

Chapter 7

ORTHOPEDIC EMERGENCIES

Learning Objectives:

- Take a proper relevant history, and perform a “Focused Physical Examination “or a “Rapid Trauma Examination” based on the mechanism of injury or illness.
- Identify orthopedic emergencies as well as common orthopedics injuries in the community
- Recognize situations which call for urgent or early treatment at specialized centers and make a prompt referral
- Plan and interpret relevant investigations, particularly x- rays
- Arrive at a logical working diagnosis after examination and review of investigations
- Order relevant laboratory investigations and imaging studies and interpret them.
- Plan and provide emergency care or initiate treatment.

INTRODUCTION

Orthopedic emergencies especially from trauma have been increasing exponentially over the years. A study of JDWNRH surgical admission records carried out in 2006 showed that 60.8% of the trauma cases were admitted in the orthopedic ward. It is a known fact that in any mass casualty situation, orthopedic injuries outnumber all other injuries.

Orthopedic or musculoskeletal injuries can result either from falls, road traffic crashes or from exposure to mechanical forces. Musculoskeletal injuries can range from minor to limb threatening and even life threatening in serious cases. Proper and timely intervention of these injuries can go a long way in reducing the complications and thereby morbidity.

Orthopedic infections such as septic arthritis or acute osteomyelitis also require immediate attention as any delay will cause increased morbidity later on.

It is our experience that the primary care of orthopedic cases in the districts is not up to the mark especially in relation to the management of orthopedic emergencies. Many cases which can easily be managed at the district hospitals get unnecessarily referred to the higher centers. Keeping in view these facts a guideline for the primary care of orthopedic emergencies is developed in order to improve emergency care of orthopedic patients in the peripheral hospitals and thereby reduce unnecessary and inappropriate patient referrals.

APPROACH TO ORTHOPEDIC PATIENTS

History:

- Chief complaint.
- Mechanism of injury.
- History: OPQRST (Onset, Provoking/ alleviating factors, Quality/ Quantity, Radiation, Site, Timing)
- Constitutional symptoms- fever, night sweats, fatigue, wt. loss.
- Referred symptoms
- AMPLE history (Allergies, Medications, past medical history, last eaten Events leading to)

Physical Examination:

- **Look:** SEADS (swelling, erythema, atrophy, deformity and skin changes).
- **Move:** Active then passive range of movement (ROM) for affected joint(s) and joints above & below.
- **Neurovascular tests:** Pulse, sensation, reflexes, power (0 to 5).

Investigations:

- Plain x-ray: AP, lateral and oblique
- It is very important to get correct views for proper diagnosis.
- X-Ray rule of 2s:
 - 2 sides= bilateral (comparison views in children when in doubt)
 - 2 views= AP + lateral
 - 2 joints= joint above + below
 - 2 times= before and after reduction
- Blood: CBC, Grouping
- Aspiration: aspirate fluid from joint for analysis
- Ultrasound where appropriate

Principles of Emergency Care of Musculoskeletal Injuries

- Perform initial patient assessment- obtain relevant history and perform a “Focused PE” or “Rapid Trauma/Illness Survey” based on the nature of injury or illness.
- During a rapid trauma exam, apply a cervical collar if spine injury is suspected.
- After life-threatening conditions have been addressed, any patient with a swollen or deformed extremity must be splinted.
- If an initial assessment reveals the patient is unstable, managing extremity injuries become a low priority.
- An unstable patient with “load and go” problems must have the ABCs managed and the entire body splinted or immobilized on a long spine board.
- No time should be wasted to splint each injury individually.
- Irrigate open wounds with plenty of NS and cover with sterile dressings and start IV antibiotics.
- DO NOT SUTURE dirty or complex wounds.

Basic Fracture Evaluation & Management

- Start with ABCs, primary & secondary surveys.
- Thorough exam of the fracture location:
 - Location along the length of bone– proximal 1/3, middle 1/3, distal 1/3.
 - Open or closed?
 - Associated dislocation?
 - Perform a complete neurovascular exam.
- Carry out relevant imaging studies.
- R/o other associated injuries- chest, abdomen, etc.
- Take AMPLE history.
- Give analgesics as required.
- Carry out appropriate splinting of injured limbs before moving the patient.
- If reduction performed, test neurovascular status before AND after.
- Refer if necessary.

Complication of Fractures

Local:

- Early:
 - Compartment syndrome
 - Neurovascular injury
 - Infection
 - Fracture blisters
- Late:
 - Mal/nonunion
 - Avascular necrosis (AVN)
 - Osteomyelitis
 - Post-traumatic arthritis
 - Reflex sympathetic dystrophy (RSD)

Systemic:

- Sepsis
- Deep vein thrombosis
- Pulmonary embolism

- Acute respiratory distress syndrome (ARDS)
- Hemorrhagic shock

Ordering X-Ray Investigations

When ordering x-rays, one must include all relevant views. It is very important to get correct views for proper diagnosis.

Pediatric X-rays

- Pediatric x-rays look different because of the ongoing growth.
- Can see normal gaps between bones (growth centers).
- Don't mistake these for a fracture.
- Must compare with the contralateral side if unsure of fracture.

Describing Orthopedic X-rays

The following points must be kept in mind when describing orthopedic x-rays:

- **Anatomic location:**
 - Which bone and location within the bone
- **Pattern of fracture:**
 - Transverse- perpendicular to long axis
 - Oblique- at angle from the long axis
 - Spiral- curves around the shaft of the bone
 - Comminuted- more than 2 fragments
- Impacted? Compressed? Depressed?
- Displacement: fragments shifted in relation to each other
- Angulated: angle between longitudinal axis of fragments
- Intra-articular: fracture extends into the joint



Figure 7.1 X-ray of a knee in child showing growth plates.

ACUTE ORTHOPEDIC EMERGENCIES

- Open fractures.
- Multiple long bone fractures & pelvic fractures.
- Major joint dislocations, e.g. Knee, hip.
- Fractures and dislocations with evidence of neurovascular compromise.
- Compartment Syndrome.
- Septic joint & Osteomyelitis.
- Cauda Equina Syndrome.

All the above conditions need prompt and timely action or the patient may lose the limb or even life.

Open Fractures:

Definition: broken bone with communication with external environment

Emergency Management:

- Start IV antibiotics
- Splint the fracture
- Will require emergent operative management
- Do not reduce bone back into wound unless N-V comprise
- Early copious irrigation with NS- irrigate open wound with 9-12 L of NS
- Cover with a sterile dressing
- Apply an appropriate splint (Immobilize)

- Tetanus inoculation
- Keep NPO and make urgent referral



Figure 7.2 Pictures showing severely comminuted open fractures both bones of left leg.

Multiple Long Bone Fractures & Pelvic Fractures:

Etiology:

- High energy trauma.
- Generally multiple lower extremity and/or pelvic fractures.
- May be associated with spinal or life-threatening injuries.

Clinical Presentation:

- local swelling, tenderness, deformity of the hips and instability of the pelvis with palpation

Investigations:

- Routine views of pelvis: AP, inlet, outlet and Judet views (iliac oblique and obturator oblique), push-pull views to assess rotational and vertical instability.
- AP and lateral XR of all long bones suspected to be injured.

Management:

- ABCDE.
- assess genitourinary injury (DRE/vaginal exam mandatory).
- If patient with pelvic fractures is in shock, pelvic binding or circumferential sheeting must be done to control internal bleeding.
- Urgent referral after stabilizing the patient.

Complications:

- hemorrhage – life threatening
- ARDS
- fat embolism syndrome
- pulmonary embolism
- bladder/bowel injury
- neurological damage
- obstetrical difficulties in future
- persistent SI joint pain
- post-traumatic arthritis of the hip with acetabular fracture



Figure 7.3 Clinical photograph showing external rotation and leg discrepancy in the patient with an open pelvic fracture.

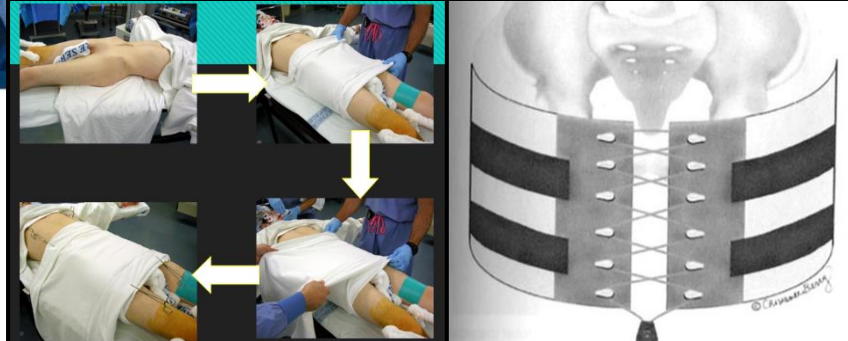


Figure 7.4 Circumferential sheeting and pelvic binder

Compartment Syndrome:

It is defined as:

- Increased interstitial pressure in an anatomic compartment.
- Interstitial pressure exceeds capillary perfusion pressure leading to muscle necrosis (in 4-6 hrs.) and eventually nerve necrosis.

Presentation: The 6 P's of Compartment Syndrome:

- Pain out of proportion to the injury
- Pain not relieved by analgesia
- Pain increased with passive stretch of compartment muscles (most specific)
- Pallor
- Paresthesia
- Polar: cold limb (late finding)
- Paralysis (late finding)
- Pulselessness (late finding)

Management:

- Divide all dressings down to skin from top to bottom.
- Remove all constrictive dressings (casts, splints).
- Elevate the limb.
- Reassess in 20 minutes
- Refer for urgent fasciotomy to decompress compartmental pressure

Complications:

Rhabdomyolysis, renal failure secondary to myoglobinuria, Volkmann's ischemic contracture



Figure 7.5 Compartment syndrome involving left forearm after a simple radius fracture – due to too tight splinting by “Traditional healers”- patient presented too late for limb salvage.

Septic Joint and Osteomyelitis:

Septic Joint-

- Infection within joint space.
- Direct inoculation or hematogenous spread.
- Often staph or strep species, maybe GC.
- Localized joint pain with warmth, swelling and restriction of active and passive ROM.

Investigation:

- Blood- CBC, ESR, CRP, culture.
- Joint aspirate- frank pus or turbid fluid.

Management:

- Emergency decompression in the OR and thorough irrigation.
- IV Antibiotics.

Osteomyelitis-

Etiology:

- Most common organism is *S. aureus*.
- Neonates and immunocompromised patients are susceptible to gram negative organisms.

Clinical presentation:

- Localized extremity swelling with pain and fever

Investigations:

- Blood CBC (leukocytosis), ESR, Blood culture.
- Aspirate cultures.
- X-rays: changes may not be seen until 1-2 weeks after.

Management:

- Emergency surgical decompression and wash out.
- IV antibiotics.
- Urgent referral required.

Cauda Equina Syndrome:

Compression of lumbosacral nerve roots below conus medullaris secondary to large central herniated disc (L4-5 or L5-S1) ± spinal stenosis, extrinsic mass like tumor or burst fracture.

Clinical presentation consists of progressive neurological deficit presenting with:

Motor-

- weakness/paraparesis in multiple root distribution.
- reduced deep tendon reflexes (knee and ankle).
- sphincter disturbance (urinary retention and fecal incontinence due to loss of anal sphincter tone).

Sensory-

- saddle anesthesia (most common sensory deficit).
- pain in back radiating to legs.
- bilateral sensory loss or pain: involving multiple dermatomes.
- sexual dysfunction (late finding).

Management:

- Emergency decompression surgery- will result in permanent urinary/bowel incontinence if prompt action is not taken.
- surgical emergency - requires urgent investigation and decompression (<48 hrs.) to preserve bowel and bladder function.
- Urgent referral for surgical decompression.

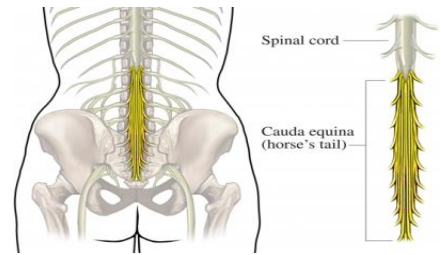


Figure 7.6 Diagram showing conus medullaris and cauda equina (Pooja & Brian, HHI).

SPLINTING

Immobilization of all painful, swollen, or deformed extremities is called splinting. For any splint to be effective it must immobilize adjacent joints and bone ends. Splints can broadly be divided into 3 types:

1. Rigid splints – ideally used to splint long-bone injuries
2. Formable splints – most commonly used to immobilize joint injuries
3. Traction splints – used specifically for femur fractures

Aims of Splinting

- Reduce the pain by preventing motion
- Protect the underlying blood vessels and nerves from further damage
- Prevent closed fractures from becoming open
- Facilitate patient transportation
- Decrease bleeding and thus reduce the likelihood of shock

Splinting Materials

A variety of materials can be utilized as splints:

- Ordinary wooden splints (padded).
- Improvised materials (cardboard, rolled up papers or magazines, pillows).
- Commercially available splints – Cramer wire splints, rigid cervical orthosis, spine boards, Thomas splints, etc.
- Splints molded from POP – are more comfortable and most effective for long time use.

General Rules/Principles of Splinting

- Remove or cut away clothing.
- Cover all wounds with a dry sterile dressing before splinting.
- Do not replace protruding bones.
- Note and record circulation and neurological status distal to the injury.
- Do not move the patient before splinting, unless there is an immediate hazard.
- Generally, splints should immobilize the joint above and joint below the fracture.
- Align a limb severely deformed with constant gentle manual traction.
- Splint the limb in the position of deformity if resistance is encountered in limb alignment when applying traction.

- Correct neck and spine deformities only if necessary, to maintain an open airway.
- Always assess neurovascular status after splint is applied.

Hazards of Splinting

- The splint may be too tight.
- If post splinting patient complains of localized “spot” pain, consider underlying pressure sore and change splint.
- Or if undue pain in the limb after splinting, consider compartment syndrome and reassess.

Tips for Applying POP Splint

- Decide which splint & plaster size to use:
 - 8-12 sheets for upper extremities.
 - 12-16 sheets for lower extremities.
 - Immobilize joints in anatomic position.
 - Keep the hand in “wine glass” position.
- Add extra padding at ends of splint and on bony protuberances.
- Hold the extremity in desired position until the plaster hardens.

Steps in making & applying Plaster Splints:

1. Measure the length of cast padding, add 10-15cm extra length.
2. Lay out 10-16 thickness of preselected width and length of POP.
3. The plaster is then wetted and excess water is squeezed out from the splint.
4. The splint is then assembled with the wet plaster sandwiched between the dry layers of cast padding.
5. The assembled wet splint is then applied to the limb with the limb held in the desired position.
6. Elastic bandages are then used to wrap the splint to the limb and the splint is molded to the extremity.
7. Must ensure adequate cast padding on the inner side of the splint to prevent any skin breakdown.



Figure 7.7 Pictures showing emergency splinting of upper and lower limb injuries.

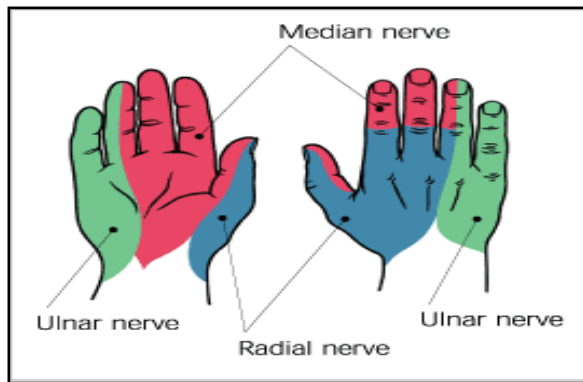
RELATIVE ORTHOPEDIC EMERGENCIES

Hand Injuries:

Review of hand innervation:

Motor-

- Radial: extension of fingers and wrist.
- Median: thumb opposition, flexion of index & middle fingers.
- Ulnar: Finger adduction and abduction, flexion of 4th & 5th finger.

**Sensory-**

- Sensory innervations of the radial, ulnar and median nerves are shown in the figure shown below.

Figure 7.8 Showing sensory innervations of the hand (Courtesy: Pooja & Brian, HHI).

Hand- Infections:**Paronychia:**

- Nail bed infection.
- Treatment: I&D, warm soaks, Antibiotic.

Felon:

- Deep pulp space infection.
- Treatment: I&D, warm soaks, Antibiotics.

Purulent Flexor tenosynovitis:

- Four cardinal signs of Kanavel:
 - Fusiform swelling "sausage finger".
 - Tenderness along the tendon sheath
 - Pain with finger extension
 - Finger held in slight flexion

Treatment:

- Urgent surgical I&D required
- Start IV antibiotics
- Make prompt referral



Figure 7.9 Pictures showing Paronychia, Felon & Purulent Flexor synovitis respectively (Courtesy: Pooja & Brian, HHI).

Hand Lacerations:

Special attention must be paid to lacerations around the wrist and hand as there may be injuries to the tendons, vessels and nerves. Diagnosis to these structures must be made by a thorough Physical examination.

Management:

- Wash out with NS and cover with a sterile dressing and apply a splint.
- Start IV antibiotics and make an urgent referral.



Figure 7.10 Pictures showing lacerations in the hand resulting in tendon and neuro-vascular injuries

Hand Dislocations:

- PIP joints more common than DIP or MCP joints.
 - Dorsal dislocation is common.
- Volar plate often entrapped in joint space, making closed red

Management:

- Under digital block.
- Distraction, hyperextension and reposition.
- If unsuccessful, refer for open reduction.

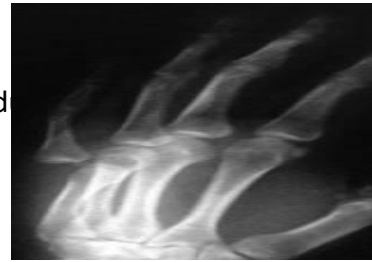


Figure 7.11 X-ray showing dislocation of fifth MCP joint.

Metacarpal Fractures:**Splinting guidelines:**

- 4th & 5th MC, apply Ulnar gutter splint.
 - 1st-3rd MC, apply Radial gutter splint.
- Operative fixation often needed for 2nd and 3rd MC

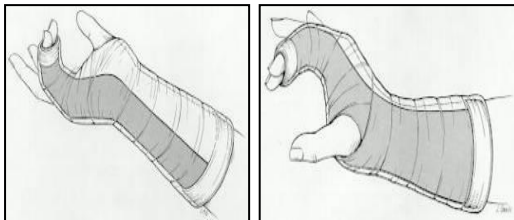


Figure 7.12 Drawings showing ulnar and radial gutter splints (Courtesy: Pooja & Brian, HHI).

Distal Radius Fractures:

Colles' Fracture- transverse distal radius fracture, about 2 cm from the articular surface with dorsal displacement. Most common in those >40yrs, especially women with osteoporosis.

Management:

- Closed reduction (CR) under hematoma block – apply traction, increased dorsal angulation followed by volar flexion in an ulnar directed force.
- Apply below elbow cast for 6 weeks.
- If unstable refer for open reduction and internal fixation (ORIF).

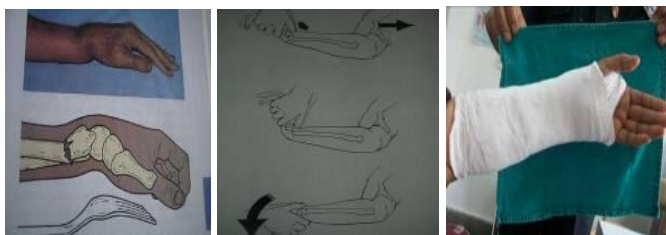


Figure 7.13 Pictures showing distal radius fracture with dinner fork deformity (left), Closed Reduction technique (middle), and Short arm cast (right)

Radius and Ulna Fractures:

- Isolated ulna fracture is called a "night stick" fracture.
- Most night stick fractures can be treated by casting.
- Both bone forearm fractures are usually displaced and may develop compartment syndrome.
- Apply long arm splint and refer for ORIF as most both bone fractures will require surgery.

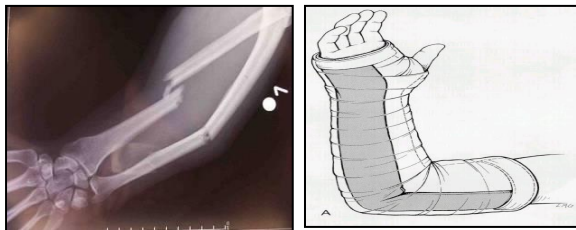


Figure 7.14 Pictures showing X-ray of both bone fracture of forearm and long arm posterior splint (Courtesy: Pooja & Brian, HHI).

Galeazzi Fracture:

- Definition – Fracture of the distal radial shaft with disruption of distal radio-ulnar joint.
- Management – Apply a long arm splint and refer for ORIF.

Monteggia Fracture:

- Definition – Fracture of the proximal ulna with dislocation of the radio-capitellar joint.
- Management – Apply a long arm splint and refer for ORIF.

Figure 7.15 Pictures showing X-rays of Galeazzi fracture (left) and Monteggia fracture (right).



Elbow, Arm and Shoulder Injuries:

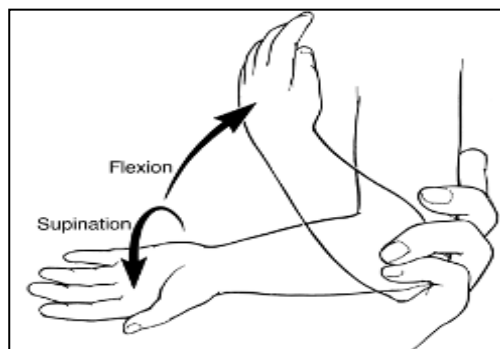
Nursemaid's Elbow-

- History of being swung by the arm, peak age 1-4 years.
- Forearm held flexed & pronated, reluctant to move.
- Subluxation of radial head beneath ligament

Management:

- Reduce by supinating forearm and flexing elbow.

Figure 7.16 Diagram showing close reduction technique of Nursemaid's elbow.



Elbow Dislocation:

- Majority is posterior.
- Must be aware of Neuro-Vascular injury.
- **Management:**
 - Immediate closed reduction (CR) under sedation and apply a long arm splint with forearm neutral rotation elbow in 90 degrees flexion.
 - Start early ROM (<2 weeks).

Figure 7.17 Pictures showing X-ray of Posterior elbow dislocation (left) and Closed Reduction Technique (right) (Courtesy: Pooja & Brian, HHI).



CR method:

- Inject 3-5cc lidocaine into joint.

- Apply inline traction with elbow flexed and wrist supinated.
- Recheck brachial artery & distribution of ulnar nerve after reduction.

Elbow Fractures (Supracondylar fracture):

Most common in pediatric population.

Management:

- Non-displaced (type I): apply a long arm splint (LAS) in flexion for 3 weeks.
- Displaced (types II & III): Requires CR and percutaneous pinning followed by LAS with elbow in 90 degrees flexion.

Figure 7.18 X-ray showing Supracondylar fracture of humerus and picture of a boy with a Posterior long arm splint.



Humerus Fractures:

In proximal humeral fractures, one must look for axillary nerve injury (deltoid sensation). In midshaft humerus fractures, one must look for radial nerve injury (wrist drop & 1st web space sensation).

Management:

Non-operative-

- Apply coaptation splint & sling
- Hanging cast.

Operative-

- Indications: open fractures, NV injuries, poly trauma, segmental fractures.

Figure 7.19 X-ray of right humerus fracture and picture of “U” or Coaptation splint & sling.



Shoulder Dislocation:

The glenohumeral joint is the most commonly dislocated joint in the body.

Anterior dislocation accounts for >90%.

Arm held in slight abduction, external rotation and internal rotation is blocked- “square off” shoulder.

Investigations:

- X-rays: AP, trans-scapular, axillary lateral
- Humeral head is anterior to the “Mercedes Benz sign” in the trans-scapular view.

Treatment:

- Closed reduction by traction and counter traction ASAP with IV sedation & muscle relaxation.
- Sling for 3 weeks.



Figure 7.20 Pictures showing different closed reduction techniques for shoulder dislocations.

Clavicle Fractures:

- Mechanism: FOOSH.
- Locations: Medial third, distal third.
- Unless open or severely displaced, non-operative treatment should be the standard of care.

Treatment:

- Cuff and collar sling.
- Figure of 8 bandage.
- Pain medication and reassurance.
- No referral is necessary unless with complications.

Scapula Fractures:

- Results from high impact injuries.
- Assess for intrathoracic or chest injuries.
- May also see concurrent shoulder injuries (dislocations).
- Mostly conservative treatment should suffice- sling, pain medication.
- Refer only if associated with complications.

Pelvis, Hip and Femur Injuries:

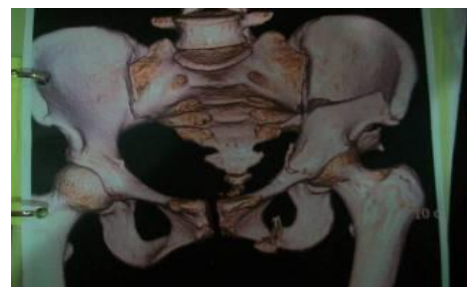
Pelvis Fractures:

Stable fractures: conservative treatment.

Unstable fractures: must be aware of internal bleeding and shock.

- Resuscitate and stabilize the patient first
- May require surgical intervention

Figure 7.21 Picture of CT scan of unstable pelvic fracture.



Hip Fractures:

- Femoral neck fracture is common in elderly women.
 - **Complication:** avascular necrosis
 - Needs surgery within 6-8 hours, especially if young.
- Intertrochanteric fractures most common in elderly.
- Sub trochanteric fractures common in young with high energy trauma.
- Patients will present with external rotation, flexion and shortening of the limb.

Management:

- Apply Traction splint.
- Refer for surgery.

Hip Dislocation:**Anterior-** uncommon

Presentation- External rotation and abduction of the limb

Posterior- common

Presentation -Internal rotation, flexion, adduction, shortening

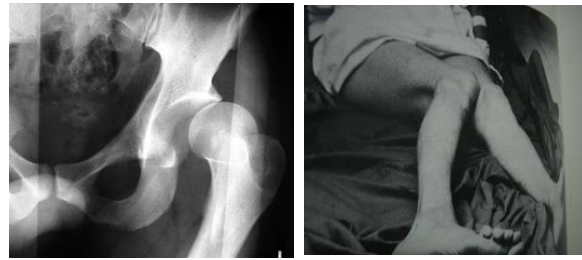
Management: immediate closed reduction.

Figure 7.22 Picture of right hip dislocation and X-ray of Posterior dislocation of left hip.

Posterior Hip Dislocation:**Reduce ASAP after dislocation since more difficult it becomes if delayed.**

- Under sedation.
- Bed lowered or on floor.
- Hip flexed, lock hands in popliteal fossa.
- Second person stabilizes pelvis.
- Apply traction at 90°, gentle internal rotation with traction maintained at 90°.

Femur Fractures:

- Potential for major blood loss, fat emboli, neurovascular injury.
- Splint extremity with traction splint.

Treatment: ORIF or closed IM nailing.**Knee, Tibia, Fibula, Ankle and Foot Injuries****Knee Dislocation:**

Occurs following a high energy trauma
 Associated with high incidence of associated injuries! Popliteal artery tear, peroneal nerve injury, ACL/PCL rupture, capsular tears.

Management:

- Immediate CR, otherwise patient may need amputation.
- CR: apply longitudinal traction to distal leg.
- Even after reduction, pulses may be reduced due to arterial damage.
- Important to do serial pulse checks and look for compartment syndrome.

Tibia/Fibula Fractures:

- Most commonly fractured long bone.
- Most common open fracture.



Figure 7.24 X-rays of hip fractures and a picture of Thomas splint immobilization.

- High incidence of NV injury and compartment syndrome.

Management: depends on fracture type.

- If minimally displaced- long leg cast for 6-8 weeks.
- If displaced- ORIF.
- Apply Long leg splint and refer.

Ankle Injuries:

Ankle injuries may include distal tibia and fibula fractures, malleolar fractures, talus fractures or fracture dislocations. Ankle fracture-dislocations have high potential for neurovascular injury, avascular necrosis, and skin break down.

Ankle fractures:

Maisonneuve Fracture-

- External rotation of ankle.
 - Rupture of medial ligament
 - Proximal fibula fracture
- Missed on isolated ankle x-ray, need to get leg film
- Treatment: Apply “U” splint and refer for ORIF

Ankle Dislocation:

Posterior ankle dislocation is most common.

Management:

- Reduce emergently and
- Apply a “U” splint
- Refer ORIF

Figure 7.27 X-ray of fracture-dislocation of the ankle and diagram showing closed reduction technique (Courtesy: Pooja & Brian, HHI).

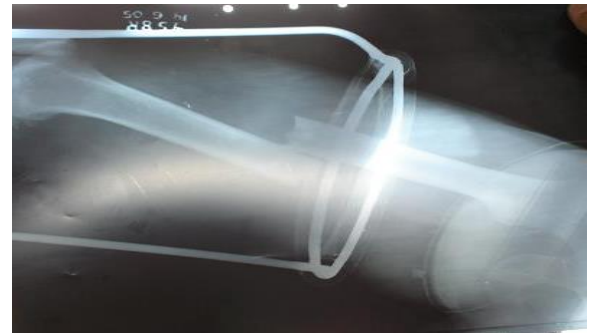


Figure 7.25 X-ray showing fracture femur with an inappropriately applied Thomas splint, the ring of the Thomas splint is seen at the fracture site.

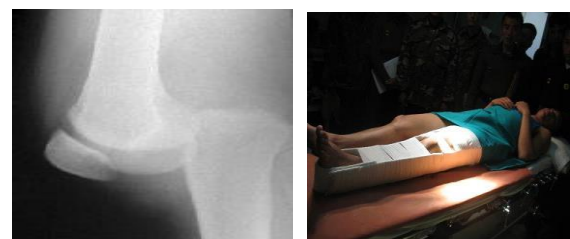
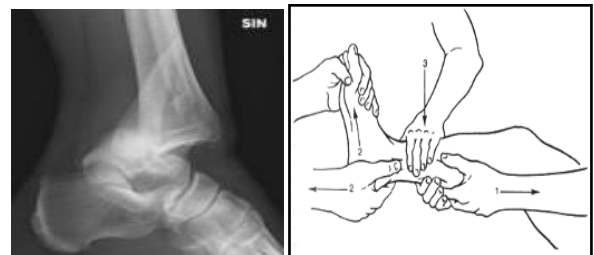


Figure 7.26 X-ray of Posterior dislocation and picture of splinting of knee injuries.

CR method:

- Hold foot in plantar flexion
- Apply axial traction to ankle
- Apply posterior traction to distal tibia and anterior pressure on heel of foot

Ankle Sprains:

Most involve lateral ligaments: Anterior talofibular (ATF), Calcaneofibular (CF) and Posterior talofibular (PTF) ligaments.

Treatment: based on stability.

- Unstable: Below knee walking cast.
- Stable: rest, ice, compression, elevation (RICE).

Foot Fractures:

Common foot fractures are:

- Calcaneal Fracture.
- Avulsion fracture base of 5th MT (Dancer's fracture).
- Transverse fracture of 5th MT (Jones' Fracture).
- Lisfranc Fracture Dislocation (Fracture of MT base + MT dislocation).

Management: will depend whether the fractures are displaced or not.

- If non-displaced, initially apply a short leg splint followed by short leg cast.
- Displaced fractures may need ORIF.



Figure 7.28 Picture of long leg POP splint

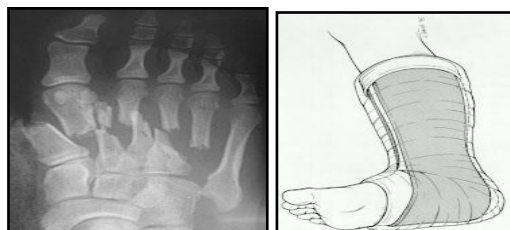


Figure 7.30 X-ray of foot showing Lisfranc fracture and diagram of U splint immobilization (Pooja & Brian, HHI).



Figure 7.29 X-ray showing Maissonneuve and bi-malleolar fractures respectively.

SPINAL INJURIES**Emergency Care of Spinal Injury Patients:****General principles:**

Proper emergency care may prevent the need for extensive medical care and permanent disability.

1. Attend to ABCs with cervical spine immobilization.
2. Always assume spine injury in the unconscious patients who are injured.
3. Apply immediate gentle longitudinal support to the cervical spine.
4. Apply an extrication collar before the patient is moved.
5. Maintain cervical support until the patient is secured on a spine board.
6. Log roll and splint the patient before you move him or her.



Figure 7.31 Picture showing log rolling of a spine injury patient and immobilization on a spine board.

Diagnosis of spinal injuries:

History:

- Violent impacts to the head, neck or pelvis.
- Sudden acceleration or deceleration accidents.
- Falls from heights with the patient landing on the head or feet.
- Gunshot wounds to the neck or trunk.

Physical Signs & Symptoms:

- In a conscious patient, pain over the spinous processes with or without deformity.
- Numbness, tingling or weakness in the limbs.
- Pain over the spine with movement.
- Tenderness over the spine.
- Absent or weak reflexes.
- Paralysis or anesthesia.
- Loss of bladder or bowel control.

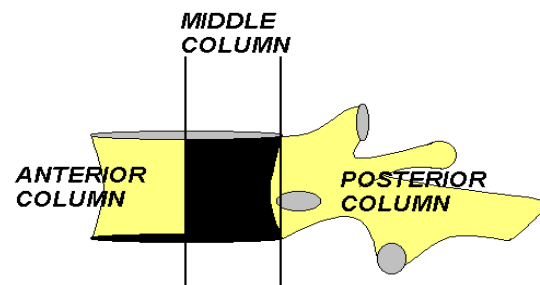


Figure 7.32 Diagram of vertebra showing 3 column theory.

Concept of Spinal Stability

- Mechanical stability: maintain alignment under physiologic loads without significant onset of pain or intolerable deformity.
- Neurologic stability: prevent neural signs or symptoms under anticipated loads.

Mechanical Stability

- 2-column theory (*Holdsworth, '53*):
 - Anterior = vertebral body, disc, ALL, PLL
 - Posterior = neural arch, Posterior ligament complex.
- 3-column theory (*Denis '83*):
 - Middle = posterior ½ vertebral body, posterior disc, posterior longitudinal ligament (PLL).

Instability based on x-rays:

- Based on 3 column theory:
 - Injury to middle column combined with either anterior or posterior column.
- Compression fracture:
 - Degree of wedging is 200 or more.
 - Collapse of the anterior margin to less than half the posterior.
- Burst fractures.
- Fracture-dislocations.

Cervical Spine

Recap of Anatomy

- 7 cervical vertebrae, 8 cervical nerve roots, nerve root exits above vertebrae, i.e. C4 nerve root exits above C4 vertebra.
- 4 lines – Anterior longitudinal, Posterior longitudinal, Spinolaminar and Spinous process.

Clearing C-spine injury

Criteria for clinical clearance:

1. No post midline tenderness
2. Full pain-free active ROM
3. No focal neuro deficit
4. Normal level of consciousness
5. No evidence of intoxication
6. No distracting injury



Figure 7.33 X-rays of lateral views cervical spine – normal (left) and fracture C-6 (right) (Courtesy: Pooja & Brian, HHI).

Cervical Spine Injuries:

In cervical spine injuries patient may either present with neurological deficit (quadriplegia/paraplegia) at the onset from the injury or develop neurological deficit from improper handling of the patient. Therefore, suspected cervical spine injuries must be handled with great caution. Most common location of fractures of the c-spine are C5, 6 and 7. Lateral c-spine x-ray in trauma is the single most important thing in trauma evaluation. 2-3 % of all polytrauma victims have associated cervical spine injuries. X-rays: at least 3 views should be taken: AP, lateral and odontoid views, must be able to see all the 7 vertebrae. If disruption of any of the 4 lines is seen, consider ligamentous injury.

T/L Spine Injuries :

Most common sites of fracture are T12 and L1. Stable fractures may not present with any neurological problems but unstable fractures such as burst fracture, chance fracture and fracture-dislocations may present with paraplegia.

Stable Fractures:

- Compression Fracture
- Wedge Fracture
- Spinous Process Fracture

Unstable Fractures:

- Burst Fracture
- Chance Fracture
- Fracture-dislocations

Burst fracture: - fracture extends into posterior vertebral wall

- May be stable or unstable
- Unstable Burst Fractures
- Related to PLC integrity
- $>30^\circ$ relative kyphosis
- Loss of vertebral body height $> 50\%$

Flexion-distraction injury- “seatbelt” injury:

- Common in children
- Most common associated non-spinal injury: perforated viscus
- Injury often involves 3-columns
- PLC disrupted or posterior neural arch fractured transversely
- MRI finding of disrupted PLC

Fracture-dislocations:

- High-energy injuries
- Highest rate of SCI of all spinal fractures
- Thoracic--worst prognosis
- Rare non-operative management
- Unstable with multi-planar deformity



Figure 7.36: X-rays showing burst fracture and Chance fractures of lumbar spine.

Management:

- Immobilization on a spine board before movement.
- X-ray investigations-AP and lateral views.
- Referral for further treatment if unstable fractures with neurological problems.

Acute Low Back Pain

- Extremely common presenting complaint.
- Most common cause of work-related disability.
 - Mechanical or strain/sprain.
- Most (90%) will resolve within a few weeks
 - Most cases cannot be given a specific diagnosis.
- D/D of Back Pain:
 - Mechanical- not due to any clearly defined pathology.
 - Degenerative- spinal stenosis, disc herniation).
 - Neoplastic- primary, metastatic.

Approach to Back Pain

- Look for “red flags”:
 - History of cancer, unexplained weight loss
 - Radiculopathy with bowel/bladder dysfunction
 - Numbness or weakness in the legs
- See if there are factors that may prolong the pain:
 - Social or psychological factors
- Investigations:
 - Image if: trauma, failure to improve in 4-6 weeks
 - Image earlier if elderly
 - Blood CBC, ESR

Reduction of Dislocations- General Principles

- Give adequate analgesia
- Evaluate and R/O concurrent fractures
- Assess neurovascular status before and after reduction
- Apply constant traction to fatigue contracted muscles

- Often need to exaggerate dislocation to achieve reduction
- Splint after reduction

SPECIFIC SPLINTS AND INDICATIONS

Volar Short Arm Splint:

Indications-

- Wrist sprain - apply splint to MCP joint.
- Metacarpal fracture- apply to DIP joint.
- Carpal tunnel syndrome.

Application-

- Wrist: 20 degrees
- Plaster: 4-5 inches.
- Metacarpal fractures
 - Neck fracture: MCP joint 90°
 - Shaft fracture: MCP joint 70°



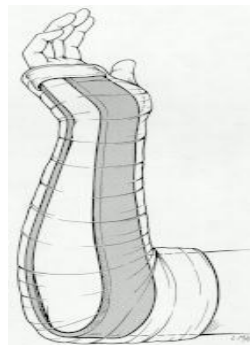
Sugar Tong Splint:

Indications-

- Good for any forearm fracture.
- Non-displaced distal radius fracture.
- Midshaft ulna/radius fracture.

Application-

- Wrist: neutral position
- Elbow: 90°
- Splint to MCP joint
- Plaster: 4 inches



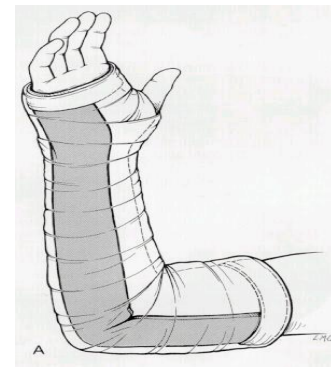
Long Arm Splint:

Indications-

- Ulnar nightstick fracture.
- Olecranon fracture.
- Midshaft humerus fracture (with humeral sugar tong).

Application-

- Wrist: neutral
- Elbow: 90°
- Thumb up
- Plaster 4 inches.



Thumb Spica Splint:

Indications-

- Thumb injuries and thumb MC fracture.
- Scaphoid fractures.
- de Quervain's tenosynovitis.

Application-

- Extends from IP joint to mid-forearm.
- Overlap MC 1 – 3.
- Thumb: "wine glass" position.
- Plaster 4 inches.



Ulnar Gutter Splint:

Indications

- Ulnar styloid fracture.
- 4th or 5th Metacarpal fracture.
- Fracture of 4th or 5th digit.

Application-

- Incorporate 4th & 5th digits.
- Extends from DIP joint to forearm.
- Wrist & Forearm: neutral.
- MCP: 50° or 90° if MC fracture.
- DIP and PIP: 10° – 15°.
- Plaster: 3-4 inches.



Radial Splint:

Indications

- 2nd or 3rd Metacarpal fracture.
- Index or middle finger fracture.

Application-

- Incorporate index & middle fingers, place cotton in between.
- Extends from DIP to proximal forearm.
- Wrist: 20°.
- MCP junction: 70°, if shaft fracture: 90°.
- DIP & PIP: 10° – 15°.
- Plaster: 6 in, cut thumb hole.



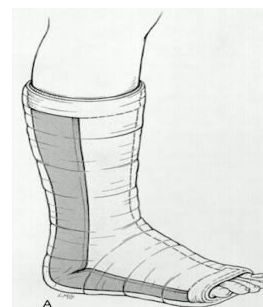
Posterior Short Leg Splint

Indication-

- Ankle sprain.
- Midfoot: metatarsal, tarsal fracture.

Application-

- Extend from the great toe to the fibular head.
- Ankle: 90°.
- Plaster: 6 inches.
- Apply with patient lying prone.



Sugar Tong Ankle Splint:



Posterior Long Leg Splint:

Indication-

- Proximal tib/fib fracture.
- Unstable knee fracture/injury.
- Soft tissue injury.

Application-

- Ankle: 90°.
- Knee: 15°.
- Plaster: 6 inches.
- Requires 2 people to apply.



Key Messages

- ✓ You should be able to interpret x-rays
- ✓ Many orthopedic injuries can be treated by the initial provider, without transfer
- ✓ Be aware of orthopedic emergencies
- ✓ Make sure you use adequate anesthesia

ORTHOPEDIC ANESTHESIA

Local Anesthesia

Action: Alters the depolarization of the nerve cells and prevents them from transmitting neurotransmitters

Indications-

- Repair of lacerations in the extremities.
- I&D of abscess.
- Hematoma block for CR of fresh fractures.

Lidocaine (Lignocaine, Jasocaine, Xylocaine) available as 1% or 2%.

- Onset: 5-15 minutes; duration: 1-3 hours, with epinephrine- up to 6 hours.
- Dosage: % = grams/100ml, (x10mg/ml); eg. 2% = 2g/100ml, ie. 20mg/ml.
- Max dose 4.5mg/kg or 300mg.
- If 1%, max dose = 30ml; 2% = 15ml.
- With epinephrine: 7mg/kg.
- Consider lower dosage for the elderly, children, impaired renal function, CHF.

Adverse reactions:

- Severe- seizures, respiratory arrest, heart block, bradycardia.

- Common- lightheadedness, dizziness, hypotension, lethargy, tremor, vomiting, anxiety, confusion.

Bupivacaine (Marcaine):

- Preparation: 0.25%; 0.5%.
- Onset: 20-30 minutes; duration: 6-8 hours, with epi. - up to 12 hours.
- Max dosage: 175mg, i.e. 35ml of 0.5% Or 70ml of 0.25%; with epi: 225mg.

Adverse effects:

- Same as lidocaine but has more cardiotoxic effects if used repeated doses.

Procedural Sedation - Prior to joint reduction.

- ✓ Diazepam: 2-5mg iv q 2-5min, max 10mg total.
 - Onset: 3-10min.
 - Peak 20-60min.
 - Duration: 2-8hrs.
- ✓ Midazolam: 0.5-2mg iv q2min.
 - Onset 1-2min.
 - Peak: 2 min.
 - Duration: 15-90min.

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