Three

- 1** SCRUTINIZE BONY FRAGMENTS AROUND THE TIBIAL PLATEAUS IN THE SETTING OF A TRAUMA: Look for Lateral Capsular sign if you suspect a Second Fracture
- 2** FOLLOW UP WITH A NON CONTRAST MRI IN THE SETTING OF A SECOND FRACTURE: You must assess for internal derangement due to its incidence with this injury
- 3** KEEP A BROAD DIFFERENTIAL FOR BONY FRAGMENTS ABOUT THE KNEE: These include the arcuate sign, reverse second fracture, and the Pellegrini Stieda Lesion

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- 5. Gottsegen CJ, Eyer BA, White EA et-al. Avulsion fractures of the knee: imaging findings and clinical significance. *Radiographics.* 2008;28 (6): 1755-70. doi:10.1148/rg.286085503 - Pubmed citation
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- 7. Juhng SK, Lee JK, Choi SS et-al. MR evaluation of the "arcuate" sign of posterolateral knee instability. *AJR Am J Roentgenol.* 2002;178 (3): 583-8. *AJR Am J Roentgenol* (full text) - Pubmed citation
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