Disclaimer: As we all know, we are still students and henceforth bound to make mistakes, however, we will try our very best to convey all knowledge based on the Malaysia protocols. By that, we do not hold any responsibilities should our presentations bear mishaps in the future.
Content:

1. General Treatment & Instruments in Orthopaedics  Page 2
2. Fat Embolism                                      Page 3 - 5
3. Compartment Syndrome                             Page 6 - 7
4. Fractures of the Humerus                         Page 8 - 11
5. Fractures of the Forearm & Hand                  Page 12-14
6. Fractures of the Lower Limb                      Page 15-18
7. Fractures of the Spine                            Page 19-23
9. Diabetic Foot Ulcer                               Page 28-29
10. Dislocation                                     Page 30-34

Presenters:
1. General Treatment & Instruments in Orthopaedics    by Ashok
2. Fat Embolism                                       by Jayan
3. Compartment Syndrome                              by Shuk Fan
4. Fractures of the Humerus                           by Sharnita
5. Fractures of the Forearm & Hand                    by Vinesh
6. Fractures of the Lower Limb                        by Previna
7. Fractures of the Spine                             by Sharnita
8. Fractures of the Hip (Pelvic & Acetabulum)         by See Choo, Karthikeswaran
9. Diabetic Foot Ulcer                                by Ashok
10. Dislocation                                       by Durairaaj

Contributors:
Ashok Marappan, Davendran Kanesen, Sharnita, Bahunu, Durairaaj, Pauline, Vinesh Kumar, Jayan, Shuk Fan, Shafnaz, Nadhilah, Previna Anatory, Vindu Nirumal Kumar, Anuja Nirumal Kumar, Karthikeswaran, Lim See Choo
1. General Treatment & Instruments in Orthopaedics

Classification of Orthopaedic Fixation Devices

A. Internal Fixation Devices
   - Screws
   - Plates
   - Wires and pins
   - Intramedullary rods and nails
   - Spinal fixation devices

B. External Fixation Devices
   - Fracture fixation
     - radius
     - tibia
     - pelvis
   - Bone lengthening
     - Ilizarov device

General Idea of Treatment in Orthopaedics

- Reduction
- Fixation
- Early Mobilization and Exercise
- Tractions
- Skin
- Skeletal

Functions

Align the bone position
Reduce pain
Prevent muscle spasm
2. Fat Embolism

- Fat embolism is a condition that usually develops after closed fractures of long bones.
- It is associated with acute post-traumatic respiratory distress.

Conditions associated with Fat Embolism Syndrome

<table>
<thead>
<tr>
<th>Trauma-related</th>
<th>Non trauma-related</th>
</tr>
</thead>
<tbody>
<tr>
<td>❖ Long bone fracture</td>
<td>❖ Pancreatitis</td>
</tr>
<tr>
<td>❖ Pelvic fracture</td>
<td>❖ Diabetes mellitus</td>
</tr>
<tr>
<td>❖ Fractures of other marrow-containing bones</td>
<td>❖ Osteomyelitis and panniculitis</td>
</tr>
<tr>
<td>❖ Orthopaedics procedures</td>
<td>❖ Bone tumour lysis</td>
</tr>
<tr>
<td>❖ Soft tissue injuries (e.g. chest compressions</td>
<td>❖ Steroid therapy</td>
</tr>
<tr>
<td>with or w/out rib fractures)</td>
<td>❖ Sickle cell haemoglobinopathies</td>
</tr>
<tr>
<td>❖ Burns</td>
<td>❖ Alcoholic (fatty) liver diseases</td>
</tr>
<tr>
<td>❖ Liposuctions</td>
<td>❖ Lipid infusion</td>
</tr>
<tr>
<td>❖ Bone marrow harvesting and transplantation</td>
<td>❖ Cyclosporine A solvent</td>
</tr>
</tbody>
</table>

Clinical Features

1. ANAMNESIS:
   - Trauma to long bones or pelvis (even during orthopaedic procedures)
   - Parenteral lipid infusion & recent steroid administration

2. CARDIOPULMONARY
   - Persistent tachycardia, tachypnoea, dyspnoea and hypoxia usually 12-72 hours after injury.
   - Febrile temperature with high spiking fever curves.

3. DERMATOLOGIC
   - Petechiae over the upper body; particularly in the axillae and conjunctival folds. They resolve quickly and are DIAGNOSTICALLY VALUABLE.
   - Subconjunctival and oral haemorrhages.

4. NEUROLOGIC
   - CNS dysfunction manifesting as agitation, restlessness, delirium progressing to stupor, seizures and coma.

Diagnostic Criteria

1. LAB STUDIES:
   - ABG: PaO2 values below 8 kPa (60 mmHg) suggests hypoxaemia and values should be monitored during the first 72 hours of a major injury.
CBC: Thrombocytopenia, anemia and hypofibrogenemia are indicative, but not pathognomic.

2. Imaging Procedures
   - CXR: reveal increasing diffuse bilateral pulmonary infiltrates within 24-48 hrs of clinical findings.

<table>
<thead>
<tr>
<th>Gurd’s Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major criteria</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Minor criteria</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

**A definitive diagnosis can be placed in the presence of 1 major criteria and any 4 of the minor criteria.

<table>
<thead>
<tr>
<th>Lindegue’s Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Sustained po2 &lt; 8 kpa</td>
</tr>
<tr>
<td>2 Sustained pco2 &gt; 7.3 kpa.</td>
</tr>
<tr>
<td>3 Sustained respiratory rate &gt; 35/min, inspite of sedation</td>
</tr>
<tr>
<td>4 Increased work of breathing, dyspnoea, tachycardia, anxiety</td>
</tr>
</tbody>
</table>

These indicate signs of hypoxemia or ARDS which is a characteristic finding in syndrome of fat embolism.

Management
- No specific treatment, only supportive.
- Provide adequate oxygenation and ventilation
- Blood substitute products- as clinically indicated
- Intravenous fluid therapy- Hypertonic Glucose/Dextrose solution 10%, 40-50 ml/kg/day.
- IV corticosteroids e.g. METHYLPREDNISOLONE (Medrol) 1.5 mg/kg every 8 hours for six doses.
- Heparin reduces pulmonary oedema and intravascular clotting.
- Continuous pulse oximetry monitoring so that PaO2 > 9.3 kPa (70 mmHg).

**Prophylaxis**
- Early stabilisation (immobilisation) of long bone fractures, for prophylaxis of venous embolisation and ARDS.
- Prophylactic placement of vena cava filters to help reduce fat volume reaching the heart.
### 3. Compartment Syndrome

Compartment syndrome (CS) is a limb-threatening and life-threatening condition observed when perfusion pressure falls below tissue pressure in a closed anatomic space.

This pressure can decrease blood flow, which prevents nourishment and oxygen from reaching nerve and muscle cells.

**Pathogenesis:** Increase of pressure in the involved compartment after injury (eg: bleeding, trauma) causing stretching of the fascia of the involved muscles. Nerve and muscle cells damage due to disrupt of blood flow to muscles and nerve cells (by compression)

<table>
<thead>
<tr>
<th>Types</th>
<th>Acute compartment syndrome (medical emergency)</th>
<th>Chronic compartment syndrome (exertional compartment syndrome)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Causes</td>
<td>- Fracture</td>
<td>-Chronic exercise (usually atlets)</td>
</tr>
<tr>
<td></td>
<td>- Badly bruise muscles</td>
<td>- running, biking, or swimming (Usually relieved by discontinuing the exercise, and is usually not dangerous)</td>
</tr>
<tr>
<td></td>
<td>- Reestablish blood flow after blocked circulation (usually after surgery)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Crush injury</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Anabolic steroid use</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Constricting bandages</td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td>- Pain (Using or stretching the involved muscles increases the pain)</td>
<td>- Numbness</td>
</tr>
<tr>
<td></td>
<td>- Paresthesias in the skin</td>
<td>- Difficulty moving the foot</td>
</tr>
<tr>
<td></td>
<td>- Muscle may feel tight or full</td>
<td>- Visible muscle bulging</td>
</tr>
<tr>
<td></td>
<td>- Late signs : numbness or paralysis (indicate permanent tissue injury)</td>
<td>- Weakness, paleness skin, decrease sensation (pain subsides when activity stops)</td>
</tr>
<tr>
<td>Treatment</td>
<td>- Fasciotomy (The incision is surgically repaired when swelling subsides. Sometimes a skin graft is used)</td>
<td>- Physical therapy, orthotics (inserts for shoes), and anti-inflammatory medicines are sometimes suggested</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- avoid the activity that caused the condition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- fasciotomy (if conservative measures fail)</td>
</tr>
</tbody>
</table>
Diagnosis
1. Physical examination:
   - Severe pain when moving the affected area
   - Tensely swollen and shiny skin
   - Pain when the compartment is squeezed
   - Prolong capillary refill
   - Confirming the diagnosis involves directly measuring the pressure in the compartment

   **6P - Pain, Paresthesia, Pallor, Poikilothermia, Pulselessness, Paralysis**

   **Compartment pressure measurement**
   Method: using a needle attached to a pressure meter into the compartment
   Confirm diagnosis: pressure is > 45 mmHg or when the diastolic blood pressure exceeds compartment pressure < 30 mmHg
   When chronic compartment syndrome is suspected, this test must be performed immediately after the activity that causes pain. The pressure remains high before and after exercise.

2. Laboratory Studies: often normal and are not necessary to diagnose compartment syndrome (CS) and are NOT HELPFUL to rule out compartment syndrome.

3. Imaging Studies
   - Radiography of the affected extremity
   - Ultrasonography:
     - in evaluating arterial flow
     - in visualizing any deep venous thrombosis (DVT)
     - Usually aids in the elimination of differential diagnoses
   - Pulse oximetry: in identifying limb hypoperfusion

Complication
- Permanent injury to nerves and muscles that can impair function
  (Permanent nerve injury can occur after 12-24 hours of compression)
- Amputati (severe case)
4. Fractures of the Humerus

A. Fractures of the proximal end
   - 5-15% of all fractures.
   - Elderly individuals with osteoporosis
   - Younger individuals, these fractures occur after high-velocity trauma

Mechanism
   - A fall on outstretched hand from standing position
   - Blow to the shoulder
   - Motor vehicular accidents, electric shocks and convulsions

Classification
   (1) Fractures of the greater tuberosity.
   (2) Fractures of the lesser tuberosity.
   (3) Fractures of the surgical neck.
   (4) Fractures of the humeral head

Clinics
   - Pain and loss of function with swelling
   - Ecchymosis
   - Pulsatile or expanding hematomas may indicate a vascular lesion
   - Associated injuries

Treatment
   - Most fractures are treated with open surgery.
   - 2- and 3-part fractures are treated with open reduction and internal fixation (a plate with screws)
   - Four-part fractures in the younger, active patient also can be treated successfully with open reduction and internal fixation
   - Patient with osteoporosis, a hemiarthroplasty is the treatment of choice

B. Fracture of Humeral Shaft

Mechanism
   - Bending force produces transverse frx of the shaft;
   - Torsion force will result in a spiral fracture
   - Combination of bending and torsion produce oblique frx w/ or w/o a butterfly fragment;
   - Compression forces will frx either proximal or distal ends of humerus
Classification
AO/ASIF classification of humeral shaft fractures is based on fracture comminution:

- Type A are simple (noncomminuted) fractures,
- Type B have a butterfly fragment, and
- Type C are comminuted

Traditional classification
- Location: Proximal, Mid, Distal
- Type: Transverse, Oblique, Segmented
- Wound: Open/closed

Clinics
- History of trauma
- Pain, loss of shoulder/arm function, swelling and bruising
- Determine injury mechanism. Is osteoporosis likely?
- Assess for associated injuries to arm/shoulder/chest wall/lungs
- Perform a neurological examination, particularly examining the axillary nerve by testing for sensation in the regimental badge area over the deltoid muscle and assessing upper limb muscle power.
- Assess for brachial plexus injury through distal neurological examination.
- Check peripheral pulses

Treatment
- Long arm cast
- Functional brace
- Compression plate
- Intramedullary nail
- External fixation

c. Fractures of the Distal End
Classification
Three basic categories:

- Grade I. Intra-articular fractures
- Grade II. Extra-articular, intracapsular fractures.
- Grade III. Extracapsular fractures
<table>
<thead>
<tr>
<th>Grade I. Intra-articular fractures</th>
<th>Extra-articular, intracapsular fractures</th>
<th>Extracapsular fractures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade I (Single column)</td>
<td>1. High transcolumn</td>
<td>Medial epicondyle</td>
</tr>
<tr>
<td>1. Low medial</td>
<td>2. Low transcolumn</td>
<td>Lateral epicondyle</td>
</tr>
<tr>
<td>2. High medial</td>
<td>3. Abduction</td>
<td></td>
</tr>
<tr>
<td>3. Low lateral</td>
<td>4. Adduction</td>
<td></td>
</tr>
<tr>
<td>4. High lateral</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Capitellum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Trochlea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade I (Bicolumnar)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. High T intercondylar</td>
<td>1. High transcolumn</td>
<td>Medial epicondyle</td>
</tr>
<tr>
<td>2. Low T intercondylar</td>
<td>2. Low transcolumn</td>
<td>Lateral epicondyle</td>
</tr>
<tr>
<td>3. Y intercondylar</td>
<td>3. Abduction</td>
<td></td>
</tr>
<tr>
<td>4. H intercondylar</td>
<td>4. Adduction</td>
<td></td>
</tr>
<tr>
<td>5. Lambda pattern (lateral)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Lambda pattern (medial)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

D. Olecranon Fracture

**Mechanism**
- A direct blow: happen in a fall or being struck by a hard object
- An indirect fracture: landing on an outstretched arm coz the triceps muscle on the back of the upper arm help "pull" the olecranon off of the ulna.

**Classification**

**Colton Classification of Olecranon Fractures**
1. Non-displaced or displacement less than 2 mm (Displacement does not increase with elbow flexion)
   Elbow extensor mechanism remains intact
2. Displaced
   - A Avulsion Fractures
   - B Oblique or Transverse Fractures
   - C Comminute
   - D Fracture Dislocations

**Clinics**
- Sudden, intense pain
- Inability to straighten elbow
- Swelling over the bone site
- Bruising around the elbow
- Tenderness to the touch
- Numbness in one or more fingers
- Pain with movement of the joint
**Treatment**
- splint or sling
- Pins/wires
- Screws only
- ("stitches") in the bone or tendons
- Plates and screws
- Sutures

E. **Coronoid Fracture**
**Mechanism:** direct impact of trochlea on the coronoid when force acts

**Classification**
- Type I — small avulsion fracture at tip of coronoid
- Type II — fragment involves 50% of the coronoid but does not extend to the base
- Type III — fracture at the base of the coronoid, likely including the insertions of the brachialis and the anterior band of the medial collateral ligament

**Clinics:** same as above fractures

**Treatment**
- I and II — early immobilization and early motion
- III — ORIF using K wires

F. **Capitellar Fracture**
**Mechanism and classification**
- This fracture is more common in individuals older than 12 years and very rare in children. A fall on the outstretched hand or directly on the elbow produces a shear force fracturing the capitellum in the coronal plane
- Type I (Hahn-Steinthal) is a coronal shear fracture with a large osseous capitellar fragment
- Type II involves a shell of the articular cartilage with a thin layer of bone and are known by the eponym Kocher-Lorenz
- Type III fractures include all comminuted fractures of the capitellum

**Treatment**

<table>
<thead>
<tr>
<th>Type</th>
<th>Undisplaced</th>
<th>Displaced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hahn Steinthal</td>
<td>splint</td>
<td>ORIF</td>
</tr>
<tr>
<td>Kocher Lorenz</td>
<td>splint</td>
<td>ORIF</td>
</tr>
<tr>
<td>Type III</td>
<td></td>
<td>ORIF</td>
</tr>
</tbody>
</table>
5. Fracture’s of the Forearm and Hand

Mnemonics:
- Scaphoid - Some
- Lunate - Lovers
- Triquetrium - Try
- Pisiform - Positions
- Trapezium - That
- Trapezoid - They
- Capitate - Cant
- Hamate - Handle

Basic Clinic’s
- Pain, Swelling, Obvious deformity, Changes in length of affected limb, Crackling sound,
- Forced position of affected limb, Pathologic mobility

Rolando’s #
- Injury normally occurs when falling on thumb, having it outstretched during fall or having it ‘entrapped’ at fall
- Intra-articular # through base of 1st MCP without involvement of CMC joint
- Depending on # line, maybe T or Y shaped

Bennett’s #
- Most common type of # of the thumb.
- # of the 1st MCP with the involvement of the CMC joints
- Usually occurs when person punches out at something or falls on thumb
- Patient will present with weakness of grasping and pinching efforts
- Treatment depends on degree of displacement from the trapeziometacarpal joint:
  - 1-3mm - close reduction + pin fixation/ K wire or nail
  - >3mm – ORIF + internal fixation

*thumb scaphoid cast required in all cases (4-6 weeks)

<table>
<thead>
<tr>
<th>Rolando’s #</th>
<th>Bennett’s #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comminuted Intra-articular Fracture through base of thumb Prognosis: worse than Bennett's fracture (difficult to reduce)</td>
<td>Intra-articular fracture/dislocation of base of 1st metacarpal Small fragment of 1st metacarpal continues to articulate with trapezium</td>
</tr>
</tbody>
</table>

Barton’s #
- Type of distal radial # (flexion #)
- Oblique # from volar surface of distal end of radius into wrist joint.
- Fragment always displaced forward, anteriorly, carrying the carpus!!!
  - Also known as the F dislocation.
- Treatment: This # is easily reduced, and will require internal fixation, usually with a small buttress plate
Colles #
- Most common #
- Usually in older women (postmenopausal osteoporosis)
- Transverse # of radius just above wrist with distal displacement.
- # maybe impacted or severely comminuted
Also known as the dinner fork #

Colles criteria:
- transverse # of radius
- 2.5cm proximal to the radiocarpal joint
- dorsal displacement
- Palmar angulation

<table>
<thead>
<tr>
<th>Bartons #</th>
<th>Colles #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intra-articular fracture of the dorsal</td>
<td>Extra-articular</td>
</tr>
<tr>
<td>margin of the distal radius</td>
<td>Does not extend into joint space</td>
</tr>
<tr>
<td>Carpal displacement</td>
<td>Dorsal angulation with radial and dorsal</td>
</tr>
<tr>
<td>Extends into joint</td>
<td>displacement of distal fragment</td>
</tr>
<tr>
<td></td>
<td>Frequently associated with fracture of ulnar</td>
</tr>
<tr>
<td></td>
<td>styloid</td>
</tr>
</tbody>
</table>

Smiths #
- Exactly the same as Colles, with exception of direction of displacement of distal radial fragment.
- Treatment: traction and extension with immobilization for 6 weeks

Monteggia’s #-dislocation
- # of proximal ulna with dislocation of head of radius( olecranon is frequently involved too)
- Injury usually occurs at fall on hand with pronated forearm
- # is obvious, but dislocations maybe missed so PAY ATTENTION
- Treatment:
  - Restore proper length of ulnar
  - ORIF and fix with plate and screws
  - Immobilize in cast with elbow in flexed position. ( max 6 weeks in most severe cases)
Encourage simple exercise after 10 days (i.e flexion, rotation and extension of the arm)

Galeazzi’s #-dislocation
- Much more common than Monteggia’s
- Shaft of radius # with dislocation of the radioulnar joint
- Patients must be evaluated for ulnar nerve lesion
- Treatment is the same as that in Monteggia’s.
- Normally, reduction of the # may be all that’s necessary but if the radioulnar joint is still unstable after the reduction, fixation with K wires and a additional period of cast immobilization may be needed.

<table>
<thead>
<tr>
<th>Galeazzi’s # dislocation</th>
<th>Monteggia’s #-dislocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft of radius # with dislocation of</td>
<td># of proximal part of ulna with dislocation</td>
</tr>
<tr>
<td>distal part of ulnar</td>
<td>of radius</td>
</tr>
</tbody>
</table>
Olecranon #
Maybe classified into:
- **comminuted #** due to direct blow/fall on elbow (mostly elderly ppl)
- **clean transverse/gap #** due to traction when patient falls with biceps contracted

**Pathologic symptoms:**
- **Comminuted #** - with the triceps intact, the patient’s elbow will be extended against gravity.
- **Gap #** - a gap will be palpable & patient won’t be able to extend his/her elbow against resistance.

**Treatment depends on type:**

<table>
<thead>
<tr>
<th>Comminuted #</th>
<th>Gap #</th>
</tr>
</thead>
</table>
| rest in sling till pain subsides - do X-ray and check the displacement - put in cast for 2 weeks and encourage active movement | • Gap # - depends on its subtypes:  
  **Undisplaced #** - immobilize elbow in cast within 60° flexion for a week  
  **Displaced #** - fixate with a long cancellous  
  - Screw inserted from the tip of the olecranon  
  - tension band wiring |

**Complications:**
- Joint stiffness
- Recurrent instability of affected joints
- Osteoarthritis
- Compartment Syndrome
- Malunion/ delayed union of bones
- Neurovascular damage during removal of screws/plates
- ‘screw hole’ #
- Nerve injuries (radial, median, ulnar)

**Carpal Tunnel Syndrome**
- Median nerve neuropathy at the wrist
- Paraesthesia, numbness and muscle weakness
- Characteristic night symptoms- severe pain that awakens patient
- Treatment includes wearing wrist splints/braces but surgery is best- carpal tunnel release surgery
### 6. FRACTURE OF LOWER LIMB

**FEMORAL #**

Divided into: 1) Proximal – Intracapsular (Femoral neck #)
- Extracapsular (Intertrochanteric # & Subtrochanteric #)
2) Middle (Shaft)
3) Distal – Supracondylar #
- Condylar #

<table>
<thead>
<tr>
<th></th>
<th>CLASSIFICATION/TREATMENT</th>
<th>CLINICAL FEATURES/X-RAY</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FEMORAL NECK #</strong></td>
<td>Garden’s Classification</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Stage I</em></td>
<td>1) Greater trochanter</td>
<td>Principles:</td>
</tr>
<tr>
<td></td>
<td>Incomplete impacted #</td>
<td>elevated</td>
<td>1) Open reduction</td>
</tr>
<tr>
<td></td>
<td><em>Stage II</em></td>
<td>2) Patient lies with the</td>
<td>2) Internal fixation –</td>
</tr>
<tr>
<td></td>
<td>Complete # but not</td>
<td>limb in lateral</td>
<td>Cannulated screw or</td>
</tr>
<tr>
<td></td>
<td>displaced</td>
<td>rotation</td>
<td>Sliding/Dynamic compression</td>
</tr>
<tr>
<td></td>
<td><em>Stage III</em></td>
<td>3) Leg is shortened</td>
<td>screw)</td>
</tr>
<tr>
<td></td>
<td>Complete # &amp; moderately</td>
<td>4) Unstable to</td>
<td>3) Early activity (Sit on bed &amp;</td>
</tr>
<tr>
<td></td>
<td>displaced</td>
<td>stand</td>
<td>walk with crutches)</td>
</tr>
<tr>
<td></td>
<td><em>Stage IV</em></td>
<td>5) Signs of inflammations</td>
<td>**If cannot be reduced or in old people, femoral head should be removed &amp; replaced with a</td>
</tr>
<tr>
<td></td>
<td>Complete # &amp; severely</td>
<td>(Pain, swelling…)</td>
<td>metal prosthetics.</td>
</tr>
<tr>
<td></td>
<td>displaced</td>
<td></td>
<td>**Children a)Undisplaced #</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(Plaster cast-Hip spica)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>b)Displaced # (Same as adult)</td>
</tr>
<tr>
<td><strong>INTER-TROCHANTERIC #</strong></td>
<td>1) Undisplaced</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2) Displaced but with</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>minimal comminution</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3) Displaced comminuted</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td># also involving greater &amp;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>lesser trochanter</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SUB-TROCHANTERIC #</strong></td>
<td>3 principles</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CLASSIFICATION/TREATMENT**

**CLINICAL FEATURES/X-RAY**

**TREATMENT**

**Principles:**

1) Open reduction
2) Internal fixation – Cannulated screw or Sliding/Dynamic compression screw
3) Early activity (Sit on bed & walk with crutches)

**If cannot be reduced or in old people, femoral head should be removed & replaced with a metal prosthetics.**

**Children**

a) Undisplaced # (Plaster cast-Hip spica)
b) Displaced # (Same as adult)
| FEMORAL SHAFT # | 1) Proximal 1/3  
2) Mid shaft  
3) Distal 1/3 |  
|---|---|---|
|  |  | Traction & bracing  
Indication: - # in children  
Contraindicated for anaesthesia  
Lack facilities for internal fixation  
Open reduction & Internal fixation (ORIF) with plates and screw  
Intramedullary nailing  
External fixation  
Indication: - Severe open injury |

| SUPRACONDYLAR # | 1) Deformed knee  
2) Signs of inflammations (Pain especially on movement, swelling…)  
3) Knee feels doughy on palpation due to hemarthrosis  
4) Unstable to stand  
**Posterior tibial pulse must be checked  
X-ray  
**Distal fragment is often tilted backwards due to pull by gastrocnemius attachment  
**Knee joint x-ray |  
|---|---|---|
|  |  | 1) Traction & bracing  
Indication: - If # is slightly displaced  
Reduced easily by knee flexion (Thomas splint with Pearson’s knee flexion piece)  
2) Open reduction & Internal fixation (ORIF) with angle compression device  
3) Intramedullary nailing – Introduced retrograde trough the intercondylar notch |
| CONDYLAR # | Aspirate hemarthrosis ASAP ORIF Single condylar # - Kirschner wires (K-wire) preparatory to insertion of compression screw Complex condylar # - Dynamic condylar screw & plate |

**OPEN FRACTURE BY GUSTILO**

**TYPE I** - # with small clean wound & little soft tissue damage

**TYPE II** - # with clean wound >1 cm but little soft tissue damage

**TYPE III** - # with excessive damage of skin, soft tissue & neurovascular structure & contamination of wound
  a. Fractured bone adequately covered by soft tissue
  b. Fractured bone not adequately covered & has periosteal striping
  c. Present neurovascular injury regardless of soft tissue

**FEMORAL SHAFT #**

Twisting force – Spiral #

Angular force – Oblique #

X-ray
1) Tibia
2) Fibula
3) Knee joint
4) Ankle joint

**Treatment**

*Undisplaced/ minimal displaced #*
- Full length cast from upper thigh to metatarsal neck

*Displaced #*
- ORIF with (i) Plate fixation – Metaphyseal #
  (ii) Intramedullary nailings – Diaphyseal #
- External fixation (in case of open injury)

**PATELLA #**

**Types**
1) Undisplaced crack across patella
2) Comminuted/Stellate #
3) Displaced transverse # (present gap between fragments ; passive flexion of knee)

**Treatment**

*TYPE 1 (Extensor mechanism is still intact)*
- Hemarthrosis aspirated
- Plaster cylinder holding the knee straight (4 -6 weeks) and quadriceps exercises.
**TYPE 2** (Extensor is still intact)
- If patella not severely displaced – Backslab + Daily exercise
- Patellectomy

**TYPE 3** (Extensor is not intact)
- Internal fixation (tension band wiring + extensors repairs) + Backslab + Exercise

### CALCANEUM #
Cause: Fall from height and land on the heels.

Types
1) Extraarticular fracture
   Fracture of tuberosity sustantaculum talus and body which does not involve articular surface of the subtaloid joint.
2) Intraarticular fracture
   Compression fracture of the body which involves the subtaloid joint

Special features
- Pain in the foot or heel
- Swollen heel/ foot/ ankle
- Tenderness on palpating the heel
- Vertical distance from tip of malleoli and ground is decreased. (calcaneum is vertically compressed)

X-Ray
**Both feet**
**Bohler’s angle is decreased/ flattened (lateral projection)**

### METATARSAL #

<table>
<thead>
<tr>
<th><strong>CAUSE</strong></th>
<th><strong>TREATMENT</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MARCH #/ STRESS INJURY</strong></td>
<td>Repetitive stress (eg: soldiers)</td>
</tr>
<tr>
<td><strong>JONES #</strong> (Extraarticular fracture of the base of 5th metatarsal bone)</td>
<td>Sprain of lateral ligament of ankle (base of fifth metatarsus is avulsed by the peroneus brevis insertion)</td>
</tr>
<tr>
<td><strong>SEVERELY DISPLACED #</strong></td>
<td>Direct blow</td>
</tr>
</tbody>
</table>
7. Fractures of the Spine

Supporting Columns
- anterior column - front half of the vertebral body, the nucleus of the intervertebral disc and the anterior longitudinal ligament
- middle column - back of the vertebral body and the posterior longitudinal ligament
- posterior column - ring of bone surrounding the nerves and the facet joints

Fractures of C1 (Atlas)

<table>
<thead>
<tr>
<th>Type</th>
<th>Injury</th>
<th>Mechanism</th>
<th>Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>I (# of the ant. Arch of atlas)</td>
<td>avulsion fracture of the tuberculum anterius of the anterior arch of the atlas</td>
<td>hyperextension</td>
<td>stable</td>
</tr>
<tr>
<td>II (# of Post. Arch)</td>
<td>wedging of the posterior arch of the atlas between the joint masses of the occipital bone and the 2nd cervical vertebra</td>
<td>hyperextension, pronounced flexion, or axial compression</td>
<td>stable</td>
</tr>
</tbody>
</table>
| III (combined Ant and Post arch #) | - 2 part  
- 3part  
- 4part | forces act upon the cervical spine from above | Depends on type |
| IV (# of Massa Lateralis)  | An isolated fracture of a joint-bearing lateral mass |                                               | stable        |
| V (# of Transverse Process) | Avulsion fractures of the transverse process of atlas |                                               | stable        |

Treatment
- Stable fractures with no dislocation of the -immobilization using special cervical braces worn for 8 weeks.
- Jefferson fractures with ligamentous avulsions, and resulting lateral dislocation of C1 in relation to C2 require surgery urgently.
- The surgical options available are:
  - Harms transoral repositioning and osteosynthesis of C1
  - C0/C2 fusion

Fractures of C2 (axis)
Odontoid fracture
Mechanism
- secondary to MVAs or falls
- flexion, extension, and rotation
Classification
- Anderson and D'Alonzo classified odontoid fractures based on the anatomic location of the fracture
Hangmans Fracture/traumatic spondylolisthesis

**Mechanism**
- secondary to judicial hangings
- bilateral pedicle fracture of C2, along with distraction of C2 from C3 secondary to complete disruption of the disk and ligaments between C2 and C3

### Classification, Stability and Treatment

<table>
<thead>
<tr>
<th>Type</th>
<th>Injury</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>oblique fracture through the upper part of the odontoid process</td>
<td>cervical orthosis</td>
</tr>
<tr>
<td>II</td>
<td>occurring at the base of the odontoid as it attaches to the body of C2</td>
<td>• halo vest&lt;br&gt;• Internal fixation (age&gt;50)&lt;br&gt;• Screw fixation (posterior displacement&gt;5mm)</td>
</tr>
<tr>
<td>III</td>
<td>fracture line extends through the body of the axis</td>
<td>halo immobilization</td>
</tr>
</tbody>
</table>

### C3 –C7 Fractures
- **Type A fractures**<br>are injuries that occur mainly in the anterior column
- **Type B fracture**<br>are injuries that generally occur in the posterior elements
- **Type C fractures**<br>fractures are injuries that affect both the anterior column and the posterior elements
**Symptom**
- Pain (local, movement-induced, radiating)
- Medullary symptoms with incomplete or complete paraplegia
- Radicular symptoms
- Increased neck circumference due to prevertebral internal hemorrhaging
- Spinal shock
- Specific symptoms of additional secondary injuries

**Treatment**

Indication for surgical fusion:
- Complete tetraplegia
- Incomplete paraplegic syndrome
- Fractures with radicular deficits due to root compression
- Unstable fractures without neurological complications

**Types of Operation**
- Cloward-Robinson ventral fusion
- Ventral corporectomy and bridging spondylodesis with titanium cage and plate
- Ventrodorsal repositioning spondylodesis with ventral and dorsal instrumentation
- Solely dorsal repositioning and fusion
- Dorsal decompression with dorsally instrumented fusion

**C3-C7 Spinous Process Fracture**
- **Mechanism**: powerful hyperflexion, usually combined with contraction of paraspinal muscles pulling on spinous processes (e.g. shoveling).
- **Stability**: stable
- **Treatment**: symptomatic

**Thoracic And Lumbar Fracture**

**Mechanism**
- Car crash
- Fall from height
- Sports accident
- Violent act, such as a gunshot wound

<table>
<thead>
<tr>
<th>Flexion Fracture Pattern</th>
<th>Extension Fracture Pattern</th>
<th>Rotation Fracture Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compression fracture.</strong> While the front (anterior) of the vertebra breaks and loses height, the back (posterior) part of it does not. This type of fracture is usually stable and rarely associated with neurologic problems.</td>
<td><strong>Flexion/distraction (Chance) fracture.</strong> The vertebra is literally pulled apart (distraction). This can happen in accidents such as a head-on car crash, in which the upper body is thrown forward while the pelvis is stabilized by a lap seat belt.</td>
<td><strong>Transverse process fracture.</strong> This fracture is uncommon and results from rotation or extreme sideways (lateral) bending, and usually does not affect stability.</td>
</tr>
</tbody>
</table>
Axial burst fracture. The vertebra loses height on both the front and back sides. It is often caused by a fall from a height and landing on the feet.

Fracture-dislocation. This is an unstable injury involving bone and/or soft tissue in which a vertebra may move off an adjacent vertebra (displaced). These injuries frequently cause serious spinal cord compression.

Symptoms
- moderate to severe back pain that is made worse by movement.
- numbness, tingling, weakness, or bowel/bladder dysfunction may occur.
- the patient may have a brain injury and may have lost consciousness, or "blacked-out."
- There may also be other injuries — called distracting injuries — which cause pain that overwhels the back pain.

Treatment

<table>
<thead>
<tr>
<th>FRACTURE</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burst</td>
<td>• Stable : hyperextension cast/brace</td>
</tr>
<tr>
<td></td>
<td>• Unstable ( height &lt;50%, ang &gt;20 deg, canal compromise &gt; 50%, scoliosis &gt;10 deg, neuro prob.) : ORIF</td>
</tr>
<tr>
<td>Flexion/distraction</td>
<td>• Bony : hyperextension cast/brace</td>
</tr>
<tr>
<td></td>
<td>• Soft tissue : ORIF</td>
</tr>
<tr>
<td>Fracture dislocation</td>
<td>ORIF and early mobilization</td>
</tr>
</tbody>
</table>

Sacral Fractures
Classification( Denis Classification)

<table>
<thead>
<tr>
<th>Zone</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone I</td>
<td>injuries are entirely lateral to the neuroforamina</td>
</tr>
<tr>
<td>Zone II</td>
<td>injuries involve the neuroforamina but not the spinal canal</td>
</tr>
<tr>
<td>Zone III</td>
<td>injuries extend into the spinal canal with primary or associated fracture lines</td>
</tr>
</tbody>
</table>

Stability
A three-stage system of stability classification has been proposed for sacral injuries.
- Stage A - Osseoligamentous injury with retention of structural function
- Stage B - Occult osseoligamentous disruption
- Stage C - Obvious complete osseoligamentous disruption

Differentiation between Stage-A and B injuries can be very difficult and may require provocative tests, such as weight-bearing and traction studies, or repeated imaging over time.
Signs and Symptom

- peripelvic pain
- Lacerations, bruising, tenderness, swelling, and crepitus
- posterior sacral osseous prominence or a palpable subcutaneous fluid mass

Treatment

<table>
<thead>
<tr>
<th>FRACTURE</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 1</td>
<td>Observation -if stable/impacted, &lt;1cm displacement</td>
</tr>
<tr>
<td>Zone 2</td>
<td></td>
</tr>
<tr>
<td>Zone 3</td>
<td></td>
</tr>
</tbody>
</table>
8. Fractures of Hip (Pelvic & Acetabulum)

a) FRACTURE OF THE PELVIC
Pelvic fractures fall into 4 groups:
1. Isolated fractures with an intact pelvic ring
2. Fractures with broken ring
3. Fractures of acetabulum
4. Saccroccocygeal fractures.

MECHANISM OF INJURY

<table>
<thead>
<tr>
<th>LOW ENERGY</th>
<th>HIGH ENERGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avulsion injury</td>
<td>Impact injury</td>
</tr>
<tr>
<td>Low energy fall</td>
<td>Crush injury</td>
</tr>
<tr>
<td>Straddle type injury</td>
<td>Eg: motor-vehicle accident, fall</td>
</tr>
<tr>
<td>Eg: sudden muscular contraction in athlete</td>
<td>from height</td>
</tr>
</tbody>
</table>

Pelvic Ring Fractures (broken ring)

Classification
- Fractures with broken ring can be either stable or unstable.

Young-Burgess Classification System
- 1. anteroposterior compression
- 2. lateral compression
- 3. vertical shear

<table>
<thead>
<tr>
<th>1. Anteroposterior compression (AP)</th>
<th>2. Lateral compression</th>
<th>3. Vertical shear</th>
</tr>
</thead>
<tbody>
<tr>
<td>The pubic rami are fractured @ the innominate bones are sprung apart and externally rotated, with disruption of the symphysis – called ‘open-book’ injury.</td>
<td>Side-to-side compression of the pelvis causes the ring to buckle and break.</td>
<td>the innominate bone on 1 side is displaced vertically, fracturing the pubic rami and disrupting the sacroiliac region on the same side.</td>
</tr>
<tr>
<td>The sacroiliac ligament are possibly torn @ a fracture of posterior part of ilium.</td>
<td>anteriorly, the pubic rami on 1 or both sides are fractured, and posteriorly there is a severe sacroiliac strain or a fracture of the ilium or sacrum.</td>
<td>Usually severe, unstable injuries with gross tearing of the soft tissues and retroperitoneal haemorrhage.</td>
</tr>
<tr>
<td>M.O.I: a frontal collision between a Pedestrian and a car</td>
<td>If the sacroiliac injury is much displaced, the pelvic is unstable.</td>
<td>M.O.I: falls from height onto 1 leg.</td>
</tr>
<tr>
<td></td>
<td>M.O.I: side-on impact in a road accident or a fall from a height.</td>
<td></td>
</tr>
<tr>
<td>Mechanism and Type</td>
<td>Characteristics</td>
<td>Hemipelvis Displacement</td>
</tr>
<tr>
<td>--------------------</td>
<td>----------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>AP compression, type I</td>
<td>Pubic diastasis &lt;2.5 cm</td>
<td>External rotation</td>
</tr>
<tr>
<td>AP compression, type II</td>
<td>Pubic diastasis &gt;2.5 cm, anterior SI joint disruption</td>
<td>External rotation</td>
</tr>
<tr>
<td>AP compression, type III</td>
<td>Type II plus posterior SI joint disruption</td>
<td>External rotation</td>
</tr>
<tr>
<td>Lateral compression, type I</td>
<td>Ipsilateral sacral buckle fractures, ipsilateral horizontal pubic rami fractures (or disruption of symphysis with overlapping pubic bones)</td>
<td>Internal rotation</td>
</tr>
<tr>
<td>Lateral compression, type II</td>
<td>Type I plus ipsilateral iliac wing fracture or posterior SI joint disruption</td>
<td>Internal rotation</td>
</tr>
<tr>
<td>Vertical shear</td>
<td>Vertical pubic rami fractures, SI joint disruption +/- adjacent fractures</td>
<td>Vertical (cranial)</td>
</tr>
</tbody>
</table>

**Clinical Pictures**

**Isolated fractures and stable injuries**
- Not severely shocked
- Pain on attempting to walk.

**Unstable injuries**
- Severely shocked
- Great pain
- Unable to stand
- Unable to pass urine
- Maybe blood at external meatus
- 1 leg maybe partly anaesthetic because of sciatic nerve injury.

**Investigations**

1. Urinalysis
2. Serial haemoglobin and haematocrit measurements
3. X-rays
4. CT Scan
5. Ultrasound
6. Urethrography
7. Arteriography
8. Cystography
Treatment

Undisplaced ring fractures

✧ 4 weeks’ rest in bed (possibly combined with lower limb traction).

Anterior Disruption without Sacroiliac displacement.

‘Open book’ injuries with a gap less than 2cm tx:

- Bed rest for 6 weeks
- Posterior sling @ elastic girdle
  but in case of severe injuries;
- External fixation with pins in both iliac blades connected by an anterior bar (8-16 weeks).

Displaced Fracture with Sacroiliac Disruption:

Severe vertical shear and compression injuries tx:

- Anterior external fixation and post stabilization using screws across sacroiliac joint.
- Plating the symphysis anteriorly and screws across the sacroiliac joint posteriorly.

External fixation ➔ 4 hemodynamic unstable pt with unstable pelvis fracture
ORIF ➔ diastases of pubic symphysis > 2.5cm
  ➔ Sacroiliac joint dislocation
  ➔ Displaced sacral F.
  ➔ Crescent F.
  ➔ Post @ vertical displacement of hemipelvis (> 1cm).

B) FRACTURE OF THE ACETABULUM

Aetiology

- Acetabulum fractures usually occur as a result of high-velocity trauma, such as:
  - vehicular accidents (blow on the front of knee)
  - falls from heights (blow on the side)
- Occur when the head of the femur is driven into the pelvis
- as a result of the force exerted through head of the femur to the acetabulum

Anatomy

- The acetabulum is divided into 2 columns: anterior and posterior
- The 2 columns are described as having the shape of an inverted Y, or of the Greek letter lambda
- Anterior column: ant border of the iliac wing, the entire pelvic brim, the ant wall, and the superior pubic ramus
- Posterior column: the ischial portion of bone (lesser and greater sciatic notches), post wall, and the ischial tuberocity

Classification

Initially published by Judet in 1964, and later modified by Letournel. Judet and Letournel classification system: simple and complex types
<table>
<thead>
<tr>
<th>Simple</th>
<th>Complex</th>
</tr>
</thead>
</table>
| • posterior wall (PW),  
  • posterior column (PC),  
  • anterior wall (AW),  
  • anterior column (AC),  
  • transverse | • T-shaped,  
  • anterior column and posterior  
    hemitransverse (AC-PHT),  
  • both-column (BC),  
  • posterior column and wall (PC-PW),  
  • transverse posterior wall (T-PW) |

| Anterior & Posterior Wall Fracture | • Affect the depth of socket  
  • Lead to hip instability unless they are properly reduced & fixed |
|-----------------------------------|--------------------------------------------------|
| Posterior Column Fracture | • Fracture runs upwards from Obturator Foramen into Sciatic Notch  
  • Separating posterior ischiopubic  
  • Breaking the weight-bearing part of acetabulum  
  • Usually associated with posterior dislocation of hip & may injure the sciatic nerve |
| Transverse Fracture | • Uncomminuted fracture  
  • Running transversely through acetabulum  
  • Separating : -above : the iliac portion  
    -below : ischial & pubic portion |
| Complex Fracture | • Damage of various portions of acetabulum including its roof & floor  
  • Badly disrupted articular surface  
  • Need operation reduction & internal fixation  
  • End result is likely less than perfect |

Clinics
- hip or groin pain
- inability to walk or to use the leg.
- bruising around hip
# in trauma patients who are unable to cooperate with an examination, an AP pelvis radiograph is mandatory

Conservative treatment

<table>
<thead>
<tr>
<th>Simple &amp; undisplaced f.</th>
<th>Significantly displaced f.</th>
</tr>
</thead>
</table>
| • Treated by:  
  -maintaining traction for 6-8 weeks  
  -traction is applied to the limb (± 10kg) | • Do:  
  -Closed reduction  
  -using combination of lateral & longitudinal skeletal traction |

Surgical approaches
- **Kocher-Langenbeck**: best access to posterior column (prone)
- **Ilioinguinal**: best access to anterior column and inner aspect of innominate bone (supine)
- **Extended iliofemoral**: best simultaneous access to the two columns (lateral)

Operative Treatment
- Reduction & stabilization can be carried out by using:
  - K-wires  
  - screws  
  - buttress plate (neutralization plate)
9. Diabetic Foot Ulcer

Classification:

Wagner's grading (Most common):

0. No ulcer
I. Superficial ulcer (partial/full thickness of skin only)
II. Deep ulcer (Ligaments & muscles but not bones)
III. Deep ulcer with cellulitis, abscess, & osteomyelitis
IV. Localized gangrene
V. Extensive gangrene of whole foot

Management upon admission:

1. Blood glucose level is determined and managed with insulin. (Usually done by the Medicine team).
2. Orthopaedic team gets the update about the patient from the medicine team and examines the patient every day.
   - Check the base of ulcer and the floor of the ulcer. Base of ulcer is What we can see (pus, maggots or necrotized tissue) and floor of ulcer is what we can touch and feel.
   - X-ray is done to see if there is any fracture of the bone.
   - Ankle Brachial Systolic Index (ABSI).
3. Treatment of the patient:
   i. Wound debridement till pink tissue or slight bleeding is visible.
   ii. Antibiotics: Local (Gentadisc) & System
   iii. Absorbent dressing
   iv. Negative pressure wound therapy/Vacuumed assisted closure (VAC)
   v. Amputation – BKA
      Ray amputation (1/3 of the metacarpal or 2/3 of the metatarsal bone is cut and each metacarpal or metatarsal is considered as 1 Ray).
# 10. Dislocation

| Acromioclavicular Dislocation = Acromioclavicular (Ac) Separation = Separated Shoulder |
|---|---|
| **Mechanism** | fall onto acromion, contact sports - hockey, rugby, wrestling |
| **Signs / Clinical Picture** | Examination reveals localized tenderness and prominence of the displaced distal clavicle. |
| **Grading / Classification** | Grade I : Sprain, AC lig intact  
Grade II: AC tear, CC sprain  
Grade III : AC, CC lig both torn, AC joint dislocated  
Grade IV : Grade III with clavicle posterior (with relation to scapula)  
Grade V : Grade III with clavicle superior  
Grade VI : Grade III with clavicle inferior |
| **Imaging** | AP, stress view : I: normal, II: minimal separation, III and up: clavicle displaced |
| **Treatment** | Grade I and II injuries are treated nonoperatively.  
Most grade III AC joint dislocations may be treated by range-of-motion and strengthening exercises after the pain subsides.  
Grade IV–VI AC separations (IV and VI not shown) are uncommon (<1%) and, because of their severity, require open repair. |
| **Complications** | Permanent deformity; Stiffness, early OA; Distal clavicle osteolysis (pain); Associated injuries: Fracture, pneumothorax. |

## GLENOHUMERAL DISLOCATION

| **Mechanism** | In the younger age groups, athletic injuries are common, such as from athletic trauma or a fall, whereas in older persons, often the result of falls. |
| **Signs / Clinical Picture** | These patients experience the sudden onset of pain and an inability to use the arm after a fall or forceful throwing movement. Inspection typically shows the patient supporting the arm with the other hand. Examination reveals flattening of the deltoid prominence, prominence of the acromion, fullness of the subcoracoid region, and downward displacement of the axillary fold. Any attempt at motion elicits pain. |
### Grading / Classification
Anatomic Classification: where humeral head is:
- Anterior (>90%)
- Posterior (5%)
- Inferior (luxatio erecta) very rare
- Superior: very very rare

### Imaging
MRI: Bankart lesion (anterior/inferior labral tear)

### Complications
Axillary nerve injury; Rotator cuff tear; Glenoid/Greater tuberosity fracture; Dead arm syndrome

---

### Sternoclavicular Joint Dislocation

#### Mechanism
The typical mechanism of injury is an indirect force on the lateral aspect of the shoulder, resulting in anterior translation of the medial clavicle.

#### Signs / Clinical Picture
Examination reveals a prominent bump and tenderness over the SC joint.
Dyspnea, dysphagia, or signs of venous congestion are indicative of a posterior SC dislocation.

#### Grading / Classification / Types
- Anterior dislocation with the clavicle displaced anterior to the sternum is the most common type.
- Posterior SC joint dislocations are rare but more serious because of the potential resultant injury to the great vessels that exit the heart and the vital structures of the neck, especially the trachea.

#### Imaging

#### Complications
- Anterior: may result in a permanent cosmetic deformity or decreased range of motion.
- Posterior: 25% complication rate including tracheal rupture, pneumothorax, laceration of the superior vena cava, occlusion of the subclavian artery and/or vein, and recurrent dislocations. There may be life-threatening consequences if the diagnosis is missed.

---

### ELBOW DISLOCATION

#### Mechanism
Elbow dislocations typically occur when a person falls onto an outstretched hand.
Posterior dislocations typically occur in a fall on the outstretched hand with the shoulder abducted.

#### Signs / Clinical Picture
Pain, inability to flex elbow, deformity, tenderness, +/- neurovascular signs.
<table>
<thead>
<tr>
<th>Grading/Classification/Types</th>
<th>Location of ulna (radius)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>➢ Posterior (common)</td>
</tr>
<tr>
<td></td>
<td>➢ Posterolateral (&gt;90%)</td>
</tr>
<tr>
<td></td>
<td>➢ Anterior</td>
</tr>
<tr>
<td></td>
<td>➢ Lateral</td>
</tr>
<tr>
<td></td>
<td>➢ Medial</td>
</tr>
</tbody>
</table>

Posterior dislocations are most common. Anterior dislocation is rare because of the shape of the olecranon process.

<table>
<thead>
<tr>
<th>Imaging</th>
<th>AP &amp; lateral: rule out fracture</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Closed reduction: + / - local anesthesia and/or conscious sedation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Splint &lt; 7days for comfort, then early ROM</td>
</tr>
<tr>
<td></td>
<td>Open: if unstable or with entrapped bone or soft tissue</td>
</tr>
</tbody>
</table>

| Complications | COMPLICATIONS Neurovascular injury: brachial artery; median or ulnar nerve; Loss of extension; Instability/redislocation; Heterotopic ossification |

### RADIAL HEAD SUBLUXATION (NURSEMAID'S ELBOW)

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>child pulled or swung by hand or forearm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signs/Clinical Picture</td>
<td>Arm held pronated/flexed. Radial head &amp; supination tender.</td>
</tr>
<tr>
<td>Imaging</td>
<td>XR: only if suspect fracture</td>
</tr>
<tr>
<td>Treatment</td>
<td>Reduce: with gentle, full supination and flexion (should feel it “pop” in).</td>
</tr>
<tr>
<td>Complications</td>
<td>Recurrence</td>
</tr>
</tbody>
</table>

### CARPAL DISLOCATION: PERILUNATE INSTABILITY

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Uncommon: hyperextension &amp; supination injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signs/Clinical Picture</td>
<td>Wrist pain, + Watson sign.</td>
</tr>
<tr>
<td>Grading/Classification/Types</td>
<td>Mayfield (4 stages):</td>
</tr>
<tr>
<td></td>
<td>I: Scapholunate diastasis</td>
</tr>
<tr>
<td></td>
<td>II: Perilunate dislocation</td>
</tr>
<tr>
<td></td>
<td>III: Lunotriquetral diastasis</td>
</tr>
<tr>
<td></td>
<td>IV: Volar lunate dislocation.</td>
</tr>
<tr>
<td>Imaging</td>
<td></td>
</tr>
</tbody>
</table>

---

CSMU HOW ORTHOPAEDICS TEAM

Page 32
| **Treatment** | Closed reduction and cast simple cases.  
Open reduction, pin fixation, and primary ligament repair usually required. |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Complications</strong></td>
<td>Wrist instability and/or pain; SLAC wrist</td>
</tr>
</tbody>
</table>

## HIP DISLOCATION

<table>
<thead>
<tr>
<th><strong>Mechanism</strong></th>
<th>High energy trauma (esp MVA-dashboard injury or significant fall.)</th>
</tr>
</thead>
</table>
| **Signs / Clinical Picture** | Severe pain, Cannot move thigh/hip.  
Thigh position:  
Post: adducted, flexed, IR  
Ant: abducted, flexed, ER. |

### Grading / Classification / Types

- **Posterior. Thompson:**  
  I. Simple, no posterior fragment  
  II. Simple, large posterior fragment  
  III. Comminuted posterior fragment  
  IV. Acetabular fracture  
  V. Femoral head fracture  

- **Anterior. Epstein:**  
  I. (A, B, C): Superior  
  II. (A, B, C): Inferior  
    A: No associated fracture  
    B: Femoral head fracture  
    C: Acetabular fracture  

### Imaging

### Treatment

- **Posterior:**  
  I: Closed reduction & abduction pillow  
  II-V: 1. Closed Reduction (open if irreducible)  
  2. ORIF fracture or excise fragment  

- **Anterior:** closed reduction, ORIF if necessary.

### Complications

- Osteonecrosis (AVN) reduced risk with early reduction; Sciatic nerve injury (posterior dislocations); Femoral artery & nerve injury (anterior dislocations); Instability & recurrence; Osteoarthritis; Heterotopic ossification
## KNEE DISLOCATION

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Usually high energy injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signs / Clinical Picture</td>
<td>Pain, inability to bear weight. Effusion, deformity, pain, +/- distal pulses &amp; peroneal nerve function</td>
</tr>
</tbody>
</table>
| Grading / Classification / Types | By position:  
Anterior  
Posterior  
Lateral  
Medial |
| Imaging | |
| Treatment | Immobilize (cast): 6-8 wks (not if ligaments torn)  
Open: If irreducible, vascular injury (+/- pro-phylactic fasciotomy), early repair of ligaments if needed. |
| Complications | Tear or thrombosis of popliteal artery, tibial and peroneal nerve dysfunction |

END NOTES:
Dear friends,

I would like to express my deepest gratitude to everyone in CSMU for making this project successful. In one year’s time, we have managed to organise 7 workshops, including the one held in Klang Hospital, ranging from Medicine, Surgery, Paediatrics, to Emergency Medicine, Orthopaedics, and Obstetrics & Gynaecology.

In the beginning, there are so many unknowns in the project. However, all of these do not hinder our CSMU students from giving their help. For the success of this project, they are even willing to sacrifice their time and effort but never asked anything in return.

All student organisations, especially Malaysian Student Council, have also given their full support, and transformed this project from a mere idea into an undisputed reality. For these, we should give ourselves a big applause.

This is a project of the students, by the students, and for the students. In the face of hardship, our students have shown admirable creativity and respectable unity in overcoming all the obstacles that have been placed in our path. Everyone has squeezed every drop of their wits out of their mind just to collect information and present it to the students. When there were no medical instruments, they created them. The instruments are of really good quality and have been useful in enhancing the students’ understanding.

All the lecture slides have been gone through again and again only to ensure that they are readily comprehensible. Finally, our audience has shown their unwavering support by staying with us from dawn till dusk in the lecture hall. Their loyalty has inspired all of us to do our best. I am so proud of everyone in CSMU.

I believe that with this spirit, we, the students of CSMU, can become a good doctor. I hope that with the coming new committee, this project will reach new heights.

Work and share, together we learn. I wish everyone a blast 2010.

Christopher Hanjian Sheng
President of H.O.W. (2009/10)

Dear all,

First of all, I would like to thank our current committee members, all 6 teams and those who have contributed directly or indirectly in making this CSMU House Officer Workshop (H.O.W.) a success. I also would like to express my highest gratitude to the new committee members who are willing to help and contribute their time and effort for the next education year. We faced a lot of obstacles in the process of running this workshop. We did make mistakes and might not manage to discuss some important topics in current workshops. Despite all that, I sincerely hope that the current 6th year senior, who are graduating soon, are willing to continue to give us advices, ideas or any forms of guidance later on, so we would be able to improve ourselves even more. Last but not least, I wish all seniors have a successful future ahead and to all current 5th year students have a wonderful holiday soon. Thank you.

“Work and Share, Together We Learn”

Goh Kiam Seong
President H.O.W (2010/11)

CSMU HOW (2009/10) committees

<table>
<thead>
<tr>
<th>Central Committee</th>
<th>Team Leaders</th>
</tr>
</thead>
<tbody>
<tr>
<td>President:</td>
<td>Christopher Hanjian Sheng</td>
</tr>
<tr>
<td>Vice President:</td>
<td>Ng Kean Seng</td>
</tr>
<tr>
<td></td>
<td>Durairaaj</td>
</tr>
<tr>
<td>Secretary:</td>
<td>Fatimah Shahidah</td>
</tr>
<tr>
<td></td>
<td>Liyana Ahmad Farid</td>
</tr>
<tr>
<td>Treasurer:</td>
<td>Chong Eng Ngen</td>
</tr>
<tr>
<td></td>
<td>Chai Kean Chung</td>
</tr>
<tr>
<td>Coordinator:</td>
<td>Teo Chiah Shean</td>
</tr>
<tr>
<td></td>
<td>Goh Kiam Seong</td>
</tr>
<tr>
<td></td>
<td>Gerard Loh Chien Siong</td>
</tr>
<tr>
<td>Student Advisors:</td>
<td>Mayurrar Panirselam (MSC President)</td>
</tr>
<tr>
<td></td>
<td>Ramish Peramasivam (MIC President)</td>
</tr>
<tr>
<td></td>
<td>Mohd. Ariffullah Ariffin (KUU President)</td>
</tr>
<tr>
<td></td>
<td>Lai Fu Yi (MCA President)</td>
</tr>
<tr>
<td>EPU Leader:</td>
<td>Karthikeashvaren Subramaniam</td>
</tr>
<tr>
<td></td>
<td>Medicine: Koh Wen Ming</td>
</tr>
<tr>
<td></td>
<td>Obstetrics &amp; Gynaecology: Lim See Choo</td>
</tr>
<tr>
<td></td>
<td>Surgery: Kong Why Hong</td>
</tr>
<tr>
<td></td>
<td>Paediatrics: Thamayanti P Shanmugam</td>
</tr>
<tr>
<td></td>
<td>A&amp;E: Anushamalar Andiappan</td>
</tr>
<tr>
<td></td>
<td>Orthopaedics: Ashok Marappan</td>
</tr>
</tbody>
</table>