GENERAL PRINCIPLES

EXAMINATION AND TREATMENT
Analgesia
Assessment of distal neurovascular status
Splinting
Definitive management
Infection control –in compound, delay in debridement of 8 hrs, delay in antibiotic of 3 hrs

COMPLICATIONS OF FRACTURES

PROBLEMS RELATED TO FRACTURE
Injuries to nerves, blood vessels, tendons, viscera, Compartment syndrome, Infection
Fat embolism

FAT EMBOLISM
Follows fractures of femur, tibia, fibula more commonly.
Fat globules embolise to pulmonary vasculature and systemic circulation, appear in the urine within 3 days in 50%.
Symptoms appear in 12-24 hours post injury
petechiae, ARDS, headache, confusion, seizures, coma
Treatment – supportive

DISORDERS OF UNION
SLOW - slower than normal
DELAYED - slow healing with little calculus formation
NON-UNION - sclerotic bone or failure of cellular activity- defined by 4 months
MAL-UNION - union in unacceptable position

TRAUMATIC EPIPHYSEAL ARREST

PROBLEMS OF IMMOBILISATION
Venous thrombosis, pneumonia, bed sores, UTI, osteoporosis, mm wasting, renal calculi.

COMPLICATIONS OF TREATMENT
SURGERY - Wound and anaesthetic complications.
Stiffness, OA,
Sudecks atrophy(reflex sympathetic dystrophy)
-sympathetic response of unknown cause resulting in pain, swelling and reduced mobility.
Tender, warm, sweaty.
Treatment- mobilisation and physiotherapy, consider regional sympathetic blockade

AVASCULAR NECROSIS
Idiopathic- Keinbock’s disease of lunate, Perthe’s disease
Traumatic-NOF, scaphoid, lunate, talus, anatomical neck of humerus
Associations- DM, steroids, irradiation.

MYOSITIS OSSIFICANS, TENDON RUPTURE.

POP
Movement, abrasions, grases, ischaemic limb, Volkman’s ischaemic contractures late.
FRACTURES WITH NERVE INJURIES

<table>
<thead>
<tr>
<th>INJURY</th>
<th>NERVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder dislocation</td>
<td>Axillary</td>
</tr>
<tr>
<td>Humerus</td>
<td>Radial</td>
</tr>
<tr>
<td>Supracondylar</td>
<td>Median</td>
</tr>
<tr>
<td>Elbow dislocation</td>
<td>Ulnar</td>
</tr>
<tr>
<td>Radio-ulnar</td>
<td>Post interosseous</td>
</tr>
<tr>
<td>Colles</td>
<td>Median</td>
</tr>
<tr>
<td>Lunat dislocation</td>
<td>Median</td>
</tr>
<tr>
<td>Base of skull</td>
<td>Vestibulocochlear, facial</td>
</tr>
<tr>
<td>Maxillary</td>
<td>Sciatic</td>
</tr>
<tr>
<td>Post hip dislocation</td>
<td>Infraorbital</td>
</tr>
<tr>
<td>Fibula neck</td>
<td>Common peroneal</td>
</tr>
<tr>
<td>Spinal fractures</td>
<td></td>
</tr>
<tr>
<td>Sacral fractures</td>
<td></td>
</tr>
</tbody>
</table>

PLASTER OF PARIS
Ca sulphate, exothermic reaction, hardens by crystalisation.
80% strength in 1 hour, 100% at 24hours
Give plaster instructions to all.
Plaster check within 24 hours- check limb, plaster, patient.
Split plaster if too tight.

FIBREGLASS CASTS
Lighter, more moisture resistant, more expensive, underlay still gets wet and smelly.

COMPOUND FRACTURES
Fractures can be classified according to amount of laceration and amount of non viable tissue. From Grade 1 – 3 with Grade 4 being total or subtotal amputation.
The MESS(mangled extremity severity score), is used to predict amputation in severe lower limb trauma. A score of \( \geq 7 \) has 100% chance of amputation

MANAGEMENT
Reduce exposed bone and then reduce any other fractures causing vascular compromise.
Pack wound
Antibiotics Cephalothin, add gentamicin for more severe 1.5 mg/kg
Tetanus prophylaxis
Definitive operative treatment within 6 hours

PREHOSPITAL LIMB AMPUTATION
Consensus between two senior medical staff, patient may be able to consent.
Optimise haemodynamics
Anaesthesia- regional in lower limb otherwise, Ketamine 2mg/kg and benzodiazepines
Arterial torniquet
Amputate through lowest possible level of limb, with transverse cut.
Pack stump with sterile saline packs and bandage.
**BONE TUMOURS**
Metastatic more common – lung, kidney, breast, prostate, thyroid, colon, adrenal, myeloma, neuroblastoma, Ewing’s sarcoma.
Common sites are: spine, ribs pelvis, humerus, femur, rare below knee/elbow

<table>
<thead>
<tr>
<th>Malignant primary</th>
<th>Benign tumours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aneurysmal bone cyst</td>
<td>Simple bone cyst</td>
</tr>
<tr>
<td>Osteosarcoma</td>
<td>Prox tibia, humerus, femur</td>
</tr>
<tr>
<td>Chondrosarcoma</td>
<td>Chondroma</td>
</tr>
<tr>
<td>Giant cell sarcoma</td>
<td>Tubular bones not flat bones</td>
</tr>
<tr>
<td>Ewing’s tumour</td>
<td>Osteochondroma</td>
</tr>
<tr>
<td>Paget’s sarcoma</td>
<td>Metaphysis of long bone</td>
</tr>
<tr>
<td>Irradiation sarcoma</td>
<td>Osteoid osteoma</td>
</tr>
<tr>
<td></td>
<td>Femur, tibia- bony sclerosis</td>
</tr>
<tr>
<td></td>
<td>Chondroblastoma</td>
</tr>
<tr>
<td></td>
<td>Epiphysis of long bone</td>
</tr>
</tbody>
</table>

**Radiological features**
- Poorly defined margin
- Absence of surrounding sclerosis
- Break in cortex
- Periosteal reaction

**FRACTURES WITH NAMES**

<table>
<thead>
<tr>
<th>CERVICAL SPINE</th>
<th>UPPER LIMB</th>
<th>LOWER LIMB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hangman’s</strong></td>
<td><strong>Hume</strong></td>
<td><strong>Tillaux</strong></td>
</tr>
<tr>
<td>Bilat pedicles C2</td>
<td>Prox ulna fract, ant</td>
<td>Avul frac tibia at inf</td>
</tr>
<tr>
<td><strong>Clay shoveller’s</strong></td>
<td><strong>Monteggia</strong></td>
<td>Tibiofib joint</td>
</tr>
<tr>
<td>Avulsion spinous proc</td>
<td>Fract ulna rad disloc</td>
<td></td>
</tr>
<tr>
<td><strong>Jefferson</strong></td>
<td><strong>Galleazi</strong></td>
<td><strong>Potts</strong></td>
</tr>
<tr>
<td>Burst fracture C1</td>
<td>Frac rad, rad-uhn disl</td>
<td>Malleoli fract</td>
</tr>
<tr>
<td></td>
<td><strong>Colles</strong></td>
<td><strong>Maisonneuve</strong></td>
</tr>
<tr>
<td></td>
<td>Dist rad frac dors angul</td>
<td>Frac fibula neck and dist</td>
</tr>
<tr>
<td></td>
<td><strong>Smiths</strong></td>
<td>T-F jnt ant lig rupture</td>
</tr>
<tr>
<td></td>
<td>Dist rad volar angul</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Barton’s</strong></td>
<td><strong>Dupuytren</strong></td>
</tr>
<tr>
<td></td>
<td>Ant part of rad</td>
<td>Frac dist fibula, rupt</td>
</tr>
<tr>
<td></td>
<td><strong>Bennett’s</strong></td>
<td>T-F jnt ant lig rupture</td>
</tr>
<tr>
<td></td>
<td>Frac, disl, base 1st met</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Boxer’s</strong></td>
<td><strong>March</strong></td>
</tr>
<tr>
<td></td>
<td>Frac 5th met neck</td>
<td>Stress frac 2nd met head</td>
</tr>
<tr>
<td></td>
<td><strong>Mallet finger</strong></td>
<td><strong>Jones</strong></td>
</tr>
<tr>
<td></td>
<td>Avul frac EDL</td>
<td>Trans frac base 5th met</td>
</tr>
</tbody>
</table>

KAMIKAZE FELLOWSHIP COURSE www.resus.com.au
UPPER LIMBS

SHOULDER INJURIES

CLAVICLE
Most fractures occur at the junction of the middle and outer third. These only need sling. Fractures of the outer third with ligamentous damage may require ORIF.
Neer classification

I  fracture lateral to coracoclavicular ligament
II fracture through conoid and trapezoid ligaments - ORIF
III intra-articular - conservative treatment

SCAPULA
Due to direct trauma. May be associated with chest injuries.
Sling and early mobilisation.

STERNOCLAVICULAR JOINT DISOCATION
Anterior
Commonest and due to direct trauma. Treat in sling for 2-3 weeks.

Posterior
Emergency due to the pressure on the great vessels. Need CT and reduction under GA.

ACROMIOCLAVICULAR JOINT INJURIES
Usually due to direct trauma to the point of the shoulder. Stress Xrs may be needed.

1st degree No subluxation; AC lig partly torn
2nd degree Subluxation. AC lig torn conoid and trapezoid intact.
3rd degree Complete disruption. Sling 4-6 wks, consider ORIF.

BICIPITAL RUPTURE
Rupture of long head of biceps with sudden elbow flexion.
Results in weakness in supination.
Treated conservatively, but consider OR. If insertion into radial head is ruptured then OR.

ROTATOR CUFF INJURIES (supraspinatus, infraspinatus, subscapularis, teres minor)
Due to chronic deterioration, or acute rupture secondary to shoulder dislocation, ie 57% of first dialocations in <40yo. Supraspinatus most commonly involved.

Clinical
Pain, loss of power in flexion, abduction and ext rotation, local atrophy, bruising.
Abduction occurs via scapular rotation and is limited to 90 degrees.
Investigate with ultrasound. Plain XR to exclude fractures

Treatment
Rest, anti-inflammatory, physiotherapy, consider operative repair.
SHOULDER DISLOCATION

ANTERIOR

95% are anterior and due to fall with external shoulder rotation.

There are 4 types of anterior dislocation:

1. Subcoracoid-commonest; head displaced ant to glenoid and inf to coracoid
2. Subglenoid; humeral head inferior and anterior to glenoid fossa.
3. Subclavicular; head is medial to coracoid, below clavicle
4. Intrathoracic; rare- head between ribs and thoracic cavity.

Clinical

Pain. Shoulder “squared off”, arm in slight ABD and ext rotatn. Pt resists ADD and int rotation. Test axillary nerve damage- pinprick over skin of the deltoid.

Treatment

Reduction- 6 methods

1. Hippocratic; pt supine, arm abd, elbow flexed 90 degrees-traction
2. Milsch: abd and ext rotation to the overhead position whist traction applied
3. Stimson: Prone, 5kg weight hanging after analgesia- takes 20-30min
4. Scapular rotation: prone, hang weight and push tip medially
5. Kocher’s: arm add, ext rotated and int rotated- painful, risk of tears to inf capsule

Immobilisation

-first dislocation- 4-6 weeks, recurrent few days.

>40yo- 14% recurrence, <20 90% will have recurrence.

Complications

2. Bony injuries
   a. Humeral head
      ii. Greater tuberosity
   b. Anterior glenoid lip
      i. Bankart lesion – avulsion anterior glenoid labrum, tear ant capsule.
3. Neurological injuries: in 10-25%- traction injury of axillary nerve- repair
4. Soft tissue injuries

POSTERIOR

Rare, 1% of dislocations, associated with high voltage electrocution, epilepsy. The most common position is, where the head is behind the glenoid and beneath the acromion.

Clinical

Arm ADD and INT rotated, pt doesn’t allow abd and ext rotation. There is prominent coracoid process, and the ant shoulder is flat and the posterior shoulder is full.

Treatment

Reduction

Traction on the adducted arm with an assistant pushing the head anteriorly.

Immobilisation – in sling

Complications

Neurovascular- complications are less common than anterior.
INFERIOR – Luxatio erecta
Rare, due to hyperabduction force. The head dislocates inferior to the glenoid, and the arm is held in abduction.

Treatment
Reduction- Traction on abducted arm – may need OR.

Complications
Rotator cuff always detached, head buttonholed through the inf capsule.

ANTERIOR vs POSTERIOR dislocations

<table>
<thead>
<tr>
<th></th>
<th>ANTERIOR</th>
<th>POSTERIOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position of arm</td>
<td>ABD, EXT rotated</td>
<td>ADD, INT rotated</td>
</tr>
<tr>
<td>Patient resists</td>
<td>Opposite of above</td>
<td>Opposite of above</td>
</tr>
<tr>
<td>Shoulder shape</td>
<td>Squared off</td>
<td>Post shoulder full, coracoid prominent</td>
</tr>
<tr>
<td>XR-Y view-head position</td>
<td>Anterior</td>
<td>Posterior</td>
</tr>
</tbody>
</table>

HUMERAL FRACTURES

SHAFT
Examine the radial nerve
Middle third fractures more likely to have complications with radial nerve palsy, and non-union

MANAGEMENT
Analgesia
Gentle traction to reduce, and U slab, collar and cuff
Internal fixation if: -Radial nerve palsy in original fracture of after manipulation
- ≥ 2 fractures in one limb
- bedridden

PROXIMAL FRACTURES
Impacted - broad arm sling, mobilise after 2 weeks, physio 6 weeks
Unimpacted - accept in elderly GAMP all others

There is a Neer classification I – VI
Anatomical neck fractures > 1 cm displacement leads to avascular necrosis- fixation

FOREARM FRACTURES

MIDSHAFT
Both bones usually fractured, need XR of entire arm as may be other fractures.
POP, closed, ORIF, depends on displacement.

MONTEGGIA Monteggiaaaaaaa = ulnaaaaaaaaa
Fracture of proximal 1/3 of ulna, and dislocated radial head
ORIF in adults, GAMP in children.

GALEAZZI
Fracture midshaft radius, with distal radioulnar joint, dislocation.
ORIF
WRIST INJURIES

COLLE’S FRACTURE
- Fracture of distal radius with dorsal angulation and displacement, and radial angulation

Indications for Reduction
1. Displacement of ulnar styloid - indicated serious disruption of inferior radio-ulnar joint
2. Deformed external appearance
3. Dorsal tilt >10 degrees

Method of reduction
Bier’s block or general anaesthesia
Traction – extension – flexion – ulnar deviation
POP for 6 weeks

Complications
1. mal-union/non-union
2. median nerve compression
3. stiffness
4. ext pollicis longus rupture – due to interruption of vascular supply
   a. accept in elderly, but need tendon transfer in young
5. Sudeck’s atrophy
   i. Osteoporotic changes when the patient comes out of plaster.
   ii. Fingers are swollen
   iii. Restricted finger flexion
   iv. Wrist and hand warm and tender

SMITH’S FRACTURE
Almost opposite to colle’s, Fall onto back of hand
Radial fracture with radial fragment angulated and displaced anteriorly

Method of reduction
Traction in supination with wrist extension. POP in wrist extension – 6 weeks

BARTON’S FRACTURE
Type of Smiths, but only the anterior portion of radius involved, fracture into joint space.
Reduce as for Smith’s otherwise ORIF

HENDERSON FRACTURE
Radial styloid fracture, usually not displaced. Treat with Colle’s plaster.
**SCAPHOID FRACTURES**
Tenderness in anatomical snuffbox, and on axial compression of thumb.
Fracture frequency is 50% mid, 38% prox, 12% distal
Scaphoid POP for 6 weeks. If clinical suspicion only, need re-XR in one week.
If displaced need surgery.
If tubercle fracture only then symptomatic treatment.
**Complications**
- avascular necrosis - 50% if >1mm displacement
- Incidence increases, the more prox the fracture
- never with tubercle fractures.
- non-union - in 50% if >1mm displacement.

**SCAPHOID SUBLUXATION/DISLOCATION**
Usually posterior: Proximal pole subluxes dorsally, distal pole anteriorly.
To reduce wrist in palmar flexion, pressure over dorsum if posterior.
Anterior is less common, but if occurs reduce as for lunate dislocations.
POP?????

**LUNATE FRACTURE**
Uncommon, but at risk of avascular necrosis, scaphoid POP and review.

**DISLOCATION**
Most common of carpal dislocations.
Threat to median nerve, and at risk of avascular necrosis.
May dislocate dorsally or volarly, concavity faces volar aspect of hand.
Reduction by compression over lunate, whilst wrist extended and flexed.

**PERILUNATE DISLOCATION**
Lunate still attached to radius, carpus dislocates around this, reduce by traction.

**TRANS-SCAPHOID PERILUNATE DISLOCATION**
Second most common carpal dislocation.
Distal scaphoid fragment displaces posteriorly with the rest of the carpal bones.
Reduction by traction and scaphoid POP. What happens to lunate?????????????

**OTHER CARPAL FRACTURES**
Rare, and only need symptomatic treatment.
Chip fractures – usually of triquetral, due to hyperflexion/extension injury.

**DEQUERVAIN'S TENOSYNOVITIS**
Inflammation of EPB and AbdPL sheaths due to excessive use of thumb.
Pain along radial aspect of wrist.
Finklestein’s test- pt grabs examiners thumb, and examiner ulnar deviates pt’s hand.
Pain occurs over tendons. Confirms diagnosis.
Treat with splint, NSAIDS, physiotherapy.
HAND INJURIES

The aim is conservation of function

Metacarpals
5th
- fracture through the neck secondary to punching injury
- accept 30 degree angulation, otherwise reduce under ulnar or Bier’s block
- U-slab and sling, but may need K wire if unstable

Other
- Rotation is the major problem. Make fist all fingers should point to scaphoid
- accept upto 15 degrees angulation
- colle’s POP for 3-4 weeks, may require reduction and internal fixation

Phalanges
- reduce displaced or rotated fractures, buddy strap for 2 weeks unless mallet
- Mallet = cannot extent DIP joint due to ext digitorum tendon avulsion
  - mallet finger splint and immobilization for 6 weeks
- Dislocations- usually posterior, exclude fracture, buddy splint 3-4 weeks
  In metacarpo-phalageal dislocations reduce, buddy strap, any need ORIF

Thumb
Bennett’s fracture
- fracture-dislocation of carpo-metacarpal joint of thumb
- reduce with traction and abduction
- scaphoid POP with pressure over base of thumb, may need K-wire

Gamekeeper’s thumb
- disruption of the ulnar collateral lig of MP joint of thumb
- if >20 degrees = disruption – compare with other side, stress views
- scaphoid POP if mild, but most need ORIF

Post dislocation of 1st MCP joint
- hyperextension injury in children
- metacarpal head may button-hole through joint capsule
- reduction and POP 3weeks
PELVIC FRACTURES
In 30% of multiply injured patients. 50% require transfusion. Most due to MCA’s or simple falls in the elderly.

Structures at risk
- **Vascular**
  - common iliac divides at sacroiliac joints, int iliac is intrapelvic, sup gluteal is at greater sciatic foramen
- **Neuro**
  - lumbar and sacral plexus
- **Other**
  - bladder, bladder neck, urethra
  - sigmoid colon, rectum, anus
  - vagina, cervix, uterus, seminal vesicles.

CLASSIFICATION OF FRACTURES
Multiple classifications based on anatomical, radiological, mechanism of injury

**Key and Cornwell classification**
- **Type I**
  - No break in pelvic ring, stable, eg single ramus, avulsion ASIS
- **Type II**
  - Single break in rim, stable, eg ipsil rami fractures.
- **Type III**
  - Double break in ring, unstable, SI
- **Type IV**
  - Acetabular fractures

**Bucholz Classification**
- **Type I**
  - solitary fracture of pubic ramus mortality 10%
- **Type II**
  - pubic rami and sacroiliac fracture, no widening. Mortality 25%
- **Type III**
  - sacroiliac joint displacement. Mortality 40% for open injuries

**Young Classification (shock-trauma classification)**

**Lateral Compression fractures**
- **I**
  - compression of sacrum on side of impact- most common by far(50%)
- **II**
  - iliac wing fracture at anterior border of sacroiliac joint
- **III**
  - cont open book injury

**Anterior posterior fractures**
- **I**
  - symphysis diastasis, slight widening of sacroiliac joint
- **II**
  - widening of anterior sacroiliac joints, open book injury, lumbosacral plexus and vessels involved
- **III**
  - complete disruption of hemipelvis without vertical displacement

**Vertical shear fractures**
- Anterior injury with hemipelvis displaced superiorly

**AVULSION FRACTURES**
- ASIS avulsed by sartorius in athletes- crutches for 2 weeks.
- AIIS by rectus femoris
- Post spine by erector spinae
- Ischial tuberosity avulsed by hamstrings
- Iliac crest by direct violence
- All need only symptomatic treatment.
ACETABULAR FRACTURES
Due to transmission of force through radial head, ie as a result of dislocation. Treat with skin traction.

CLINICAL SIGNS
Pain, tenderness, haematoma, pain on pelvic springing.
Destot’s sign - haematoma above inguinal ligament or in scrotum
Roux’s sign - Distance between greater trochanter and pubic symphysis unequal
Earle’s sign - tender fracture line palpable on rectal examination.

WHO TO XR?

<table>
<thead>
<tr>
<th>Xray</th>
<th>No Xray</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altered mental state GCS&lt;14</td>
<td>Alert, orientated, no pelvic pain, not</td>
</tr>
<tr>
<td>Unexplained hypotension</td>
<td>under the influence of alcohol or drugs</td>
</tr>
<tr>
<td>Positive examination</td>
<td>Normal examination</td>
</tr>
<tr>
<td></td>
<td>No femoral fracture</td>
</tr>
</tbody>
</table>

OTHER RADIOLOGY
CT SCAN PELVIS
Good for complex pelvic injuries, better for acetabular and rami fractures. Doesn’t change management.
Not reliable for bladder injuries

CYSTOGRAM
Not in microscopic haematuria, but in macroscopic 30% have lower urinary tract injury.

MANAGEMENT OF PELVIC FRACTURES
A B C, cervical spine, oxygen, fluid resuscitation, investigations etc..
Stabilise fracture – MAST suit, int, ext fixation.
LC I and II – bed rest, delayed ORIF, if instability or bleeding ext fixation
APC II, III, VS – acute ext fixation in first 4 hours.

angiography and Embolization
If continued blood loss and other sources excluded. After ext reduction/fixation. Patient must be stable. Only detects direct arterial bleeding in 10%

Surgery
Major visceral or vascular damage, ongoing blood loss, open fractures

COMPLICATIONS
1 Haemorrhage-up to 6L, major cause of death, MAST suit, mechanical fixation, embolisation.
2 Bladder injuries-ruptured dome or body or neck
3 Urethral injuries- in 5% of fractures. Twice as common as bladder injuries. Pubic ramus and sacroiliac involvement make it more likely. Blood at meatus, high riding prostate. Suprapubic. Retrograde urethrogram.
4 Gynaecological- uncommon. Vaginal lacerations most common. High foetal death rate
5 Rectal injuries- uncommon
6 Neural- S1,2 commonly damaged, lumbosacral plexus. Impotence in 1/6
7 Diaphragmatic- avoid MAST
FEMORAL FRACTURES

SHAFT
High force is needed, usually MCA.
Range from undisplaced to compound.
Complications are:
- haemorrhage up to ≥2L of blood
- fat embolism risk if not treated for >24 hours.

MANAGEMENT
A B C, Oxygen, aggressive fluid resus
Analgesia - parenteral, femoral block
Immobilisation - Thomas splint / Donway splint
Internal fixation for adults, gallows traction for children.

SUPRACONDYLAR FRACTURE
In adults tend to rotate, may be comminuted.
ORIF

KNEE INJURIES

COLLATERAL LIGAMENT
Test stability at 30°, if only painful but not lax = strain. If lax repeat in full extension.
If lax at full extension = serious injury, collat, cruciates, post capsule damaged.

CRUCIATE LIGAMENT
ANTERIOR
Most common, 70% of haemarthroses. Due to non-contact rotational injury.
Lachman test – knee flexed to 20°, tibia lifted upwards. 95% sensitive.
Anterior draw sign – knee flexed 45°, tibia pulled forward, 60% sensitive.
Pivot shift test – Complex-knee flexed with tibia in int rotation, lateral tibial
epicondyle subluxes anteriorly but relocates with a jerk, 70% sensitive.
Knee arthrometer – 95% sensitive if 3mm displacement occurs.

POSTERIOR
Blow to leg with flexed knee ie., motorcycle/dashboard injury, associated with hip
injuries and femoral and tibial fractures. Posterior draw test maximal at 90°.

MANAGEMENT
Grade 1 No fibre disruption – conservative treatment.
Grade 2 Part ligament failure-conservative Rx, mobilise 6 wks, > for cruciates
Grade 3 Complete disruption- repair dependant on several factors

Surgical repair depends on:
Number of ligaments injured, instability of joint
Age and activity of patient
Time post injury- early repair better, >2 weeks difficult
Open repair – 6 month disability, arthroscopy- 3 months.
**MENISCUS**
Medial more common - locking, medial joint tenderness, effusions and anterior joint pain on activity, McMurray and Grind test +ve in 50%
If locked- urgent arthroscopy.

**PATELLA**
**FRACTURES**
May be transverse, comminuted or avulsion. Difficult to straight leg raise.
Undisplaced- zimmer or POP, displaced- ORIF, comminuted- excision.

**DISLOCATION**
Twisting on extended knee or direct blow, dislocates laterally over lateral condyle.
Extend knee and reduce manually. POP/zimmer 2-4 weeks then mobilise.

**PROXIMAL TIBIA**
**TIBIAL PLATEAU FRACTURES**
Tibial plateau driven into tibial condyles, lateral condyle more commonly.
*Lipohaemarthrosis*-fat-fluid level on supine lateral may be only sign- indicates bony injury communicating with marrow space.
*Treatment*: depressed fractures may need elevation other??????????

**SEGOND FRACTURE OF PROXIMAL TIBIA**
Small avulsion fracture, 13mm usually undisplaced, proximal lateral tibia- associated with severe internal disruption of the knee. Signifies tear of the menisco-tibial attachment of middle third of lateral capsular ligament.
All have anterior cruciate, majority have meniscal tears.

**OTHER**

**KNEE DISLOCATION**
Severe injury, both cruciates are torn and hinges around one collateral ligament.
Popliteal artery at risk. High incidence of amputation if delayed > 6hours. If arterial supply impaired after reduction then angiography required.
High incidence of compartment syndrome.

**QUADRICEPS TENDON RUPTURE**
Divot in thigh proximal to patella, cannot straight leg raise. Surgical repair.

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<thead>
<tr>
<th>HAEMARTHROSIS OF THE KNEE</th>
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<td><strong>ADULTS</strong></td>
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<td>Osteochondral fractures –10%</td>
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<td>70% with no fracture have ACL</td>
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<td>20% collateral ligament</td>
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<td>9% posterior cruciate</td>
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WHO TO XRAY WITH KNEE INJURIES
≥ 55yo
tenderness head of fibula
isolated tenderness of patella
can’t flex knee to 90°
Inability to weight bear – immediately and at assessment – 4 steps
100% sensitivity for significant fractures, 49% specific
Decreases Xray by 25%

TIB / FIB FRACTURES

TIBIA
Look for associated fibula fractures
Treatment varies and ranges from conservative to closed reduction, ORIF, rods.
Complications are infection, compartment syndrome, neurovasc injury, non-union.
Nutrient artery runs at junction of upper and middle thirds.

FIBULA
Isolated fractures are uncommon - look for the tibial fracture.
In fractures of the tibial head peroneal fractures are common.
Isolated fractures are treated with below knee walking plaster for 6 weeks.

ANKLE INJURIES
Indications for XR
1 pain in malleolar zone and
2 unable to take 4 steps in ED (Ottawa ankle rules)
3 bone tenderness distal 6cm or distal tip of malleolus

FRACTURES and TREATMENT – Classified as Pott’s fractures
1 Unimalleolar
   a. If stable – crepe bandage
   b. If unstable – below knee POP for 6 weeks
2 Bimalleolar - ORIF
3 Trimalleolar- lat, med, post tibial – ORIF
Other indications for OR are, talar shift, displaced fragments
Xr may show avulsion fracture but if < 3mm treat as ligamentous

DISLOCATION
May dislocate and relocate with no bony injury. Need to relocate rapidly to avoid vascular compromise.
POP for 6 weeks, may need ORIF

ACHILLES TENDON RUPTURE
Due to forceful dorsiflexion of foot. There is sudden pain and a snap.
Unable to walk or stand on toes. Calf squeeze or Thompsons test fairly accurate.

Treatment
Conservative All < 48hrs
Long leg plaster – knee at 45°, ankle plantar flexed at 45° for 4 weeks
Operative- if young and detected early or if > 1 week

LIGAMENTOUS INJURIES
75% of ankle injuries are sprains, 90% involve lateral ligament.
Grade 1
Pain on movement, can weight bear. Partial tear usually of anterior talofibular ligament.

Grade 2
Pain at rest, limitation of weight bearing. Calcaneofibular ligament involved.

Treatment
R.I.C.E. (ice 10 min every 2 hours for first 24 hours)
POP if swelling and severe pain
Non-weight bearing for first 24 hours.

Grade 3
Severe pain
Complete tear of two or more ligaments, joint movement on stressing
Needs ankle reconstruction.

CALCANEAL FRACTURES

25% are associated with lower extremity fractures
5-10% associated with spinal fractures.

Fracture type
Crush
Intra-articular

Pain swelling and tenderness over the heel. Lat X-ray may miss. Need Harris(axial) view.
May need a CT scan to work out how bad it is.

Bohler’s angle- Good to pick up occult fracture. Normal is 25-40° If <25 = fracture

Management:
Conservative: Splint , non-weight bearing 6-8 weeks
Surgery: Remove fragments ang provide best position as have best outcome. If comminuted may not be able to put together.

Functional disability approaches 50%, so make sure you refer early.

Conservative approach: Early consult with ortho surgeon, as outcomes are potentially so bad.
FOOT INJURIES

CALCANEAL FRACTURES
Usually fall from height, landing on feet. Most commonly fractured tarsal bone.  
Key factor is if there is involvement of subtalar joint.  
There may be other associated injuries- limb (25%), Cx, lumbar spine (10%).  
Boheler’s salient angle- usually 40°- angle decreases.  
Several types of fractures- if body fracture or joint involved need screw, otherwise POP

TALUS FRACTURES
Uncommon, but through the neck risk avascular necrosis

METATARSAL FRACTURES
2nd and 3rd  
March fractures- relatively fixed prone to stress fractures.
5th  
Base-  
-inversion injury, avulsion of Peroneus longus.  
-Jones- 7 weeks below knee POP, ORIF in athletes, non-union

common  
Epiphyseal plate of base of 5th  
-fracture usually transverse, symptomatic treatment, crepe or POP.

LISFRANCS FRACTURE/DISLOCATION
Most common midfoot fracture, at tarso-metatarsal joint.  
Due to hyperextension of forefoot on midfoot, with dorsal dislocation of tarso-metatarso joint.  
May fracture 1st cuneiform and 2nd metatarsal, this causes 1st metatarsal to separate.  
Treatment- Needs accurate reduction, as ongoing pain is a major problem.

NAVICULAR
In isolated fracture – POP for 6 weeks.