X ray is Normal....Now What?
WE do this a lot….usually well!

10-20% of ED visits are for musculoskeletal injuries

Unfortunately, most common cause of litigation in Canada

Pitfalls include missed injuries, failure to recognise significance of injuries, inadequate initial management, and failure to refer to appropriate specialists in a timely manner
Fundamentals:

● Complete hx: mechanism of injury, age, risk factors
● Accurate physical (e.g. there is more to the wrist exam than checking the “snuffbox” and more to the ankle exam than included in the Ottawa rules)
● X ray studies:
  ○ 20% of MSk litigation involves failure to order X rays in the first place
  ○ Ensure adequate quality of films (e.g. proper lateral views of hands, wrists and elbows) and order additional views if required
  ○ Be acutely aware of common locations for occult fractures: scaphoid, radial head, hip, talar dome, tibial plateau etc.
  ○ Most commonly missed fracture is the second fracture.
AGE matters:

- **Children:**
  - Open growth plates result in different patterns of injury
  - Ligaments are stronger than bone, therefore more likely to sustain facture than sprain
  - Lower threshold to X ray children (even the Ottawa ankle rules urge caution under the age of 18)

- **Elderly:**
  - More likely to fracture with less force
  - Important to consider the effects of illnesses and medication on patterns of injury and appearance of X rays
Lower limb: HIP

- Usually elderly
- Often after a fall or sometimes (? 10-20%) pivot on leg, twist, break and then fall
- Classically shortened and externally rotated BUT only if displaced
- Unable to lift leg due to pain, tender over greater trochanter
- X ray not 100% accurate. Up to 5% are normal!
- If suspicious, request further imaging (usually CT)
- Be cautious of “test drive”. Sending home an undisplaced hip fracture can result in a displaced fracture, or worse, another fall and further injury
Initial X rays provide diagnosis in less than 7% of injuries, therefore clinical skills are crucial!

- X ray negative injuries include:
  - Dislocation
  - ACL tear
  - MCL tear
  - Meniscus tear
  - Patellar and quadriceps tendon tears
  - Tibial plateau injuries
56 year old man falls off scaffold....

- Hyperextended knee. Swears that his foot almost touched his groin but when bystanders dragged him away, his knee seemed to straighten out
- OE: right knee grossly swollen with a lot of bruising, large effusion. Difficult to examine but ligaments seem lax. PP’s present.
- X ray normal
Knee Dislocation

- Potentially limb threatening injury secondary to neurovascular complications
- Usually anterior but can be any direction
- More than 50% spontaneously reduce!
- If 3 out of 4 ligaments unstable, strong evidence of possible dislocation
- Vascular injury can occur even with palpable pedal pulses
- If clinically suspicious, refer immediately. Don’t splint and send home!
ACL injury:

- Acute sudden deceleration or change in direction or landing after jump
- Common in skiing, football, soccer, basketball
- Usually significant swelling and effusion occurring rapidly
- Often unable to weight bear immediately, i.e. can no longer continue to play
- X ray usually normal. Avulsion of tibial spine more common in children
- Segond fracture (lateral tibial plateau avulsion # uncommon but highly suggestive of ACL tear)
MCL injury:

- Valgus strain: football player tackled from side
- If also tender laterally AND has effusion, suspect occult lateral tibial plateau fracture
  - Especially in older adults
  - E.g. 68 year old male greeted enthusiastically from the side by his pet Newfoundland dog
Meniscus injury:

- Usually medial
- In the young, usually caused by significant twisting injury
- In older adults can occur with relatively minor injury
- Swelling and pain tend to progress over 1-2 days. Athletes can sometimes continue playing.
- If unable to fully extend, bucket handle tear is very possible and must be referred ASAP for possible arthroscopy. Any delay can result in permanent disability or prolonged recovery!
60 year old man slips in shower.....

- States he landed on knee and then fell backwards
- Cannot extend at knee. Not much pain.
- Large palpable defect between superior patella and quadriceps
- Xray normal
Patellar and Quadriceps tendon tears:

- Sudden quad contraction with knee flexed
- Patellar if less than 40 yo
- Quad if older than 40
- Always assess straight leg raise as part of your exam of knee
- If patient can raise heel off stretcher, extensor mechanism is intact
Pedestrian struck by bumper of car:

- Unable to weight bear
- Significant swelling and effusion
- Tender over lateral edge of knee
- Xray normal
Tibial Plateau fracture:

- Usually high velocity force in young patient
- Elderly more prone with even minor injury, usually involving valgus strain
- Frequently missed on Xrays
- If suspicious, do CT or refer early
2 year old that won’t walk:

Playing, fell, won’t weight bear on left leg….Exam normal otherwise

● “Toddler’s fracture”
● 9 months to 5 years old
● Twisting injury results in oblique fracture of tibia
● Often unable to weight bear after seemingly minor injury
● Xray can be normal or fracture could be very subtle
● Splint and refer to Ortho if suspicious
Ankle:

- Ottawa ankle rules are useful to determine which adults need Xrays but NOT a description of a thorough ankle exam
- Bimalleolar swelling is always concerning
  - If no fracture on Xray, could be ankle subluxation that reduced
  - If lateral malleolus is fractured AND medial swelling, could be a surgical ankle if deltooid ligament is disrupted
Hockey player slides into boards feet first....

- External rotation and eversion
- Large effusion, medial swelling
- Tender over anterior aspect of ankle
- Xray normal
Synthesmosis injury:

- If medial malleolus swollen and tender
  - Xray tib fib
  - Examine entire length of fibula
- Mechanism of injury:
  - Synthesmosis is disrupted
  - Medial injury (either deltoid ligament tear or malleolus fracture)
  - Force continues up the interosseous membrane and exits with a spiral fracture of fibula
  - Fracture often subtle: “Maisonneuve” if proximal ⅓, “Dupytren’s” if middle ⅓ of fibula
- Injury is unstable and is treated operatively as it represents an ankle diasthesis
Ankle: anterior joint tenderness

- Commonly missed. Not in Ottawa rules.
- External rotation can result in significant injury to syndesmosis ligaments.
- In children with open growth plates can result in Salter III fracture of distal tibia.
  - Often in 11-15 year olds when medial half of growth plate has fused but not lateral half.
  - “Tillaux” #
- Occult fractures of distal tibia and talar dome.
Walking home, stepped into pothole….

- Tender bruised and swollen over dorsal aspect of medial midfoot
- Lisfranc’s injury (tarsometatarsal)
- Xray can be normal or very subtle changes easy to miss
- Often high velocity injuries (MVC, contact sports, foot planted in hole)
- Can be mild but also quite devastating in terms of long term complications
- Refer, refer, refer
Now for the Upper limb:

- The examination of a FOOSH injury should go beyond snuffbox tenderness.
- Although scaphoid fractures make up more than 50% of carpal fractures, any of the carpal bones can break, some with more serious consequences than others.
- The diagnosis is often easier to make clinically than with Xrays.
Golfer swings, hits the ground with club….ouch!

- **Hook of Hamate fracture:**
  - Direct blow to ulnar base of hand
  - Often while swinging a club, racket or bat but can be a FOOSH
  - Tender approximately 1 cm distal and lateral to pisiform
  - Often missed and not visible on plain Xrays
  - Ask for “carpal tunnel view” but even this misses up to 50%
  - If suspicious order CT or refer early
  - Often require excision because of non union with chronic pain and disability
FOOSH #1

- Tender over dorsum of wrist near base of 4th metacarpal with localised bruising and swelling
- Xray normal or small chip fracture visible on lateral view over dorsum of carpus
- Triquetral “flake” fracture
- Results from hyperextension of wrist and direct trauma of triquetral bone against radius
- Removable wrist splint for comfort is adequate treatment
FOOSH #2: Scapholunate dissociation

- Tender over snuffbox and more medially on dorsal side (between base of 2nd and 3rd metacarpals)
- Xray may be normal or > 3mm gap between scaphoid and lunate
- Ask for “clenched fist view”. If gap widens, suggests injury
FOOSH #3: Scaphoid

- Less common in children and adults > 40 yo (more likely to fracture radius)
- 20% not visible on Xrays
- Physical exam:
  - Palpate snuffbox with wrist ulnar deviated (exposes more of scaphoid)
  - Palpate opposite side: a significant proportion of people have a small branch of the radial nerve that crosses the snuffbox and they are tender there whether it is injured or not. Should be symmetrical however
  - Axial load 1st metacarpal
  - Palpate scaphoid over palmar aspect. Located at wrist crease medial to snuffbox
FOOSH #4: Distal Radio-Ulnar Joint

- May occur with or without distal radius fracture
- Examine by stabilising radius and depressing the distal ulna dorsally and volarly. “Piano key” sign
- Volar dislocation more common than dorsal. Very unstable. Usually splint in supination and refer.
FOOSH #5 with elbow pain:

- Injury can be due to FOOSH or hyperextension of elbow
- Look and feel for effusion
- If effusion present clinically or visible on Xray (“sail” sign, posterior fat pad sign) but no visible fracture, occult # very likely
  - In children, most likely Salter I supracondylar #
  - In adults, more likely to be radial head # especially if tender over radial head and increased pain on supination/pronation
FOOSH #6 with thumb pain:

- Fall with forced abduction of thumb
- “Gamekeeper’s (or ski pole) thumb”
- Injury to ulnar collateral ligament of 1st MCP
- Xray normal or avulsion fracture
- Important to distinguish between 1st, 2nd or 3rd degree tears (stretch, partial and complete tears)
- Local anaesthetic injected into injured area can help with the exam.
- 3rd degree tears require surgical repair, the others need 4-6 weeks of splinting and follow up