

Paediatric Injuries

Matt Woronczak

Advanced Musculoskeletal Physiotherapist –
Emergency Department
Dandenong Hospital

the.emergencyphysio.com

<http://intranet/ed/>

Structure

- Assessment
 - Knee
 - Ankle and Foot
- Overuse Injuries
- Avulsion Injuries
- Knee Injuries
- Ankle and Foot Injuries

Paediatric injuries

- Most children are not little adults



- There are different injuries associated with paediatric patients compared to those who are skeletally mature, but also some of the same

Paediatric injuries

- Need to be mindful of injuries that could occur in children that we might assess or manage differently than in adults.
- Need to be mindful of exposure to radiation



KNEE ASSESSMENT

Knee Assessment

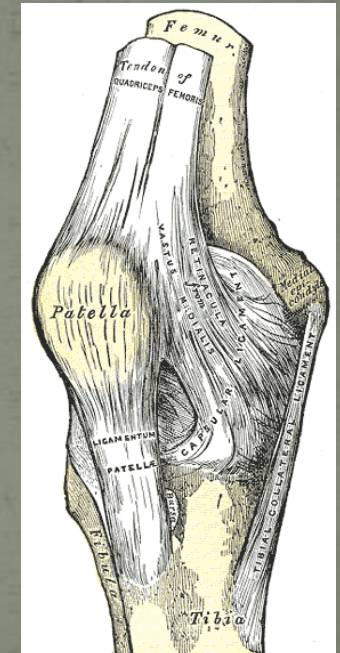
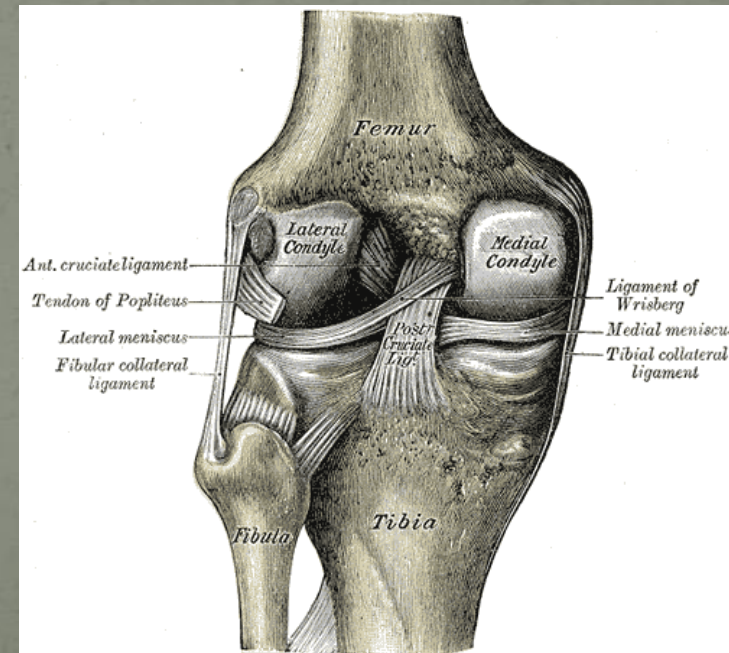
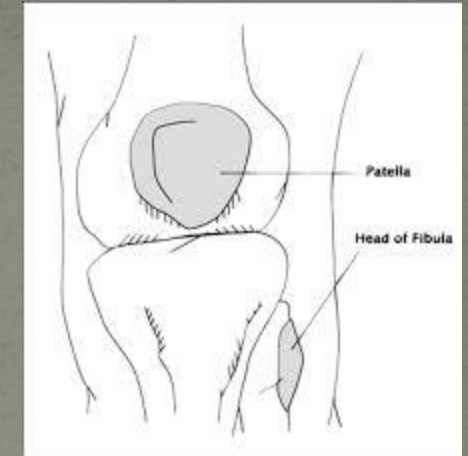
- Subjective
- May be a bit tricky – sometimes children are shy or don't offer much – may need to use targeted questioning
 - If acute injury, get an idea:
 - Mechanism
 - Ability to continue
 - Ability to weightbear
 - How long swelling took to develop (hours cf overnight)
 - Ask if any problems in that area before
 - How long has it been there?
 - What tends to stir it up?
 - What helps?
 - How long does it take to settle after activity?
 - How is it the next day? (especially in the morning)
 - Giving way? Due to pain or just collapses?
 - Locking / Catching?
 - Enquire about activity level
 - Type
 - Duration
 - Frequency

Knee Assessment

- AROM / PROM
 - Flexion / Extension
- Power
 - Ability to straight leg raise
- Palpation
 - Joint Line, MCL, LCL, quadriceps tendon, patellar tendon
 - Bony tenderness, in particular:
 - Fibular head
 - Patella
- Ability to Weightbear (regardless of limp)
- Ligament Stability Tests
 - Valgus 0,30 degrees
 - Varus 0,30 degrees
 - Lachmans
 - Anterior Drawer
 - Posterior Drawer
 - McMurrays
 - Appley's Grind
 - Apprehension Test

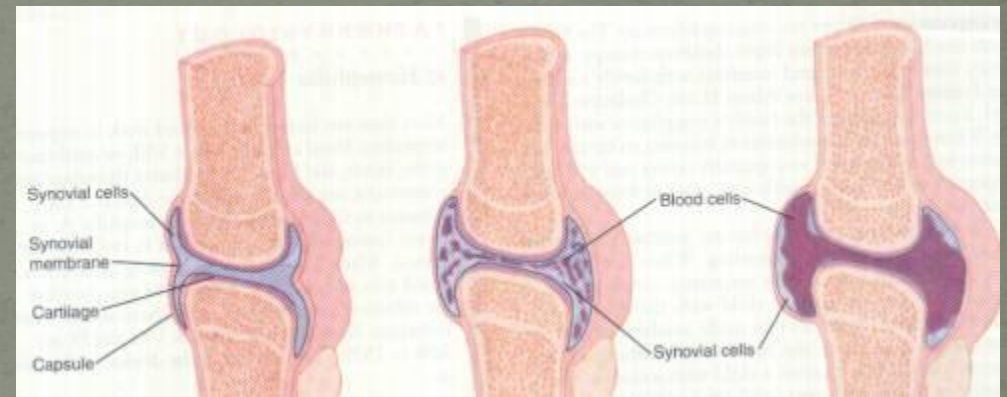
Knee x-ray indications: Ottawa knee rules (acute)

- Age ≥ 55 years
- Isolated patella tenderness
- Tenderness at head of fibula
- Inability to flex knee 90°
- Inability to bear weight (4 steps) immediately after injury and in emergency department



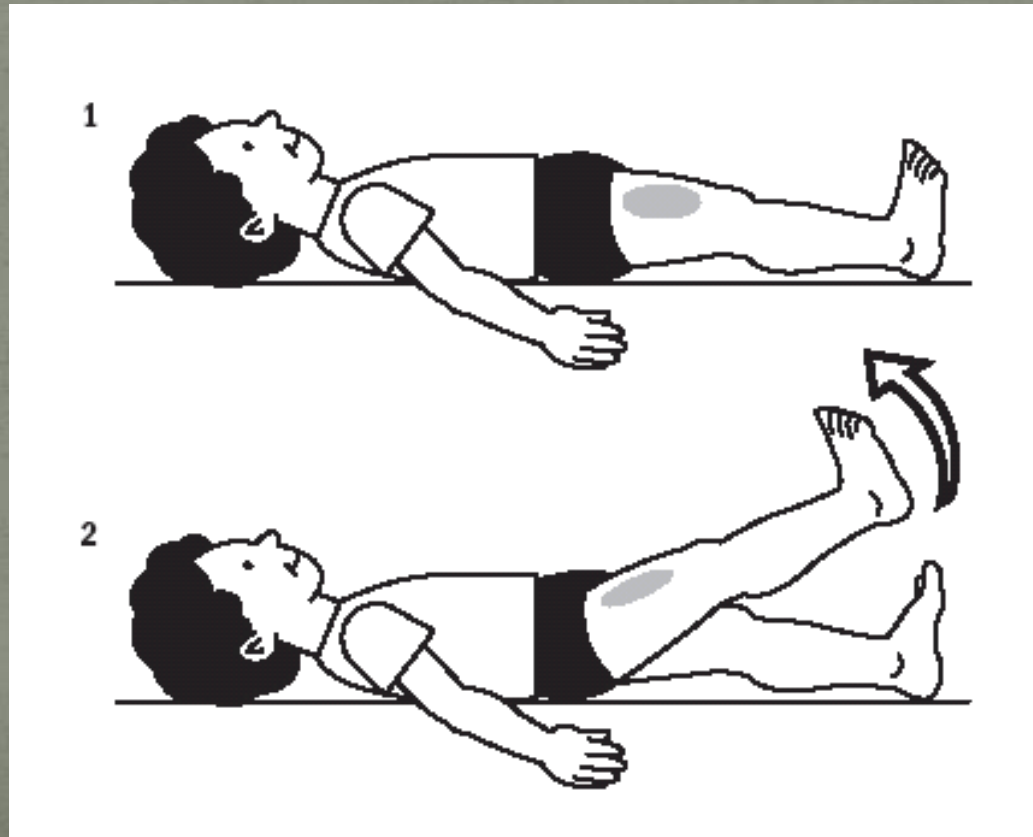
Knee Assessment

- Observation
 - Swelling – Haemarthrosis vs Effusion
- Haemarthrosis (not necessarily a *lipohaemarthrosis*)
 - Rapid Onset
 - Bloody / Boggy
 - Cause*
 - Intra-articular fracture
 - PFJ dislocation
 - ACL rupture
 - PCL rupture
 - Meniscal tear
- * Can have these injuries without a haemarthrosis, so don't assume just based on this, but if present, need to be strongly suspicious of them.
- Effusion
 - Gradual onset
 - Watery, easily moved



Straight Leg Raise Test

- Good all round test for knee, especially the quadriceps mechanism
- MUST be part of your initial assessment



Valgus and Varus Testing

- Need to test at 0 and 30 degrees
 - Full extension is the close packed position of the knee – collaterals and cruciates are taut, menisci are wedged in the intercondylar notch and there is most bony apposition
 - If grossly unstable in full extension = significant injury involving collaterals, one of both of the cruciates; if you can only test one other thing, do this!!!



Lachman's Test

- Best test for ACL in this setting
- Difficult to get the hang of
- Assessing end feel (should be like pulling a slack piece of rope in that it “snaps” tight at the end) and amount of movement



Anterior Drawer Test

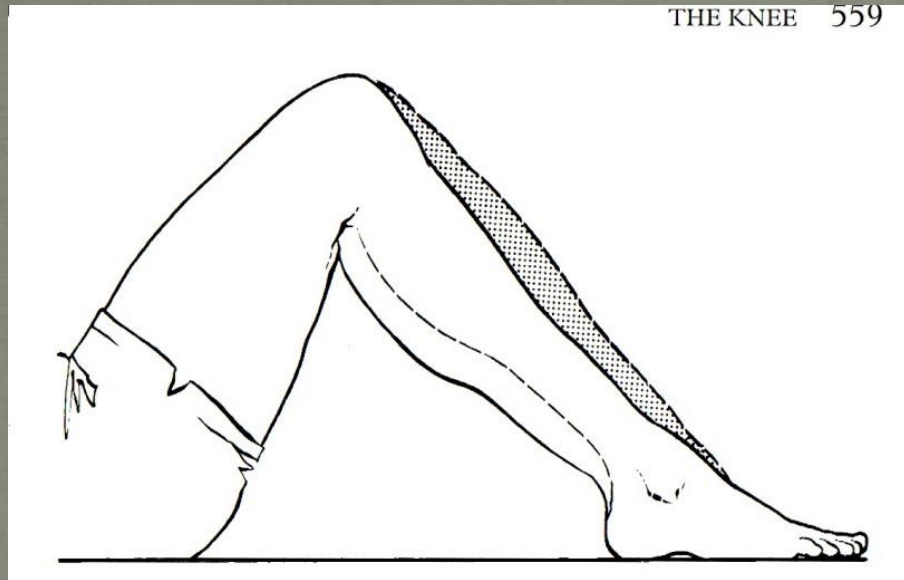
- Not as useful as Lachmans but easier to do
- Hamstrings in much better position to resist movement



Posterior Drawer Test



Posterior Sag Sign



McMurray's Test

- Aiming to reproduce pain, clunk
- Flexion, ER and varus and then straighten knee
- Can also do combinations of ER/IR and varus/valgus
- If too difficult to do in this manner, try flexing the knee and adding rotation – medial and then lateral



Appley's Grind Test

- Position patient in prone
- Bend knee to 90 degrees
- Apply a downward compressive force through the foot to rotate the knee medially and laterally
- Repeat with a upward distractive force
- Aiming to reproduce pain – theoretically should be worse with compression for a meniscal injury / internal derangement



Apprehension Test

- With knee in full extension*, attempt to dislocate the patella laterally
- Can also be tested in knee flexion (30 degrees) but retro-patellar force from passive quads tension makes this position more difficult to create a lateral glide naturally. Often easier to see change with knee extended as opposed to flexed.
- Looking for increased movement, pain, or “apprehension sign” – patient reflexively contracts quads to prevent patella dislocating or grabs your arms or says it feels like patella will dislocate.



ANKLE AND FOOT ASSESSMENT

Ankle and Foot Assessment

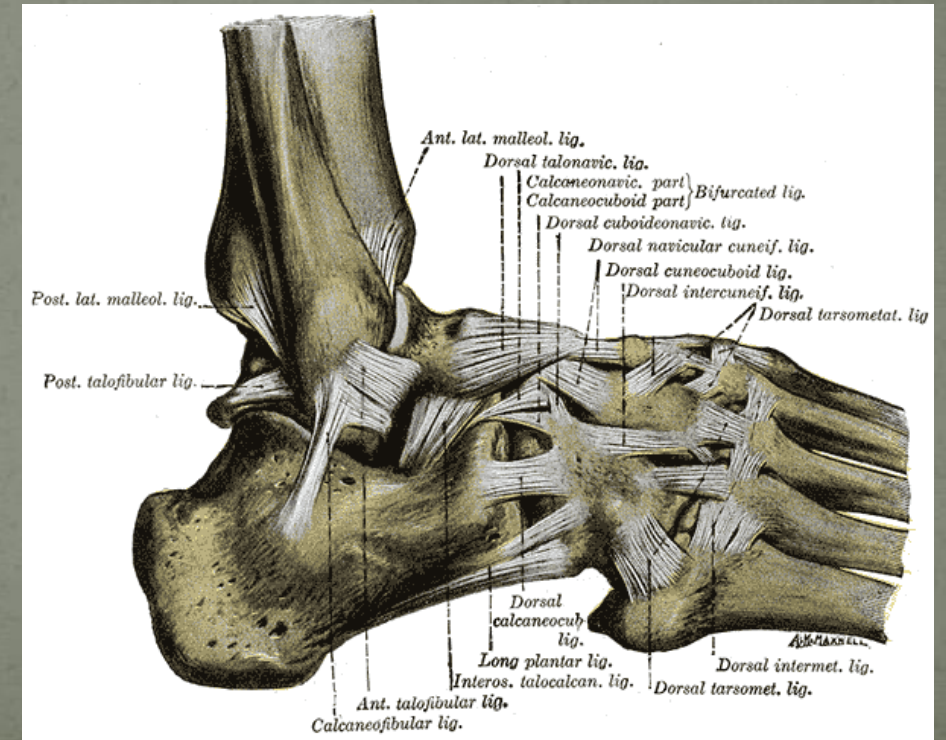
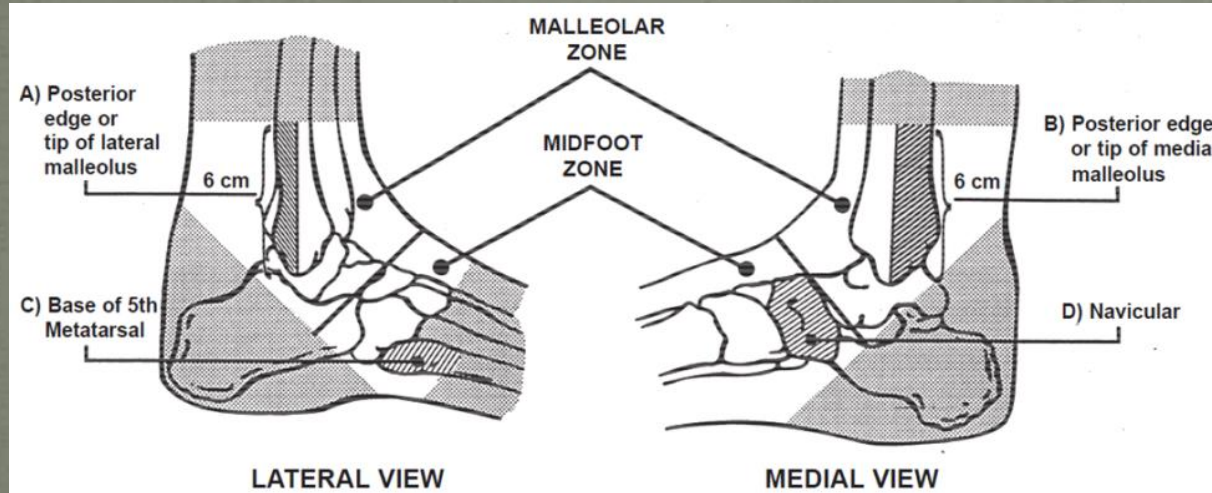
- Subjective
 - May be a bit tricky – sometimes children are shy or don't offer much – may need to use targeted questioning
- If acute injury, get an idea:
 - Mechanism
 - Ability to continue
 - Ability to weightbear
 - How long swelling took to develop (hours cf overnight)
- Ask if any problems in that area before
 - How many times has it happened before (if relevant)?
 - How long has it been there?
 - What tends to stir it up?
 - What helps?
 - How long does it take to settle after activity?
 - How is it the next day? (especially in the morning)
- Enquire about activity level
 - Type
 - Duration
 - Frequency

Ankle and Foot Assessment

- AROM / PROM
 - Dorsiflexion / Plantarflexion
 - Inversion / Eversion
- Resisted Contraction
 - Eversion
 - Plantarflexion
- Ability to weightbear (regardless of limp)

Ankle and Foot Assessment

- Palpation
 - In particular:
 - Distal 6cm of the fibula and tibia (noting if tender posteriorly)
 - Base of the 5th metatarsal and navicular



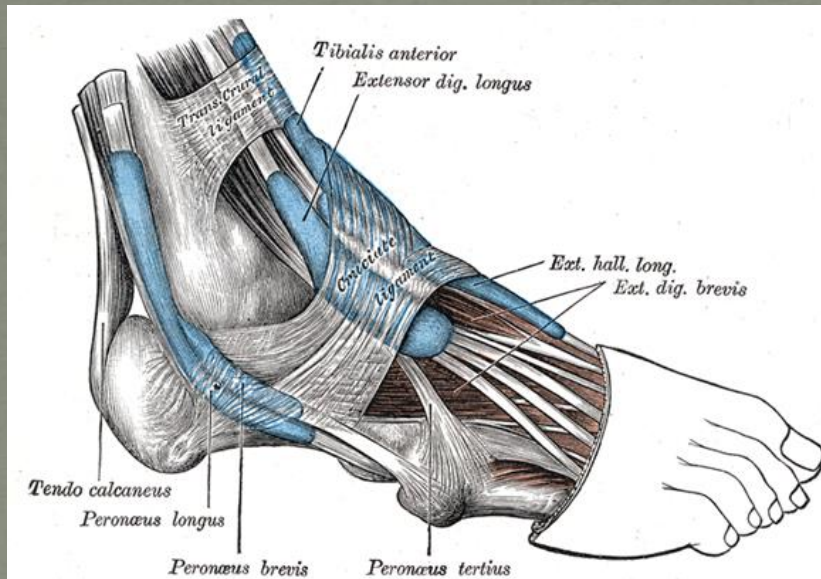
Ankle and Foot Assessment

- Ligament stability tests
 - Anterior drawer
 - Talar tilt
- Thompson / Simmonds



Resisted Contraction

- Resist active eversion



- If a deficit, is it NEUROLOGICAL or MUSCULOSKELETAL?

Neuropraxia

- 17% of grade II sprains and 86% of grade III sprains sustained common peroneal nerve abnormalities (without an actual footdrop, which is rare)

(Nitz AJ, Dobner JJ, Kersey D. Nerve injury and grades II and III ankle sprains. Am. J Sports Med. 1985;13:177-82.)

OVERUSE INJURIES

Apophyseal Injuries

- Overuse injuries are common in the athletic paediatric population
- Rather than failing in the TENDON as in the skeletally mature, in children the weakest point is at the tendon insertion into the BONE
- This is particularly common in the knee and ankle, where the strong tendons attach to traction epiphyses = APOPHYSIS
- The paediatric equivalent of tendinopathy is APOPHYSITIS and is usually caused by relative or actual overuse
 - Mechanics
 - Excessive activity

Osgood-Schlatter's

- Apophysitis at the tibial tubercle, the site of the distal insertion of the quadriceps mechanism (patellar tendon / ligament)
- Chronic condition
- May have a prominent tibial tubercle
- On x-ray = fragmented tibial tubercle, but corticated
- Cause
 - Repetitive high force through the quadriceps mechanism ie jumping
 - Basketball / Volleyball / Netball



Sinding-Larsen-Johannson's

- Apophysitis at the proximal insertion of the patellar tendon / ligament = inferior pole of the patella
- Chronic condition
- Corticated on x-ray
- Cause
Repetitive high force through the quadriceps mechanism ie jumping
Basketball / Volleyball / Netball



Knee Apophysitis

- Treatment
 - **REST!!**
 - Problem is excessive load from what body can recover from
 - Rest is important
 - Sometimes need a period of complete rest
 - If you don't change anything though, symptoms will return
 - **Address biomechanics**
 - Physiotherapy
 - Muscular length – quadriceps / hamstrings
 - Strength – quadriceps / gluteals
 - Posture / Core
 - Podiatry
 - Appropriate footwear +/- orthotics
 - **Gradual return to activity**
 - Adequate rest in between sessions (have a day off in between sessions)
 - May need to moderate activity long term
 - Patient may need to choose most important activity and cease other

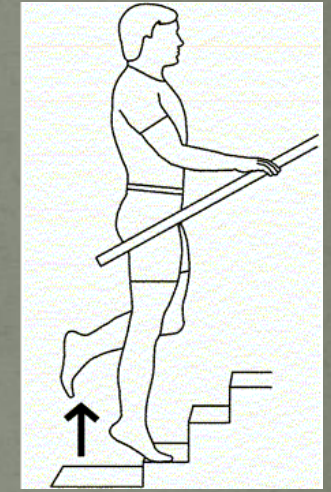
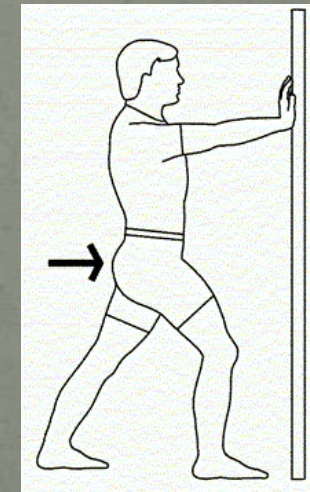
Sever's Apophysitis

- Apophysitis at the calcaneal tuberosity, where the Achilles tendon inserts
- X-ray = fragmentation of the calcaneal tuberosity
- Chronic problem
- Cause
 - Tightness of the Gastrocnemius / soleus complex (bones grow first and then muscles have to adapt)
 - Mechanics of the foot and ankle
 - Flat out too much activity



Sever's Apophysitis

- Treatment
 - **REST!!**
 - Problem is excessive load from what body can recover from
 - Rest is important
 - Sometimes need a period of complete rest
 - If you don't change anything though, symptoms will return
 - Heel wedges may reduce strain on this area if unable to walk heel to toe
 - May need crutches for a few days if acutely irritable
 - **Address biomechanics**
 - Physiotherapy
 - Muscular length – gastrocnemius / soleus
 - Strength – calf
 - Posture / Core
 - Podiatry
 - Appropriate footwear +/- orthotics
 - **Gradual return to activity**
 - Adequate rest in between sessions (have a day off in between sessions)
 - May need to moderate activity long term
 - Patient may need to choose most important activity and cease other



AVULSION INJURIES

Avulsion Fractures

- Forces that would cause a muscular injury in an adult, may result in an avulsion fracture in a paediatric patient
- Typically for an adult, we wouldn't image a suspected hamstring, quadriceps or hip flexor muscle strain, however this is different in the paediatric population due to the likelihood of different structures being involved
- Sudden violent muscle contraction can avulse the bony insertion of muscles – this is especially common around the pelvis, but can also occur about the knee and ankle.
- Can be associated with tight muscles

Patellar Sleeve Avulsion

- Acute traumatic condition
- Patellar sleeve fractures represent chondral or osteochondral avulsion injury at the inferior pole of the patella.
- 8 to 12 years of age, when patellar ossification is nearly complete
- Powerful contraction of the quadriceps muscle applied to a flexed knee
- MRI may be necessary if x-ray normal (as it might only be cartilaginous)

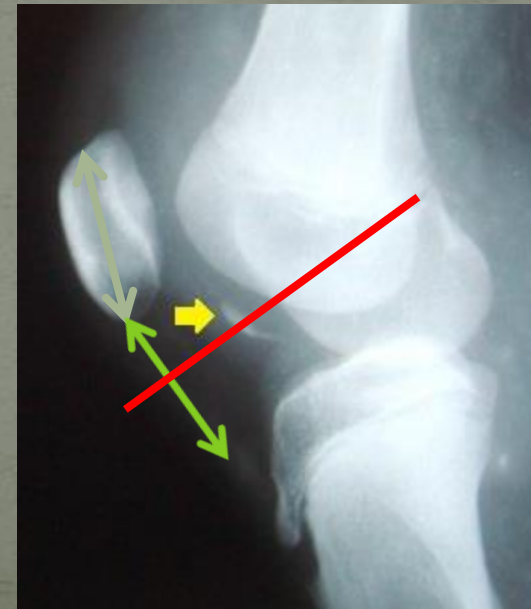
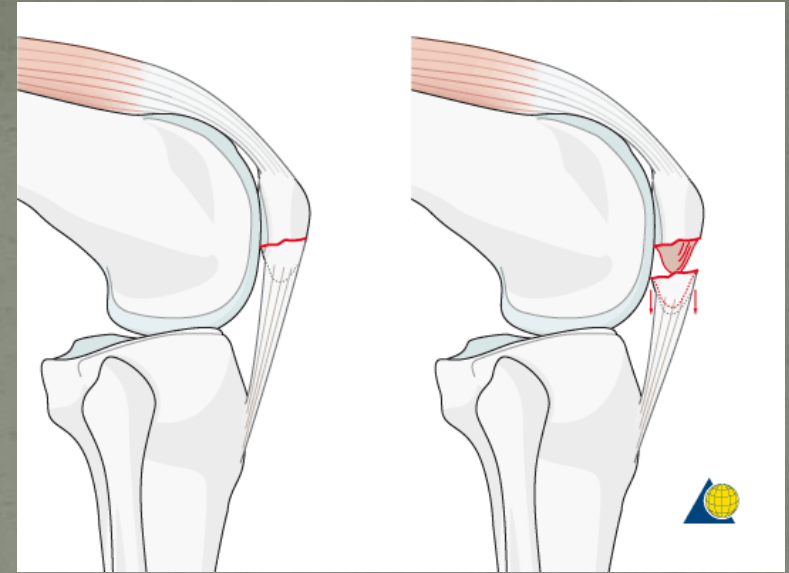


Patellar Sleeve Avulsion vs Sinding-Larsen-Johannson's



Patellar Sleeve Avulsion

- Patella alta - the distance between the patella and the tibial tubercle should be less than $1.1 \times$ patella height (green arrows)
- On a true lateral, with knee slightly flexed, **Blumensaat's** line (in red) should point to the inferior pole of the patella
- Treatment is surgical – injury is NOT TO BE MISSED!



Tibial Tubercle Avulsion

- Tibial tubercle avulsion
 - Sudden violent muscle contraction
 - Often take off the whole anterior part of the tibia (not just the tubercle)

SURGICAL MANAGEMENT IF DISPLACED



Tibial Tubercle Avulsion vs Osgood Schlatter's



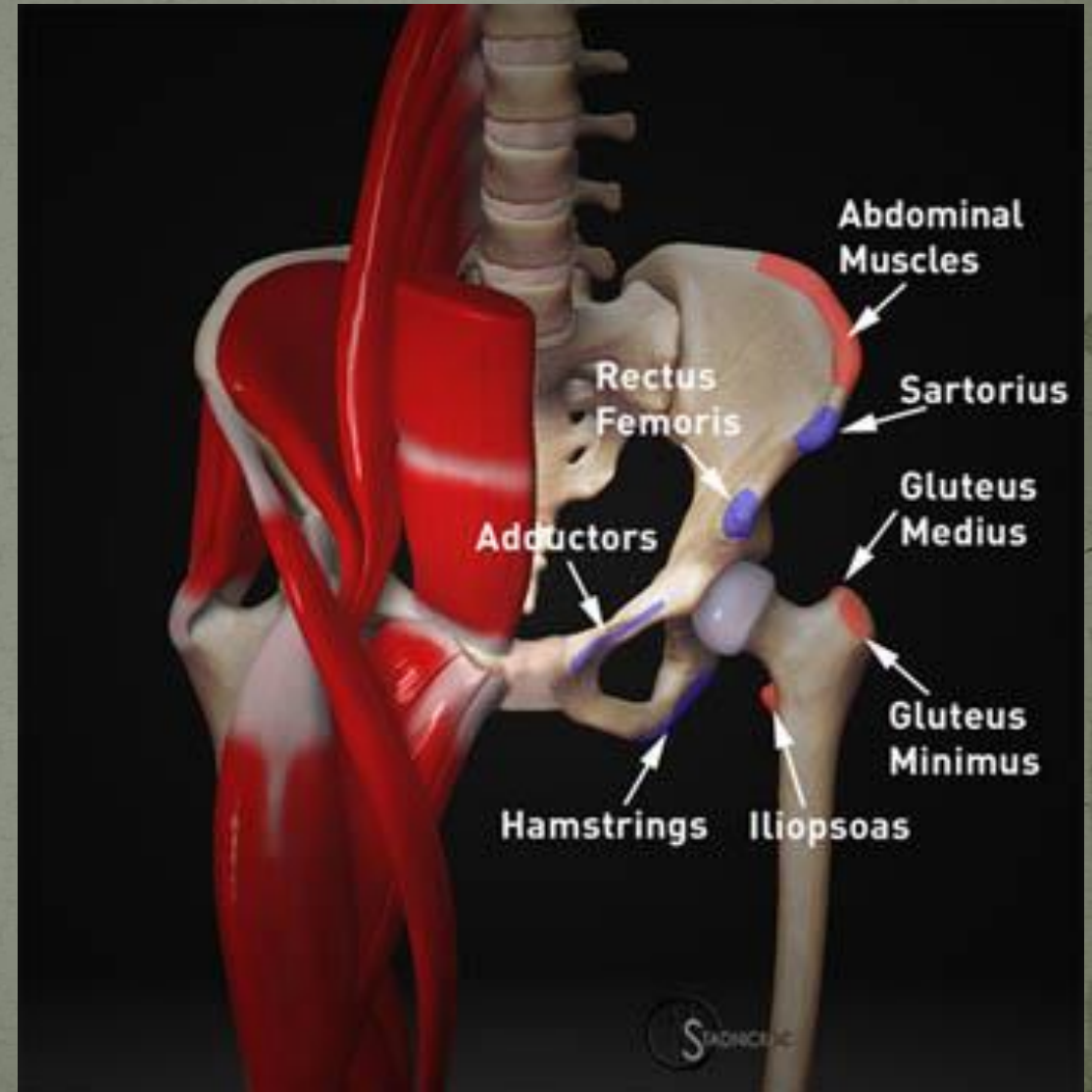
Tibial Spine Avulsion

- Children CAN rupture ACLs, however need to exclude tibial spine avulsion fractures – promptness of operative management critical
- If suspicious of ACL injury in a child, need x-ray (may not always meet Ottawa Rules either)



Pelvic Avulsion Fractures

- Anterior Inferior Iliac Spine (Rectus Femoris)
 - Sprinting / Kicking
- Anterior Superior Iliac Spine (Sartorius)
 - Kicking (soccer / football)
- Ischial Tuberosity (Hamstrings)
 - Sprinting / Kicking
- Iliac Crest (Abdominals / Erector Spinae)
 - Jumping
- Lesser Tuberosity (Iliopsoas)
 - Sprinting
- Superior Pubic Ramus (Adductors)
 - Rapid change of direction



Pelvic Avulsion Fractures

- Most, (unless grossly displaced = more commonly ischial tuberosity), they are managed conservatively:
 - Rest until pain settles
 - May need crutches
 - Stretch and strengthen + Core work
 - Gradual return to activity (can take > 6 weeks)

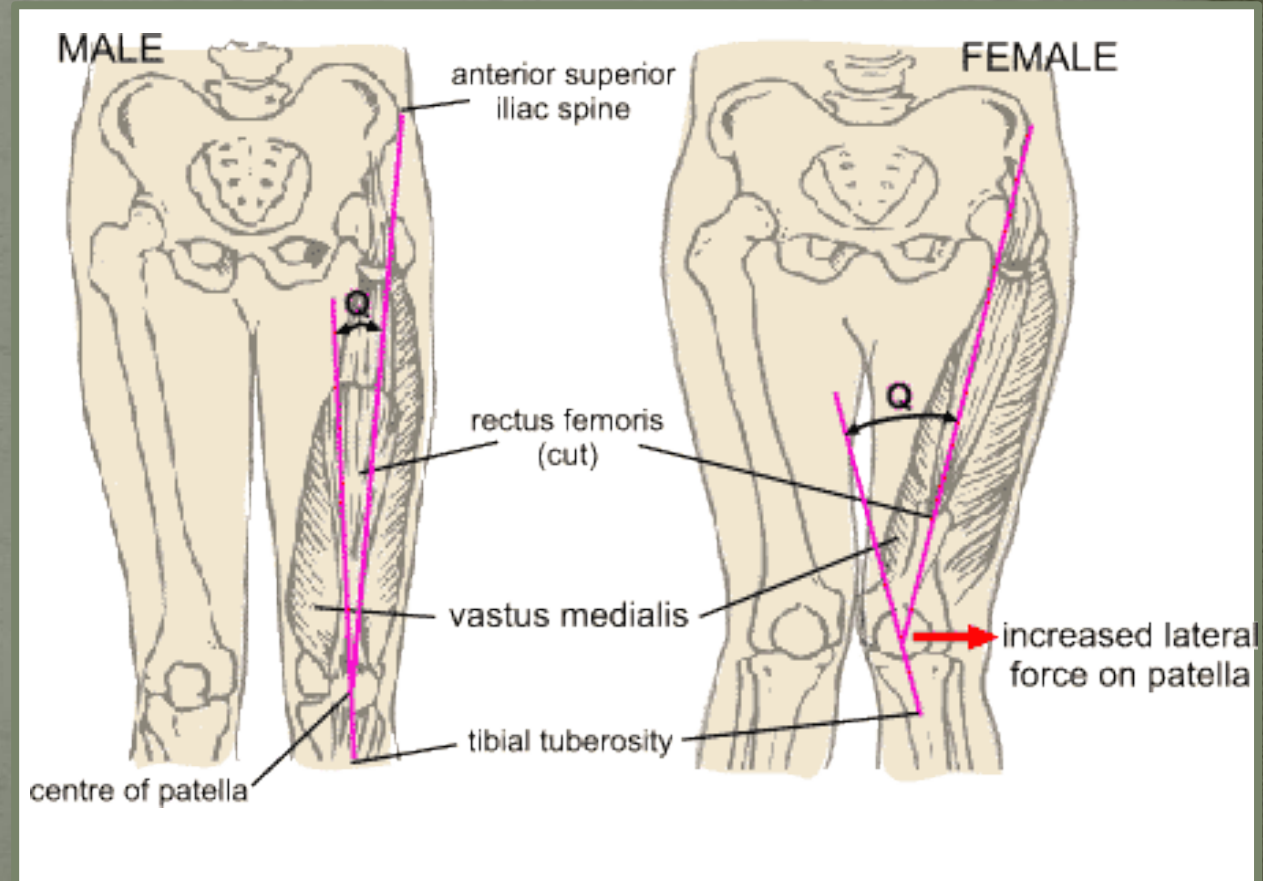


KNEE INJURIES



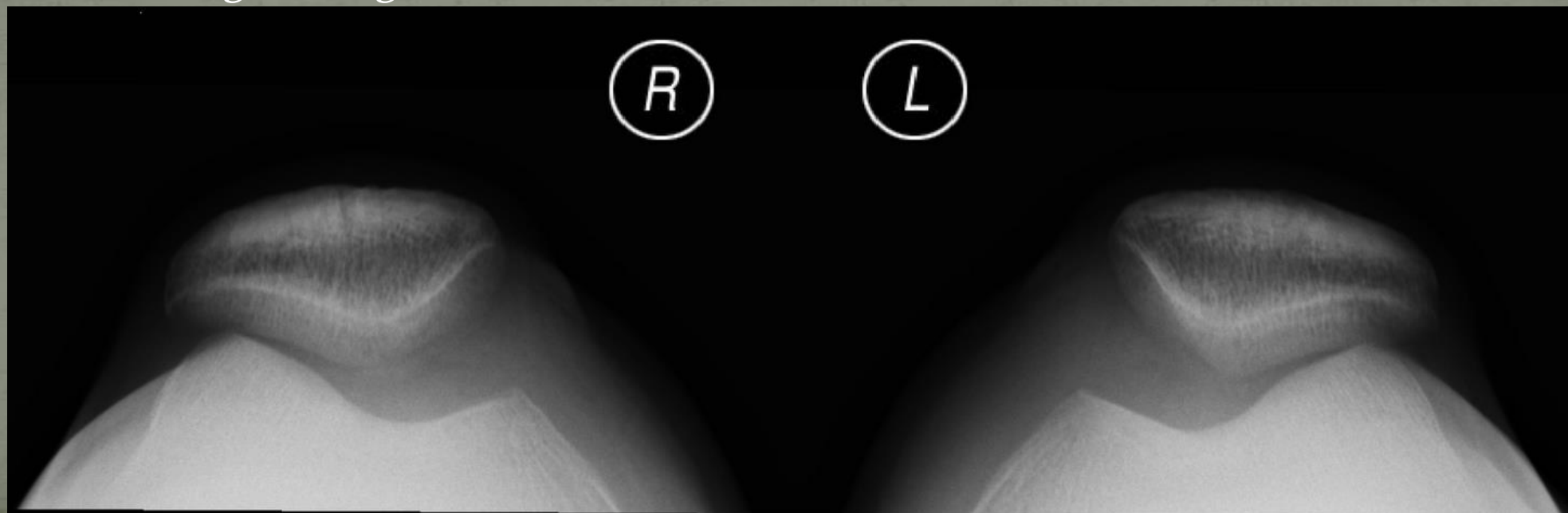
Patellofemoral Dysfunction

- Contributing factors
 - Overweight
 - Generalised ligamentous laxity
 - Increased Q angle
 - Female
 - Femoral anteversion
 - External tibial torsion
 - Genu valgum



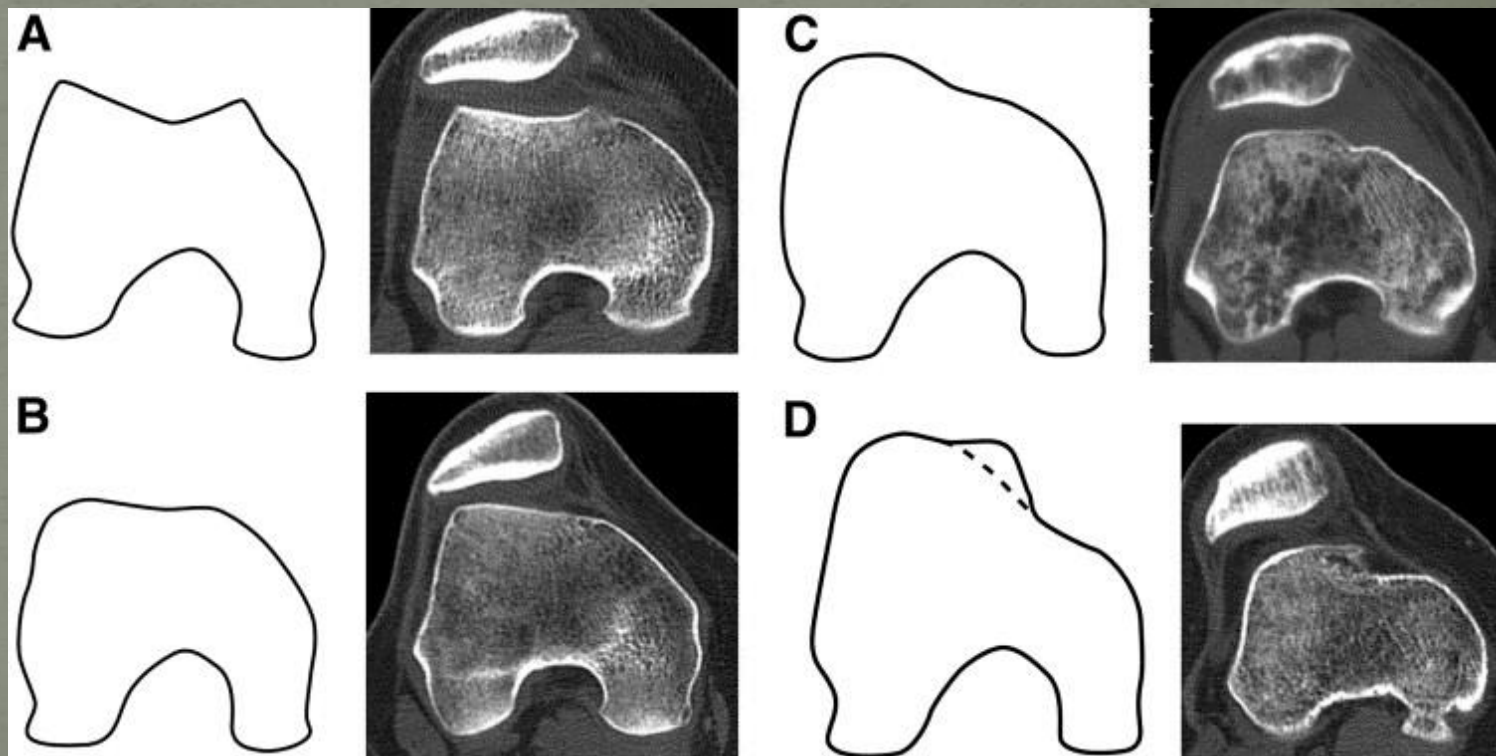
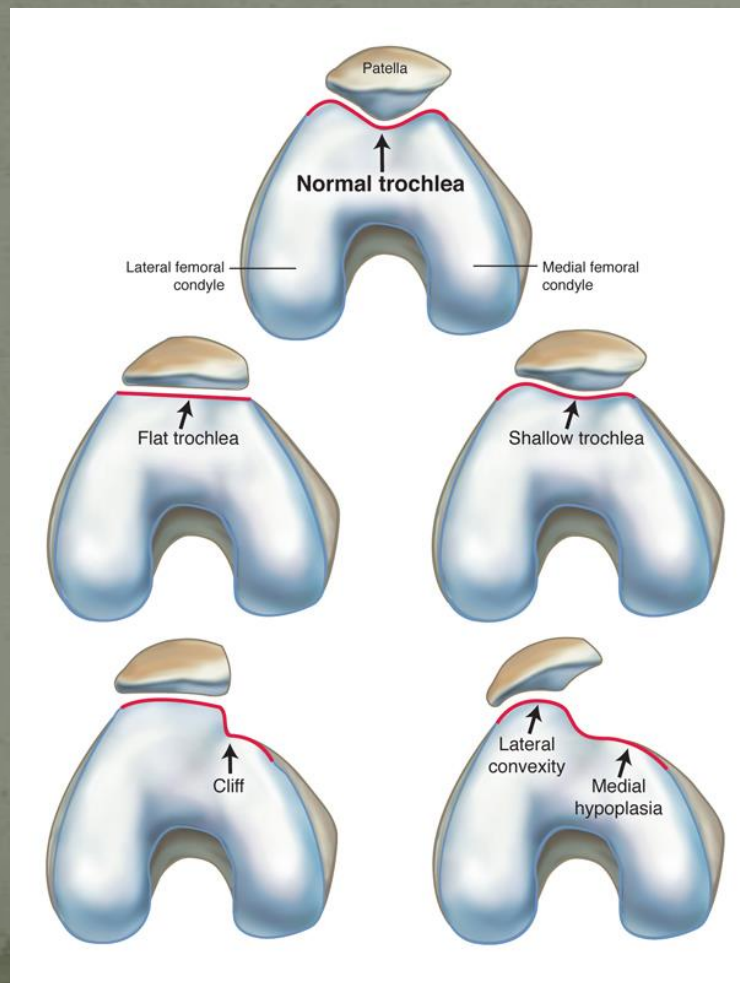
Patellofemoral Dysfunction

- Contributing factors
 - Shallow trochlear groove
 - Lower limb biomechanics
 - Glutes, quads weakness
 - Hamstring, calf tightness



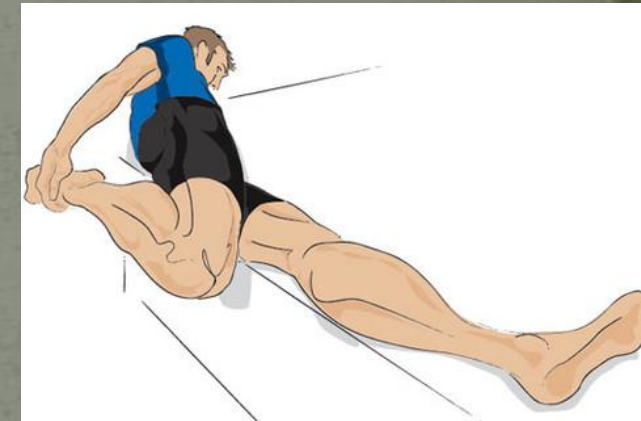
Patellofemoral Dysfunction

- Contributing factors



Patellofemoral Pain

- Management
 - Address modifiable factors
 - Physiotherapy
 - Gluteal and quadriceps / vastus medialis obliquus strength
 - Quadriceps / ITB / Hamstring length
 - Weight loss
 - Podiatry
 - Footwear +/- orthotics



Patellofemoral Pain

- Management
 - Taping / Bracing
 - Can help to pull the patella medially
 - May provide more proprioceptive feedback than mechanical support



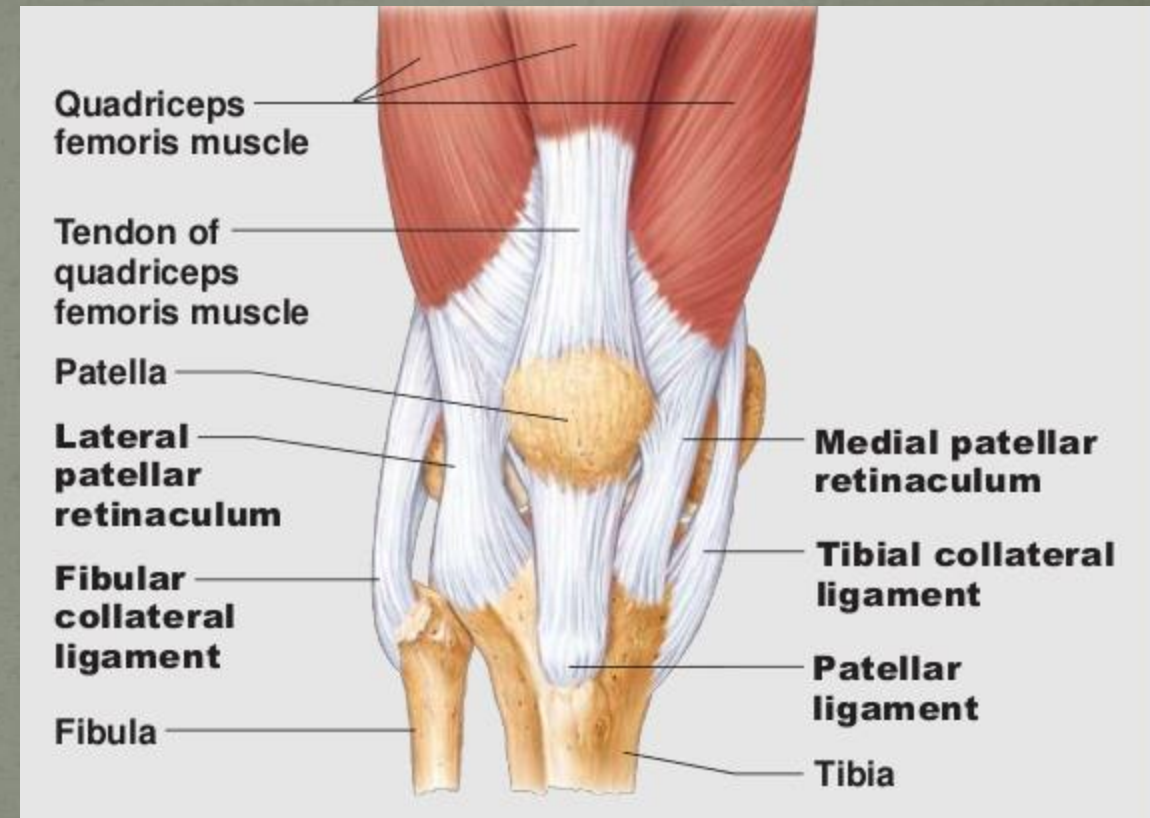
Patellofemoral Dislocation

- Easy when obviously still out
- May be underdiagnosed when not actually visualised though
- Suspect when
 - Description of something going out and coming back in (by itself, low threshold)
 - Positive apprehension test
 - Tender around patella
 - Usually get a haemarthrosis – so swelling++
- Always
 - Make sure that can SLR
 - Ensure that doesn't have any other injury



Patellofemoral Dislocation

- Injured structures
 - **Medial structures**
 - Medial retinaculum
 - Medial patellofemoral ligament
 - **Osteochondral**
 - Damage to articular surface
 - Osteochondral fracture (patella / femur)
 - Avulsion # (medial patella)



Patellofemoral dislocation

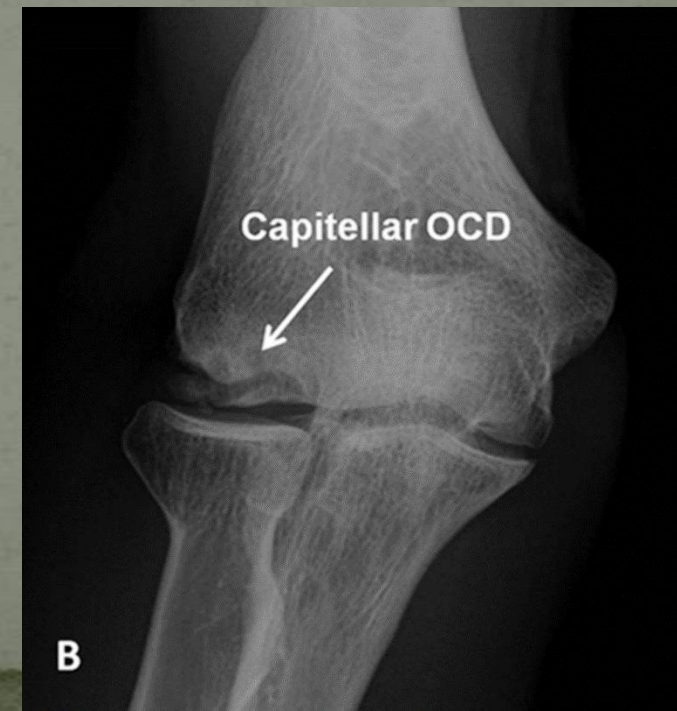
- Management
 - ZKS for 2-3/52 to allow damage structures to tighten / heal (until apprehension -ve)
 - WBAT
 - Physiotherapy for strengthening, rehabilitation
 - No sport for at least 6/52
 - 3 strikes and you're out – consider surgical options for repeat dislocations
 - Surgery not hugely successful and can be quite drastic compared to say ACL rupture as there are multiple contributing factors:
 - Tibial tubercle realignment
 - MPFL augmentation
 - Medial retinacular repair
 - Lateral release

Patellofemoral dislocation

- Management
 - Keep knee extended for 2-3/52
 - Allows damaged structures to heal
 - Less PFJ compressive force (so allows cartilage to heal)
 - Rehab as per PFJ dysfunction

Osteochondritis Dessicans

- Small segment of bone begins to separate from its surrounding region due to a lack of blood supply. As a result, the small piece of bone and the cartilage covering it begin to crack and loosen.
- Most common joints affected are the knee, (75% = mostly MFC) elbow (6% = mostly capitellum) and ankle (5% = talar dome)



Osteochondritis Desiccans

- The condition typically affects just one joint.
- May be caused by subchondral bone bruise following injury (so may not show up on initial imaging)
- Surgery is considered in most cases and is often the treatment of choice, although the exact option is controversial

FOOT AND ANKLE Injuries

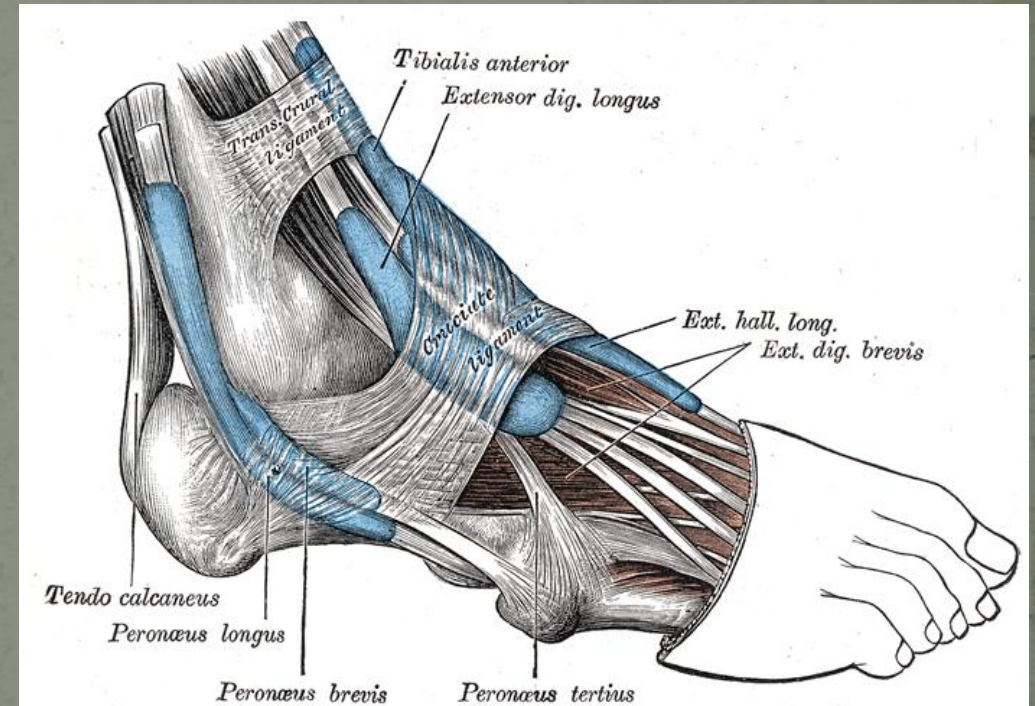


Ankle Sprains

- Ultrasound irrelevant
 - All grades of ankle sprain (even if the ATFL is ruptured) are managed conservatively.
 - Surgical reconstruction is when conservative management (>3/12) has failed and there is ongoing instability

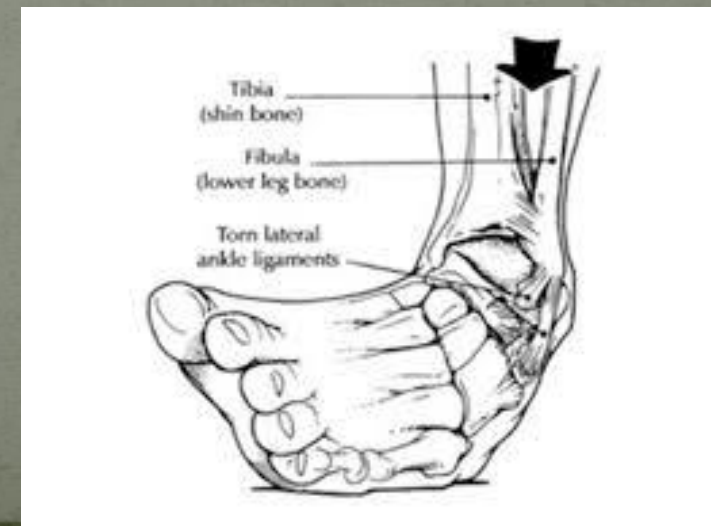
Have you ever heard of a football player going down mid-season needing an ankle reconstruction?

- Manage
 - RICE
 - WBAT
 - Consider ankle brace for early support (which will allow WB) vs backslab (which will not).



Ankle Sprains

- If have higher grade sprain, may have plantarflexion / inversion posturing at rest
- If have poor active movement and cannot dorsiflex their ankle (especially if cannot weightbear), consider a backslab for a few days until the pain improves / they gain greater control
- Also consider ankle brace (can get from chemist) which will minimise plantarflexion / inversion but allow weightbearing (and is useful for early return to sport)
- Manage
 - RICE
 - WBAT



Ankle Sprain Handout

Ankle sprains

Emergency department factsheets

health

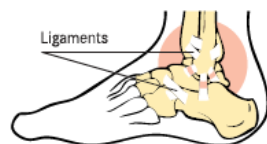
General

What is an ankle sprain?

Ankle sprains happen to people of all ages. They occur when you 'roll your ankle', which over-stretches the *ligaments* (the fibrous bands that hold the ankle together).

What are the symptoms?

When ligaments are damaged, there is pain, swelling and sometimes bruising. Too much swelling can slow the healing process. Pain is usually worst in the first two to three days.



Treatment

You may require an x-ray to determine if you have a broken bone (*fracture*).

Significant injuries may require an ankle brace, or even a plaster cast to allow ligaments to heal properly.

Some people who have repeated ankle sprains may need surgery to stabilize the weakened ligaments.

If you have pain, medications such as paracetamol, codeine (or a combination of both) may help. Anti-inflammatory medications can also help to reduce the swelling and pain. Ask your health-care professional what is best for you.

Prevention

There are simple measures you can take to reduce the risk of an ankle sprain.

- Warm up before exercise.
- Wear supportive shoes.
- If you have previously injured your ankle, you may need to tape or brace your ankle for sport. Speak to your physiotherapist for further information.

First aid for sprains

The initial treatment (first 72 hours) for ankle sprains is based on the 'RICE' principles: Rest, Ice, Compression and Elevation.

Rest Avoid activities that cause pain. If you are unable to put weight on your leg comfortably, use crutches.

Ice Wrap ice cubes in a damp towel, use frozen peas or a sports ice pack in a towel. Apply to the injured area for 15-20 minutes every one to two hours while you are awake. Never apply ice directly to the skin.

Compression Apply a firm bandage from the toes to above the ankle. Ensure the bandage does not increase your pain or restrict blood flow to your toes.

Elevation When resting, raise your foot so it is above the level of your heart.



Avoid 'HARM' – Heat, Alcohol, Re-injury and Massage. In the first 48-72 hours, **avoid**:

Heat Increases blood flow and swelling.

Alcohol Increases blood flow and swelling, and can make you less aware of aggravating your injury.

Reinjury Protect your joint until it has healed adequately.

Massage Promotes blood flow and swelling. Massage can increase damage if begun too early.

Ankle sprains

Emergency department factsheets

health

General

What to expect

Most people fully recover in one to six weeks. If you are not better after a week, see your local doctor or physiotherapist. For more significant injuries, a physiotherapist can provide assistance with healing and rehabilitation. As the pain settles down after the first few days, gradually increase your level of activity.

Exercises

It is important to maintain flexibility and strength as you recover. Progress down the list of exercises as you are able. Perform each exercise three times, twice a day.

Exercise 1. Using a towel, pull your toes back as far as comfortable, and hold for 30 seconds.



Exercise 2. Keeping your foot flat on the ground, slide it back under the chair and hold for 30 seconds.



Exercise 3. Keeping your foot flat on the ground, bend your knee towards the wall and hold for 30 seconds.



Exercise 4. Rise up and down on your toes as many times as you can in a row. Do this with just the injured leg when you can. To make it harder still, do this exercise on a step with your heels off the edge.



Seeking help



In a **medical emergency** go to the nearest hospital emergency department or call an ambulance (dial 000).



See your local doctor or health care professional if you have not improved at all after a week, especially if you are still unable to put weight on your leg.



For health advice from a Registered Nurse you can call **NURSE-ON-CALL 24 hours a day on 1300 60 60 24** for the cost of a local call from anywhere in Victoria.*

NURSE-ON-CALL provides access to **interpreting services** for callers not confident with English. Call **1300 60 60 24**.

*Calls from mobile calls may be charged at a higher rate



Want to know more?

- Ask your local doctor or health care professional.
- Contact a physiotherapist.
- Visit the **Better Health Channel** www.betterhealth.vic.gov.au

Notes:

If you would like to receive this publication in an accessible format, please phone 9096 0578 or email edfactsheets@health.vic.gov.au



December 2010. Also available online at www.health.vic.gov.au/edfactsheets

Disclaimer: This health information is for general education purposes only. Please consult with your doctor or other health professional to make sure this information is right for you.

Authorised by the Victorian Government Melbourne (1009025)

Fifth Metatarsal Base

- Don't confuse the apophysis for a fracture
- Fractures of the 5th metatarsal base are never longitudinal and are almost always transverse / slightly oblique
- Can get apophysitis here as well = pull from Peroneal Brevis = "Iselin's"



BEWARE OVERUSE INJURIES

- Repetitive trauma injuries present differently
- Always ask about previous injuries or problems in that area
- Be suspicious of stress fractures in the very active

Stress fractures

- 14 year old female presented with painful foot - came on during race, but able to finish and do several more. Once cooled down, painful and difficult to WB
- Athletics++
- Worsening pain as day goes on
- Still able to run, hurdle
- OX
 - Limping
 - Minimal swelling
 - Navicular tenderness
- On Probing
 - Pain during athletics for 5/12
 - Never bad enough that had to stop
 - Often limping after athletics and takes maybe 2 days after before can walk without limp

Stress fractures

- Navicular

