



—B E L M A T T—
HEALTHCARE TRAINING

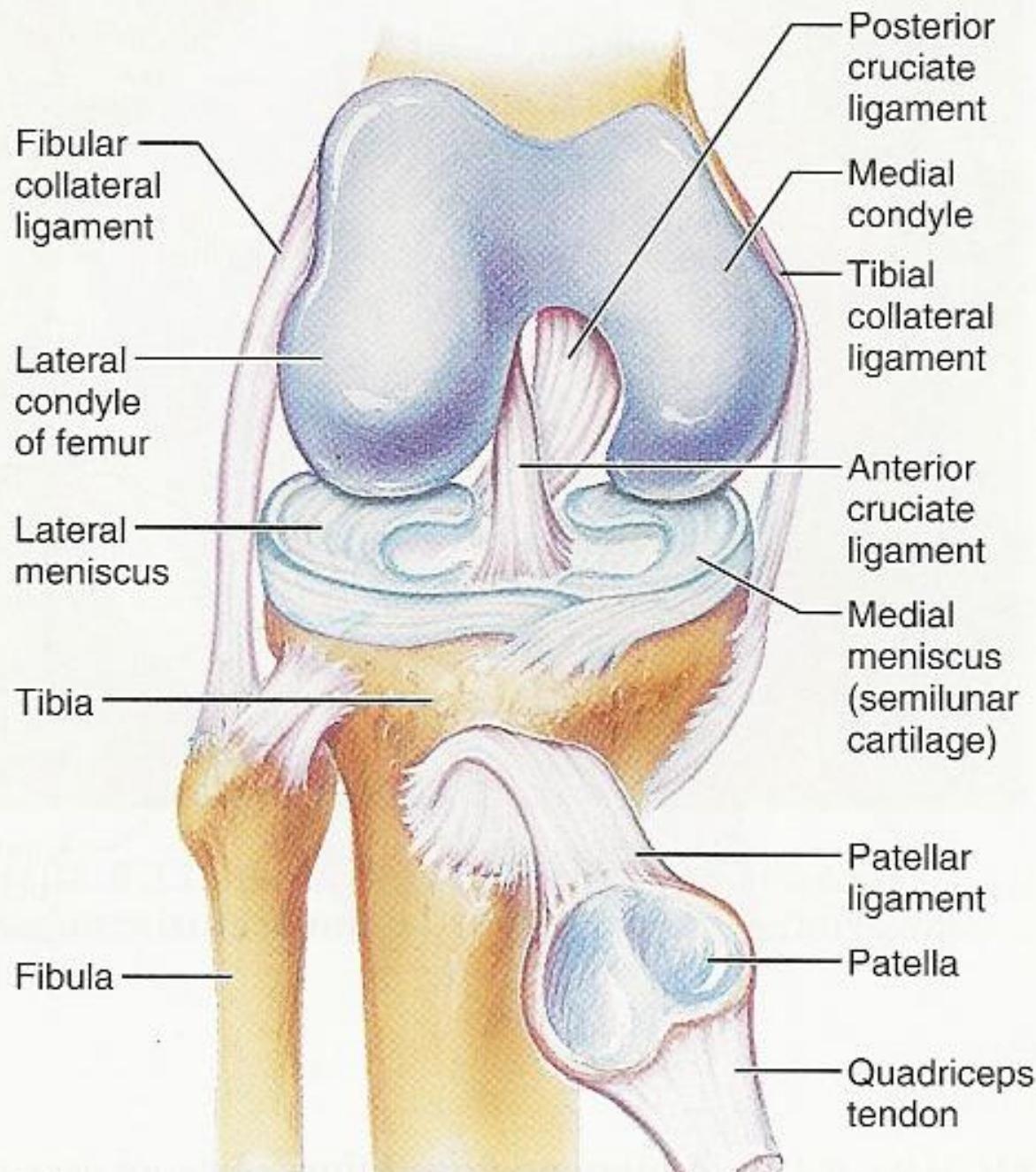
THE KNEE

Dorthe Swaby-Larsen



THE KNEE

- ❖ Largest and most complex joint in the body.
- ❖ Undergoes tremendous stress as it absorbs the impact of full body weight during physical activity
- ❖ Several ligamentous/soft tissue structures : only 6-12% of knee injuries result in #



HISTORY

Mechanism of injury

- Bent or straight on injury (the knee is much more vulnerable when bent)
- Direction and force involved

Progress and duration of symptoms

- Timing of swelling
- Recurrent swelling
- ? Immediate disability

Giving way

- Especially going down stairs
- Anterior cruciate or meniscus
- Osteochondritis dissecans

Locking

- Inability to fully extend
- Loose body or meniscal tear
- Osteochondritis dissecans

Clicking

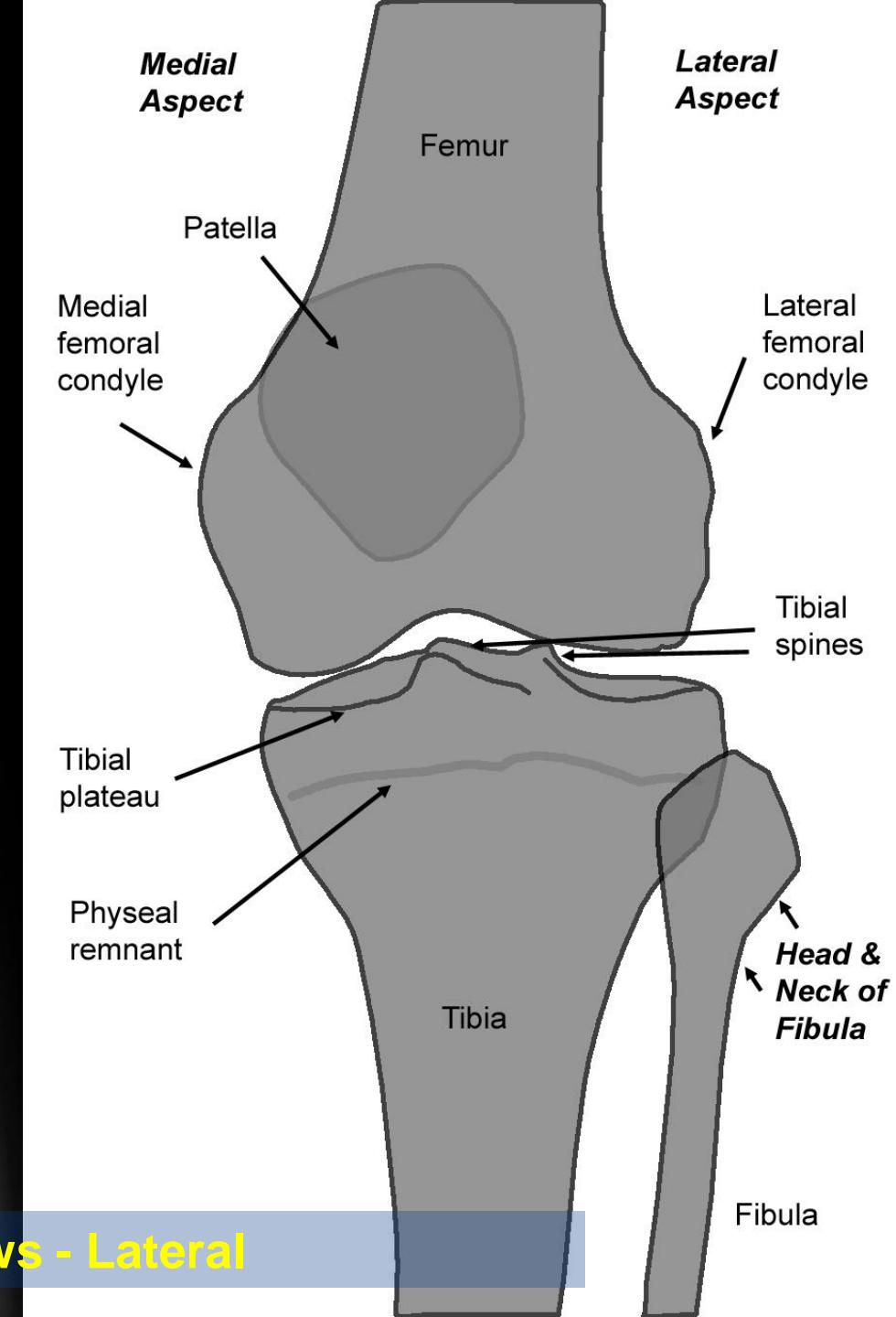
- ? Meniscal tear
- Osteochondritis dissecans (loose fragments separate from the femoral condyle)

PMH

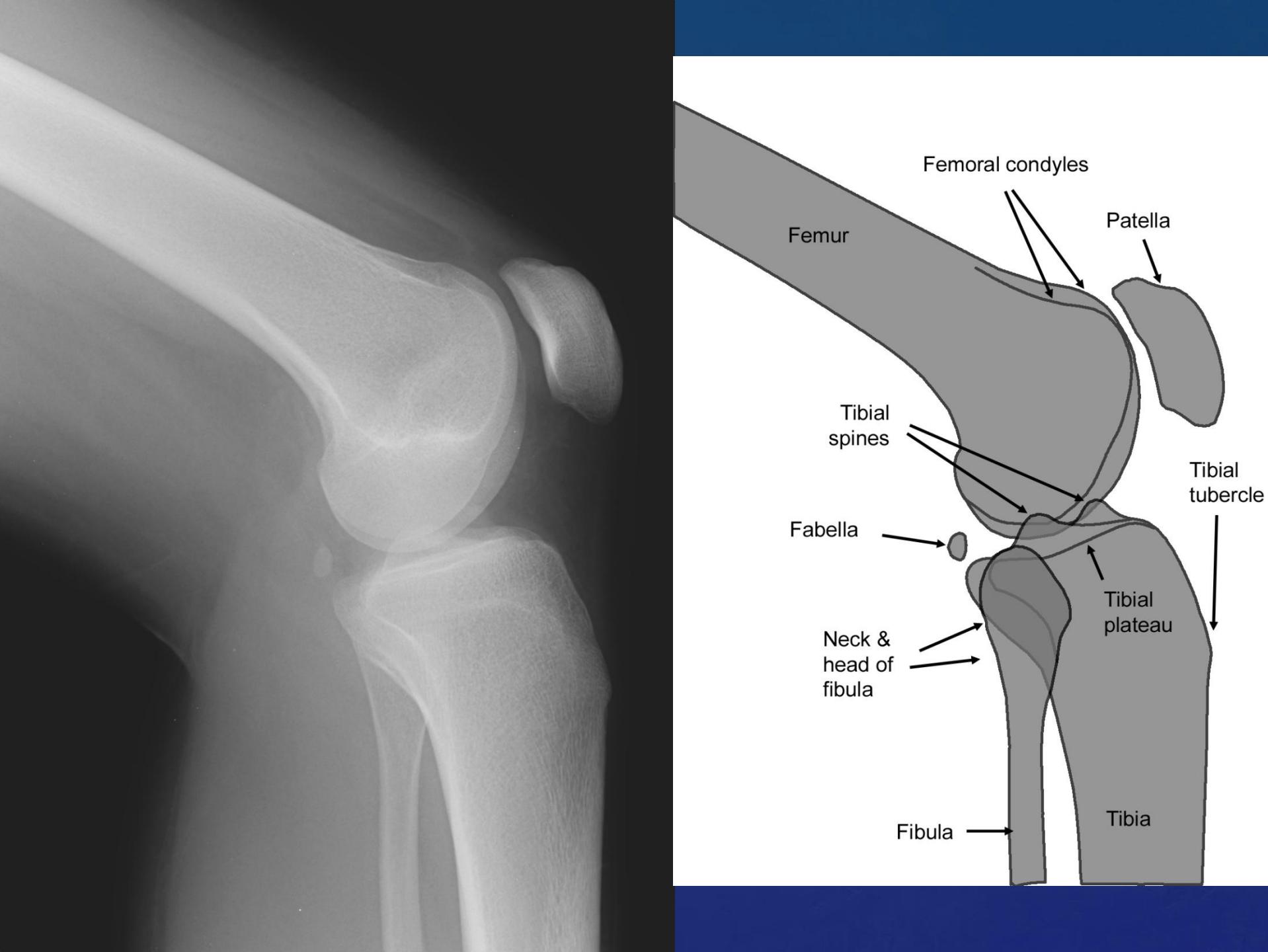
- Surgery
- Previous injuries
- RA, OA or gout
- Diabetes
- Osteochondral dissecans
- Osgood-Schlatter's disease

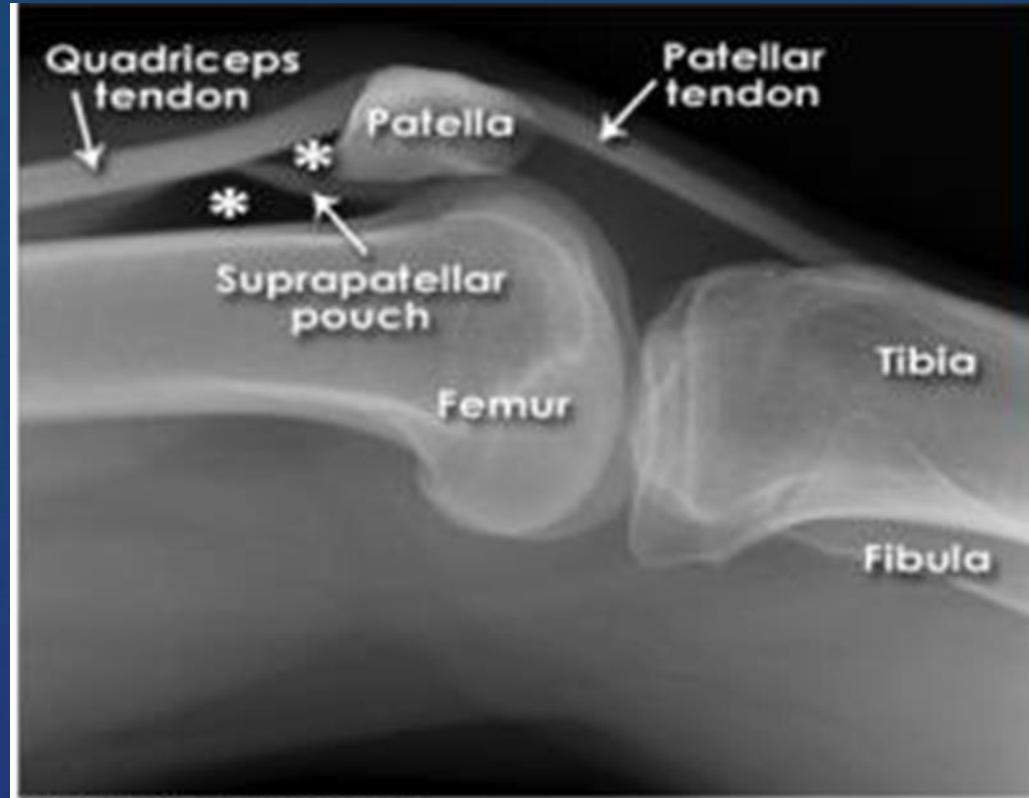
Medications

Allergies



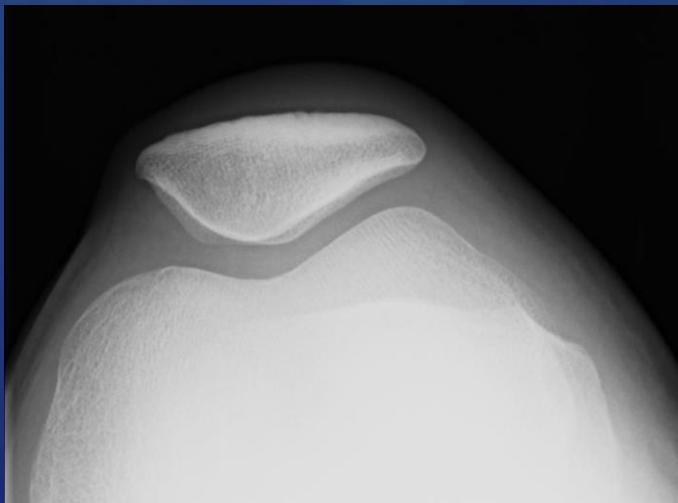
Standard Views - Lateral







Positioning for horizontal beam lateral view



Normal skyline view. This is obtained with the patient sitting up and holding the cassette against the distal femur, the knee is flexed to about 60°, and the X-ray beam is directed horizontally to pass through the patellar-femoral joint. It can be useful if a longitudinal patella fracture is suspected but is contra-indicated in the case of possible transverse fracture as the fracture fragments could be further separated.

OTTAWA AND PITTSBURGH KNEE RULES

Ottawa knee rule: Acutely injured knees only

X-ray if one or more findings are present:

- Age 55 or over
 - Tenderness at fibula head
 - Isolated tenderness of the patella
 - Inability to flex knee to 90°
 - Inability to weight bear * (4 steps) both immediately and in the department.
- (Steill, et al, 1997)

Pittsburgh knee rules

In the patient with a history of a fall or blunt trauma, X-ray if one finding is present:

- Age <12 or >50 or
- Inability to walk 4 weight bearing steps* in the department.

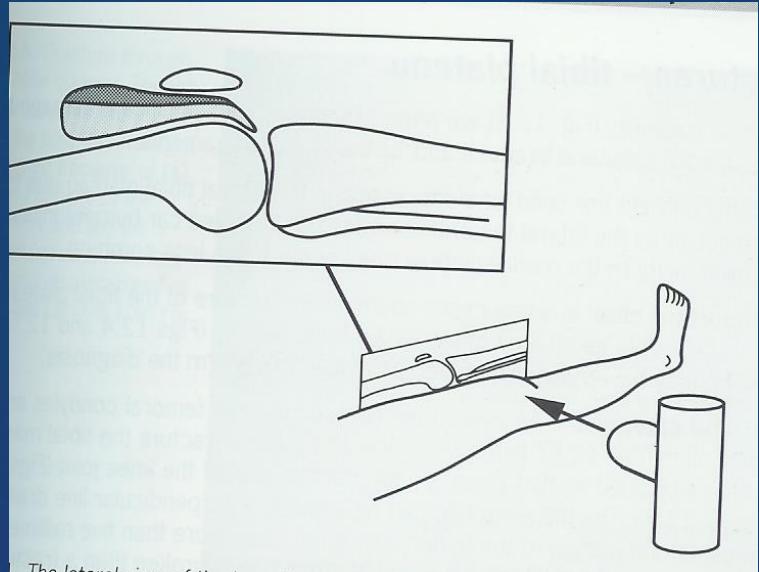
(Seaberg & Jackson, 1994)

* In the Ottawa knee rules, the inability to weight bear is the inability to transfer weight twice onto the affected leg regardless of limp, whereas the Pittsburgh rule is fully weight bearing with no limp (Adams, 2004).

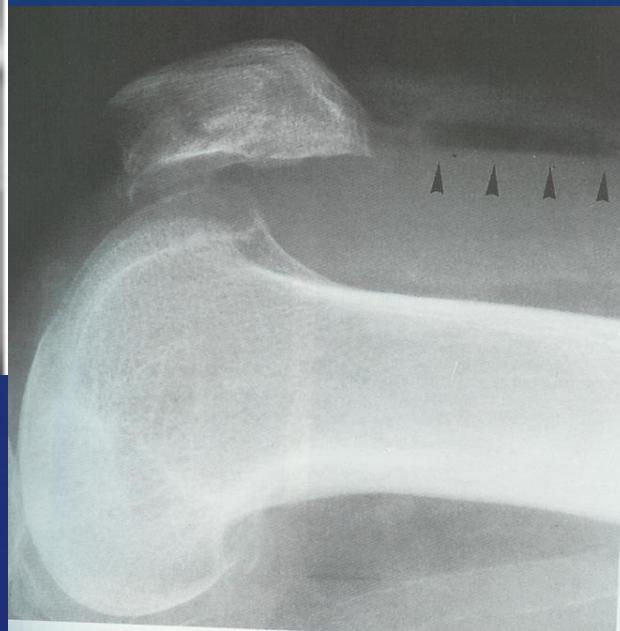
Typical presentation of a haemarthrosis

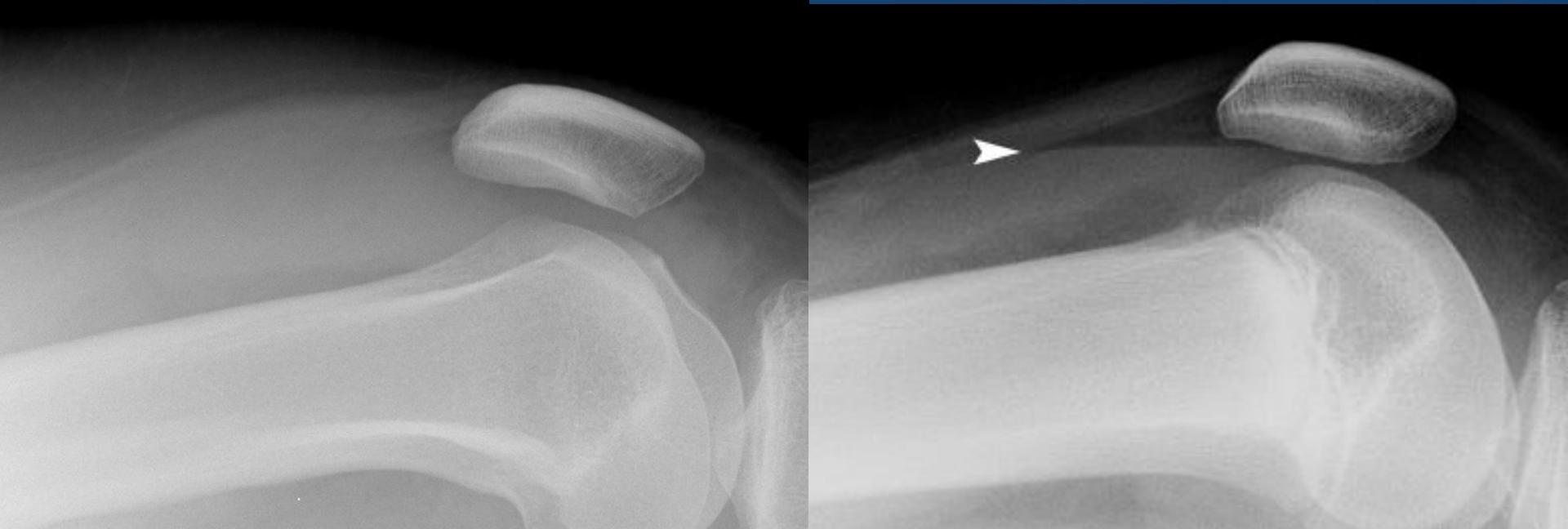


Positioning for horizontal beam lateral view



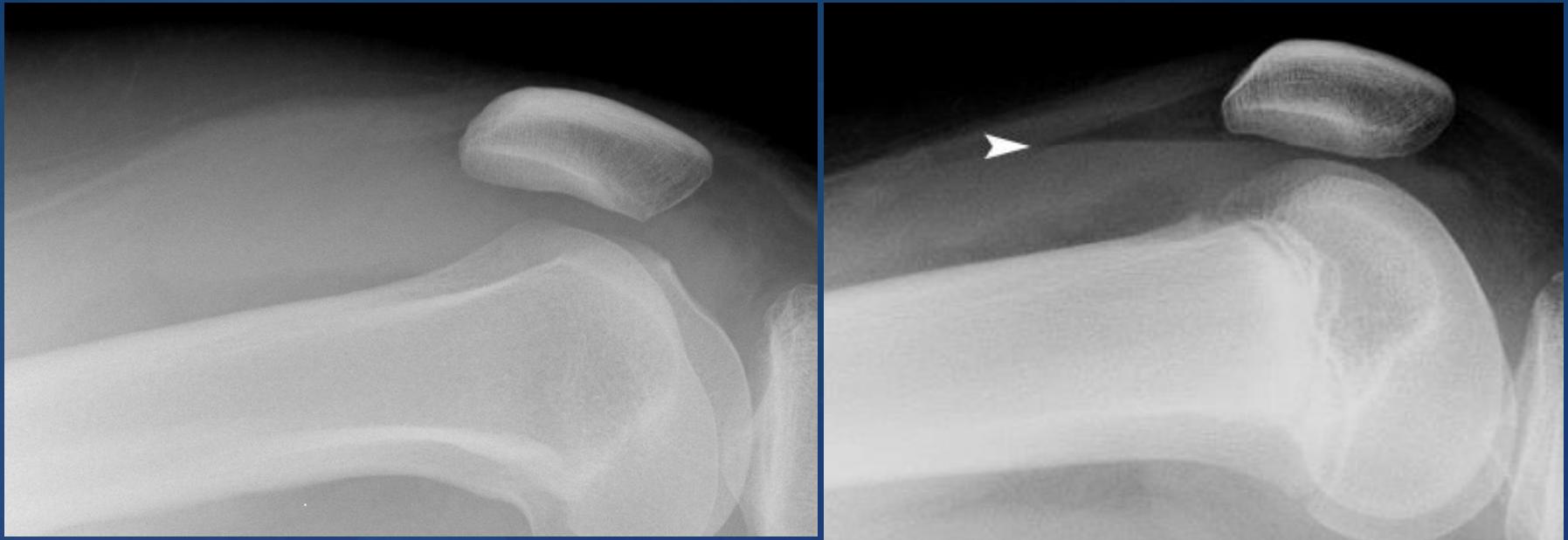
- ▶ Lipohaemarthrosis is only ever seen on lateral (horizontal beam) view
- ▶ Fat is never seen within joint- released from bone marrow in fractures
- ▶ Fat is less dense than blood and therefore 'rises to the top'- and lies on top of blood
- ▶ Fat blocks less of the rays than blood and therefore appears darker than blood (lighter)





Joint effusion and lipohaemarthrosis. In the left hand figure, a large amount of fluid has collected within the joint capsule and been forced up into the supra-patellar pouch. This has resulted in the bulbous grey region superior to the patellar and tipped the patella anteriorly and inferiorly.

In the right hand figure, a horizontal line (white arrowhead) is seen in the pouch separating a region of synovial fluid and blood (below) from a layer of fat (above) that has leaked from a fracture site. Even if a fracture line is not visible the presence of a lipohaemarthrosis is indicative of an occult (unseen) fracture.



The supra-patellar pouch is a part of the joint capsule that lies superior to the patella. It is not normally seen except when, due to injury or infection, there is a joint effusion and the pouch becomes distended with fluid. If there is a fracture within the confines of the joint capsule then fat from the medullary cavity leaks into the capsule. The fat, being less dense than blood or synovial fluid, will float to the highest point of the joint capsule and form a fat/fluid interface with a darker plane above the denser blood beneath. This phenomenon is known as a lipohaemarthrosis and is only seen if the X-ray beam passes tangentially across the joint and the fluid level, thus all knee X-rays done post-trauma should be with a horizontal beam to demonstrate this.

Patella Fractures

Mechanism

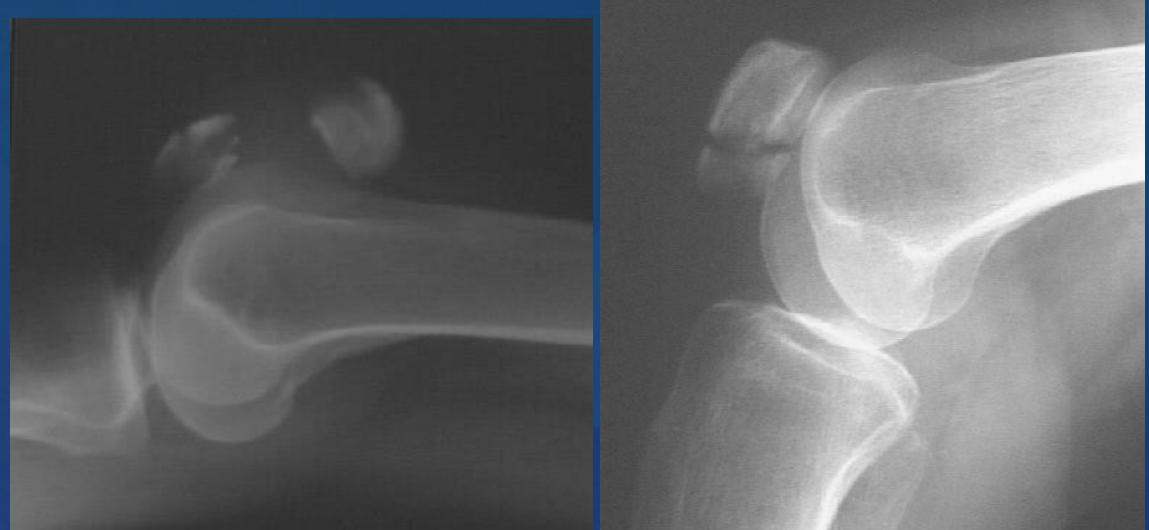
- Direct Trauma

Signs and Symptoms

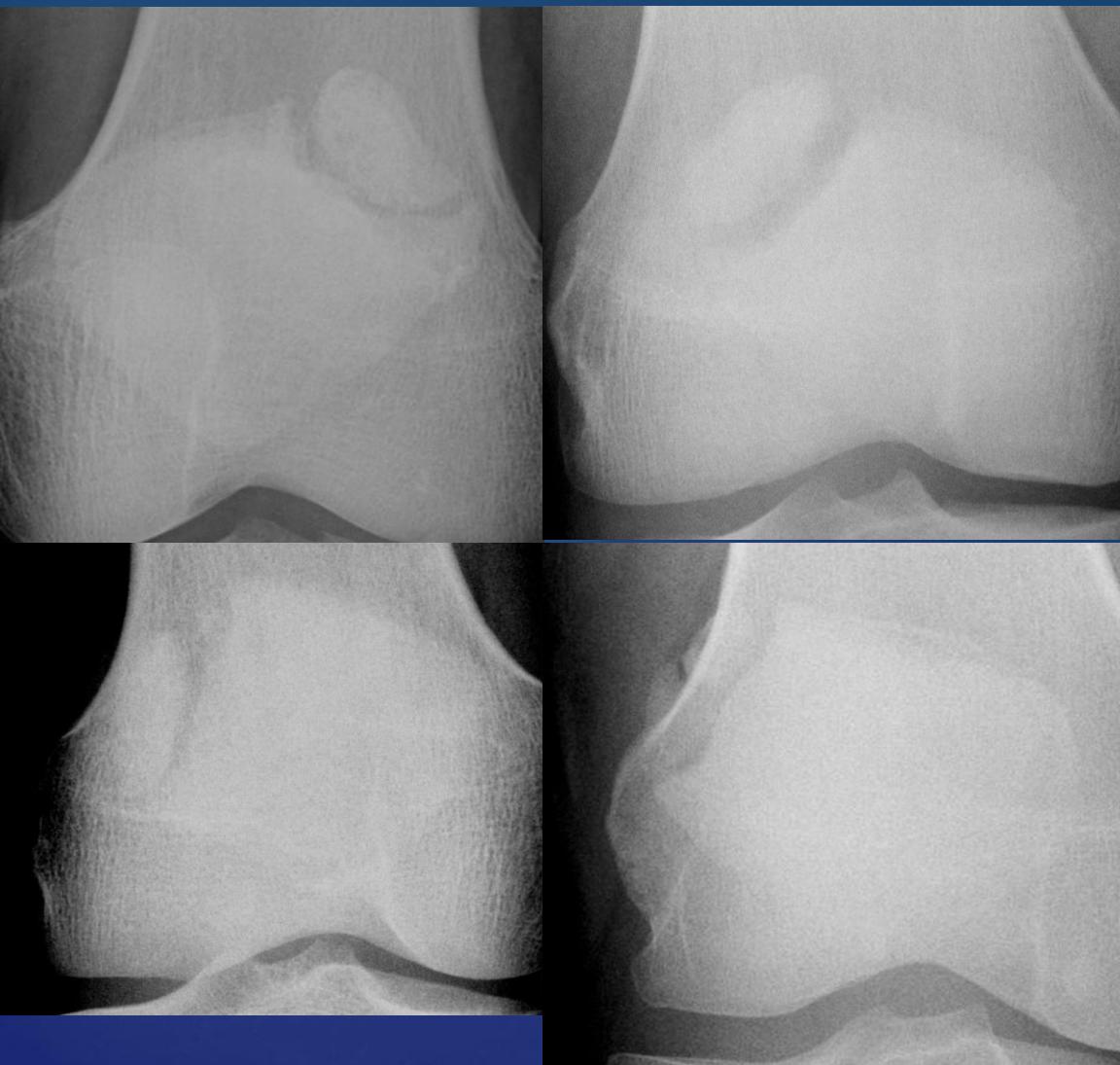
- Pain
- Swelling
- Bruising

Treatment

- Refer / surgery







A common normal variant (approx 2% of the population) is a bipartite patella which is where the patella forms from two (or more) separate ossification centres which do not necessarily unite even in adulthood.

Usually present by 12 years of age

In the figure above left are two examples of bipartite patellae) and two tripartite patellae left, lower.- rarely also multi-partite

43% are bilateral

The smaller components are usually seen in the upper lateral region and these appearances should not be confused with a patellar fracture.



Lateral



AP

Patella Dislocation

Mechanism

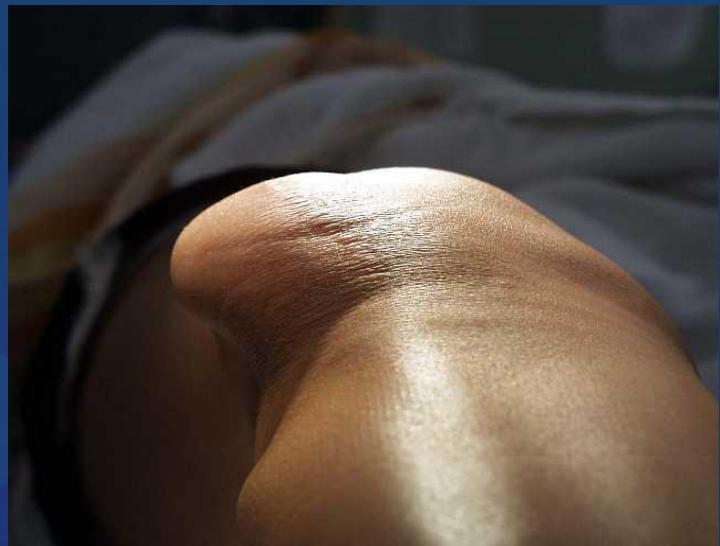
- Direct Trauma
- Common in females 10-18

Signs and Symptoms

- Pain
- Swelling
- Obvious deformity
- Displaces laterally
- +/- haemarthrosis

Treatment

- Reduction
- Pop
- X-ray
- # clinic



Osteochondritis Dessecans (teenagers knee)

Mechanism

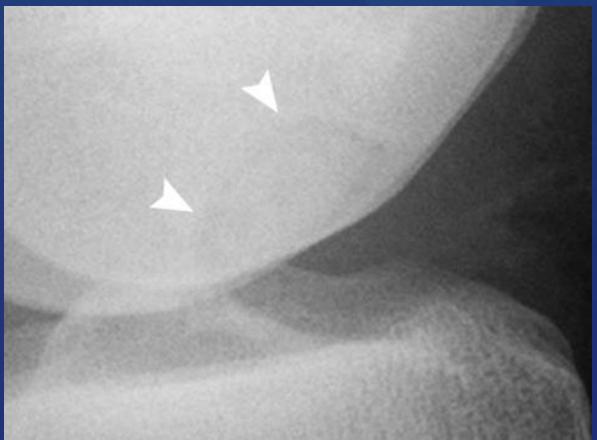
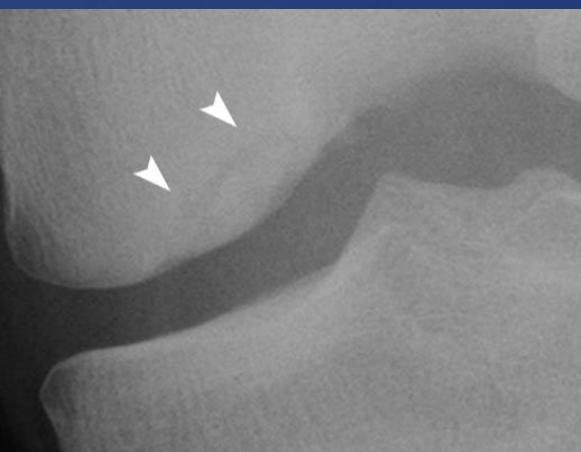
- ¶ Loose body in joint due to necrosis
- ¶ Common in males 7-14

Signs and Symptoms

- ¶ Pain
- ¶ Worse on exercise
- ¶ swelling
- ¶ +/- effusion
- ¶ Crepitus
- ¶ +/- locking for large fragments

Treatment

- ¶ Rest
- ¶ NSAID
- ¶ physio
- ¶ Ortho referral / surgery if >14



Osteochondritis dissecans in the medial femoral condyle.

Osteochondritis dissecans is generally considered to be a chronic process as a result of repeated relatively low grade trauma rather than a single event as in acute osteochondral fracture (Greenspan, 2000). The appearance tends to be more irregular although with unchecked progression ultimately a bony fragment may become isolated and dislodged and migrate within the joint capsule. The loose fragment can prevent full extension (a true 'locked' knee).

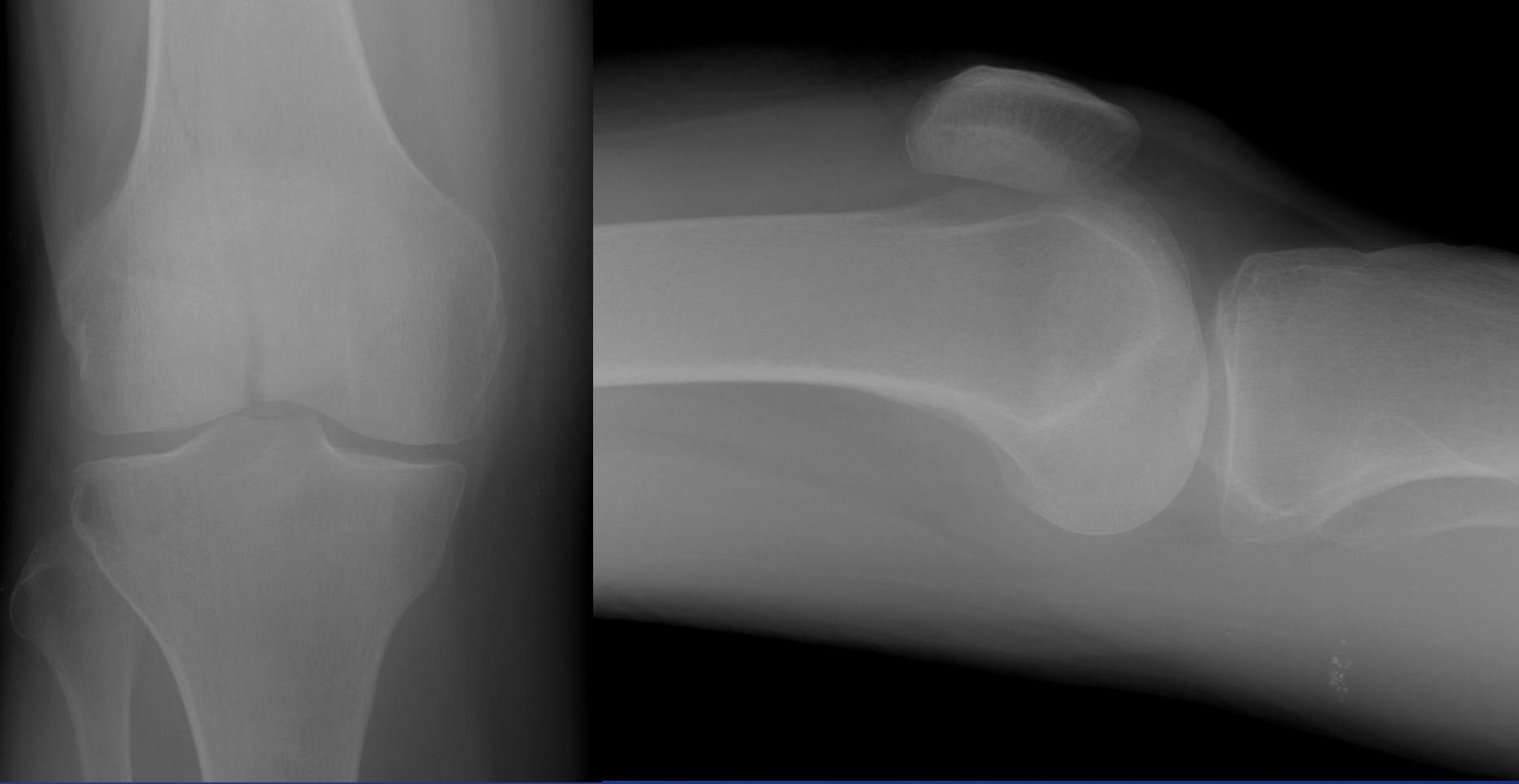
Osteochondral fractures



Osteochondral fracture. Look at the articular surface of the medial femoral condyle on the AP view; there is an elliptical shaped lucency which represents an osteochondral fracture at this point. A portion of the articular bony surface has fractured away along with the cartilaginous lining of the bone surface leaving the lucent appearance.

The lateral view shows one loose fragment in the suprapatellar pouch and two smaller fragments just posterior to the femoral condyles (arrowhead).

The bony defect is seen as an irregularity just below the patella (arrow)



This is an intercondylar fracture of the distal femur which extends into the joint. There is a joint effusion but no lipohaemarthrosis is seen. Needs orthopaedic referral.



A subtle fracture of the medial femoral condyle, when there is degenerative change then very careful scrutiny of the cortex is required as fractures tend to be more easily overlooked. The lateral view is distorted as the patient was in great pain and the leg could not be moved for optimum positioning.



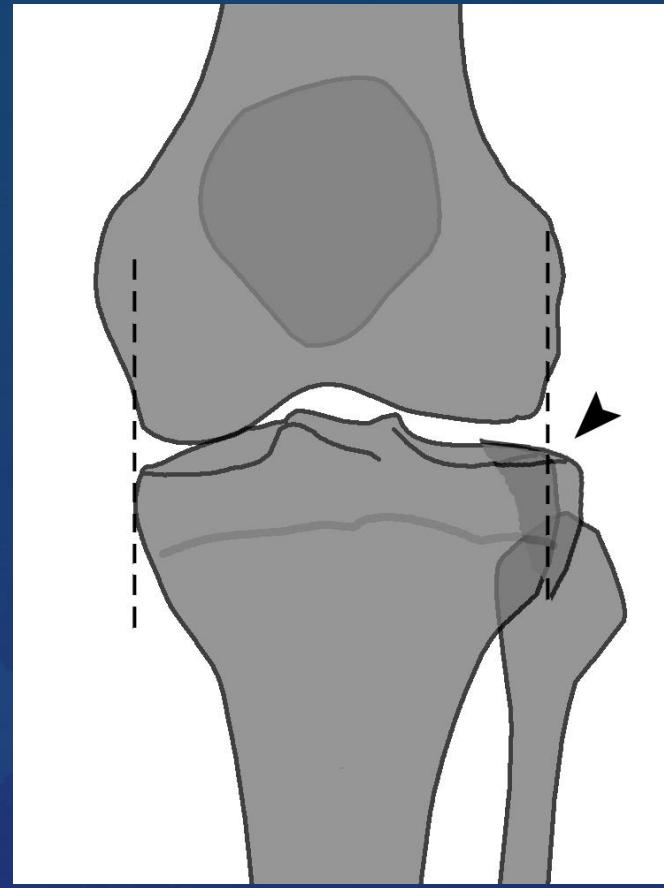
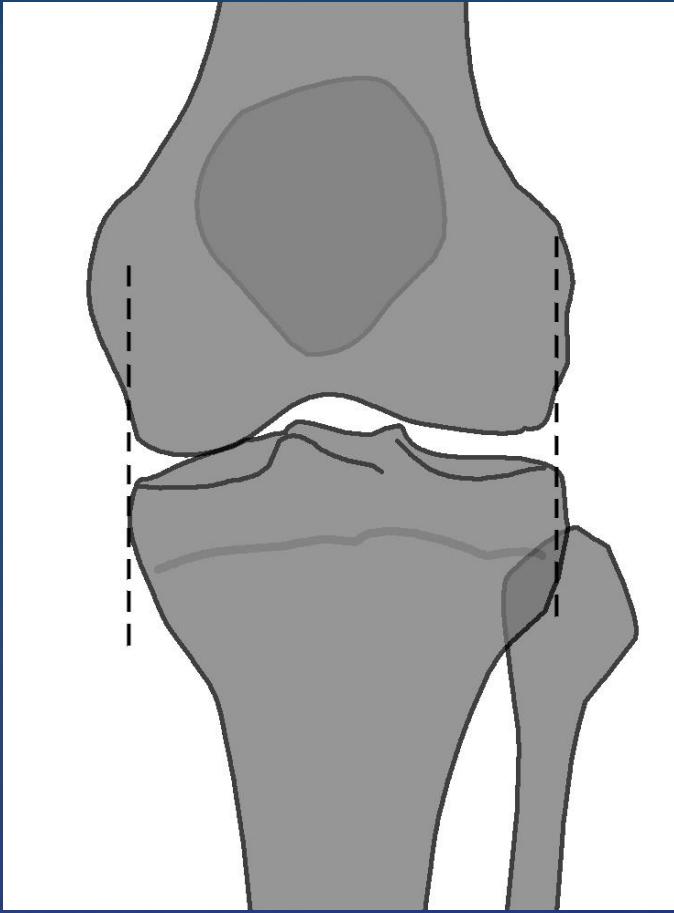
This is a greenstick fracture of the distal femur and there is shift of the lateral aspect of the metaphysis with respect to the epiphysis. The fracture line extends from the buckle seen at the medial side of the shaft to the lateral aspect of the physeal line. This would be classified as a Salter & Harris II.



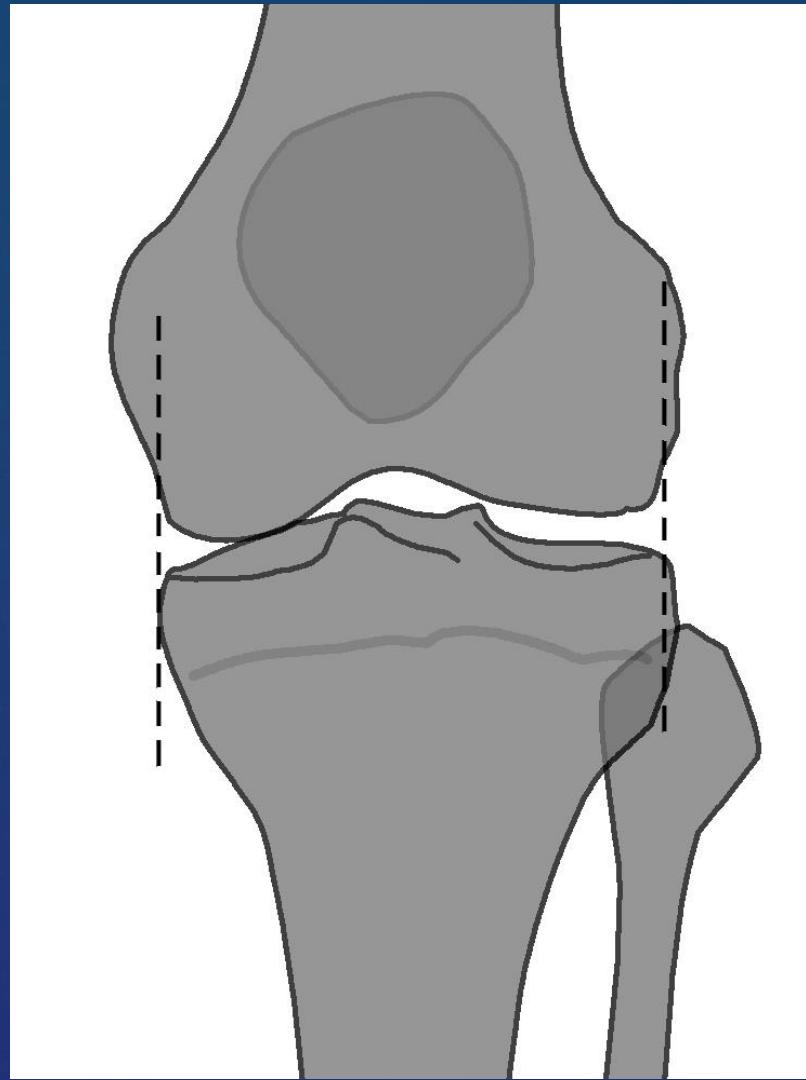
Tibial plateau fracture (I). This is a relatively undisplaced fracture of the lateral tibial plateau. On the AP view the main cortical break happens to coincide with the medial fibula neck

The lateral view has no discernible fracture line; however there is a prominent lipohaemarthrosis which indicates the presence of a fracture within the joint capsule. This is shown as the fat/blood interface with the fat layer floating on the blood and resulting in the patella tipping forward somewhat. A CT scan would demonstrate the extent of the injury more fully.

80% of tibial plateau # affect lateral.



Draw a line laterally against the femur down to the tibia. In the normal knee, no more than maximum 5 mm of the tibia should lie outside the line. If the articular surface of the tibia is projecting more than 5mm beyond the line then a tibial plateau fracture should be suspected

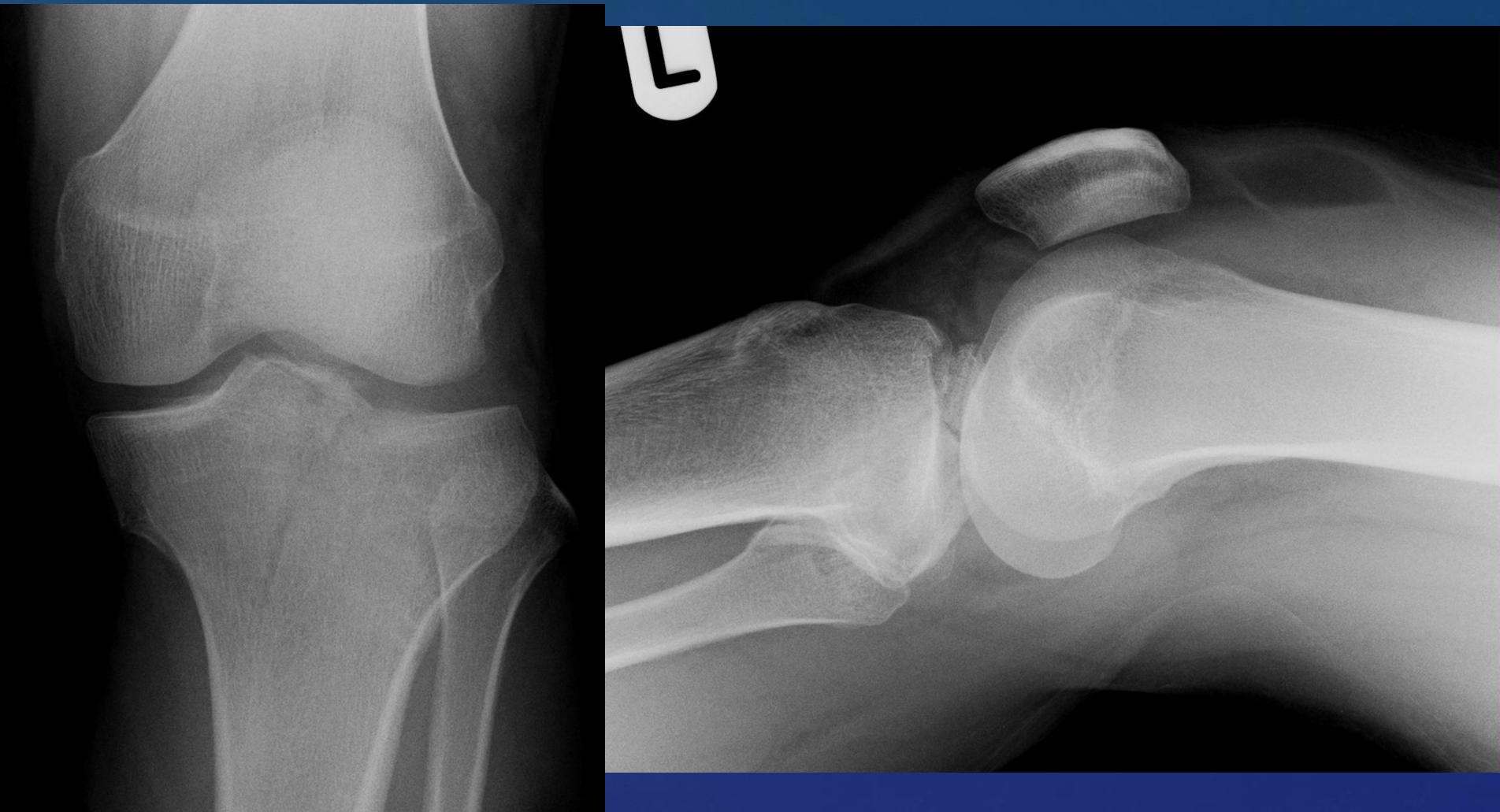


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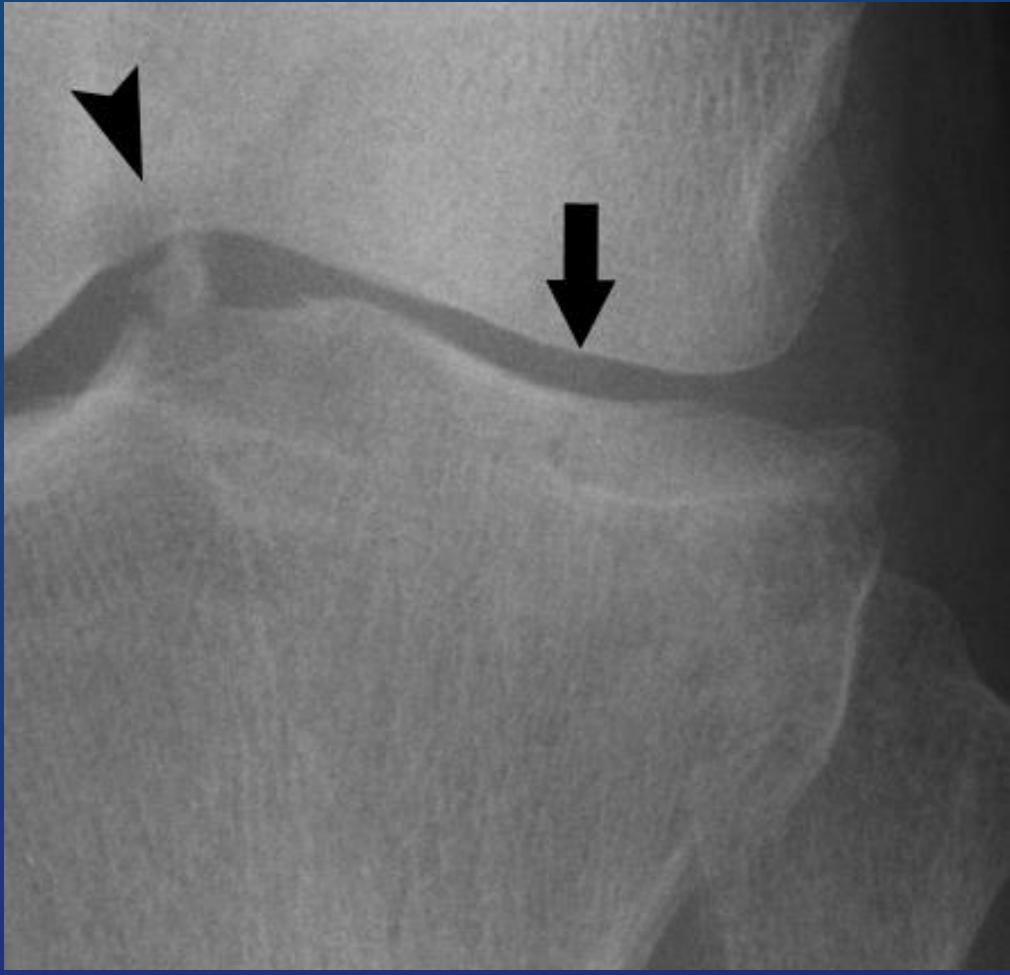
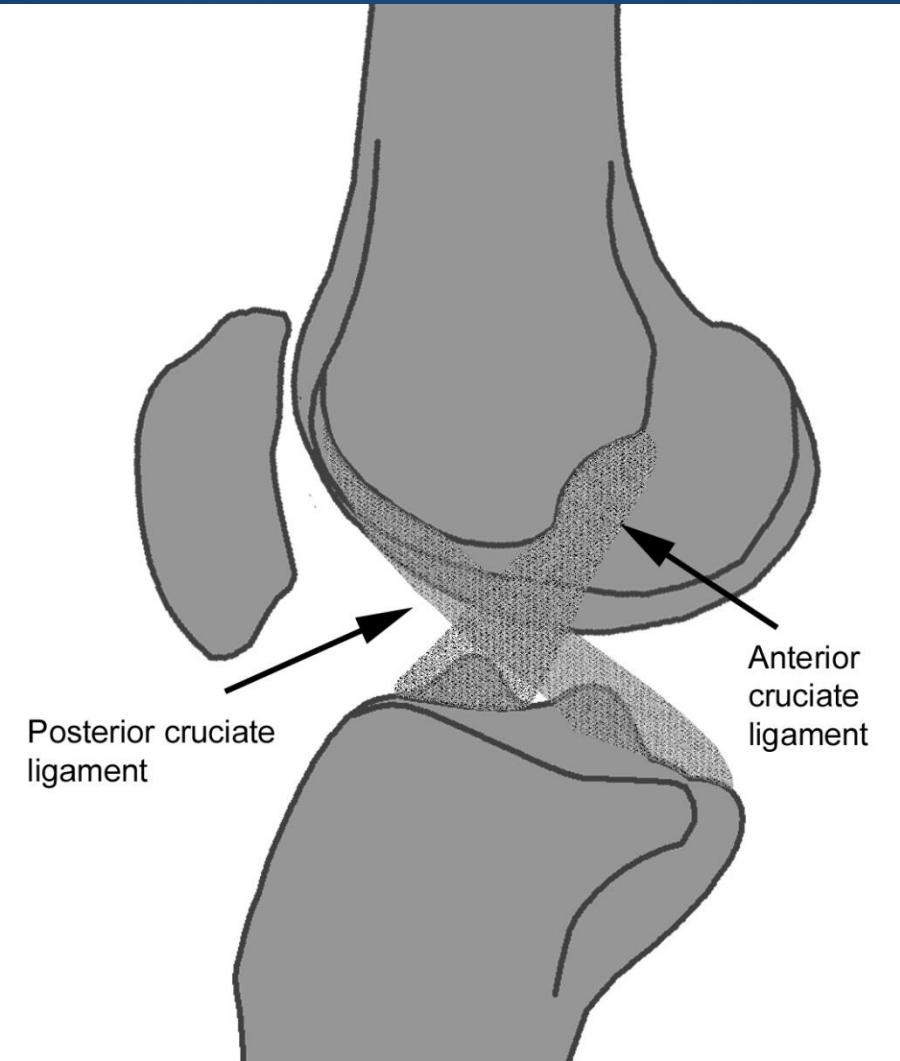
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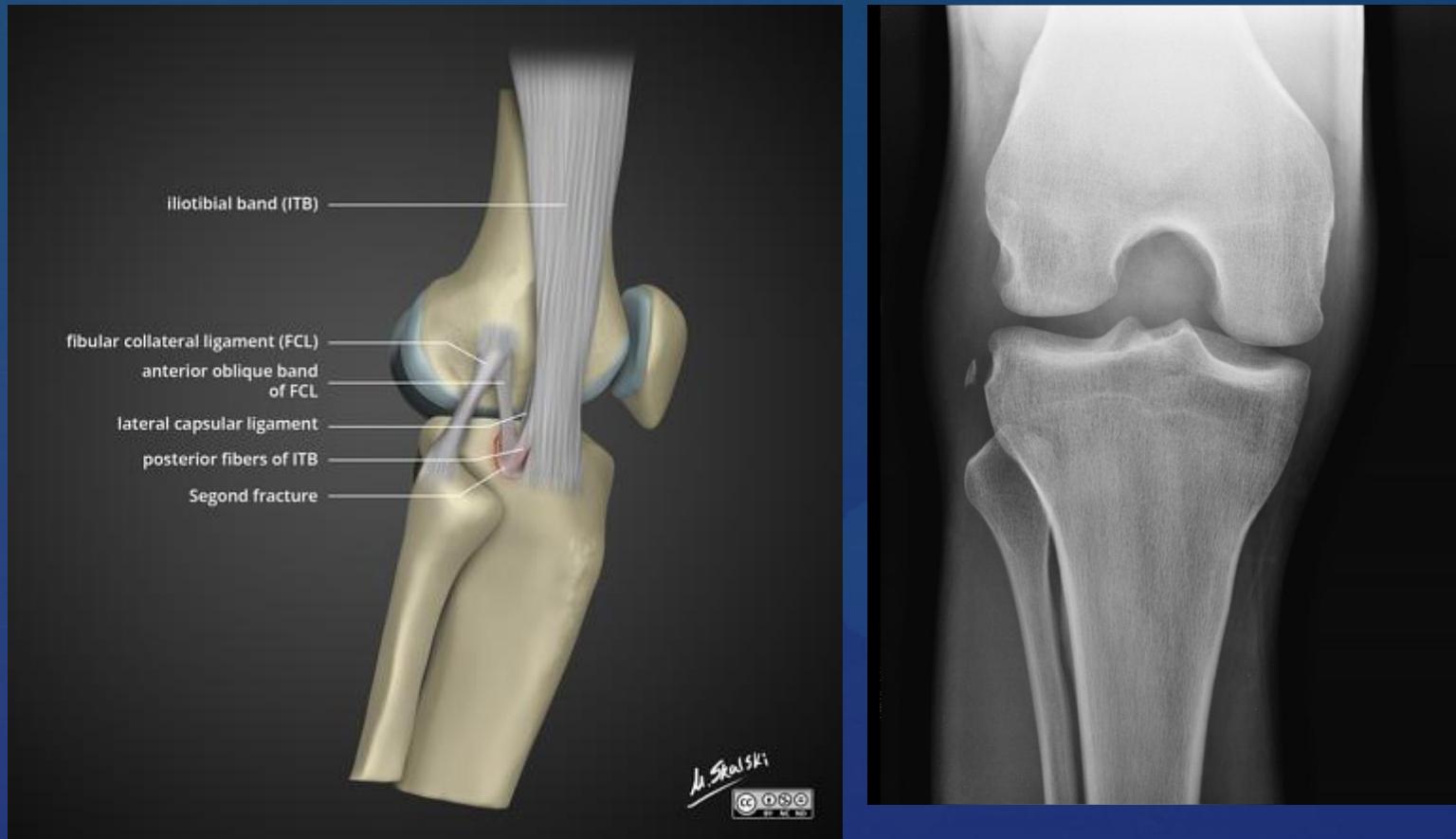


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Segond fracture



Avulsion # involving the lateral aspect of the tibial plateau. Commonly (~75% of cases) associated with disruption of the anterior cruciate ligament (ACL) tear and/or meniscus.

¶ Ossified haematoma
medial femoral condyle
from incomplete tear
MCL



Pellegrini Steida

Case study

- ¶ Pt attended for the 3rd time in 2/12 with non traumatic knee pain,that was worse at night. Slight swelling.
- ¶ He had had 7/7 flucloxacillin and 7/7 diclofenac ,with no effect.
- ¶ He was apyrexial,no weight loss and appeared well.
- ¶ He had bony tenderness to the proximal right tibia.
- ¶ Would an X-ray be justified?





4 year old





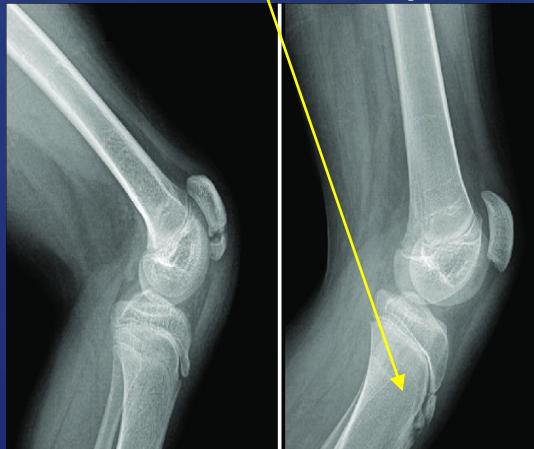
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Tibial tuberosity

- Acts as an attachment site for the inferior patella ligament.
- Prior to ossification, the anterior surface of the proximal tibia can appear 'indented'.

Secondary ossification centre	First appear (approximate)		Ossification complete (approximate)	
	Female	Male	Female	Male
Patella	3 years	4-5 years	Puberty	
Femoral distal epiphysis	6 months gestation to 1 month	6 months gestation to 1 month	17 years	18-19 years
Tibial proximal epiphysis	8 months gestation to 1 month	8 months gestation to 1 month	16-17 years	18-19 years
Tibial tuberosity	7-15 years	7-15 years	19 years	
Fibular proximal epiphysis	3 years	4 years	16-18 years	18-20 years

During ossification the surface of the tuberosity may seem irregular and there can be more than one ossification centre (that

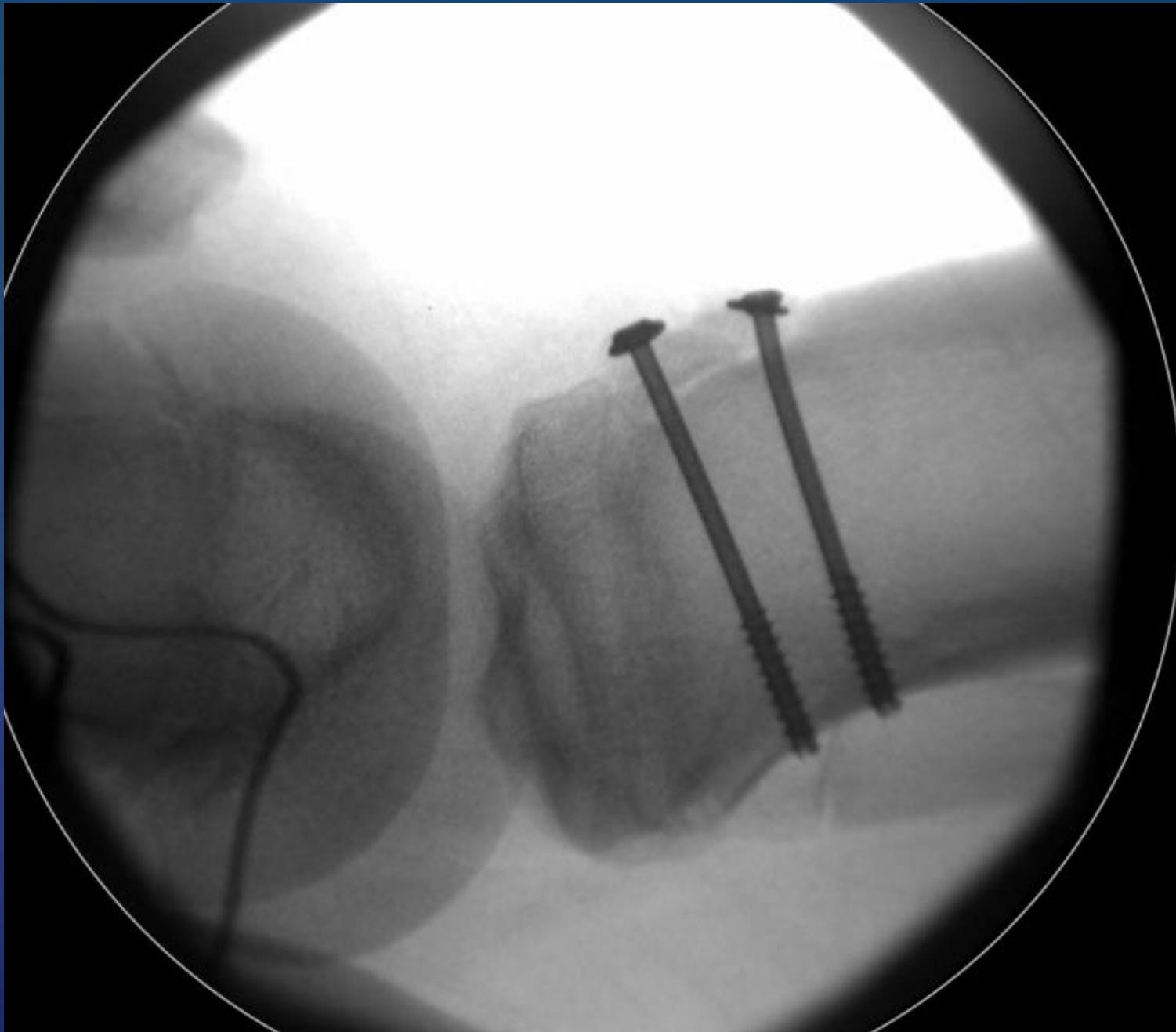


Tibial tuberosity fracture



- Tibial Tubercl Fractures are common fractures that occur in adolescent boys (12-15) near the end of skeletal growth during athletic activity.
 - less than 1% of paediatric fractures
 - Male >> female
- Most common MOI : basketball, football, sprinting and high jump with contraction of quadriceps during jumping or forced knee flexion





11 year old with knee pain

- Playing football- fall.
- Pain in rt knee but weight bearing with slight limp
- Slight tenderness & ‘hardness’ to muscles around femoral condyles
- PMH: nil, but awaiting orthopaedic opa due to 4 months hx of non traumatic knee pain
- Would an X-ray be indicated ?



R



70 year c/o painful, swollen right knee

: Hpc: approx 3/12 ago tripped in garden and fell directly onto right knee- pain immediately which settled, but over past few days, pain returned with swelling- unable to tolerate trousers over knee., No other complaints

SH: retired

Examination: Looks well
walking with slight limp only

RIGHT KNEE

Swollen + but no obvious effusion

No erythema and not hot to touch
tender proximal pole of patella

no bony tenderness to femoral condyles/ remaining patella/ joint lines

No tenderness to proximal /shaft or distal tibia or fibula

Able to SLR but pain felt

flexion: slight reduction to pain

Stress testing ACL/PCL and collateral ligaments: no obvious pain or laxity
full sensation distally with cap refill < 2 sec

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HBL

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Myositis dessicans

Any questions ?





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