

- *Miscellaneous cause*
 - Simple bone cyst
 - Monostotic fibrous dysplasia
 - Eosinophilic granuloma.
- *General affections of bone*
- *Developmental disorders*
 - Osteogenesis imperfecta
 - Fibrous dysplasia
 - Gaucher's disease, etc.
- *Generalized rarefaction of bones*
 - Senile osteoporosis
 - Hyperparathyroidism
- Osteomalacia
- Nutritional rickets
- Scurvy
- *Miscellaneous*
 - Multiple myeloma
 - Diffuse metastatic carcinoma
- *Disseminated tumors*
 - Paget's disease
 - Fibrous dysplasia
 - Gaucher's disease, etc.

Clinical Features

The patient usually complains of fracture following a trivial trauma. He or she complains of having suffered pain or discomfort in the region of the affected bone some time before the fracture. The cause could be either a generalized or a local skeletal disorder (See Box).

Radiology: Plain X-ray of the affected part helps to identify the pathological fracture (Fig. 2.4).

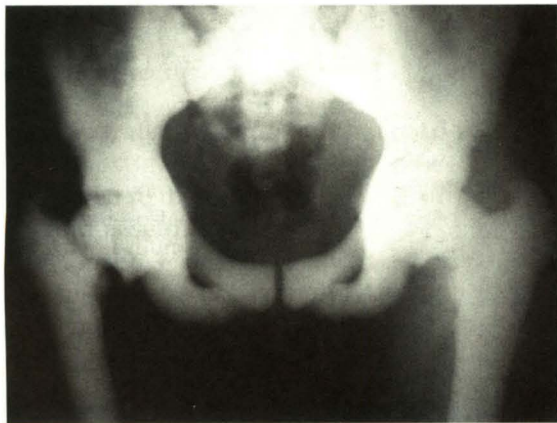


Fig. 2.4: Intracapsular femoral neck pathological fracture in osteoporosis

QUICK FACTS: CAUSES VS SITES

Local disorders

- **Metastatic carcinoma:** The primary could be in the lungs, breast, prostate, thyroid, or kidney.

Common sites

- Vertebral bodies (thoracic/lumbar).
- Proximal half of femoral shaft.
- Proximal half of humerus.
- **Bone cyst of a long bone.**

Generalized disorders

- **Senile osteoporosis**

Common sites

- Thoracic or lumbar vertebral body.
- Neck or trochanteric region of femur.
- **Paget's disease of bone:** Common sites
- **Shaft of tibia or femur.**

Treatment

Conservative treatment has little role in the treatment of pathological fractures. The treatment recommended is open reduction, rigid internal fixation with or without cement and bone grafting. The aim is to obtain quick union and mobilize the patient early. Pathological fractures due to Paget's disease, osteogenesis imperfecta, etc. unite in the usual time, fractures due to osteomyelitis, bone cyst unite late but fractures due to malignancy, metastasis do not unite at all though union is possible after chemotherapy or radiotherapy.

FATIGUE OR STRESS FRACTURES

Fatigue or stress fractures occur due to repeated stress or minor trauma to a particular bone usually on the lower limbs. There is no single specific causative injury as in a traumatic fracture. The onset of pain is gradual or insidious. Activity increases the pain and rest relieves it. On examination, there is significant local tenderness, thickening of bone, local swelling, etc.

Radiology

Radiograph of the part at first may not reveal any fractures but may be seen after 3 to 4 weeks. The fracture itself will be hairline, transverse and undisplaced. More striking than the fracture is a zone of callus that surrounds it.

Treatment

Stress fractures usually heal by rest and support to the affected part.

QUICK FACTS: COMMON SITES

- Second metatarsal bone, e.g. March fracture (due to repeated marching as in soldiers).
- Tibia or fibula—repeated running or dancing.
- Femur—occasionally.

RADIOLOGY

- First week—usually no fracture is detected.
- Second/Third week—faint hairline fracture, transverse/undisplaced.
- Zone of callus that surrounds the fracture is more significant than the fracture itself.

Treatment is by rest

INTERESTING FACTS OF ATYPICAL FRACTURE

- **Greenstick fracture:** Occurs in children.
- **Torus fracture:** Buckling of outer cortex in children.
- **Stress fracture:** Common in athletes.
- **Fatigue fracture:** In occupations like police, nurse.
- **Pathological fracture:** Usually seen in elderly people.
- **Hairline or crack fracture:** A special category of incomplete fracture.

After this initial aid, once you are sure that the patient's vital organs are stable, proceed to carry out examination of other parts of the body.

EXAMINATION OF VITAL STRUCTURES

Head Injuries

Examine the patient for head injuries. Cover the skull injuries with a clean cloth, and examine pupils and the level of consciousness.

Chest Injuries

Open chest injuries are dangerous as they may cause tension pneumothorax. Application of a clean cloth with firm pressure over the open wounds is required.

Abdominal Injuries

All injured patients should be examined for intra-abdominal injuries under emergency. Board-like rigid abdomen suggests blunt injury abdomen and there could be damage to liver, spleen, colon, etc. Arrangement should be made to shift the patient immediately to a hospital. In open wounds of the abdomen, firm pressure should be applied by a clean cloth.

Pelvic Fractures

Suspect pelvic fracture if the patient complains of pain during compression test or distraction test which is performed by applying pressure over the iliac bones. Tenderness over the symphysis pubis is also suggestive.

Injuries to the Genitourinary System

Suprapubic swelling indicates bladder injury, injury to the scrotum or perineal hematoma indicates urethral rupture.

Spine Injuries

Cervical spine injury should be suspected if the patient is lying still and loathes turning the neck. Injuries to the thoracic and lumbar spine should be suspected if the patient has developed paraplegia or complains of pain when individual spinous processes are palpated. Extreme care should be exercised in managing and shifting a patient with spinal injuries.

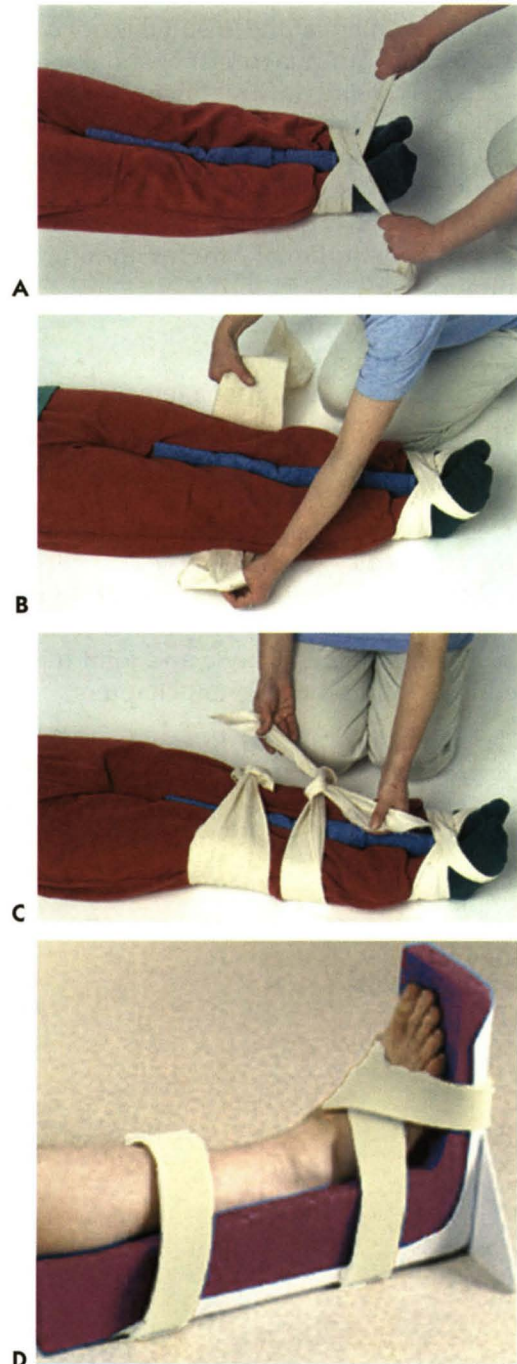
Fractures

Deformity, pain, swelling, loss of function of a limb are suggestive of fracture. Fracture needs to be splinted with whatever material is available at the scene of accident. The effective first aid measures during a bone and joint injuries are:

- Sling, strapping, etc. for clavicle and upper limb injuries.

- Splinting the injured limb with make shift or regular splints or using patient's own body (Figs 4.4A to D) at the scene of accidents.
- Rest to the patient
- Limb elevation
- Firm compression bandage
- Cold sponging
- Providing pain killers

They can be managed effectively after shifting the patient to the hospital.



Figs 4.4A to D: Splinting of injured limbs by using patient's own body part

6

Management of Open Fractures and Polytrauma

Introduction
Mechanism
Approach
Management
Complications

INTRODUCTION

Open fracture is a surgical emergency and presents as a problem which is much more difficult than closed fractures. It is defined as 'a fracture which communicates with the external atmosphere due to break in the soft tissue cover'. Open fractures 'open' up the possibility of 'infections' and 'closes' the options of internal fixations and plasters. It thus throws an 'open' challenge to the treating orthopedic surgeons in managing them. These fractures are also not 'open' for sound union and end mostly maluniting or nonuniting!

Mechanism of injury

Open fractures commonly occur due to high velocity RTA's violent falls, gunshot injuries crush injuries, etc. Tibia due to its subcutaneous location is notoriously susceptible for open fractures (Fig. 6.1).

Gustillo and Anderson's Classification

- *Type I:* Wound is less than 1 cm in size. It is usually due to a low-velocity trauma (Fig. 6.2A).



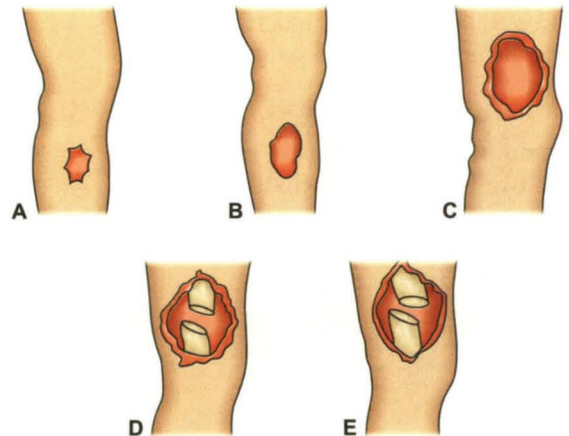
Fig. 6.1: Bumper injuries in RTA commonly cause open femur and tibia fracture.

- *Type II:* Wound is more than 1 cm and less than 10 cm but there is no devitalization of soft tissue and is associated with very little contamination (Fig. 6.2B).
- *Type III:* Wounds moderate and severe in size (> 10 cm) and the soft tissues are devitalized and contaminated (Fig. 6.2C).
- *Type IIIA:* Extensive soft tissue injury but with adequate soft tissue to cover the fractured bone (Fig. 6.2D).
- *Type IIIB:* Extensive soft tissue damage and loss. Bone cannot be covered and is exposed to the atmosphere (Fig. 6.2E).
- *Type IIIC:* Compound fractures with arterial injuries.

APPROACH IN COMPOUND FRACTURES

Compound fractures are usually serious injuries and are due to high-velocity trauma. They may be associated with multisystem and multiskeletal injuries. The approach should be more cautious and the following protocol is recommended:

- *General physical examination:* This is of vital importance since the patient is usually in shock. Levels of consciousness, pulse, blood pressure, breathing, etc. should be recorded.
- *Examination of other systems:* Examinations should be carried out for head injury, neck and face injury, chest injury, blunt injury abdomen, pelvic fractures and spine fractures.



Figs 6.2A to E: Types of compound fractures: (A) type I (< 1 m), (B) type II (> 1 m), (C) type IIIA, (D) type IIIB, and (E) type IIIC

COMPARTMENTAL SYNDROME OF FOREARM

This is one of the most dreaded complications in orthopedics and ranges from mild ischemia to severe gangrene.

Definition

It is an ischemic necrosis of the structures contained within the volar compartment of the forearm (Fig. 8.3).

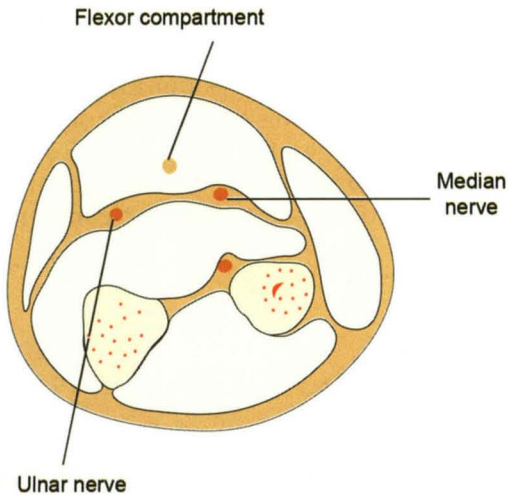


Fig. 8.3: Compartments of the forearm

Incidence and Etiology

It is common in children less than 10 years of age. Supracondylar fracture is the most common in children while crush injuries of the forearm are most common causes in adults. Occasionally fracture of both bones of forearm may be the cause. More recently intraarterial injections in drug addicts who lie on their forearm for prolonged periods in narcotized conditions are mooted to be a cause (Fig. 8.4). Improper application of splints is another important cause.



Fig. 8.4: Mechanism of compression of forearm in drug addicts

Pathophysiology

Usually the flexor muscles of the forearm, especially the flexor digitorum profundus and flexor pollicis longus and rarely flexor digitorum superficialis are involved.

External or internal constrictions → ↑ Arterial spasm or occlusion → Causes muscle ischemia → ↑ Capillary permeability → ↑ Intramuscular edema → ↑ Intramuscular pressure → Further arterial compromise → Muscle necrosis → Replaced by collagen → Contractures.

Pathology

An inelastic and unyielding deep fascia surrounds the forearm muscles. Rise in the intra-compartmental pressure due to any cause is not accommodated and the vessels are compressed resulting in muscle ischemia and consequent fibrosis.

Clinical Features

In the acute stages patient gives history of trauma and after an interval of few hours, severe, poorly localized pain develops in the forearm. The volar aspect of the forearm is swollen, red, warm, tender and tense. Fingers are held in flexion and attempt to extend the fingers, increase the pain (stretch pain) (Fig. 8.5). Peripheral pulses, which are present initially, disappear later. Median nerve is more commonly affected than the ulnar nerve. Impending acute Volkmann's ischemia is diagnosed by looking for the **6Ps** (See box).

Note: In compartment syndrome, patient complains of pain out of proportion to the injury.

Impending Volkmann's ischemia is detected by **6Ps**:

- **Pain**
- **Pallor**
- **Paraesthesia**
- **Paralysis**
- **Pulselessness**
- **Positive passive stretch test**

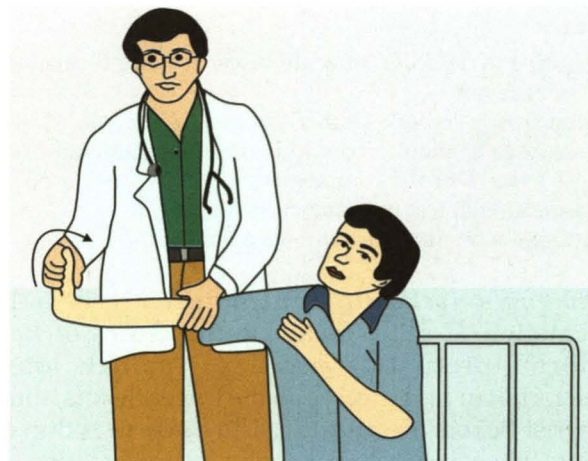


Fig. 8.5: Method of performing the passive stretch of fingers