

MODULE 3

System Specific Trauma

OBJECTIVES FOR MODULE 3

To learn specific management strategies for trauma

- Head
- Spine and spinal cord
- Chest
- Abdomen
- Female genitalia
- Musculoskeletal system

Head Injury

HEAD INJURY

- Altered level of consciousness is a hallmark of acute cerebral trauma
- Never assume that substances (alcohol or drugs) are causes of drowsiness
- Frequent clinical mistakes:
 - Incomplete ABC's, priority management
 - Incomplete primary, secondary surveys
 - Incomplete baseline neurologic examination
 - No reassessment of neurologic status

HEAD INJURY

Basal skull fractures

- Periorbital ecchymosis (raccoon eyes)
- Mastoid ecchymosis (Battle's sign)
- Cerebrospinal fluid leak from ears or nose

Depressed skull fracture

- Fragments of skull may penetrate dura, brain

Cerebral concussion

- Variable temporary altered consciousness

HEAD INJURY

Intracerebral hematoma

- Caused by acute injury or delayed, progressive bleeding originating from contusion

Clinical features of increased intracranial pressure:

- Decreased level of consciousness
- Bradycardia
- Unequal or dilated pupils
- Seizures
- Focal neurologic deficit

HEAD INJURY

Basic medical management for severe head injury:

- Intubation with supported ventilation, if available
- Sedation
- Moderate intravenous fluid input (euvolemia)—do not overload; use normal saline, avoid dextrose
- Head of bed elevated 30 degrees
- Prevent hyperthermia

HEAD INJURY

Acute Extradural or Subdural Hematoma

Traumatic bleeding within epidural or subdural spaces (rarely both) increases intracranial pressure, causes neurological impairment, possibly death

Signs classically consist of:

- Hemiparesis on opposite side as impact
- Dilating pupil on same side as impact

Management is surgical: burr hole drainage of hematoma is an emergency, potentially life-saving procedure—the patient needs immediate referral

HEAD INJURY IN CHILDREN

Skull fracture

- Open, closed, depressed

Brain injury

- Concussion: variable, temporary alteration of neurological function
- Contusion: brain bruise
- Compression: swelling or haemorrhage

Diagnosis

- History
- Diminished level of consciousness, seizure

HEAD INJURY IN CHILDREN

Treatment

- Give nothing orally
- Protect airway
- Limit fluid intake (2/3 maintenance)
- Elevate head of bed to 30 degrees
- Urgent review by paediatric or neurological surgeon

Spinal Injury

SPINAL INJURY

Standard ABCDE's

Immobilize patient

Careful, thorough spinal examination

- Focal tenderness
- Deformities, such as "step-off injury"
- Swelling
- Difficulty in breathing—diaphragmatic, accessory muscles
- Flaccid muscles with areflexia
- Neurogenic shock: hypotension with bradycardia due to loss of sympathetic tone

NEUROLOGICAL EXAMINATION

Sensation

- Test pinprick sensation in extremities and trunk
- Test perianal sensation to evaluate sacral roots

Motor Function

- Evaluate motion, strength of major muscle groups
- Evaluate rectal sphincter tone

Reflexes

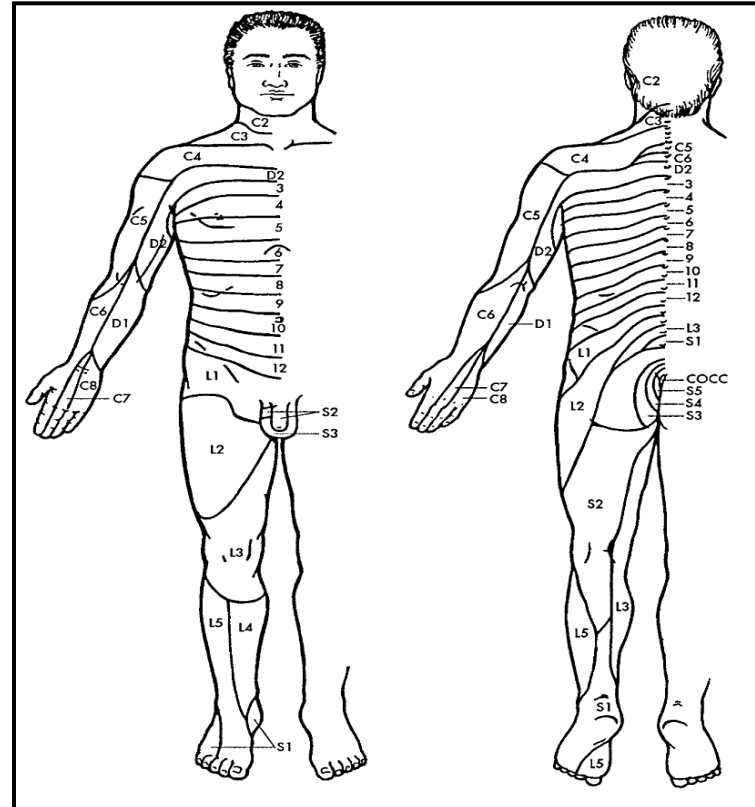
- Deep tendon reflexes in upper, lower extremities
- Anal wink: scratch skin next to anus—anus contracts in positive test
- Babinski reflex: stroke bottom of foot—toes flex normally and extend with upper motor nerve injury

MOTOR EXAMINATION

- Diaphragm intact C3-5
- Shrug shoulders C11
- Deltoid C5
- Biceps C6
- Triceps C7
- Finger abduction C8-T1
- Hip flexion L2
- Knee extension L3-4
- Ankle dorsi flexion L5-S1
- Ankle plantar flexion S1-2

SENSORY EXAMINATION

Deltoid	C5
Dorsum hand	C6-8
Nipple	T4
Navel	T10
Ant. Knee	L3
Lateral foot	S1



SPINAL INJURIES

- Evaluate spine based on
 - History of injury
 - Physical examination
 - Complete neurological examination
 - X-rays, if available
- Spinal column injuries are stable or unstable, based on bone, ligament damage
- Neurological function may be normal, show incomplete injury or complete spinal cord disruption
- Base your treatment on extent of injury

SPINAL INJURIES

- Ask the patient regarding spine pain and midline tenderness
- Ask regarding strange feelings or loss of feeling in an extremity
- Assume that an unconscious patient has a spine injury
- The patient must be maintained in neutral position
 - No flexion, extension, rotation
- Log roll the patient
 - Look for bruising, swelling
 - Look for displacement of spinous processes
- Perform a complete neurological assessment

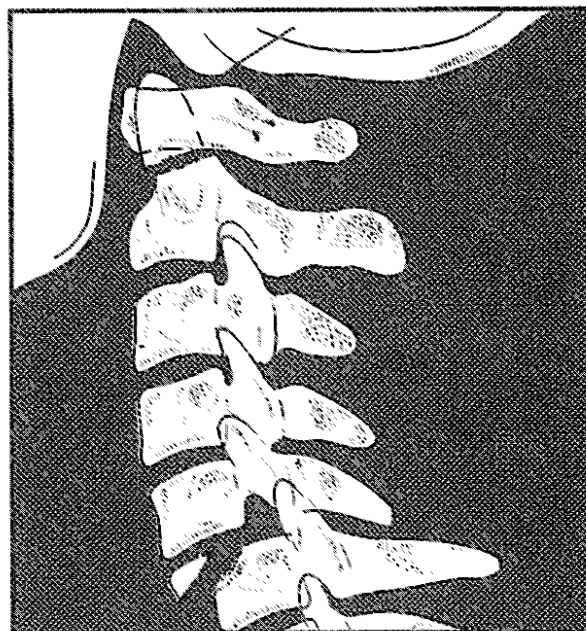
SPINAL INJURIES

X-ray examination

- Entire spine in unconscious patients
- Symptomatic areas of cervical, thoracic and lumbar spines in conscious patients
- Cervical spine in all patients in high-energy multiple trauma
 - Lateral and AP-films
 - All seven cervical vertebrae
 - Open mouth odontoid view

SPINAL INJURIES

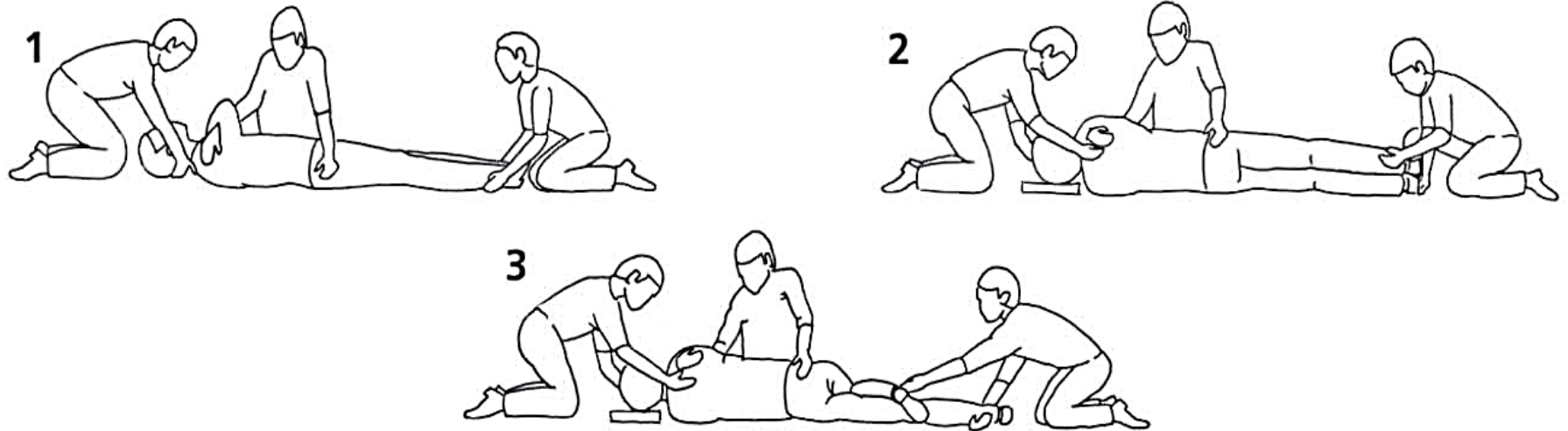
- Entire spine immobilized in neutral position, regardless of neurological status
- Log roll for examination
- Must have IV hydration; spinal shock may be delayed
- Patients with spine fractures or spinal cord injury should be referred.



X-ray of C2 and C6 fractures

LOG ROLLING

Moving any patient before spine is cleared requires very careful turning: maintain entire spine in neutral position, particularly cervical spine



Thoracic Trauma

THORACIC TRAUMA

- Tension pneumothorax/simple pneumothorax
- Hemothorax
- Flail chest
- Sucking chest wound
- Pericardial tamponade
- Vascular injury
- Rib fractures

THORACIC TRAUMA

Hemothorax

- More common in penetrating injury
- May be the cause of hypovolemic shock
- Urgently place large chest drain

Less than 1500-2000 ml bleed that stops after drain placement - drainage alone often suffices

If greater bleed or bleeding continues at more than 200-300ml/hour, thoracotomy may be needed

THORACIC TRAUMA

Rib fractures

- May contuse or puncture underlying lung causing pneumothorax
- May occur with minimal injury in elderly
- May require block for pain management

Flail chest

- Unstable segment of chest—emergency
- Needs to be treated with positive pressure ventilation, analgesia

THORACIC TRAUMA

Pulmonary contusion

- Common after blunt chest injury
- Onset of symptoms may be slow, progressive over 24h
- Signs and symptoms:
 - Dyspnoea
 - Hypoxemia
 - Tachycardia
 - Rare or absent breath sounds
 - Rib fractures

THORACIC TRAUMA IN CHILDREN

- Rib fractures
 - Since ribcage in children is much more pliable, they may have extensive chest injury without rib fractures
- Pulmonary contusions
- Pneumothorax
- Hemothorax
- All need urgent review by a surgeon experienced in paediatric surgery or referral

Abdominal Trauma

ABDOMINAL TRAUMA

Blunt

- Compression or crush
- Seat belt
- Acceleration/deceleration

Penetrating

- Penetrating
- Gunshot wounds
- Stab wounds

Deep or fixed penetrating foreign bodies should be removed only under controlled conditions in theatre

ABDOMINAL TRAUMA

- 20% of patients with acute traumatic hemoperitoneum have no initial signs of peritoneal irritation
- The importance of **repeated abdominal examinations** cannot be overstressed
- Intra-abdominal bleeding, gastrointestinal perforation may be present without external evidence
- Suspect intra-abdominal bleeding in multiple trauma, especially if there is unexplained hypotension

ABDOMINAL TRAUMA IN CHILDREN

- Blunt and penetrating injury to abdomen may injure a variety of organs
- Splenic injuries from blunt injury especially common
- Assume that penetrating wound to the abdominal wall has entered the abdominal cavity and that there are injuries to abdominal organs

ABDOMINAL TRAUMA: Pregnant Woman

- Risk of:
 - Uterine irritability
 - Premature labor
 - Incomplete, complete uterine rupture
 - Placental separation (may occur up to 48 hours after injury)
 - If pelvic fracture present, severe blood loss potential

ABDOMINAL TRAUMA: Pregnant Woman

- **ABCDE**
- Resuscitate in left lateral position to avoid aortocaval compression. Tilt the patient to the left.
- Vaginal examination with speculum for bleeding, cervical dilatation
- Record fundal height, note any tenderness
- Record, monitor fetal heart rate

ABDOMINAL TRAUMA: Pregnant Woman

- Consideration of pregnancy should always be given to any woman of childbearing age
- Pregnant patient at term can usually be effectively resuscitated only after delivery
- If mother and child are both critically ill, it is your clear duty to attend to the mother first
- Best treatment for the fetus is resuscitation of the mother

Postpartum Bleeding And Childbirth Injuries

POSTPARTUM HAEMORRHAGE (PPH)

- Vaginal bleeding in excess of 500 ml after childbirth
- Causes one in four maternal deaths worldwide
- Most common cause of maternal death in low income countries
- Assessment in antenatal period does not effectively predict who will have post-partum haemorrhage
- Closely monitor all postpartum women to early diagnose PPH

BLEEDING: Atonic Uterus

- Bleeding occurs from the placental site after delivery
- Blood vessels in the placental site are surrounded by uterine muscles, which normally contract after delivery and close off vessels
- Failure of uterus to contract (atonic uterus) results in excessive bleeding; commonest cause of bleeding after childbirth

PREVENTION OF POSTPARTUM HEMORRHAGE

- Bleeding may occur at slow rate over several hours; condition may not be recognized until woman suddenly enters shock
- Practice active management of third stage of labour in all cases to prevent PPH, including
 - **Give oxytocin to mother when baby is born, 10 IU IM/IV**
 - Assess uterus tone through repeated abdominal palpation to early identify cases of uterine atony
 - Placenta delivery by controlled cord traction (CCT) is only indicated if performed by skilled birth attendant
 - Uterine massage is not indicated for prevention if oxytocin has been given.

WHO recommendations for the prevention and treatment of postpartum haemorrhage:

http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/9789241548502/en/index.html

TREATMENT OF PPH

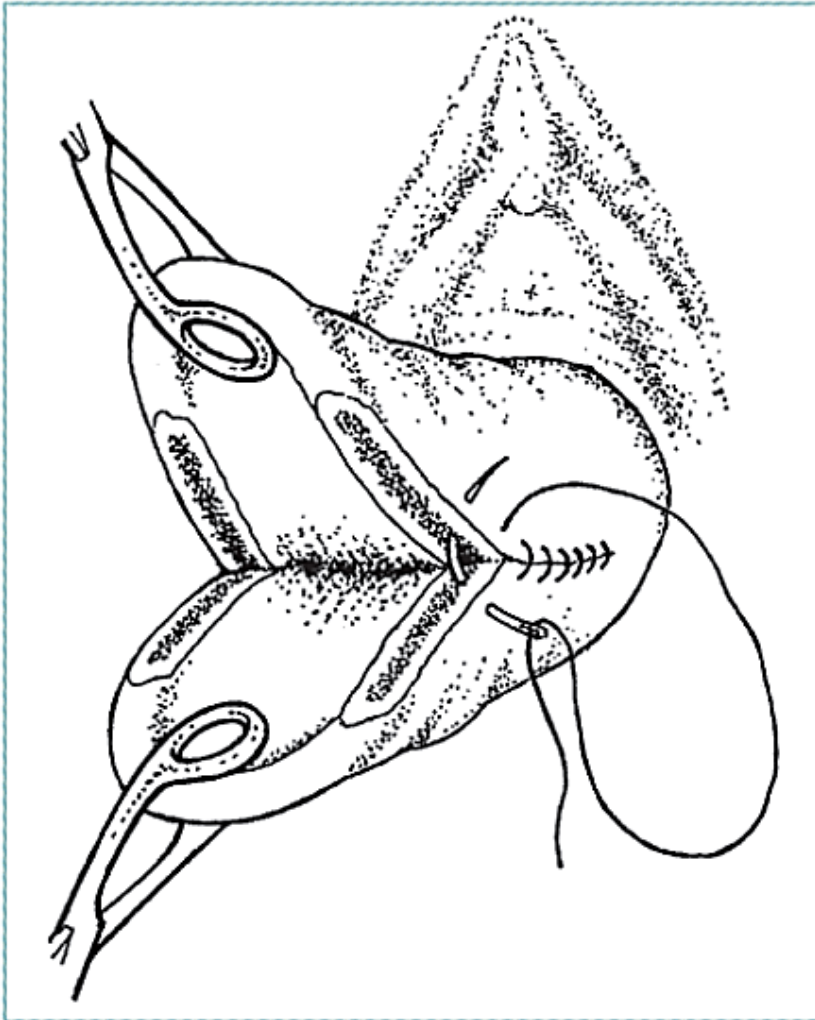
- Intravenous oxytocin alone is the recommended uterotonic drug
- If intravenous oxytocin is unavailable, or if bleeding does not respond to oxytocin, use:
 - Intravenous ergometrine
 - Oxytocin-ergometrine fixed dose, or
 - A prostaglandin drug, including sublingual misoprostol, 800 µg).
- The use of non-pneumatic anti-shock garments is recommended as a temporizing measure until appropriate care is available.

REPAIR OF VAGINAL AND PERINEAL TEARS

Four degrees of tear can occur during delivery:

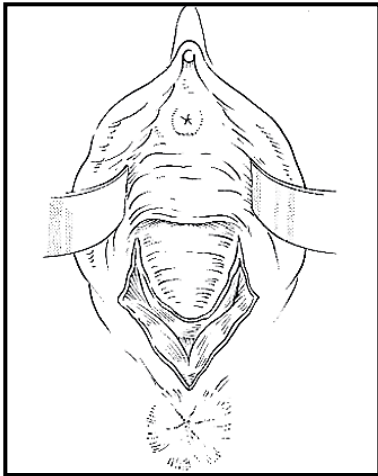
- First degree Vaginal mucosa + connective tissue
- Second degree Vaginal mucosa + connective tissue + muscles
- Third degree Complete transection of anal sphincter
- Fourth degree Rectal mucosa also involved

REPAIR OF CERVICAL TEARS

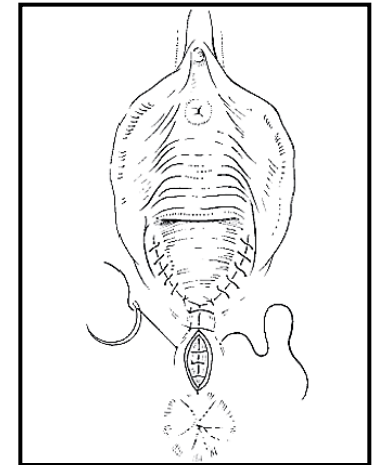
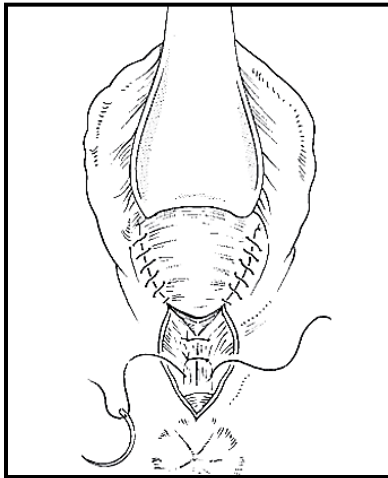
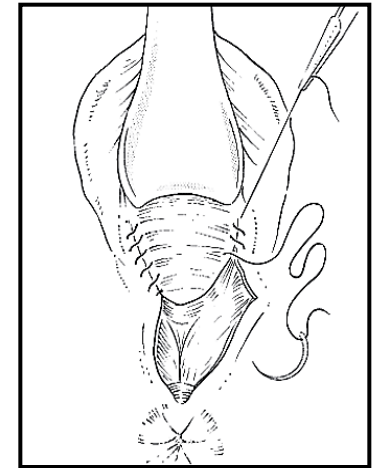


- Gently grasp cervix with ring or sponge forceps, apply on both sides of tear
- Gently pull in various directions to see entire cervix, tear
- Close tears with continuous 0-chromic non-absorbable suture

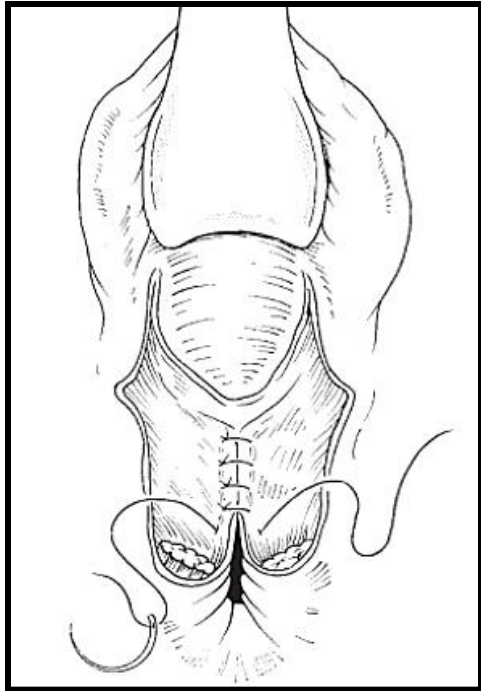
Repair of First and Second Degree Tears



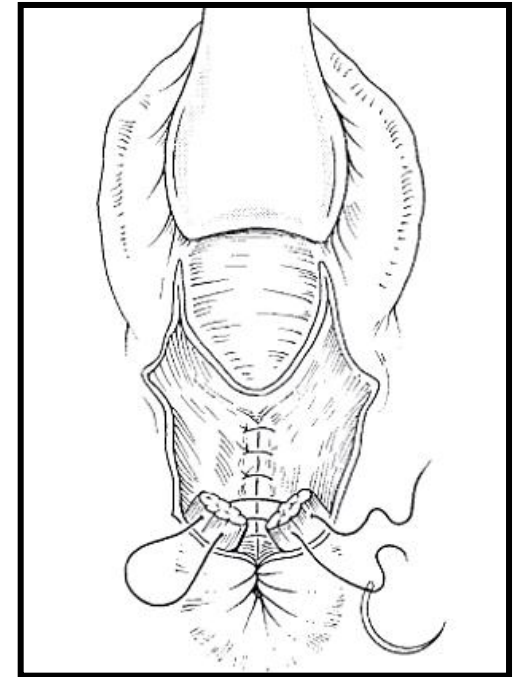
1. Use local anaesthesia
2. Carefully examine vagina, perineum, cervix
3. Make sure there are no 3rd or 4th degree tears
4. Most first degree tears heal spontaneously
5. Repair vaginal mucosa with 2-0 suture, begin at apex of tear
6. Repair perineal muscles
7. Close skin with subcuticular stitch



Repair of Third and Fourth Degree Tears



1. If you cannot see edges, use general anesthesia
2. If you can see edges, use local or block
3. Repair rectal mucosa with 3-0 or 4-0 interrupted sutures
4. Close fascial layer
5. Close sphincter with interrupted 2-0
6. During repair, use multiple rounds of antiseptic wash
7. Change gloves
8. Repair vaginal mucosa, perineal muscles, skin



FEMALE GENITAL INJURY

- Obtain information regarding nature of injury
- Conduct local examination of genitalia
- Check for tears of hymen, vaginal walls, fornices, cervix
- Irrigate with saline
- Ligate bleeding vessels
- Excise only devitalized tissues
- Repair deep lacerations with absorbable suture; skin with non-absorbable suture
- Catheterize bladder if urinary retention

FEMALE GENITAL INJURY

Clinical Care For Survivors Of Sexual Assault

- Take a complete history and full physical examination, documenting all injuries
- Provide supportive care ('psychological first aid')
- Provide emergency contraception (if up to 5 days after the event)
- Provide prophylaxis for STIs
- Use shared decision-making with survivor regarding HIV Post-exposure Prophylaxis
- For further information refer to: WHO Guidelines for medico-legal care of sexual violence survivors (2002) & e-learning tool for Clinical Management of Rape survivors (WHO/UNHCR 2009).

FEMALE GENITAL INJURY

Complications:

- Infection
- Haematoma in parametrium
- Recto-vaginal, vesico-vaginal fistulae
- Dyspareunia

FEMALE GENITAL MUTILATION

- There are NO health indications for female genital mutilation
- Acute complications:
 - Haemorrhage
 - Shock
 - Urinary retention
 - Damage to urethra, anus
 - Cellulitis
 - Abscess formation

FEMALE GENITAL MUTILATION

Treatment:

- Wound debridement, saline irrigation, remove all foreign material
- Remove minimal tissue, drain abscess
- Antibiotics for infected wounds, cellulitis, abscess
- Catheterize bladder
- Tetanus toxoid if non-immune
- Excise epidermal tissue, if present, to permit urinary flow and sexual intercourse

FEMALE GENITAL MUTILATION

Chronic complications include:

- Sexual dysfunction, dyspareunia
- Psychological disturbance
- Urinary obstruction
- Keloids
- Large epidermal inclusion cysts
- Difficult urination
- Vaginal stenosis; may cause obstructed labour, often complicated by vesico- or recto- vaginal fistulae

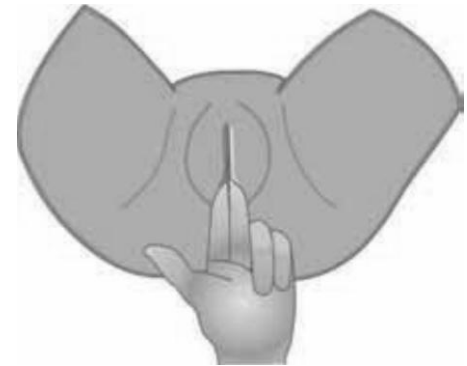
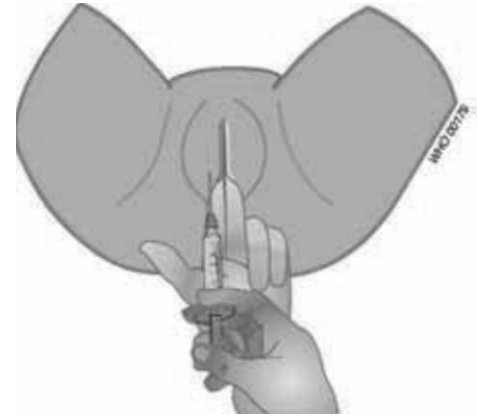
DELIVERY IN THE PRESENCE OF INFIBULATION

Vaginal closure due to type III female genital mutilation

- Women with type III FGM – infibulation need to be opened for childbirth to reduce the risk of serious tears and obstructed labor.
- The first choice should be defibulation, opening of the infibulated scar, which is a less infringing procedure than episiotomy, as the seal of skin covering the vagina is usually thin with few nerves and blood vessels

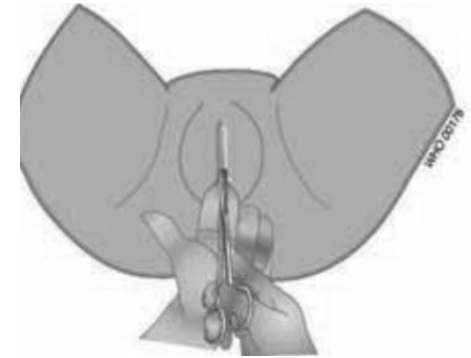
DELIVERY IN THE PRESENCE OF INFIBULATION

1. Infiltrate 2-3 ml of local anesthetics into the area where the cut will be made, along the scar and in both sides of the scar
2. With your finger or dilator inside the scar, introduce the scissors and cut the scar alongside the finger or fingers to avoid injury to the adjacent tissues



DELIVERY IN THE PRESENCE OF INFIBULATION

3. The cut should be made along the mid-line of the scar towards the pubis
4. Incise the mid-line to expose the urethral opening
5. Review whether episiotomies will also be necessary to avoid tearing
6. After childbirth, suture the raw edges separately using fine 3/0 catgut to secure hemostasis and prevent adhesion formation



Musculoskeletal Trauma



LIMB INJURY

Examination must include:

- Skin colour, temperature
- Distal pulse assessment
- Bleeding sites
- Alignment, deformities
- Active, passive movements
- Level of pain caused by injury

OPEN FRACTURES

- Open or compound fractures: injuries involving both bone, soft tissue, open skin
- All contaminated; primary closure is contraindicated
 - Predisposes to anaerobic infection, chronic osteomyelitis
- Treatment:
 - aggressive wash-out, debridement, immobilization
 - Perform debridement within 6 hours;
 - If indicated, do not delay referral

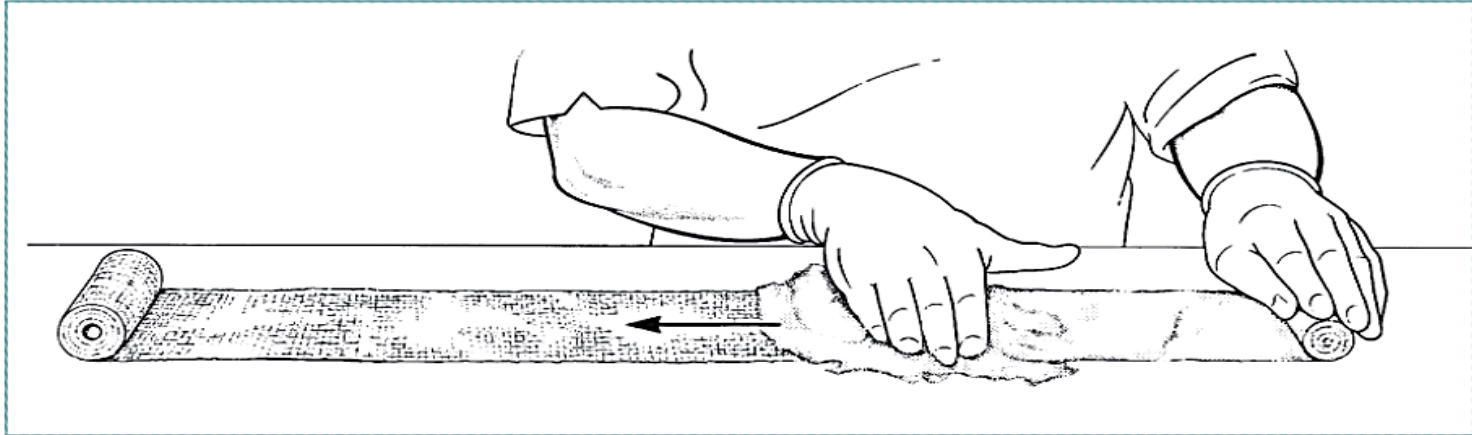
OPEN FRACTURES

- Remove small free bone fragments without obvious blood supply
- Do not strip muscle, periosteum from fractured bone
- Leave vessels, nerves, tendons intact
- Pack wound
- Stabilize fracture after wound debridement; perform definitive fracture treatment later
- Stabilize with a well-padded posterior plaster slab or complete plaster cast split to prevent compartment syndrome

CASTS AND SPLINTS

- Provide immobilization of extremities and spine following injuries, other abnormalities of bone, soft tissues
- Use plaster or fibreglass to construct casts, splints
 - Fibreglass is lighter, resists water, but more expensive and more difficult to remove
- Wood, cardboard can serve as temporary splints
- Use splint for acute injuries to allow room for swelling
- Casts are wrapped circumferentially around extremity; they provide more rigid fixation than splints

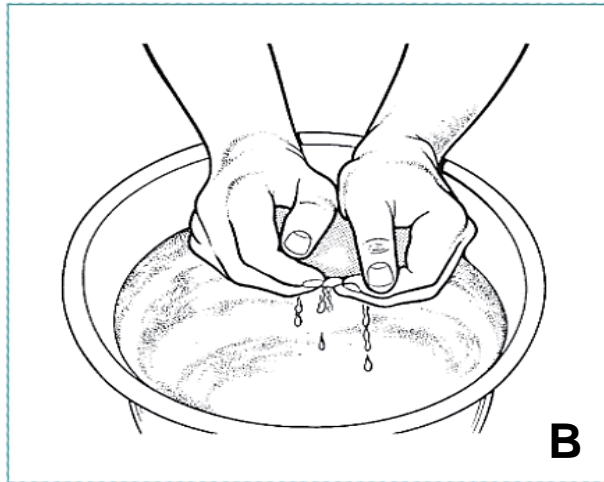
CASTS AND SPLINTS



To prepare plaster of Paris bandage, use dry cotton gauze (muslin) bandage 500 cm long and 15 cm wide. Unroll a portion on a dry table and apply plaster powder evenly to the surface.

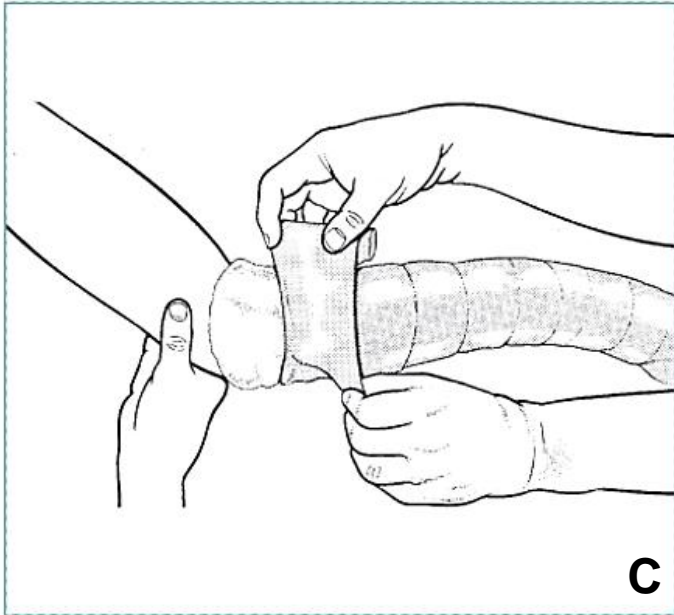
Gently, but firmly, rub the powder into the mesh of the cotton and carefully roll up the powdered portion. The bandage may be stored for later use.

CAST APPLICATION



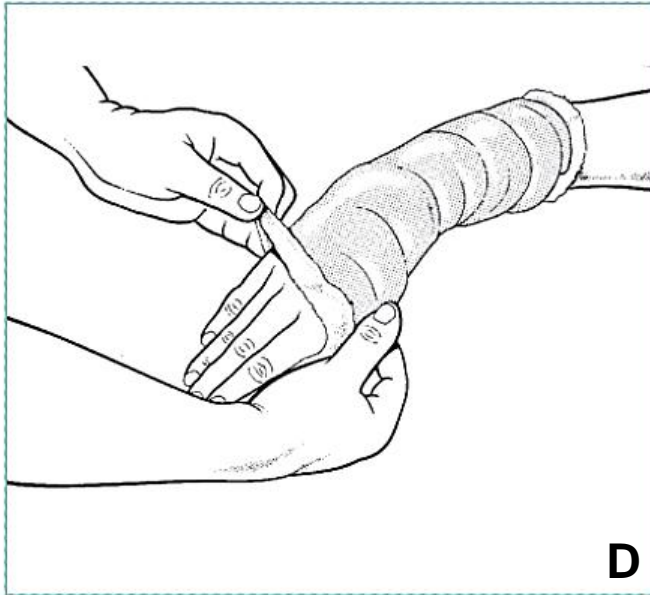
- Cleanse skin, apply stockinet; avoid wrinkles
- Apply layer cotton padding over stockinet, extra padding over bony prominences (A)
- Soak plaster roll in water at room temperature; leave in water until completely soaked, air bubbles cease to rise
- Gently pick up ends of bandage with both hands, lightly squeeze, pushing ends together without twisting, wringing (B)

CASTS AND SPLINTS



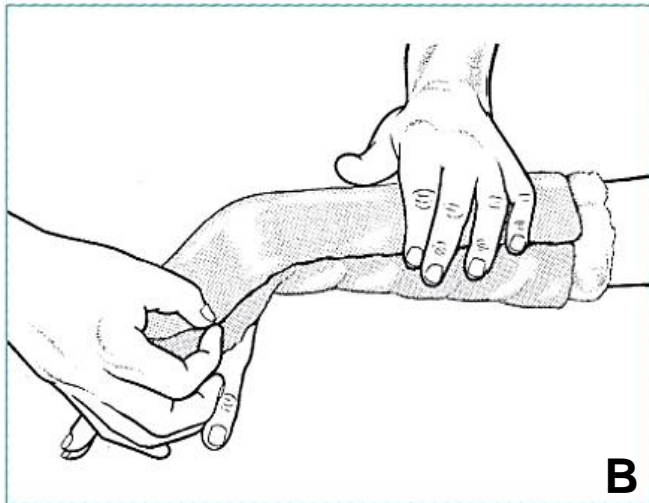
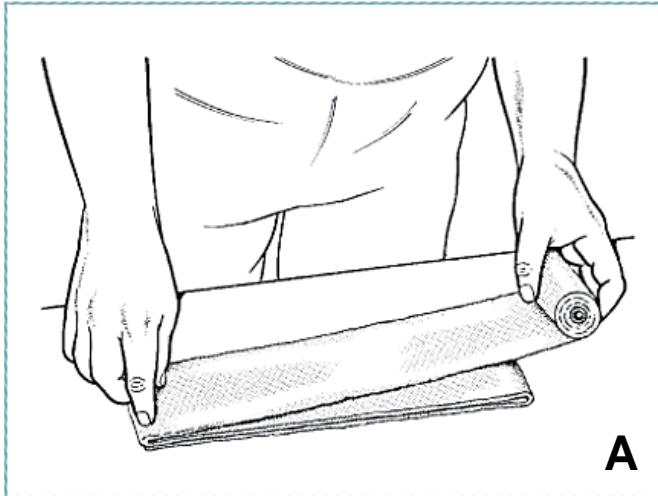
- While applying plaster, hold relevant body part in correct position; movement causes ridges on inside of plaster
- Work rapidly, without interruption, rubbing each layer with the palm so that the plaster forms homogenous mass rather than separate layers
- Apply plaster by unrolling bandage as it rests on limb, do not lift it up from the patient or apply tension to roll
- Overlap previous layer by about half width of roll (C)

CASTS AND SPLINTS



- Mould plaster evenly around bony prominences, contours, leaving 3cm padding at upper and lower margins of cast to protect skin; fold over, incorporated in last plaster layer (D)
- Mould cast until plaster sets, becomes firm; completely sets in 24 hours
- Technique for fibreglass is similar, but fibreglass is slightly elastic, will contour to limb more easily; sets firmly in 30 minutes

SPLINT APPLICATION



- Measure length of material needed to secure limb
- Place 3-5 layers of padding on flat surface, unroll 5-10 layers plaster onto padding (A)
- Grasp plaster layer at each end, dip in water, gently squeeze together without twisting
- Place on padding, smooth with the palm into homogenous layer
- Place splint on limb, padding side towards the patient, mould it to limb contours
- Secure with elastic bandage or gauze wrap (B)

CASTS AND SPLINTS

Patient instructions

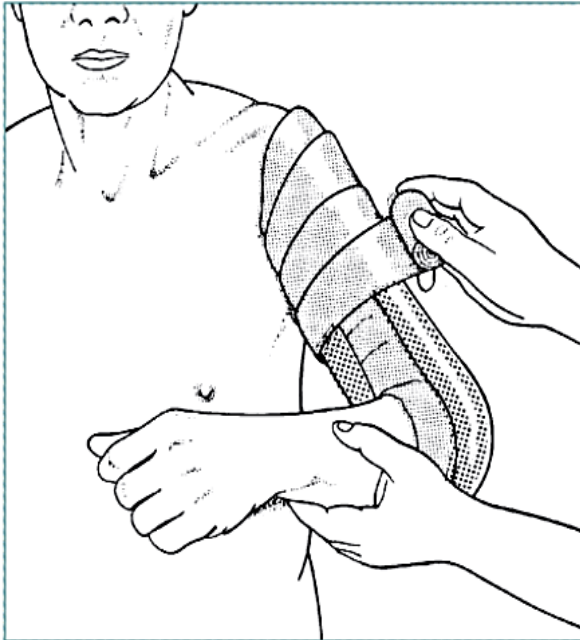
- Give oral and written instructions to the patient and/or to accompanying relatives, others
- Give instructions in non-technical language that the patient, family can easily understand
- Give opportunity for questions

PATIENT INSTRUCTIONS

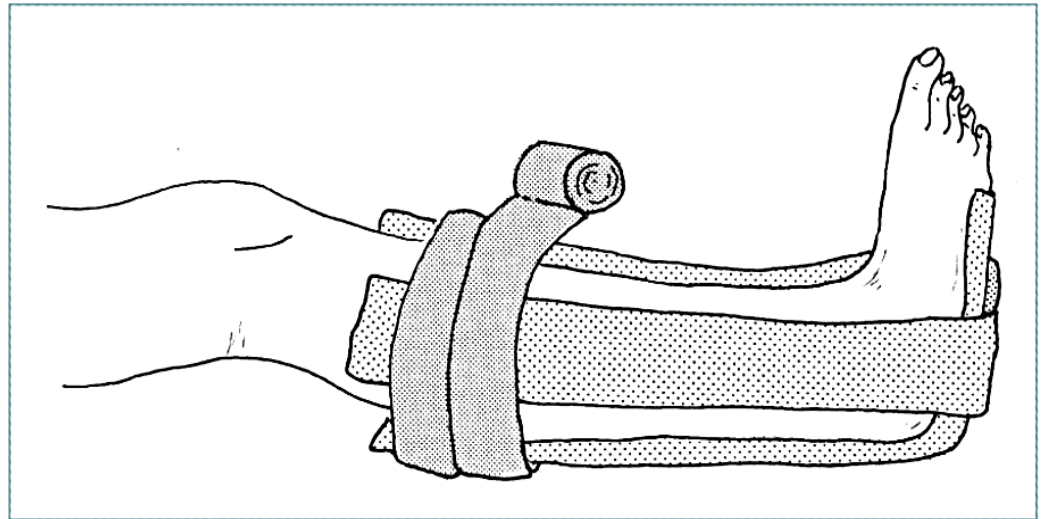
for splints and casts

- Keep the cast or splint dry at all times
- Do not try to scratch your skin under the cast or splint with a sharp or blunt object
- Allow the cast to dry for 24 hours before putting weight on it or resting it on a hard surface
- For acute injuries, elevate the injured part for 1-2 days and wiggle your fingers or toes frequently
- Return to the health clinic immediately if:
 - Your cast or splint gets wet or becomes soft or broken
 - You have increasing pain
 - You experience numbness or tingling, or have difficulty moving your fingers or toes
 - You see a change in skin colour of the extremity with the cast
 - Your cast or splint has a foul odour

TYPICAL SPLINTS

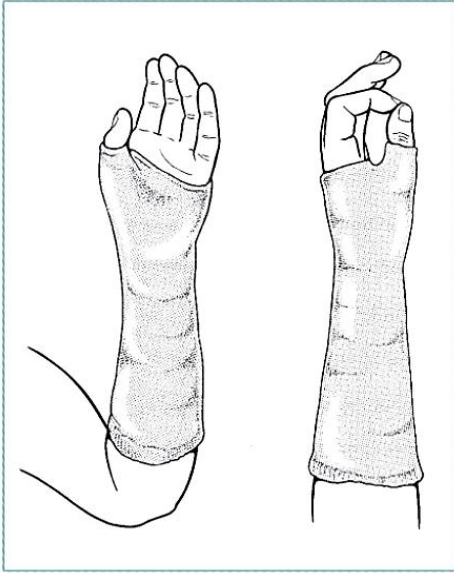


Sugar tong splint

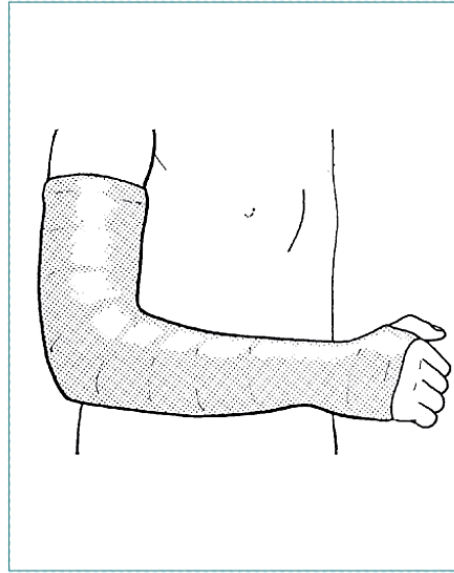


3-way ankle splint

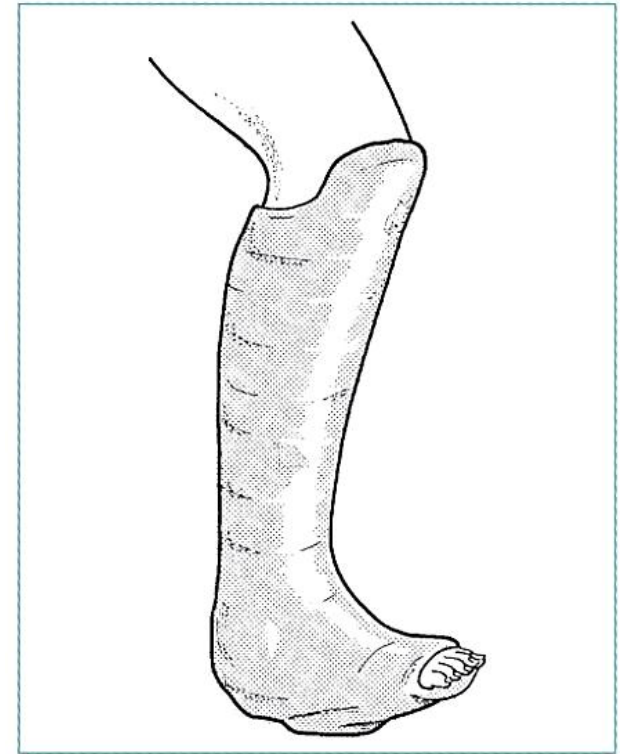
TYPICAL CASTS



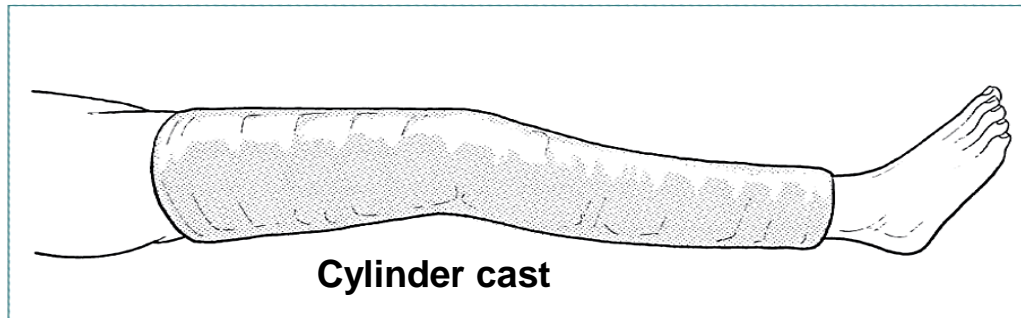
Short arm thumb spica cast



Long arm cast

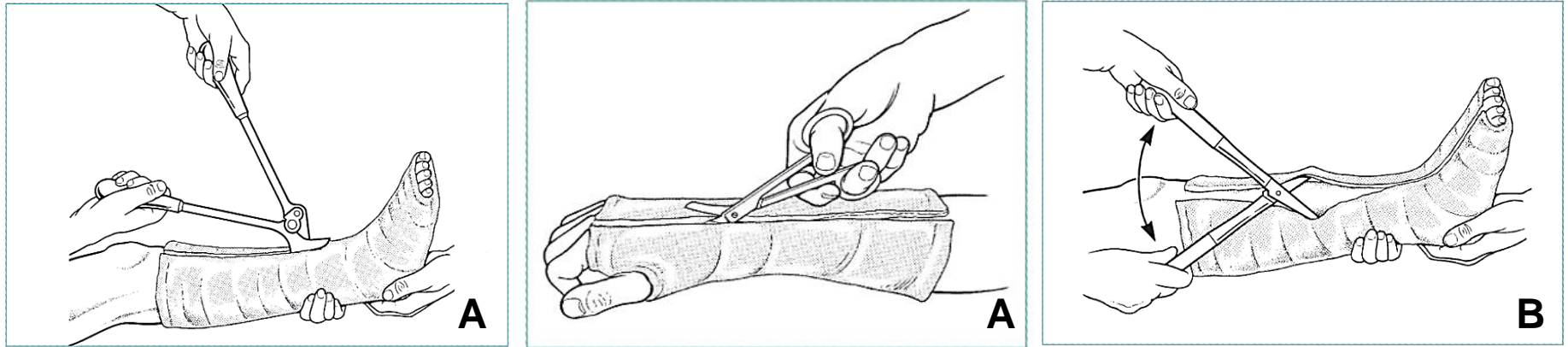


Short leg patella tendon weight-bearing cast



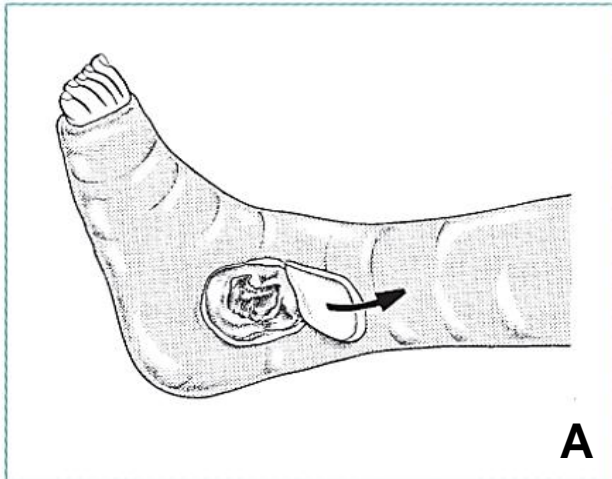
Cylinder cast

REMOVING A CAST WITH PLASTER SHEARS



- Make 2 cuts along opposing surfaces of cast (A), avoiding bony prominences
- Begin cutting at an edge, then loosen cast with plaster spreader (B)
- Complete division of plaster and padding with plaster scissors, be very careful not to injure underlying skin
- Under difficult conditions, or if a child, soften plaster by soaking in water (or water and vinegar) for 10-15 minutes, then unroll like a bandage

COMPLICATIONS: Pressure Sores

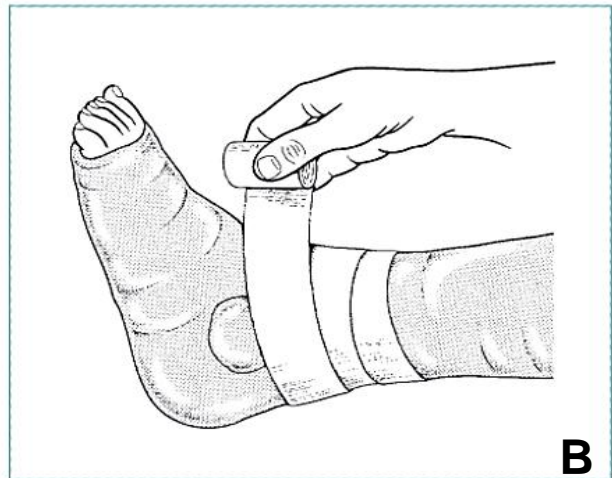


Location

- Ankle (malleolus)
- Dorsum of foot
- Distal ulna at wrist

Treatment

- Put on new cast or cut window in plaster at suspected site (A)
- Clean wound, treat with dressing changes
- Fill hole in cast with padding
- Hold plaster in place with firm bandage (B)



COMPLICATIONS

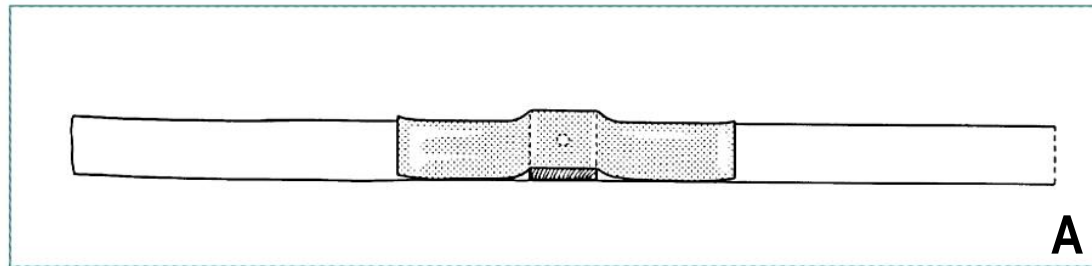
Skin blistering

- Skin under plaster becomes dry, scaly
- Rarely, skin allergy to plaster or fibreglass
- Staphylococcal infection of hair follicles and sweat glands can lead to severe painful, purulent dermatitis
- Can be treated with antihistamines, systemic antibiotics, limb elevation; should respond within 2 days
- If severe, find another way to treat fracture

TRACTION

- Weight applied through traction system counteracts muscle force pulling across fracture, keeping bone in proper alignment, length
- Use appropriate method of traction to treat fractures of extremities
- Apply extremity traction to skin distal to fracture
- Do not apply traction to skin with:
 - Abrasions, lacerations
 - Surgical wounds
 - Ulcers
 - Loss of sensation
 - Peripheral vascular disease

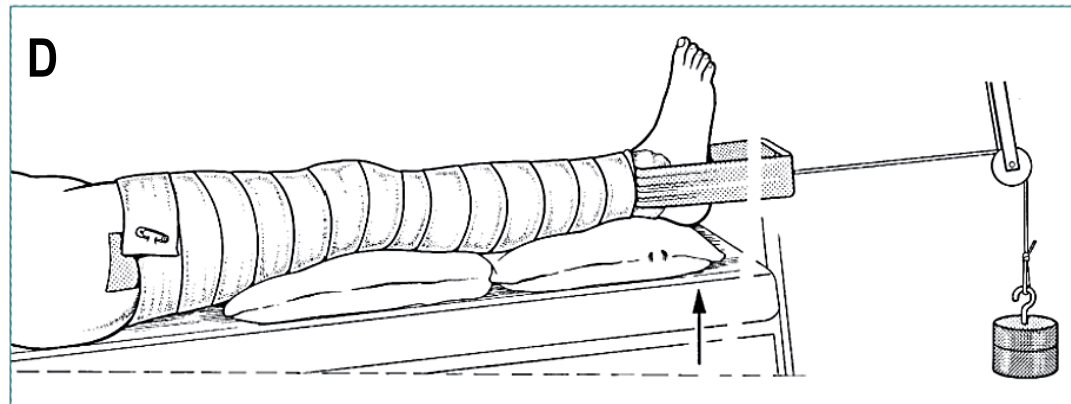
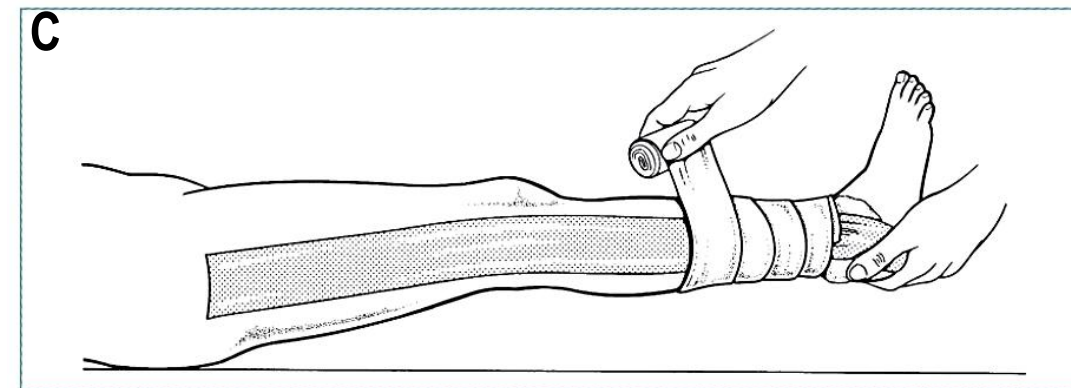
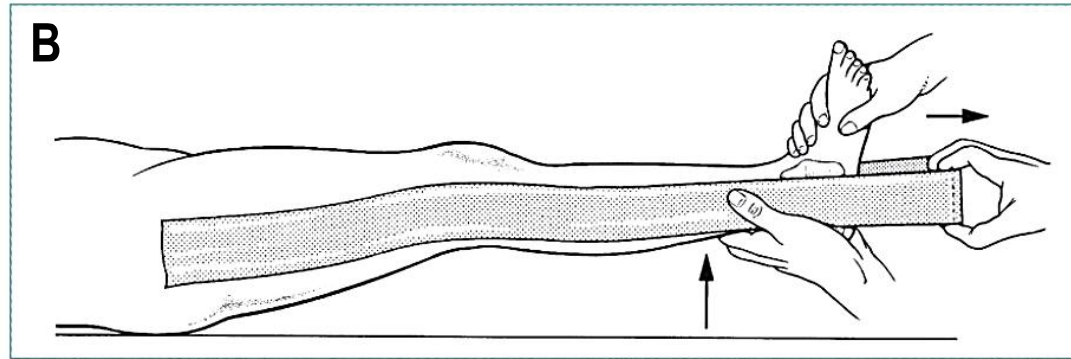
SKIN TRACTION



- Clean limb with soap and water, then dry
- Measure appropriate length of adhesive strapping, place on level surface, adhesive side up
- Place 7.5 cm square wooden spreader with central hole in the middle of the strapping (A)

SKIN TRACTION

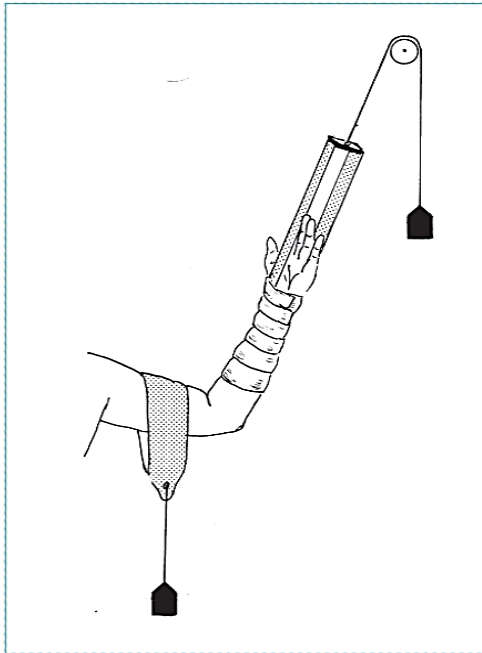
- Apply strapping to medial and lateral sides of limb, allowing spreader to project 15 cm below sole of foot (B)
- Gently elevate limb off bed while applying longitudinal traction (C)
- Apply traction (D)



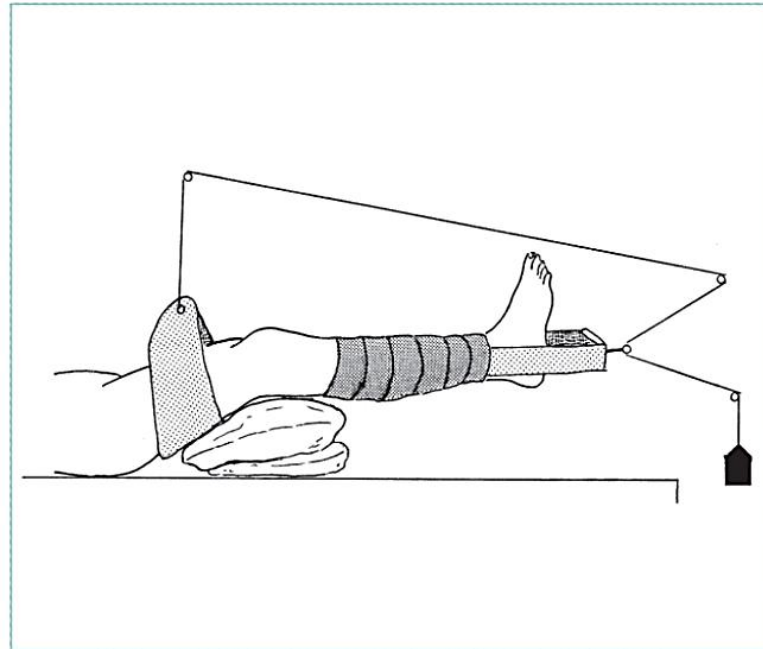
SKIN TRACTION: COMPLICATIONS

- Allergic reactions to adhesive material
- Blister formation, pressure sores from slipping straps
- Compartment syndrome from over-tight wrap
- Peroneal nerve palsy from tight wraps around knee
- Joint stiffness prevented by active, active-assisted exercise

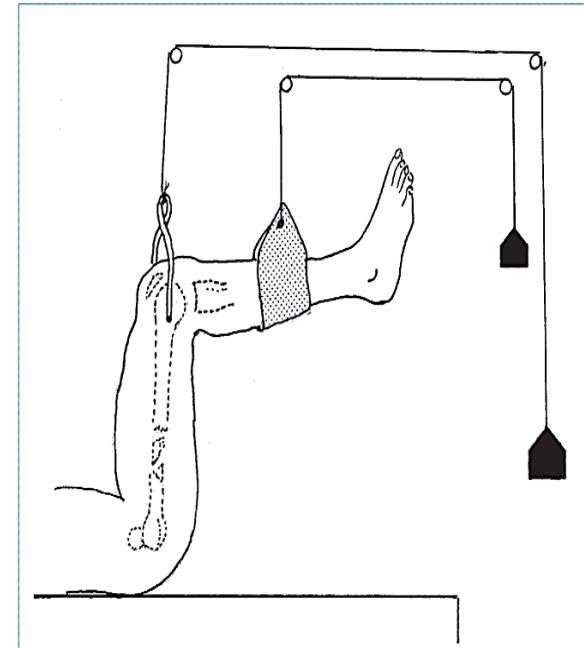
EXTREMITY TRACTION



Skin traction: forearm fracture



Skin traction (suspension traction)



90/90 balance suspension

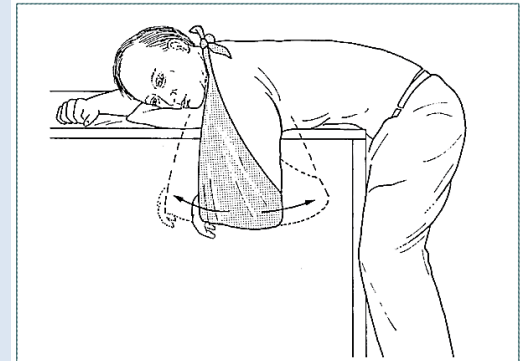
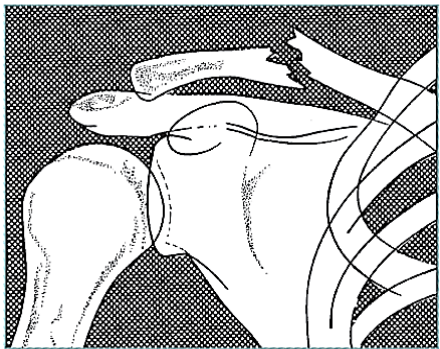
UPPER EXTREMITY INJURIES

Clavicle Fractures

Diagnose from history and physical examination

Treat with sling for comfort

Release to allow elbow extension and hanging arm exercises.



UPPER EXTREMITY INJURIES

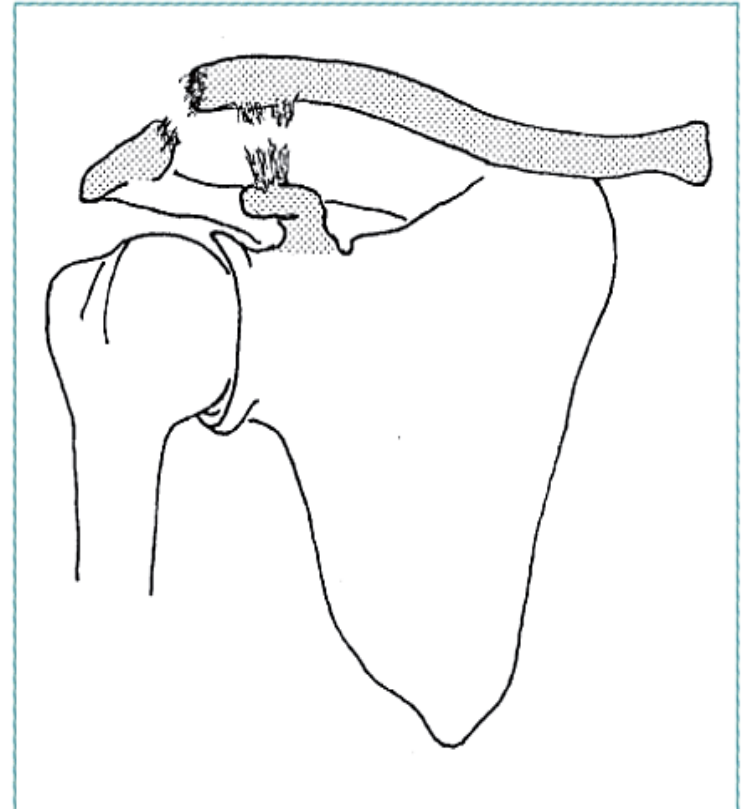
Acromial-clavicular Joint Separation

Separation of acromial-clavicular joint results from falls on the tip of the shoulder

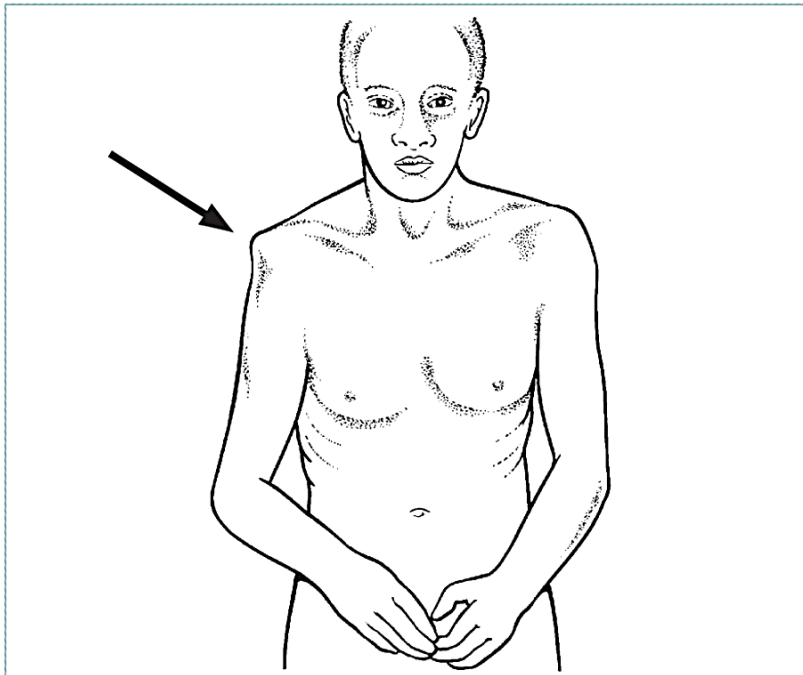
Make diagnosis based on history, physical examination

Treat with arm sling

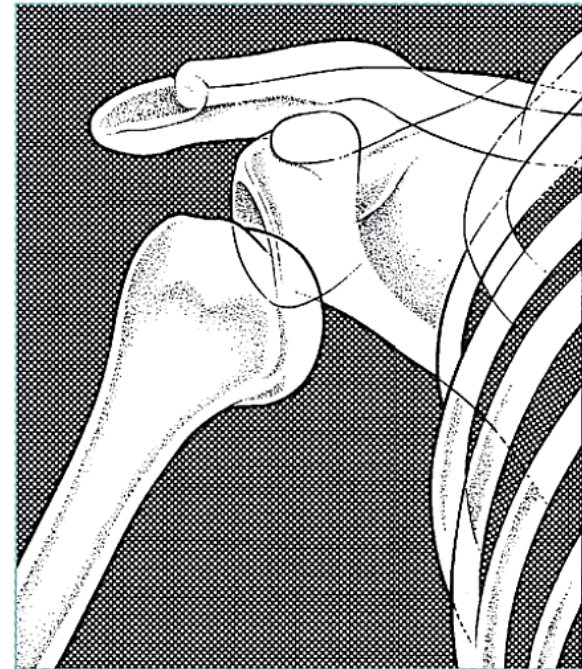
When comfortable, begin range of motion, active muscle strengthening in shoulder



SHOULDER DISLOCATION



Hollow area in place of humeral head (arrow)



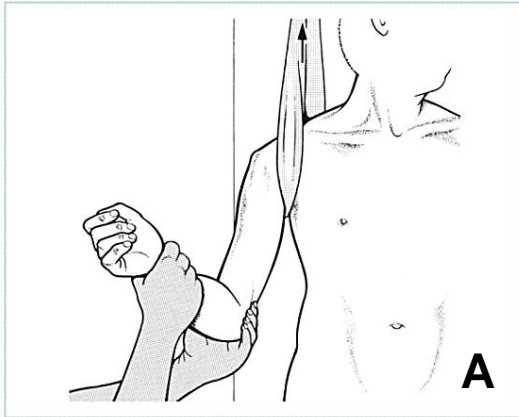
X-ray to determine if there is fracture

SHOULDER DISLOCATION

Shoulder Dislocation

- Make diagnosis by physical examination
- X-ray if significant trauma to exclude fracture
- Neurological exam, look for peripheral nerve or brachial plexus injury
- Treat with closed manipulation (next slide)
- X-rays to evaluate reduction
- Recurrent dislocations are common, especially in younger patients

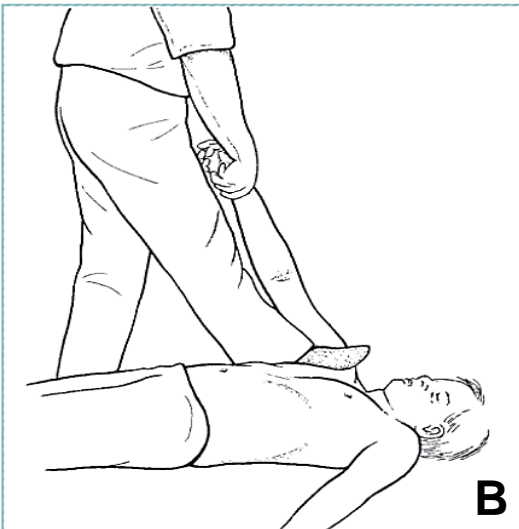
SHOULDER DISLOCATION



Patient supine

If assisted

- he/she should place sheet under axilla for counter traction
- pull slowly, steadily on flexed elbow (A)



If alone

- place foot in axilla for counter traction
- gently pull on arm (B)

SHOULDER DISLOCATION

After reduction, place arm in sling;
swath to prevent abduction,
external rotation (C)

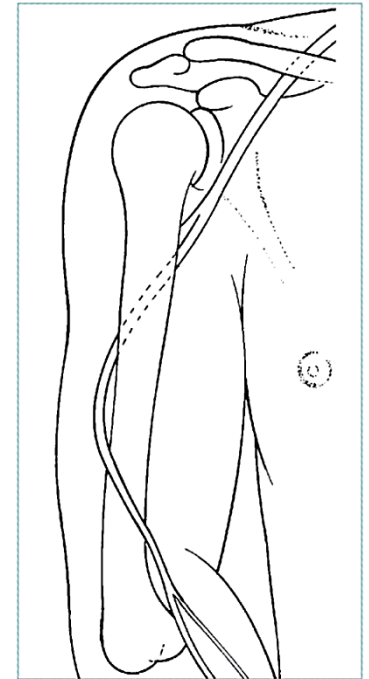
Begin strengthening exercises at 6
weeks, with emphasis on internal
rotation strength



HUMERAL SHAFT FRACTURES

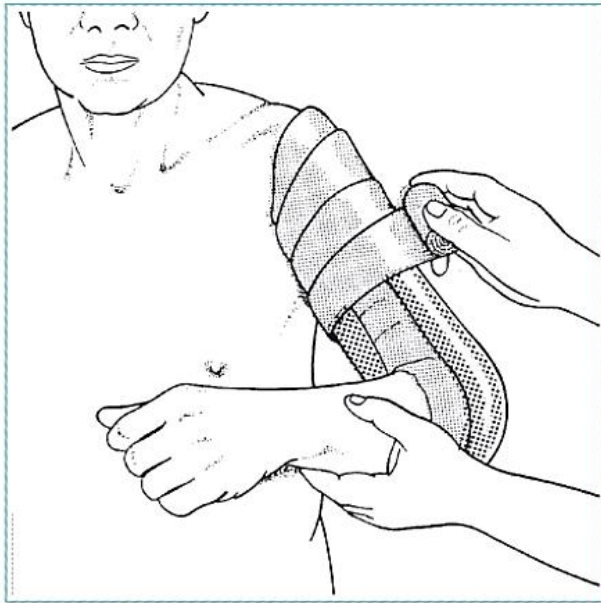


- Humeral shaft fractures result from direct trauma or rotation of arm
- Closed reduction, coaptation splint
- Most significant complications are radial nerve injury (15%) and non-union

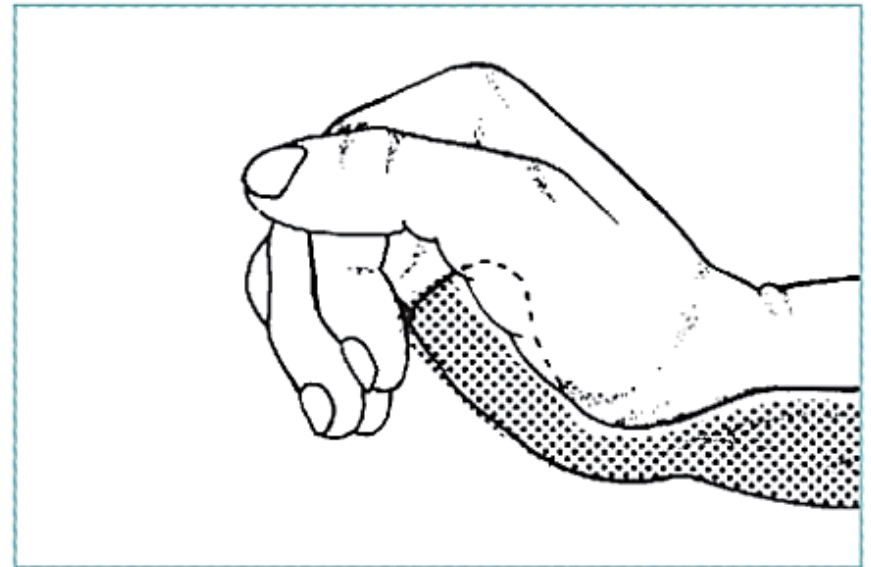


Path of radial nerve passing around humerus

HUMERAL SHAFT FRACTURES TREATMENT



Coaptation splint

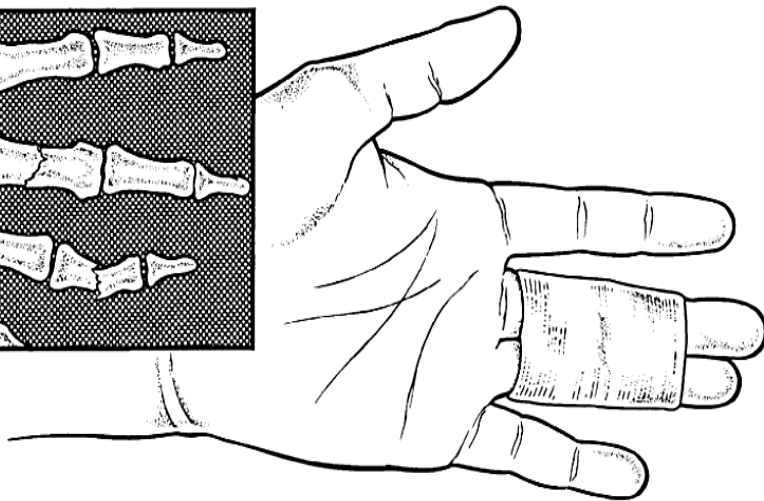
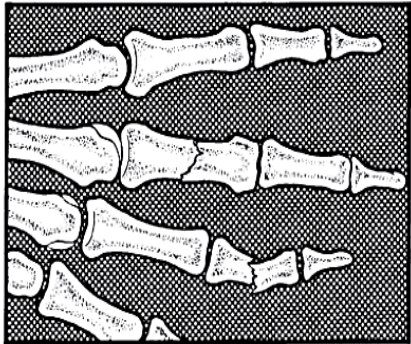


Splint for radial nerve palsy

THE HAND: Fractures and Dislocations

Phalangeal fractures

- Treat non-displaced, stable fractures by taping to adjacent uninjured digit— "buddy tape"—or with a simple dorsal splint



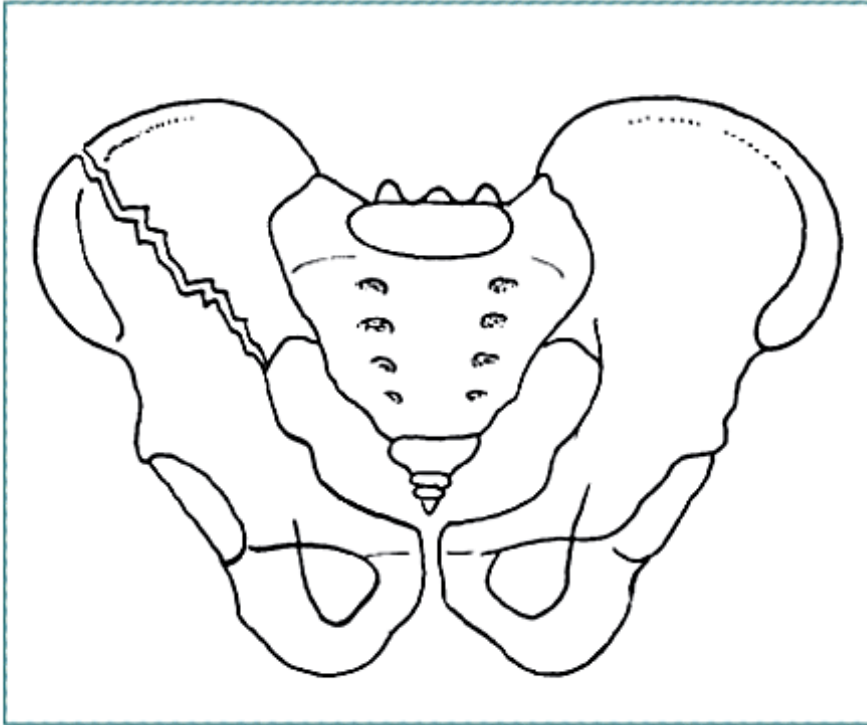
FRACTURES OF THE PELVIS AND HIP

Pelvic Ring Fractures

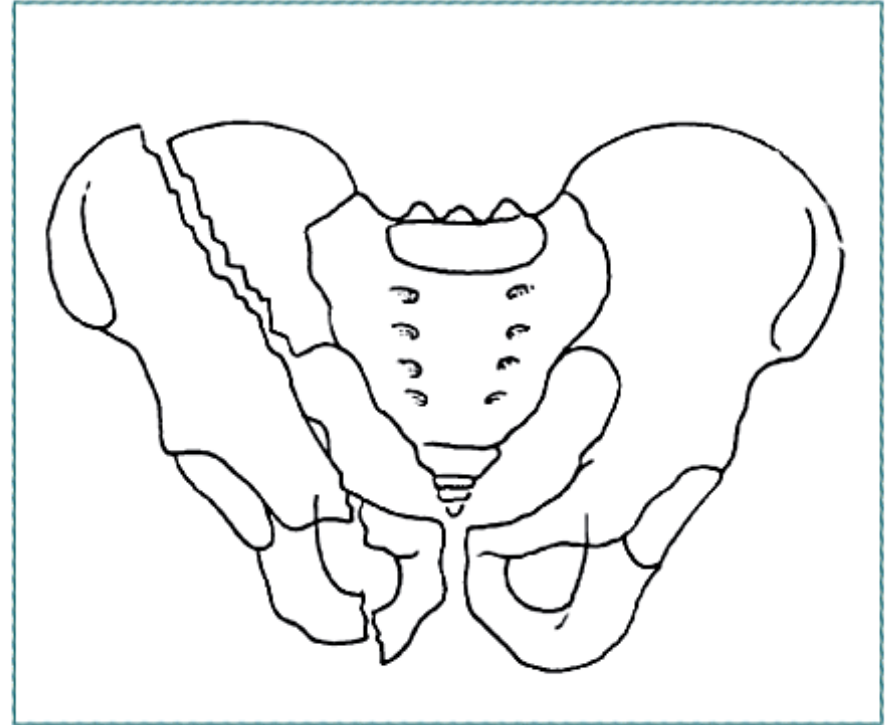
- Pelvic ring fractures result from high-energy trauma
- Classified as stable or unstable
- Unstable fractures associated with significant blood loss, multiple system injury
- Treat initially with systemic resuscitation, temporary pelvic compression

FRACTURES OF THE PELVIS AND HIP

Pelvic Ring Fractures



Stable fracture with single fracture component



Unstable pattern: fracture at 2 or more sites, or those with disruption of symphysis pubis or sacroiliac articulation

FRACTURES OF THE PELVIS AND HIP

Pelvic Ring Fractures

Evaluation

- Flank ecchymosis
- Labial or scrotal swelling
- Abnormal position of lower extremities
- Pain with pelvic rim compression

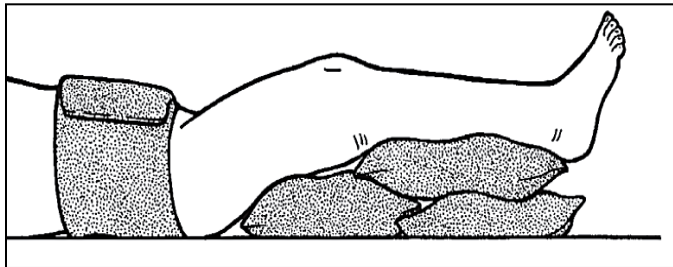
Treatment

- Focus initially on general resuscitation efforts
- Stable fractures—bed rest and analgesics; rarely significant blood loss

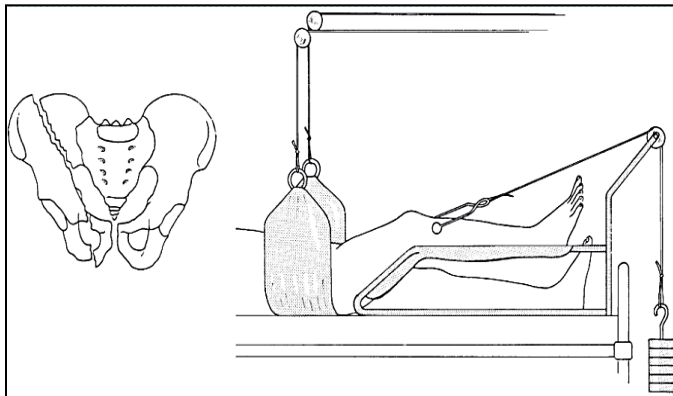
FRACTURES OF THE PELVIS AND HIP

Unstable Pelvic Ring Fractures

A



B



Assessment

- Result of high impact blunt injury
- Associated with visceral damage, significant bleeding

Treatment as emergency procedure

- Place compression on **greater trochanters** using sheet or sling to close pelvic space, tamponade active bleeding (A)
- Treat with pelvic sling and/or traction on leg to reduce vertical shear component of fracture (B)
- Maintain traction until fracture is consolidated—usually 8-12 weeks

COMPARTMENT SYNDROME

Swelling within closed fascial spaces, intra-compartmental pressure increases and blood supply to muscles and nerves is lost.

- External limb compression, e.g. tight casts or dressings
- Burn eschar
- Fractures
- Soft tissue crush injuries
- Arterial injury

COMPARTMENT SYNDROME

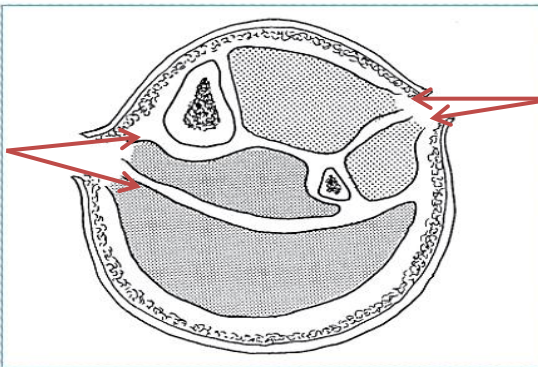
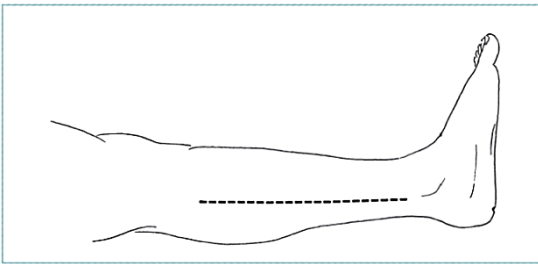
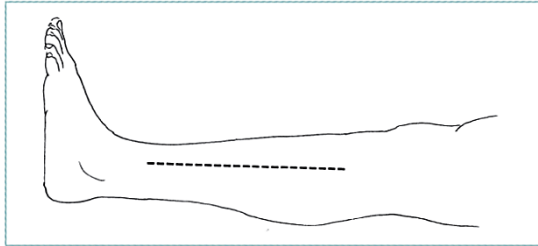
Diagnostic findings

- **Pain out of proportion** to injury
- Tense muscle compartments to palpation
- Pain with passive stretch of involved muscle
- Decreased sensation
- Weakness of involved muscle
- Pallor or decreased capillary refill (late finding)
- Elevated compartmental pressures (if measurable)

Treat with immediate surgical release of skin and fascia

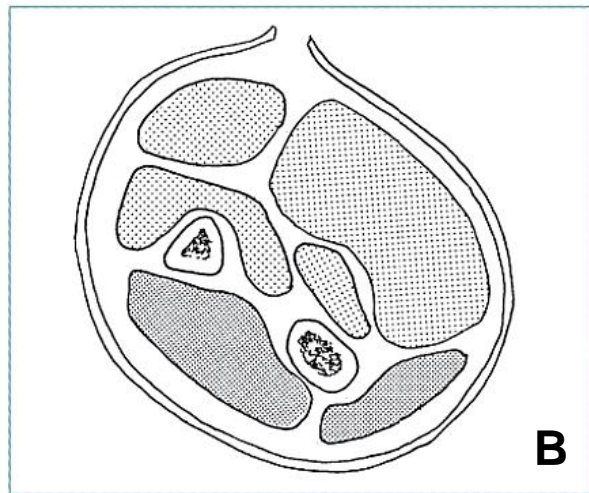
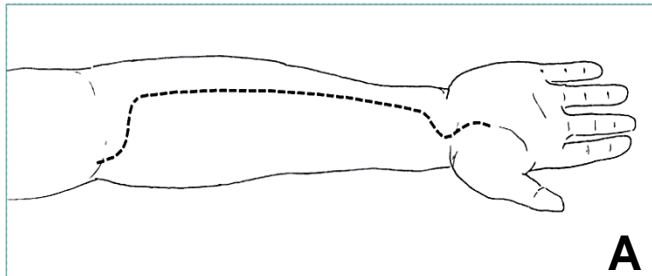
COMPARTMENT SYNDROME: Leg

Technique



- Use two full length incisions to decompress four leg compartments
- Place one incision on anterior lateral aspect of leg just anterior to fibula
- Divide skin and the fascia surrounding the anterior and lateral compartments
- Place second incision 1-2 cm posterior to medial border of tibia to access the superficial and deep posterior compartments

COMPARTMENT SYNDROME: Forearm



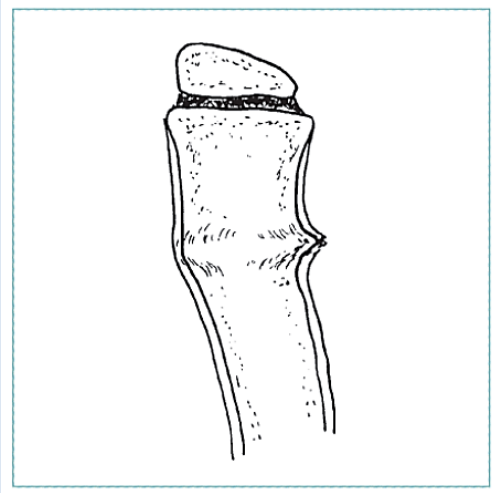
Technique

- Decompress superficial and deep volar compartments through single incision (A, B)
- Divide superficial fascia for entire length, open carpal tunnel
- Inspect muscles for necrosis; remove obviously dead muscle—if in doubt, leave it
- Do not close wound
- Apply sterile dressing; splint wound

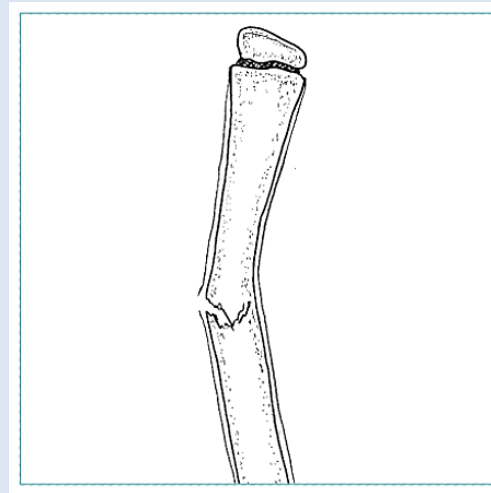
FRACTURES IN CHILDREN

- Open growth plates, thick periosteal membrane make fractures in children different from those in adults
- Treat fractures by closed reduction; certain displaced epiphyseal fractures may need surgical reduction
- Future growth will remodel some residual deformity in length, angulation, displacement but not rotation

INCOMPLETE FRACTURES IN CHILDREN



Torus or buckle fracture



Greenstick fracture

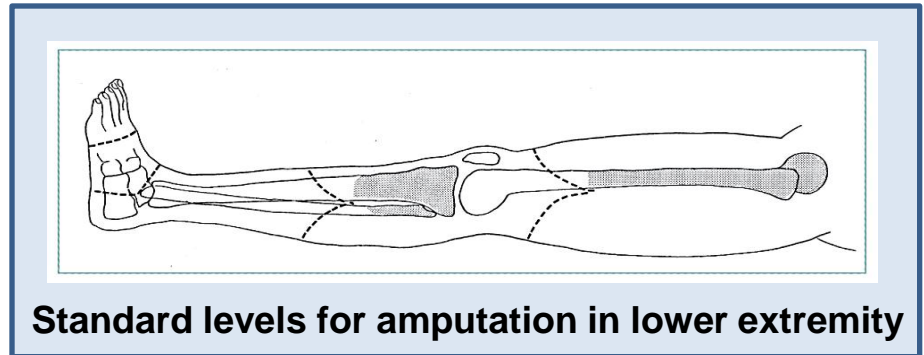
- Growth in length occurs through cartilaginous epiphyseal plates; growth in width through periosteal membrane
- The periosteal membrane is a thick fibrous layer that covers bone, provides stability to torus and greenstick fractures

AMPUTATIONS

Evaluate skin, muscle, vascular supply, nerve function and bone integrity
Mangled but intact extremity following trauma requires careful consideration

Indications for amputation:

- Malignant tumour
- Severe infections
- End-stage arterial disease
- Irreparable trauma to extremity
- Loss of vascular supply and sensation
- Severe damage to three of five major tissues (artery, nerve, skin, muscle, bone) = indication for early amputation



GUNSHOT WOUNDS

- Severity of gunshot wound related to bullet size, shape, velocity
- Low velocity injuries: minor wounds
- High velocity injuries: extensive soft tissue, bone damage
- Treat associated fractures with plaster, traction or external fixation

GUNSHOT WOUNDS

Low velocity injuries

- Debride wounds superficially; usually done in outpatient department
- Lavage wound with large amounts of fluid
 - Do *not* close skin
 - Administer intravenous antibiotics for 1–3 day
 - Give tetanus prophylaxis
- Treat fractures by closed means with cast, traction or external fixation
- If bullet fragments remain in joint cavity, arrange to have them removed within a few weeks

GUNSHOT WOUNDS

High velocity injuries

- Debride wounds in operating theatre, using adequate anaesthesia
- Lavage each wound after removing all dead tissue, foreign material
- Lavage between entrance and exit wounds, passing gauze through tract if necessary
- Do *not* close wound; re-debride in 2–5 days
- Administer antibiotics, tetanus prophylaxis
- Treat fractures with cast or, preferably, external fixation or traction

WAR-RELATED TRAUMA: Landmines

- Injury patterns related to type of landmine encountered
- Blast injuries occur from pressure sensitive mines; trip-wire mines produce injury from multiple flying fragments
- Evaluate entire patient for injury to multiple systems
- Treat extremity injuries with debridement, skin coverage
- Amputation often necessary

Review of Core Learning Objectives

- **Central Nervous System Trauma**
 - Head injuries
 - Glasgow Coma Score
 - Spinal cord injuries
- **Thoracic trauma**
- **Abdominal trauma**
- **Female genital injuries**
- **Musculoskeletal trauma**
 - Splint, cast immobilization
 - Traction techniques
 - Closed management of fracture/dislocations
 - Compartment Syndrome