**FRACTURES**

1&2&4&5&6: GENERAL PRINCIPLES

-Stabilize ABCs, and rule out life-threatening injuries.

-History should include:

 -Mechanism of injury

 -Significant past injuries or surgeries in the affected area

 -Concomitant injuries ("Did you injure any other part of your body?")

 -Chronic medical conditions and medications. Most recent Tetanus.

 -Allergies

 -Last meal (in case an injury requiring urgent surgery is identified)

-On physical:

 -Evaluate neurovascular function

 -Look for open fracture – breaks in skin and signs of soft tissue damage.

 -Palpate the entire area around the fracture site, including the entire bone in question, adjacent bones, and at least one joint above and below.

-Basic principles when obtaining imaging:

 -Obtain multiple and orthogonal views (at least two orthogonal).

 -Include the entire bone or joint in question.

 -Obtain advanced imaging if clinical findings suggest # but plain x-rays are unrevealing.

-Fracture immobilization usually required if:

 -Reduction was required, in order to maintain it.

 -Two adjacent bone are involved (eg, fracture of radius and ulna) -Segmental or spiral fractures

 -Fracture dislocations

 -Fractures where muscles exert strong forces that may cause displacement

-Provide adequate analgesia. Fracture immobilization, ice, elevation, and analgesic medications all reduce pain.

-Provide clear instructions for injury care and monitoring, including cast or splint care, and a follow-up plan. For uncomplicated fractures, a return visit within 3-7 days.

3. FRACTURES PRONE TO NORMAL X-RAYS

A. SCAPHOID #
-Most common carpal bone #. Typically occur from a FOOSH with the wrist in dorsiflexion. Suspect a scaphoid fracture in any patient with wrist pain following a fall.
-Plain radiographs soon after injury may not reveal #. Order advanced imaging if an immediate Dx is needed or immobilize and repeat imaging with a bone scan (after 3-5 days) or x-rays (after 7-10 days). Check x-rays for concomitant injury of the scapholunate ligament.
-The scaphoid has a tenuous blood supply leading to the possibility of nonunion or osteonecrosis with # of the proximal pole.
-All # that are displaced (>1 mm) and those with a significantly ↑ or ↓ scapholunate angle should be immobilized in a thumb spica splint and referred to ortho.
-Non-displaced # (≤1 mm) of the distal scaphoid → short-arm thumb spica cast for 6-10 weeks. Non-displaced # at the wrist or proximal third of the scaphoid → long-arm thumb spica cast for six weeks, followed by a short-arm cast until healing documented. These # require a longer period of immobilization.
-If prolonged immobilization cannot be tolerated, refer the patient for operative fixation. Athletes and workers engaged in heavy labor must continue to wear protection (rigid splint) for two months after radiographic healing is noted.

B. ELBOW #
-Suspect # of the prox radius in all pts with lateral elbow pain following FOOSH.
-Immediate orth evaluation if: open #, neurovascular compromise, or # dislocation.
-Immediate reduction critical if there is a radial head or neck # and elbow dislocation. The longer the joint remains dislocated, the more difficult the reduction and the greater the risk of avascular necrosis.

-Isolated nondisplaced # (Mason I) can be managed by posterior splint for 1-2days or sling for comfort for 1-2d.

-Obtain AP and lateral xray in all patients where a # about the elbow is suspected. If no # is evident, a radiocapitellar (Greenspan) view may better characterize the radiocapitellar joint.
-Elevated anterior or posterior fat pads may be the only indication of a radial head #; can be treated in the acute setting with either a posterior splint or sling.

-Assessing range of motion of both flexion-extension and pronation-supination is vital in patients with Mason Type I radial head #s. If deficits are identified, further evaluation is needed following hemarthrosis aspiration and local anesthetic injection. Early mobilization is paramount in obtaining good short-term and long-term results.

C. GROWTH PLATE #. Salter #. 

D. STRESS #

-# that occurs when a bone breaks after being subjected to repeated tensile or compressive stresses, in a person who is not known to have an underlying disease that would be expected to cause abn bone fragility.

-High-risk stress # are those at greater risk for displacement, nonunion, or # propagation

-Important risk factors for stress # include a hx of prior stress #, low physical fitness, a sudden ↑ in the volume and intensity of physical activity, female gender and menstrual irregularity, a diet poor in calcium and vit D, poor bone health, and poor biomechanics.

-Early Dx of stress # is essential to avoid Cx. In most cases, the history and physical provide sufficient info to Dx and manage low-risk stress # without imaging studies.

-Many patients with stress # describe the insidious onset of localized pain within days to weeks of beginning a strenuous activity. Examination →focal tenderness at the # site.

-X-ray when high-risk stress # are suspected→ neg → MRI or bone scan.

-The ddx for stress # includes tendinopathy, muscle strain, joint sprain, nerve entrapment, exertional compartment syndrome, neoplasm, and infection.

-Stress # at low-risk sites are managed conservatively with the following interventions:

* + Acute pain control
	+ Protection of the fracture site with reduced weightbearing or splinting
	+ Reduction or modification of activities such that pain is not present
	+ Gradual resumption of activities if pain-free
	+ Rehabilitative exercise to promote optimal biomechanics
	+ Risk factor reduction

-Ortho consultation for pts with high risk #; if lengthy rehabilitation process interferes with return to work; or some high-level athletes.

7. HIGH RISK COMPLICATIONS

-Life threatening conditions: severe hemorrhage as with femur or pelvic #; conditions associated with hip # in elderly such as pneumonia, PE, or rhamdomyolitis secondary to immobilization; or pulmonary contusion with rib #.

-Thromboembolic disease.

-Fat embolism: associated with closed long bone fractures of the lower extremity and pelvis. FE typically manifests 24 to 72 hours after injury with dyspnea, tachypnea, and hypoxemia. Neurologic abnormalities and a petechial rash may be present. Severe respiratory distress and death can occur.

-Arterial injury

-Nerve injury

-Compartment syndrome: Acute compartment syndrome (ACS) occurs when increased pressure within a compartment compromises the circulation and function of tissues within that space. With #s, bleeding or swelling within a fascial compartment creates the increased pressure. Long bone #s → most commonly associated with ACS, particularly #s of the tibia, distal radius, supracondylar area of the humerus, and femur. ACS can also be caused by casts or bandaging that limits the space available for soft tissue swelling.

Early S&S: pain out of proportion to the apparent injury, persistent deep ache or burning pain, paresthesias, and pain with passive stretching of muscles in the affected compartment.

Early recognition of ACS and immediate fasciotomy may be limb sparing.

-Open #: treat with immobilization, tetanus prophylaxis as needed, surgical irrigation and debridement, and antibiotics. Rx of Posttraumatic osteomyelitis → Cefuroxime +/- Vancomycin for 48 to 72 hours total or for 24 hours after wound closure.

Hallmarks of posttraumatic osteomyelitis are nonunion of the # site and poor wound healing after wound closure. Other symptoms: fever and local wound drainage, erythema, warmth swelling and pain. The tibia is the bone most frequently involved by posttraumatic osteomyelitis.

-Osteomyelitis: open fractures are at greatest risk. The extent of soft tissue injury at presentation appears to be the most significant risk factor.

-Nonunion and malunion: Incomplete healing of a fracture where the cortices of the bone fragments do not reconnect is called a nonunion. When a fracture heals with a deformity (eg, angulation, rotation, incongruent joint surface), this is called a malunion. Nonunions commonly present with persistent pain, swelling, or instability beyond the time when healing should normally have occurred. In most cases, symptomatic nonunions are treated with open reduction and fixation.

-Complex regional pain syndrome: a complex disorder of the extremities characterized by localized pain, swelling, limited range of motion, vasomotor instability, skin changes, and bone demineralization. Fractures, with or without a nerve injury, are a common inciting event. Early recognition and initiation of therapy is important for successful treatment.

-Post-traumatic arthritis

8. CLINICAL DECISION RULES

THE CANADIAN C-SPINE RULES involves the following steps:
**Condition One**: Perform radiography in patients with any of the following:
 1)Age 65 years or older
 2)Dangerous mechanism of injury: fall from 1 m (3 ft) or 5 stairs; axial load to the head, eg diving accident; motor vehicle crash at high speed (>100 km/hour [>62 mph]); motorized recreational vehicle accident; ejection from a vehicle; bicycle collision with an immovable object, such as tree or parked car
 3)Paresthesias in the extremities
C**ondition Two**: In patients with none of the high risk characteristics listed in Condition One above, assess for any low-risk factor that allows for safe assessment of neck range of motion:
 1)Simple rear end motor vehicle accident; excludes: pushed into oncoming traffic; hit by bus or large truck; rollover; hit by high speed (>100 km/hour [>62 mph]) vehicle
 2)Sitting position in emergency department
 3)Ambulatory at any time
 4)Delayed onset of neck pain
 5)Absence of midline cervical spine tenderness
If no low-risk factors → **NOT** suitable for ROM testing and must be assessed with xray.
If low-risk factors → ROM testing, as below.
**Condition Three**: Test active ROM. Perform xray in pts who are **not** able to rotate their neck actively 45˚ both L and R. Pts able to rotate their neck, regardless of pain, do not require imaging.

OTTOWA ANKLE RULES

Ankle Xrays indicated if: pain in malleolar zone and any of: 1) tenderness at the posterior edge or tip of either the medial or lateral malleolus extending 6cm prox, 2) inability to weight bear immediately and in the ER.

Foot Xrays indicated if: pain in mid-foot zone and any of: 1) bone tenderness over the navicular or the base of 5th metatarsal, 2) inability to wt bear immediately and in the ER.

OTTOWA KNEE RULES

Xray indicated if any of: 1)age >55, 2)inability to wt bear immediately and in the ER, 3)isolated tenderness of the patella, 4)tenderness over head of the fibula, 5)inability to flex to 90 degrees.

HIP #

-Substantially ↑ risk of death and major morbidity in the elderly.

-Hip # are classified by anatomic location and fracture type. The general categories include intracapsular (femoral neck and head) and extracapsular (intertrochanteric and subtrochanteric). Intracapsular # have higher rates of nonunion, malunion, and avascular necrosis of femoral head.

-Initial management: analgesia and consult ortho. Obtain blood for type and crossmatch in pts with any 2 of: age over 75 years, initial Hg ˂120, and a peritrochanteric fracture.

-Provide prophylaxis against thromboembolism and infection.

-Obtain an AP view of hip with max internal rotation, lateral view, and AP pelvis. If plain x-rays neg but pain ++ or clinical suspicion is high, MRI is best, but CT 2nd line.

-In elderly patients, determine the reason for any fall (eg, syncope, stroke), and assess for additional orthopedic and internal injuries (eg, intracranial hemorrhage, cervical spine fracture).

-Femoral neck # are intracapsular and have a tenuous blood supply. ↑ risk of Cx. Fracture-dislocations have greatest risk. A displaced hip # → significant groin pain; the leg → externally rotated and shortened. Typically little bruising. With insufficiency #, there may be no obvious history of trauma and the patient may complain of vague knee, buttock, groin, or thigh pain.

-Intertrochanteric # are extracapsular. Lower risk for Cx. Significant ecchymosis may be present. A large amount of blood can be lost into the thigh → closely monitor hemodynamic status.

-Assess the patient's ambulation, overall functional status, and medical comorbidities. Aside from those in severely debilitated patients, most hip fractures are treated surgically.

-Isolated fractures of the greater and lesser trochanters are typically avulsion fractures caused by forceful muscle contraction in active young adults. In the elderly, such injuries can occur from direct trauma (eg, fall), but have also been associated with pathologic fractures.