Bone fractures

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Trauma and Orthopaedic surgery

fracture

is a break in the structural continuity of bone.

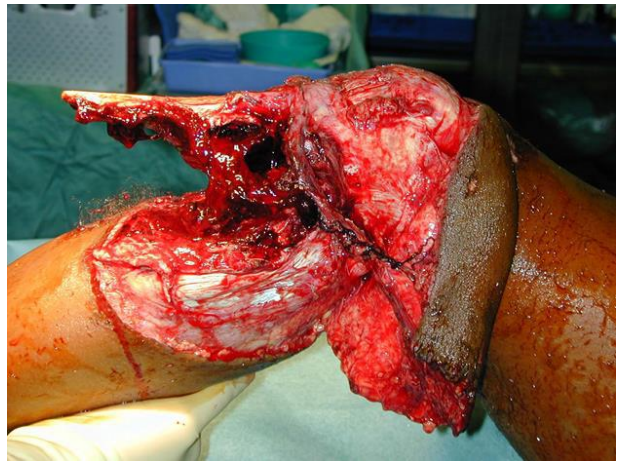
- It may be no more than a crack (incomplete)

Here the bone is incompletely divided and the periosteum remains in continuity. greenstick fracture the bone

- more often the break is complete and the bone fragments are displaced (complete).

*If the overlying skin remains intact it is a closed (or simple) fracture

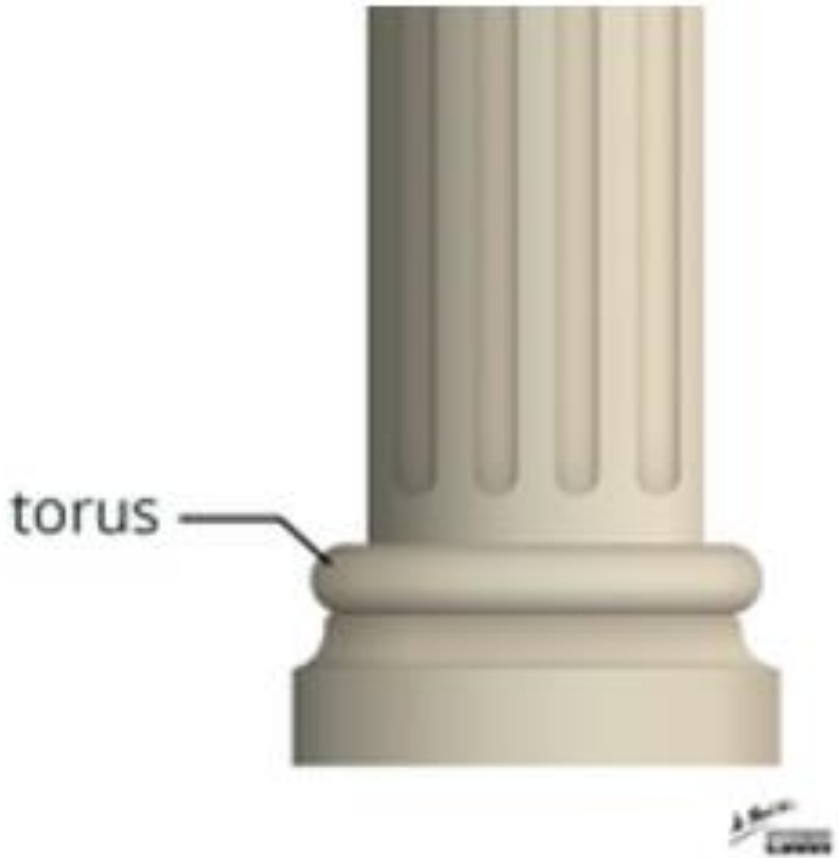
* if the skin is breached it is an open (or compound) fracture that's mean its liable to contamination and infection.



incomplete fractures
Bowing fractures

incomplete fractures

Torus fractures (buckle fractures)



incomplete fractures
greenstick fractures

Complete fractures

Can be classified as:

- Transverse: straight across the bone
- Oblique: oblique line across the bone
- Spiral: looks like a cork-screw
- Comminuted: more than 2 parts to the fracture

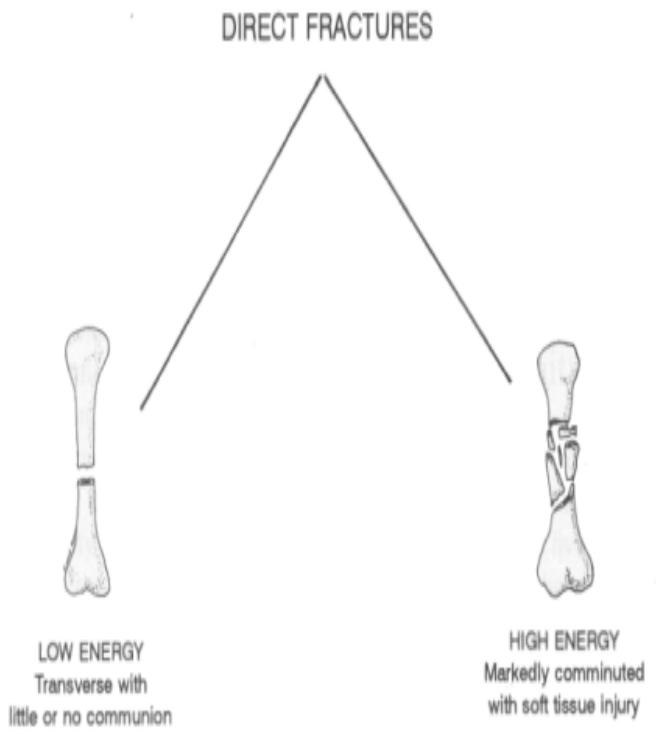
Mechanism of injury

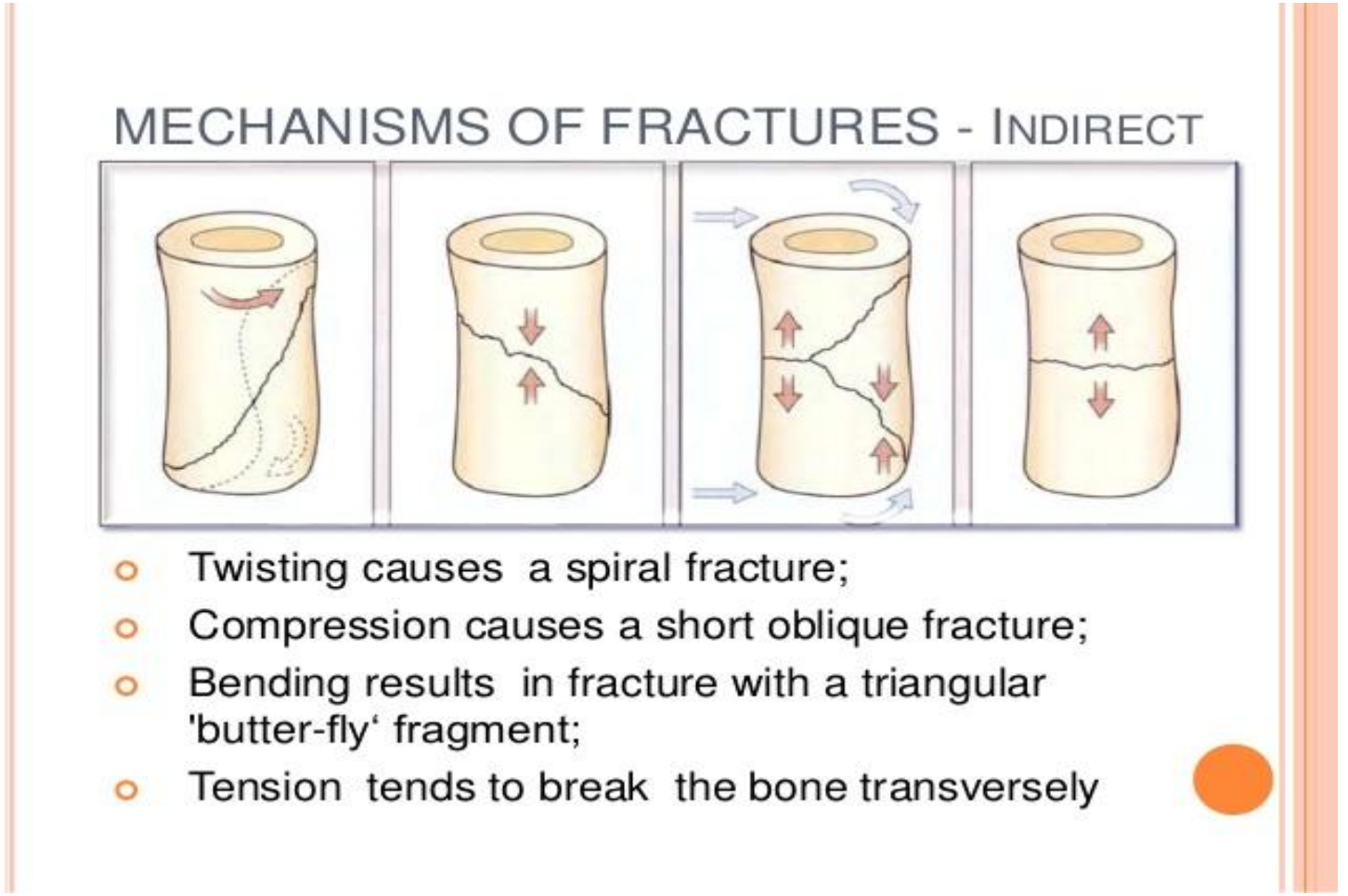
Most fractures are caused by sudden and excessive force, which may be direct or indirect.

* direct blow usually splits the bone transversely

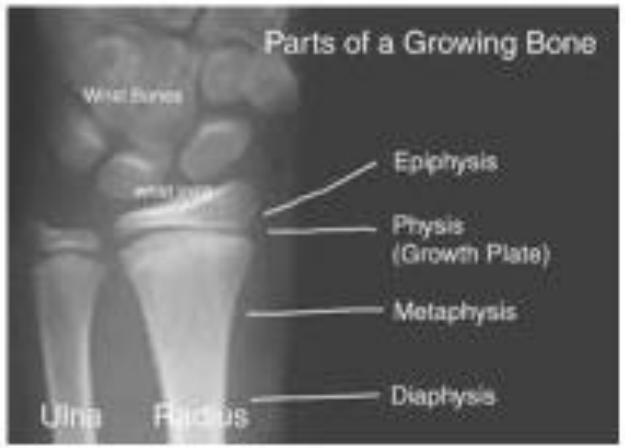
Damage to the overlying skin is common; the fracture pattern will be comminuted.

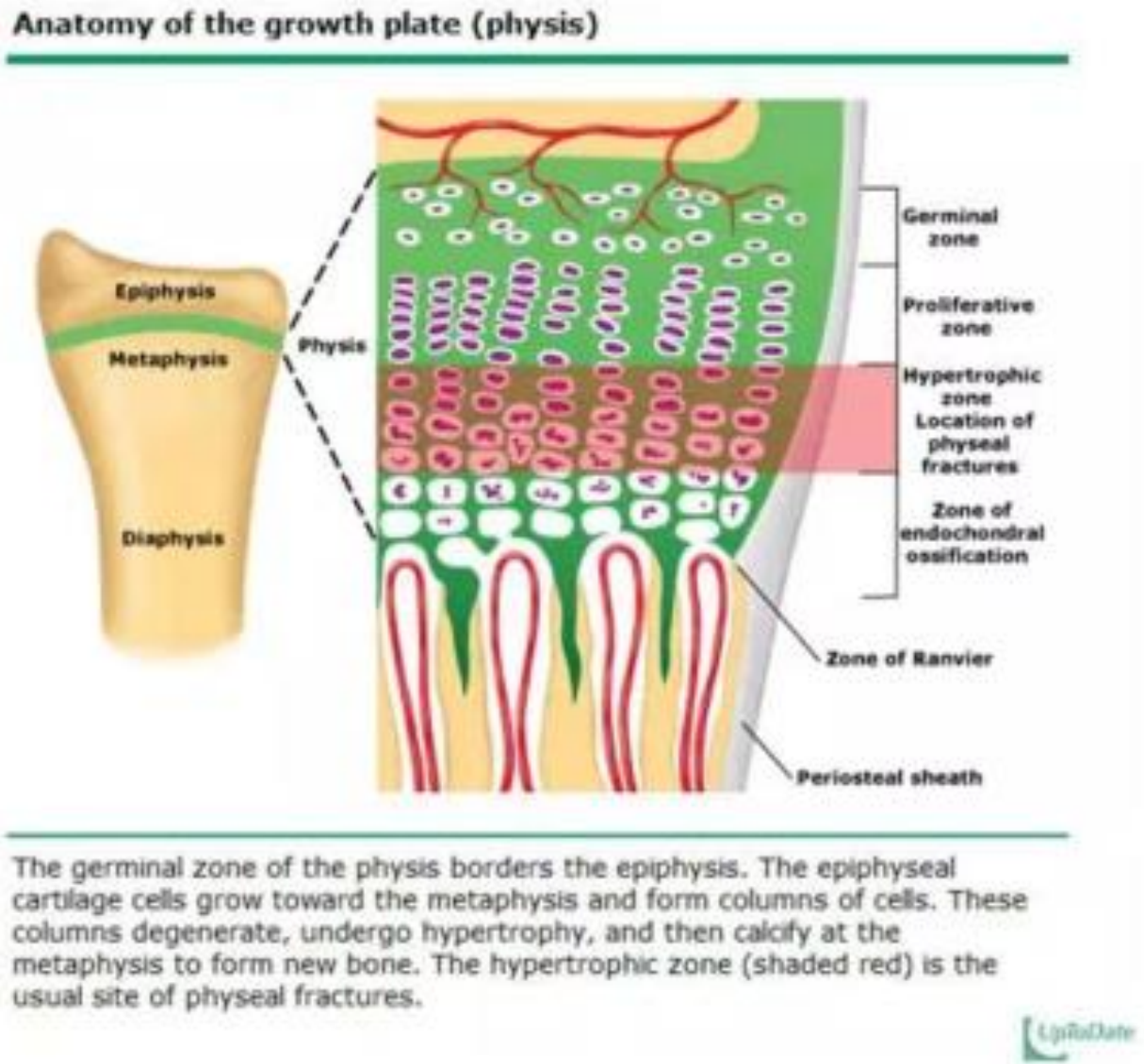
* indirect force the bone breaks at a distance from where the force is applied



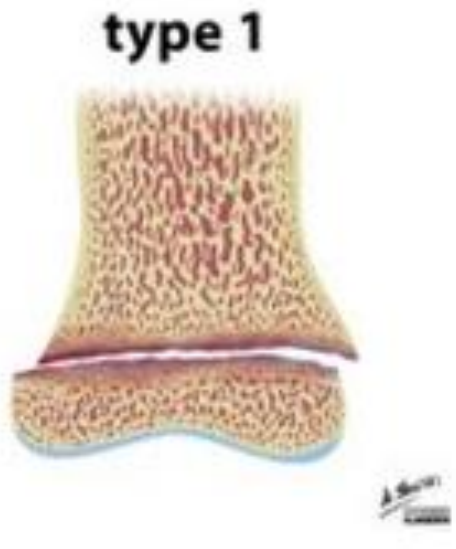


physeal plate





Salter-Harris fractures (physeal plate injuries)



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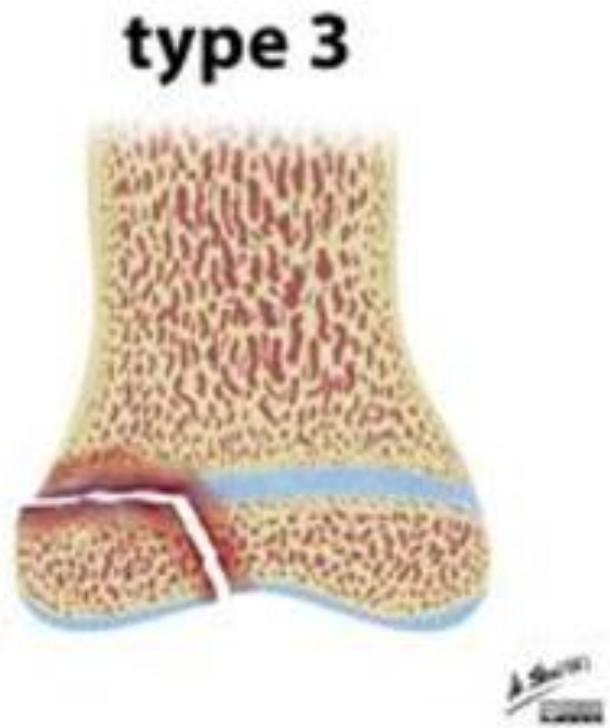

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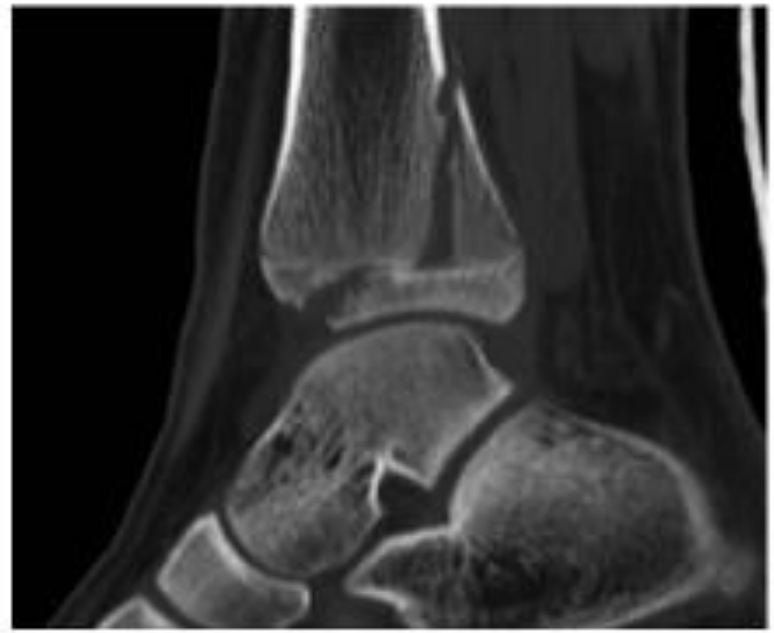


Salter-Harris fractures (physeal plate injuries)

type 5

HOW FRACTURES ARE DISPLACED

After a complete fracture the fragments usually become displaced,
*partly by the force of the injury
*partly by gravity and
*partly by the pull of muscles attached to them.

Displacement is usually described in terms of translation, alignment, rotation and altered length:

• Translation (shift) – The fragments may be shifted sideways, backward or forward in relation to each other, such that the fracture surfaces lose contact.

• Angulation (tilt) – The fragments may be tilted or angulated in relation to each other. Malalignment, if uncorrected, may lead to deformity of the limb.

• Rotation (twist) – One of the fragments may be twisted on its longitudinal axis; the bone looks straight but the limb ends up with a rotational deformity.

• Length – The fragments may be distracted and separated, or they may overlap, due to muscle spasm, causing shortening of the bone.

HOW FRACTURES HEAL

natural’ form of healing in tubular bones; in the absence of rigid fixation, it proceeds in five stages:

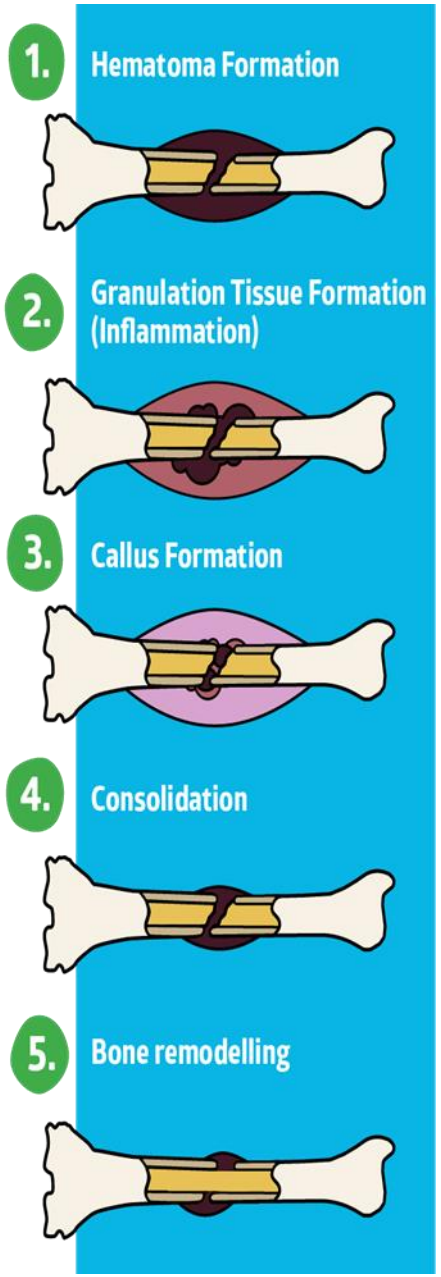
1-Haematoma formation

2-inflammation and cellular formation

3-callus formation

4-consolidation

5-remodelling



CLINICAL FEATURES

*There is usually a history of injury, followed by inability to use the injured limb.

*The patient's age and mechanism of injury are important. If a fracture occurs with trivial trauma, suspect a pathological lesion.

*Pain

GENERAL SIGNS

Follow the ABCs: look for,

Airway obstruction,
Breathing problems,
Circulatory problems and Cervical spine injury.

LOCAL SIGNS

Injured tissues must be handled gently. To elicit crepitus or abnormal movement is unnecessarily painful; **x-ray diagnosis is more reliable**.

X-RAY

X-ray examination is mandatory.

Remember the rule of twos:

- Two views –at least two views (anteroposterior and lateral) must be taken.
- Two joints – In the forearm or leg, one bone may be fractured and angulated. Angulation, however, is impossible unless the other bone is also broken, or a joint dislocated. The joints above and below the fracture must both be included on the x-ray films.
- Two limbs – In children, the appearance of immature epiphyses may confuse the diagnosis of a fracture; x-rays of the uninjured limb are needed for comparison.
- Two injuries – Severe force often causes injuries at more than one level. Thus, with fractures of the calcaneum or femur it is important to also x-ray the pelvis and spine.
- Two occasions – Some fractures are difficult to detect soon after injury, but another x-ray examination a week or two later may show the lesion. Common examples are

Undisplaced fractures of the distal end of the clavicle,
scaphoid,
femoral neck and
lateral malleolus,
stress fractures
physeal injuries wherever they occur.

Plain film radiography (x.ray)

Interpretation :

1. Patient. Name , age , date.
2. Region and views.
3. Soft tissues.
a. generalised changes
b. Localised changes
4. Bone.
a. generalised changes.
b. localised
5. joints. Articulating bones, joint space,erosion.

SPECIAL IMAGING

Sometimes the fracture – or the full extent of the fracture – is not apparent on the plain x-ray.

Computed tomography (CT) may be helpful in lesions of the spine or for complex joint fractures; indeed, these cross sectional images are essential for accurate visualization of fractures in ‘difficult’ sites such as the calcaneum or acetabulum.

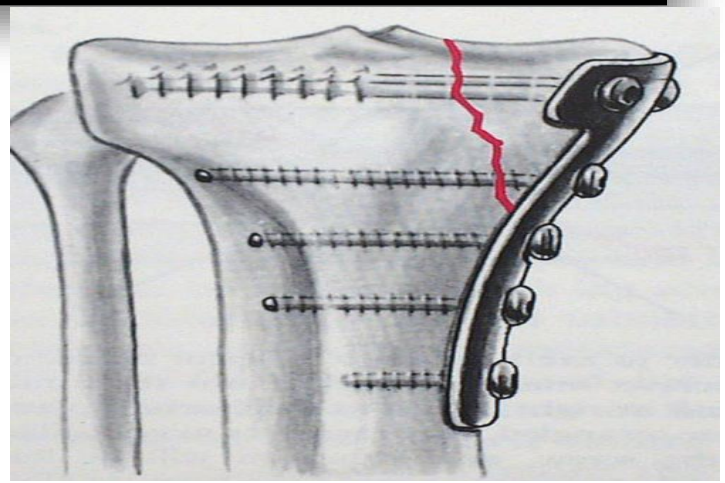
Magnetic resonance imaging (MRI) may be the only way of showing whether a fractured vertebra is threatening to compress the spinal cord.

Radioisotope scanning is helpful in diagnosing a suspected stress fracture or other undisplaced fractures.

TREATMENT OF CLOSED FRACTURES

- ***Reduce.***
- ***Hold.***
- ***Exercise.***

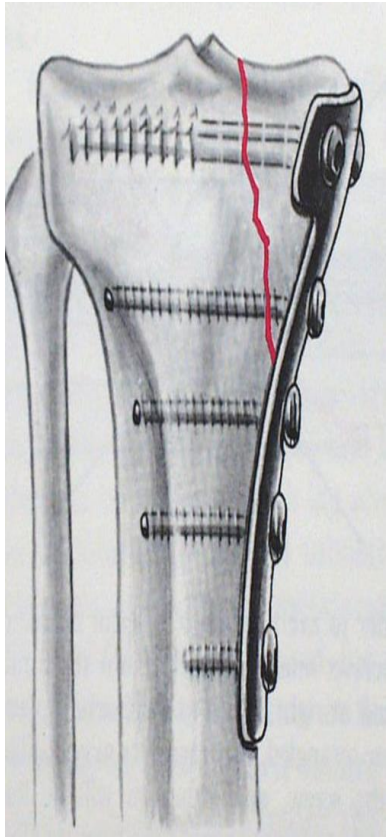
Reduce aim for adequate apposition and normal alignment of the bone fragments. Closed or open

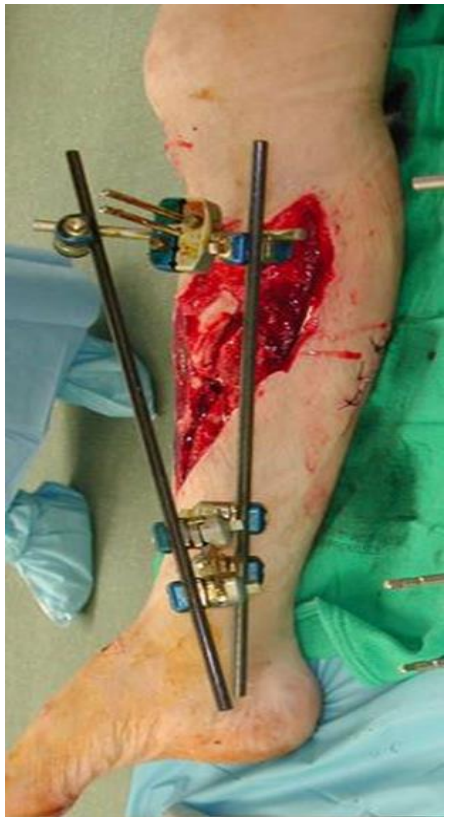


Hold

The available methods of holding reduction are:

- Continuous traction.
- Cast splintage.
- Functional bracing.
- Internal fixation.
- External fixation.





Complication of fractures:

General complications:

1-Bleeding hypovolaemic shock.?
2-fat embolism?
3-cardiorespiratory failure?
4-DVT and pulmonary Embolism.?
5-Multiple organ failure or dysfunction syndrome (MODS).?
6-crush syndrome?
7-tetanus?

LATE COMPLICATIONS

DELAYED UNION

NON-UNION

MALUNION

GROWTH DISTURBANCE

DELAYED UNION

- Fracture takes more than the usual time to unite.

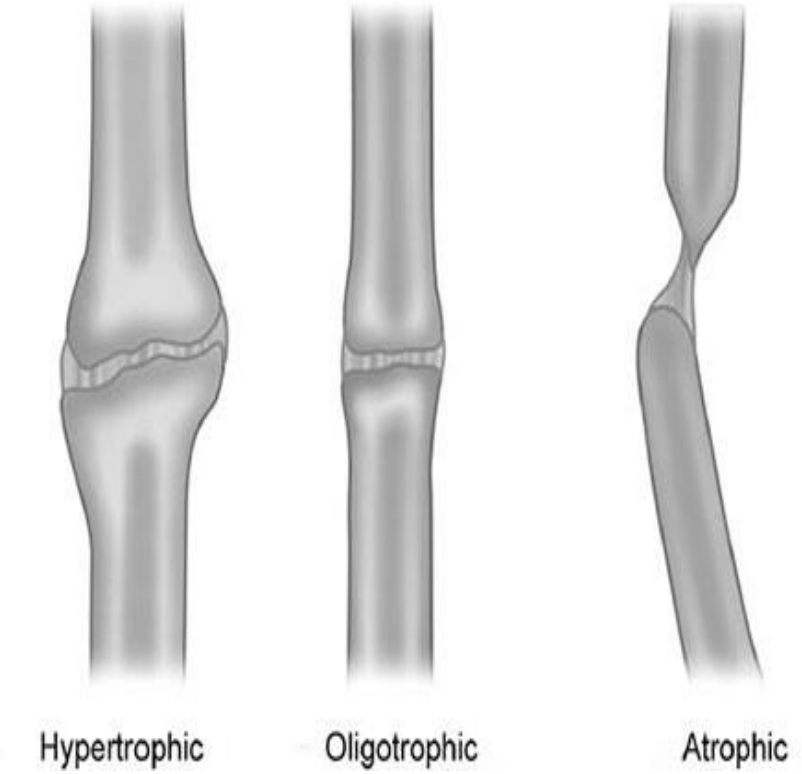
- Causes
  - Inadequate blood supply
  - Severe soft tissue damage
  - Periosteal stripping
  - Excessive traction
  - Insufficient splintage
  - Infection

Nonunion

Causes When dealing with the problem of non-union, four questions must be addressed. They have given rise to the acronym CASS:

1. Contact – Was there sufficient contact between the fragments?
2. Alignment – Was the fracture adequately aligned, to reduce shear?
3. Stability – Was the fracture held with sufficient stability?
4. Stimulation – Was the fracture sufficiently ‘stimulated’? (e.g. by encouraging weight bearing).

There are, of course, also biological and patient related reasons that may lead to non union:
(1) poor soft tissues (from either the injury or surgery);
(2) local infection;
(3) associated drug abuse, anti-inflammatory or cytotoxic immunosuppressant medication and
(4) non-compliance on the part of the patient.



MALUNION

When the fragments join in an unsatisfactory position (unacceptable angulation, rotation or shortening) the fracture is said to be malunited.

Causes are

failure to reduce a fracture adequately,

failure to hold reduction

Pathalogical fractures

Stress fracture

An overuse injury where normal bone is subjected to repetitive stress, resulting in microfractures commonly seen in runners and military recruits
seen after change in training routine
Onset of symptoms often insidious
Symptoms initially worse with running, then may develop symptoms with daily activities
Physical exam: pain directly over fracture

Imaging

- Radiographs
  - recommended views
    - AP and lateral
  - findings
    - lateral xray may show "dreaded black line" anteriorly indic
      tension fracture from posterior muscle force
    - endosteal thickening
    - periosteal reaction with cortical thickening
- Technetium Tc 99m bone scan
  - findings
    - focal uptake in cortical and/or trabecular region
- MRI
  - replacing bone scan for diagnosis and is most sensitive
  - findings
    - marrow edema
    - earliest findings on T2-weighted images
      - periosteal high signal
    - T1-weighted images show linear zone of low signal

Clavicular fractures

These are common injuries in adults and children about 10% of all fractures. The majority of cases follow a fall on the shoulder.

Most fractures involve the middle third of the bone.

There is tenderness with visible and palpable deformity at the site of the fracture.

Clinical assessment should include an assessment of the neurovascular status of the upper limb. Virtually all of these fractures can be diagnosed with plain radiographs.

Shoulder injuries

Fractures and dislocations involving the proximal humerus and shoulder girdle are very common and affect all age groups.

There are three common injuries: Acromio-clavicular dislocation, glenohumeral dislocation and proximal humeral fractures.

PROXIMAL HUMERAL FRACTURES

It is the second most common fractured upper limb bone

They are most frequent in elderly female patients.

About 80% are undisplaced which can be treated conservatively.

Clinical examination reveals bruising and swelling of the shoulder.

HUMERAL SHAFT FRACTURES

Occur as a result of direct or indirect trauma applied to the upper arm. they are quite a frequent injury in elderly patients or alcohol abusers as a consequence of simple falls.

The radial nerve has a close relationship to the humeral diaphysis and radial nerve palsy occurs in 12% of distal third humeral fractures

The humerus has a good blood supply and the majority of these fractures will heal with non-operative treatment

Supracondylar fractures of the humerus

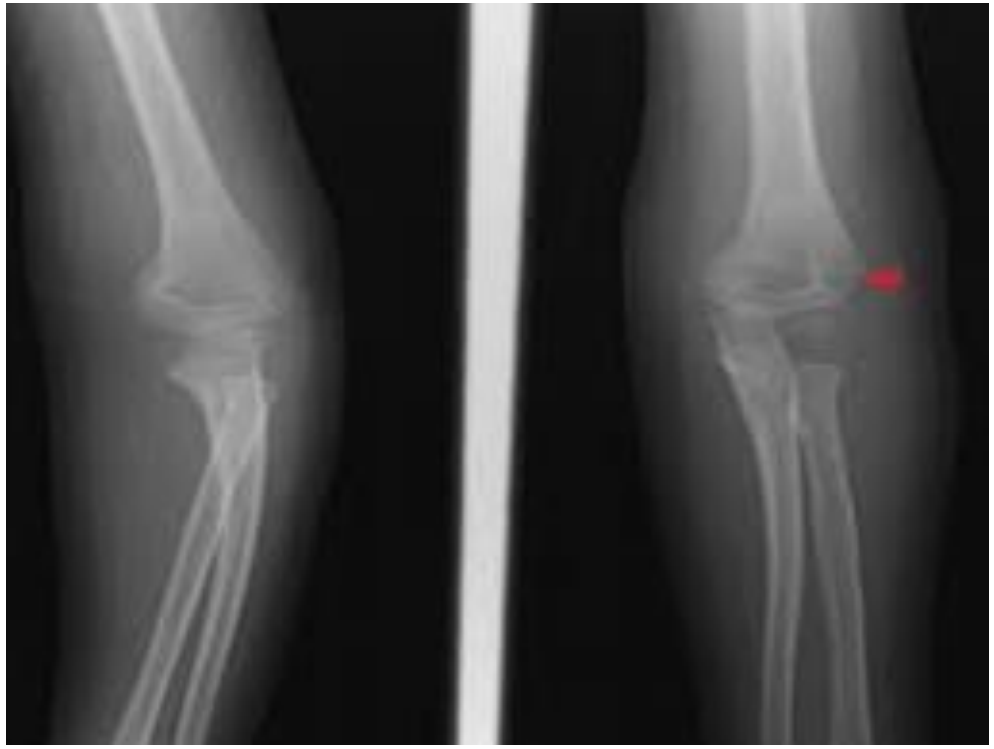
Are the commonest elbow injury in children aged 5-7 years and result from a fall onto the outstretched hand.

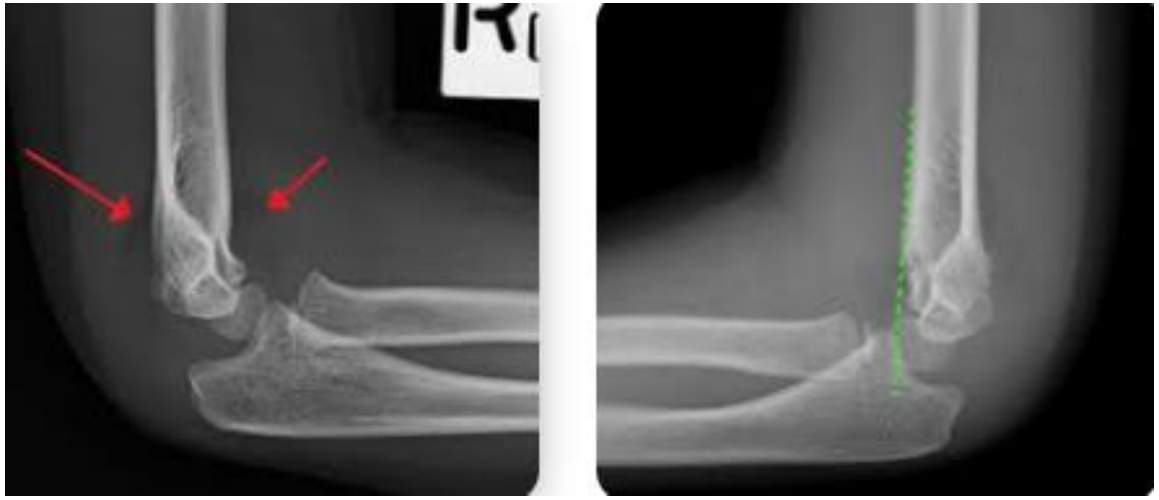
Pain & local tenderness in a swollen elbow.

Deformity may be obvious.

Distal neurovascular status might reveal a defecite.

XR findings: Lat.view : Posterior displacement, the distal fragment shifted &tilted backward. Anterior displacemt, the distal fragment is tilted forwards. AP view: (always difficult to do because of the pain) but if done it will reveal, lateral shift &tilt with medial rotation.





Olecranon fractures

Olecranon process is commonly fractured in falls on the elbow.

The triceps inserts onto the olecranon and this commonly results in distraction of the fracture.

Radial head and neck injuries

It is a common fracture in adult but rarely seen in children.

Cl/F: localised tenderness at the radial head, painful rotation of the forearm.

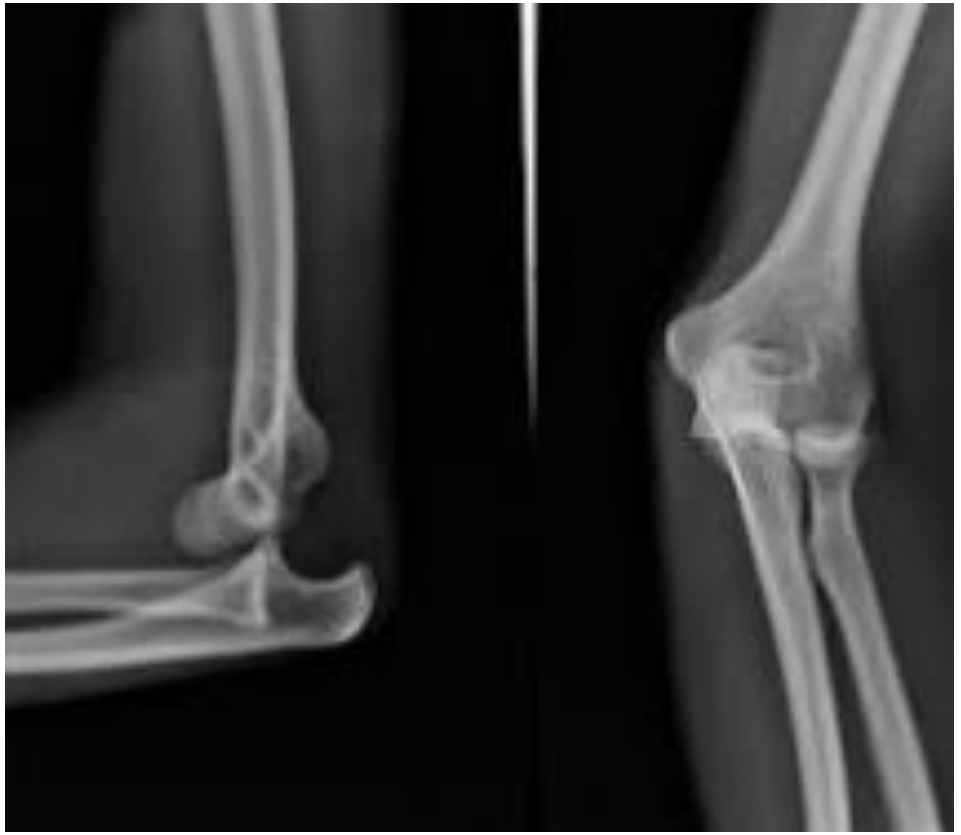
X-Ray: one or more fragments of radial head seen in the film none displaced or with some degree of displacement.

The wrist must be x-rayed also for any associated injury.

Elbow dislocations and fracture dislocations

The elbow may dislocate as a result of a fall on the outstretched hand with the elbow extended.

The olecranon and radial head dislocate in a posterolateral direction.



FRACTURES OF THE FOREARM

Single bone In children : Fractures of the forearm are very common injuries in children, but are much less common in adults.

Single bone fracture in Adult: Forearm fractures in adults are more often a consequence of high-energy trauma. Compartment syndrome is a well recognized complication.

Forearm fracture dislocation

Two patterns of forearm fracture dislocation occur and a known as the **Monteggia fracture dislocation and the Galeazzi fracture dislocation**. **The Monteggia** is the more common pattern and is characterized by an ulnar shaft fracture and a radial head dislocation.

The Galeazzi pattern is a radial shaft fracture and a dislocation of the distal radio-ulnar joint.

Good-quality radiographs including elbow and wrist joints are necessary in all forearm injuries to avoid missing associated dislocations at these joints.

Monteggia fracture

Galeazzi fracture

FRACTURES AT THE WRIST

Distal radial fractures are the most common fracture seen in clinical practice and are the consequence of a fall on the outstretched hand.

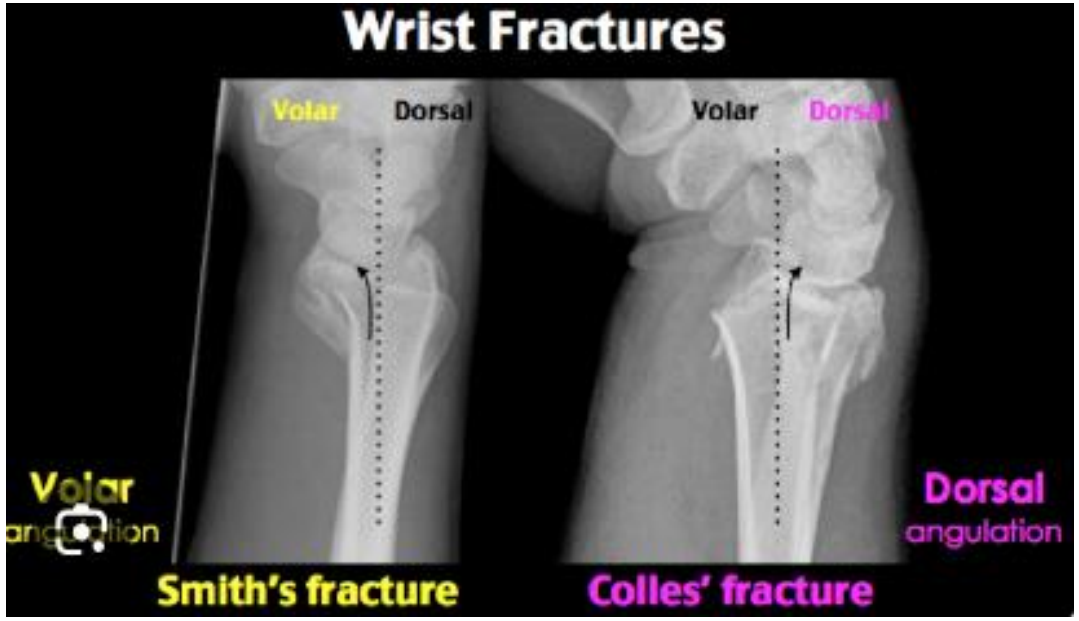
In adults these fractures are most commonly seen in older female patients and are often associated with osteoporosis.

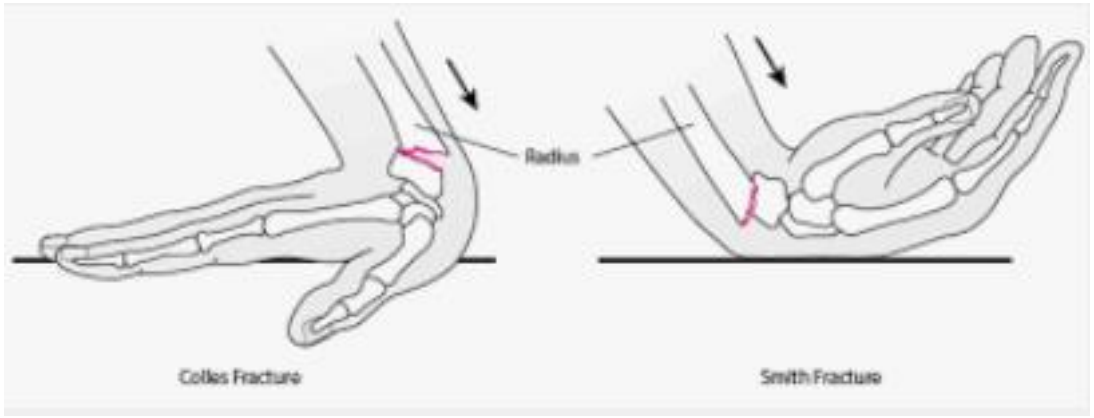
The most widely used term is

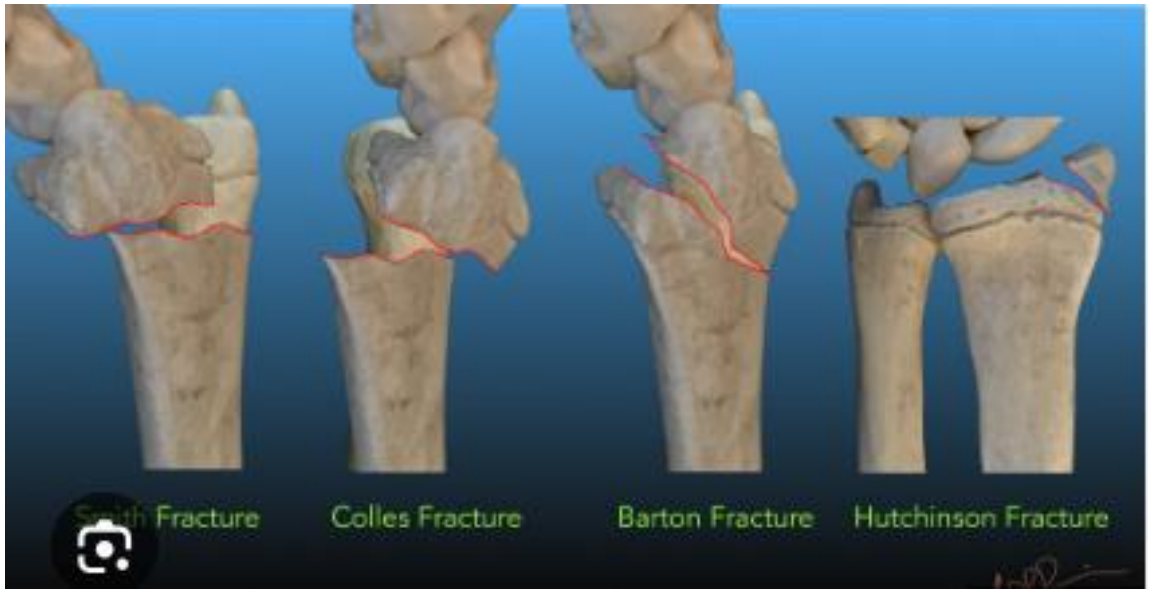
1- **Colles' fracture.** This refers to an extra-articular fracture of the distal radius with dorsal angulation, dorsal displacement and shortening.

2- **Smith's fracture** refers to an injury in a similar location but with volar displacement.

3-**Barton's fracture** refers to a partial articular fracture usually associated with volar displacement.


Wrist Fractures
Volar
Dorsal
Volar
Dorsal
Volar
Dorsal
angulation
Smith's fracture
Colles' fracture


Radius
Colles Fracture
Smith Fracture


Fracture
Colles Fracture
Barton Fracture
Hutchinson Fracture


Colle's Fracture
(Outward)
Smith's Fracture
(Inward)

Fractures of the scaphoid bone

are the commonest carpal bone fracture and typically affect young adult males.

The fracture may be difficult to pick up on standard AP and lateral views and two additional oblique 'scaphoid views' should be obtained as a routine when fracture is suspected.

The blood supply of the scaphoid enters distally and consequently avascular necrosis is a risk, particularly with proximal pole or displaced fractures.

Fractures of the metacarpals and phalanges

Fractures of the small bones of the hand are very common injuries.

Most hand fractures can be diagnosed without difficulty with radiographs. These need to include AP, oblique and true lateral views for a full assessment of the extent of injury and the need for treatment.

Bennett's fracture: In the case of the thumb metacarpal, a partial articular fracture at the base of the thumb meta-carpal is called a Bennett's fracture and is an unstable pattern of injury.