Complications of fractures

Complication Of Fractures

A) General complication:

1) Shock ,,
2) Respiratory distress syndrome
3) Fat embolism
4) Tetanus
5) Crush syndrome ,
6) Disseminated intra- vascular coagulation
7) Gas gangrene
8) Deep vein thrombosis (DVT)

Complications of Fractures

B) **Local complication**

1) Early complication

which happened within the first few hours or (3-7) days of injury which include:-

A-visceral injury .

B-nerve injury.

C- vascular injury .

D- compartment syndrome.

E- haemarthosis.

F- infection






2) Late bone complication

1-Delayed union .
2-Mal-union .
3-Non –union.
4-Complex regional pain syndrome.(CRPS)
5-Avascular necrosis.
6-Joint instability.
7-Growth disturbances.
8-Osteoarthritis.

3) Late soft tissue complication

1)Joint stiffness,
2)Muscle contractures
3)Heterotopic ossification (Myositis ossifican)
4)Nerve entrapment or nerve compression.
5)Tendon rupture.

General 1: **Shock**

Altered physiologic status with generalized inadequate tissue perfusion relative to metabolic requirements. → irreversible damage to vital organs

Cardiogenic	• direct injury to heart → effect the pump functions
Neurogenic	• injury to brain stem (vasomotor center) spinal cord → loss of sympathetic tone → increase venous capacitance → low venous return àlow cardiac output (but bradycardia)
Hypovolemic	• reduction of blood volume

1500-3000ml

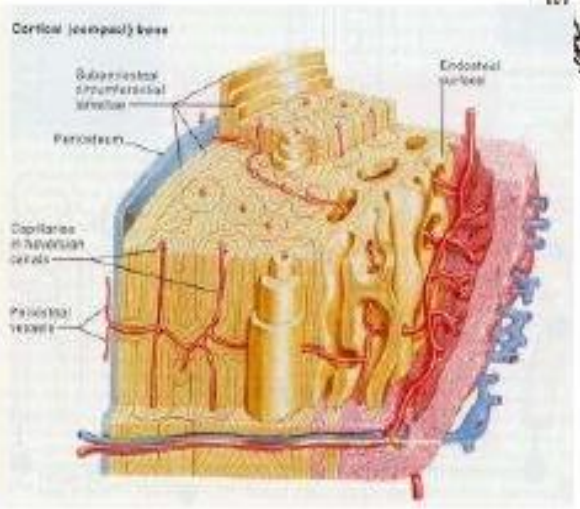
500-1000ml

1500-3000ml

100-300ml

1000-2000ml

1000-2000ml



VOLUME DISTRIBUTION

Shock :

-It can be caused by any injury or condition that affects the flow of blood through the body and can lead to multiple organ failure as well as life threatening complications (renal shutdown, metabolic acidosis, ARDS, intestinal ischemia & tissue hypoxia)

Treatment:

-IV fluid (CV line may need)

-CPR (not breath)

-O2 therapy

- Inotropic drugs

Signs & symptoms:

- rapid, weak, or absent pulse
- irregular heartbeat
- rapid, shallow breathing
- Lightheadedness
- cool, clammy skin
- dilated pupils
- lackluster eyes
- chest pain
- Nausea
- confusion
- decrease in urine
- thirst and dry mouth
- low blood sugar
- loss of consciousness
- Anxiety

Fat embolism

This is a relatively uncommon disorder that occurs in the first few days following trauma with a mortality rate of 10-20%.„Fat drops are thought to be released mechanically from bone marrow following fracture and form emboli in the pulmonary capillary beds and brain, with a secondary inflammatory reaction and platelet aggregation. …..An alternative theory suggests that free fatty acids are released as chylomicrons following hormonal changes due to trauma or sepsis. Fat Embolism Syndrome (FES) increases with number of fractures, but is also seen following severe burns, CPR, bone marrow transplant and liposuction.

Risk factors :- Closed fractures, Multiple fractures, Pulmonary contusion, Long bone/pelvis/rib fractures¨

Presentation ;-Sudden onset dyspnea , Hypoxia , Fever ,Confusion, coma, convulsions ,,Transient red-brown petechial rash affecting upper body, especially axilla ,chest , conjunctiva

Management

Supportive treatment oxygen therapy , Corticosteroid drugs (used in treatment, more controversial in prevention) ,,Surgical stabilization of fracture

General 7: Gas Gangrene

Rapid and extensive necrosis of the muscle accompanied by gas formation and systemic toxicity due to clostridium perfringens infection

Clinical Features

- sudden onset of pain localized to the infected area.
- swelling , edema
- +/- pyrexia
- profuse serous discharge with sweetish and mousy odor .
- Gas production

Management

- early diagnosis .
- surgical intervention and debridement are the mainstay of treatment.
- IV antibiotics
- fluid replacement.
- hyperbaric Oxygen

DVT Deep vein thrombosis

causes due,, to stasis of blood flow, endothelial damage, and hypercoagulabity of blood. It is precipitated by incorrectly applied cast, traction, local pressure on vein, prolonged bed rest, advanced age, and trauma..... usually happened in extensive prolong surgery eg. post- total knee- hip joint replacement ((45 - 75 %))

clinical features :- Have redness, tenderness, swelling, pitting edema....

prevention & Treatment by leg pumping, quadriceps exercises, frequent position change & Assessment Of the patient ,,

. For prevention Often use Lovenox (enoxaparin) low molecular weight heparin; given deep subcutaneous post-surgery & require routine monitoring of PT or PTT.

Early Complications

1. Visceral Injury
2. Vascular Injury
3. Compartment Syndromes
4. Nerve injury
5. Haemarthrosis
6. Infection

Early 1: **Visceral injury**

- Fractures around the trunk are often complicated by visceral injury.
  - E.g. **Rib fractures** → pneumothorax / spleen trauma / liver injuries.
  - E.g. **Pelvic injuries** → bladder or urethral rupture / severe hematoma in the retro-peritoneum .
- Rx: Surgery of visceral injuries

Case presentation :

A 16 years old male patient sustained a high velocity missal injury to the lateral aspect of the upper 1\3rd of the Rt. Thigh. Causing a compound comminuted fracture of the Rt. Femur + a penetrating wound to the U.Bladder. Ended with urinary fistula through the pins of the external fixation .

Early 2: **Vascular injury**

- Commonly associated with high-energy open fractures. They are rare but well-recognized.
- **Mechanism of injuries:**
  - The artery may be cut or torn.
  - Compressed by the fragment of bone.
  - normal appearance, with intimal detachment that lead to thrombus formation.
  - segment of artery may be in spasm.
  - It may cause
    - Transient diminution of blood flow
    - Profound ischaemia
    - Tissue death and gangrene

Early 2: **Vascular injury**

5P's of ischemia

- Pain
- Pallor
- Pulseless
- Paralysis
- Paraesthesia

X-ray: suggest high-risk fracture.
Angiogram should be performed to confirm diagnosis.

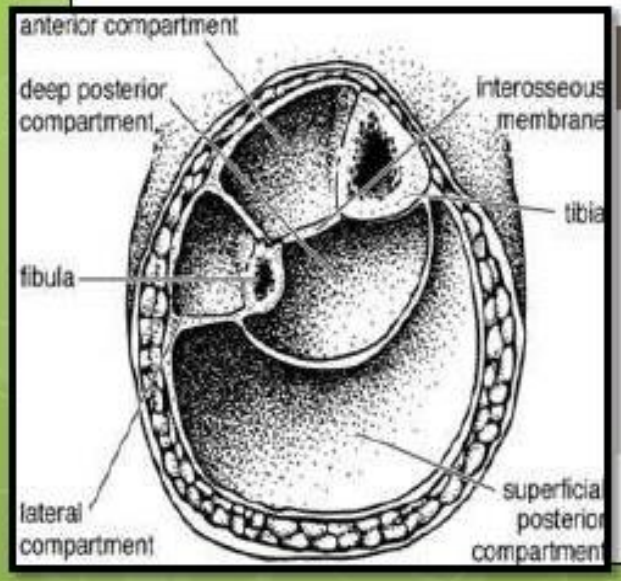
Early 2: **Vascular injury**

- muscle ischaemic is irrevesible after 6 hours.
  - **Remove** all bandages and splint & assess circulation
  - **Skeletal stabilization** – temporary external fixation.
  - Definitive **vascular repair**.
    - Vessel sutured
    - endarterectomy

Injury	Vessel
1st rib fracture	subclavian
Shoulder dislocation	Axillary
Humeral supracondylar fracture	Brachial
Elbow dislocation	Brachial
Pelvic fracture	Presacral and internal iliac
Femoral supracondylar fracture	Femoral
Knee dislocation	Popliteal
Proximal tibial fracture	Popliteal or its branches

Early 3: Compartment Syndrome

A condition in which increase in pressure within a closed fascial compartment leads to decreased tissue perfusion.
Untreated, progresses to tissue ischaemia and eventual necrosis



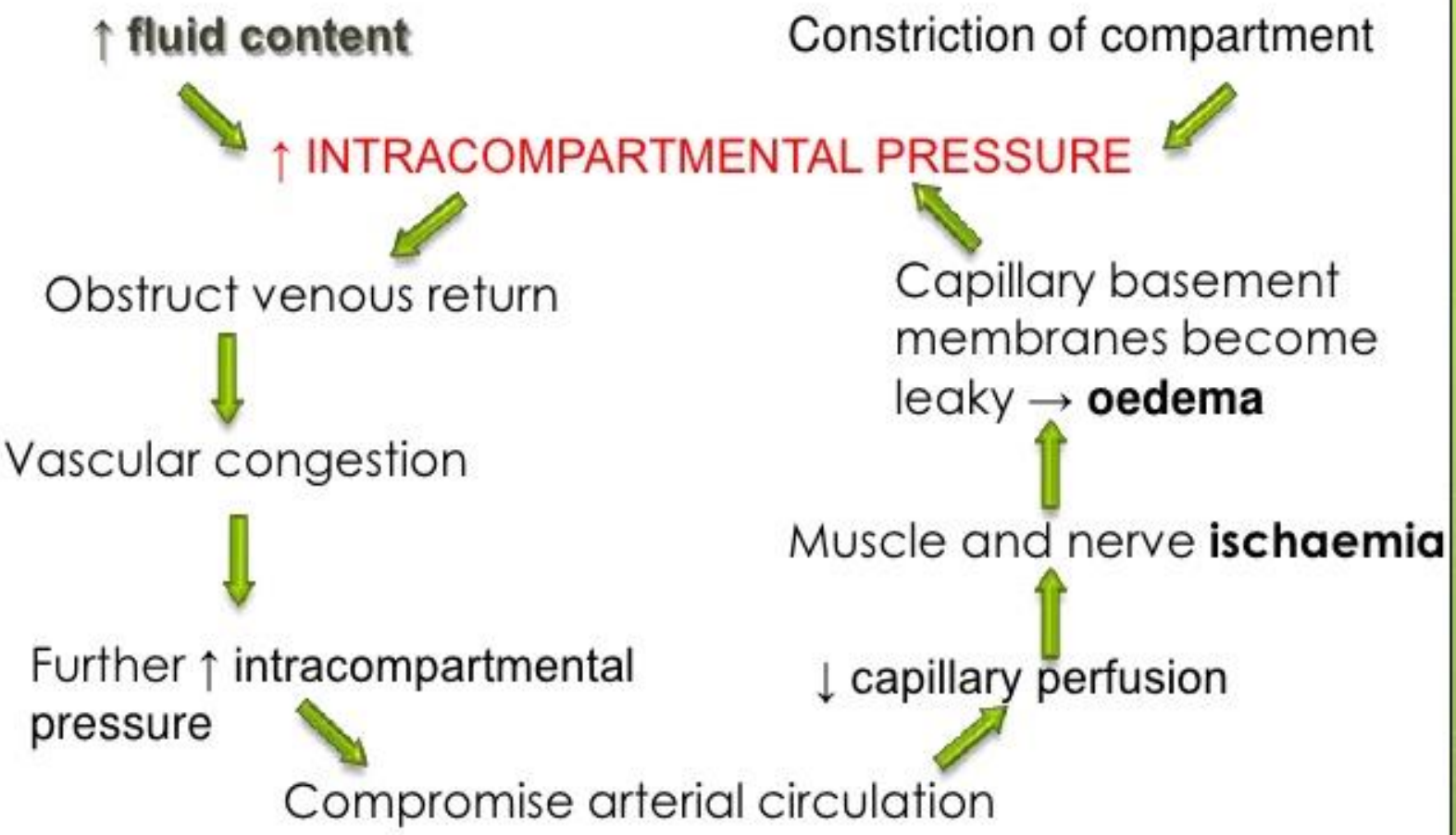
Leg	Forearm
•4 compartments: anterior, lateral, superficial and deep posterior •NOT interconnected	•3 compartments: dorsal, superficial and deep volar •interconnected, hence fasciotomy of 1 compartment may decompress the other 2

Early 3: **Compartment Syndrome**

- **Most common sites (in ↓ freq):** leg (after tibial fracture) → forearm → thigh → upper arm. Other sites: hand, foot, abdomen, gluteal and cervical regions.

- **High risk injuries:**
  - # of elbow, forearm bones, and proximal 3rd of tibia (30-70% after tibial #)
  - multiple fracture of the foot or hand
  - crush injuries
  - circumferential burns

Vicious cycle



A vicious circle that ends after 12 hours or less

Necrosis of the nerve and muscle within the compartment

Nerve
-capable to regenerate

Muscle
-infarcted

Never recover

Replaced by inelastic fibrous tissue
(Volkmann's ischaemic contracture)

Investigations of **compartment sydromes**

- **Intra-compartment Pressure Measurement (ICP)**
  - Use of slit catheter; quick and easy
  - Indications:
    - Unconscious patient
    - Those who are difficult to assess
    - Concomitant neurovascular injury
    - Equivocal symptoms

  - Especially long bone # in lower limb
  - Perform as soon as dx considered
  - > 40mmHg – urgent Rx! (normal 0 – 10 mmHg)

Management

- Measure intra-compartment pressure
  - **If > 40mmHg**
    - Immediate open fasciotomy
  - **If < 40mmHg**
    - Close observation and re-examine over next hour
    - If condition improve, repeated clinical evaluation until danger has passed

Don't wait for the obvious sings of ischemia to appear. If you suspect An impending compartment syndrome, start treatment straightaway

Fasciotomy

- Opening all 4 compartments
- Divide skin and deep fascia for the whole length of compartment
- Wound left open
- Inspect 5 days later
- If muscle necrosis, do debridement
- If healthy tissue, for delayed closure or skin grafting

Compartment syndromes

Fractures of the limbs can cause severe ischemia, even without damage to a major blood vessel. Bleeding or edema in an osteofascial compartment increases pressure within the compartment, reducing capillary flow and causing muscle ischaemia. A vicious circle develops of further oedema and pressure build-up, leading swiftly to muscle and nerve necrosis. Limb amputation may be required if untreated.

Compartment syndromes can also result from:

- Crush injuries caused by falling debris or from a patient's unconscious compression of their own limb.
- Swelling of a limb inside an over-tight cast.

Compartment syndrome can occur in any compartment, e.g. the hand, forearm, upper arm, abdomen, buttock, thigh, and leg. 40% occur following fracture of the shaft of the tibia (with an incidence of 1-10%) and about 14% following fracture of a forearm bone. Risk is highest in those under 35 years.[2]

Presentation

•Signs of ischaemia (5 P's: Pain, Paraesthesia, Pallor, Paralysis, Pulselessness) –
• but diagnosis should be made before all these features are present. *The presence of a pulse does not exclude the diagnosis*.
•Signs of raised intracompartmental pressure:
- · Swollen arm or leg
- · Tender muscle - calf or forearm pain on passive extension of digits
- · Pain out of proportion to injury
- · Redness, mottling and blisters

•Watch for signs of renal failure (low-output uraemia with acidosis)Where the diagnosis is uncertain, measure intracompartmental pressure directly. The pressure at which fasciotomy becomes mandatory is controversial.

Management

•Remove/relieve external pressures
•Prompt decompression of threatened compartments by open fasciotomy
•Debride any muscle necrosis
•Treat **hypovolaemic shock** and oliguria urgently
•Renal dialysis may be necessary

Complications

• **Acute renal failure** secondary to **rhabdomyolysis**
•DIC
• **Volkmann's contracture** (where infarcted muscle is replaced by inelastic fibrous tissue)

2)Late local bony complications

Late 1: **DELAYED UNION**

- Union of the upper limbs - 4-6 weeks
- Union of the lower limbs - 8-12 weeks(rough guide)
- Any prolong time taken is considered delayed

Late 1: DELAYED UNION

- Factors are either biological or biomechanical
- Biological :
  - Poor blood supply
    - Tear of periosteum, interruption of intramedullary circulation
    - Necrosis of surface# and healing process will take longer
  - Severe soft tissue damage
    - Most important factor
    - Longer time for bone healing due less inflammatory cell supply
  - Infection: bone lysis, tissue necrosis and pus
  - Periosteal stripping
    - Less blood circulation to bone

Late1: DELAYED UNION

- Clinical features:
  - Tenderness persist
  - Acute pain if bone is subjected to stress*

  (* ask pt to walk, move affected limb)

X RAYS -visible line# and very little callus formation/periosteal reaction

- bone ends are not sclerosed/ atrophic (it will eventually unite)

2)Non-union (Non-union consider if fracture healing doesn't occur in 6-9 months)

Non-union, delayed union, aseptic necrosis are major complications of fractures as in lower 1/3rd tibia ,# neck femur, # scaphoid bone…

CAUSES

1) increased motion at fracture site (in proper fixation) ,

2) poor nutrition, lack of approximation of bone ends,& devitalized tissue,

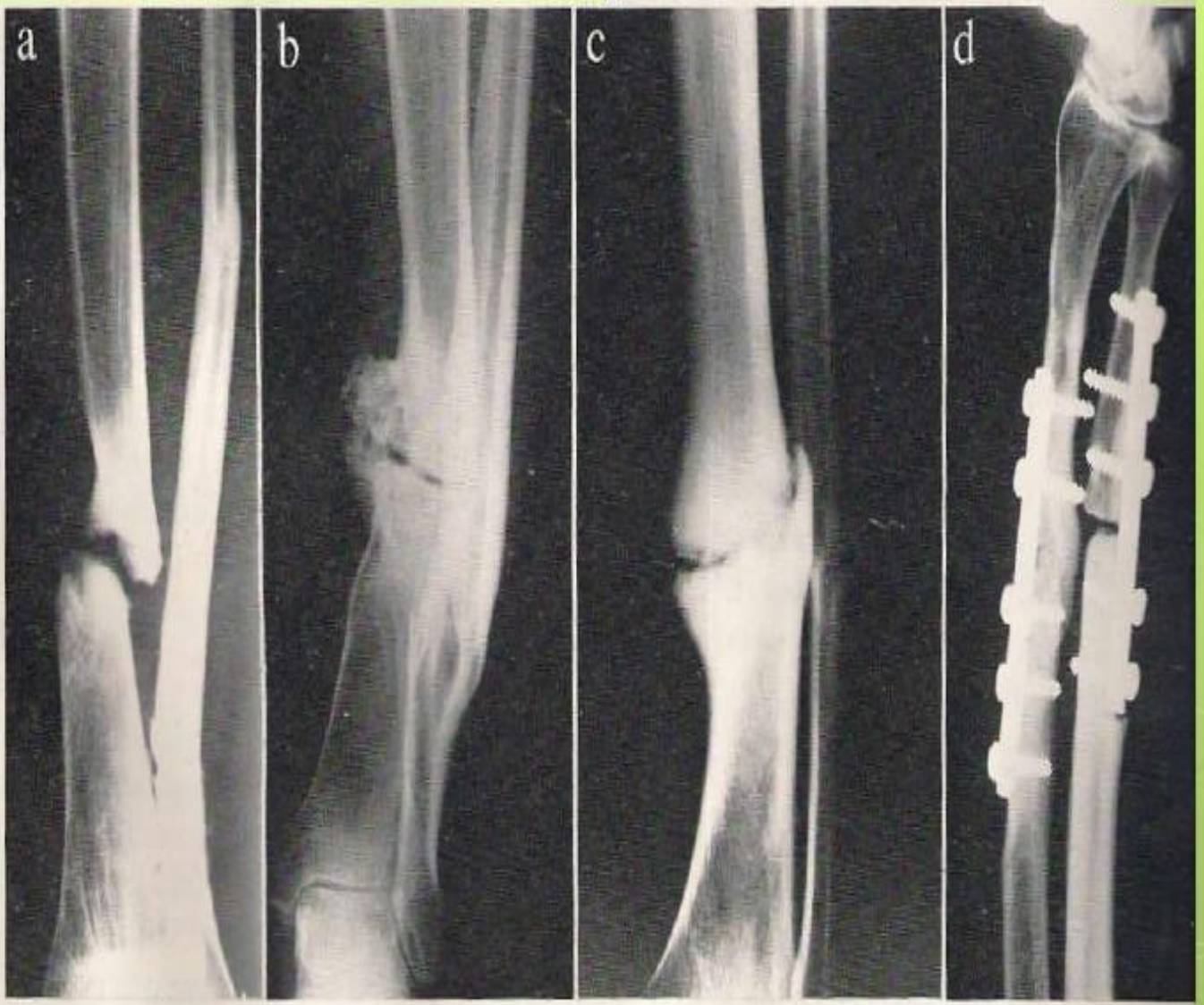
3)infection ,,,

4)presence of foreign body

5) intact flu bone

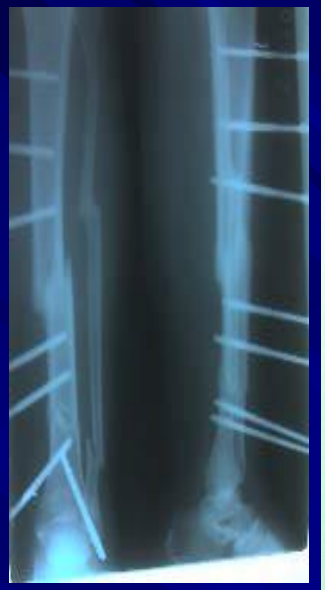
- clinical features there will be motion at the fracture site, called a "pseudoarthrosis". & it's obvious on X-ray examination

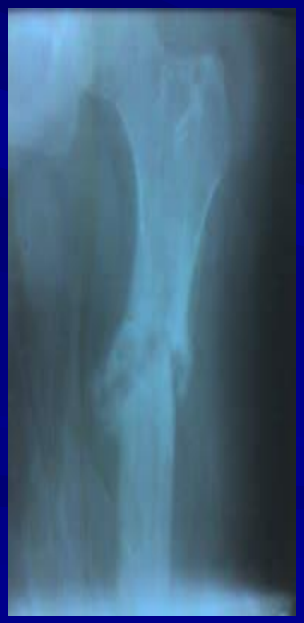
Treatment with bone graft, muscle flap. Re-attempt internal fixation, debridement of devitalized tissue and possible use of electrical bone stimulation.



22.33 Non-union (2) (a) Atrophic non-union – bone grafting is needed. (b) Hypertrophic non-union – fixation would probably suffice. (c) The so-called elephant's foot appearance – although partly hypertro fixation plus grafting would be wise. (d) This patient had atrophic non-union of both forearm bones – both plated, but grafts were added only to the radius and (predictably) it alone has united.





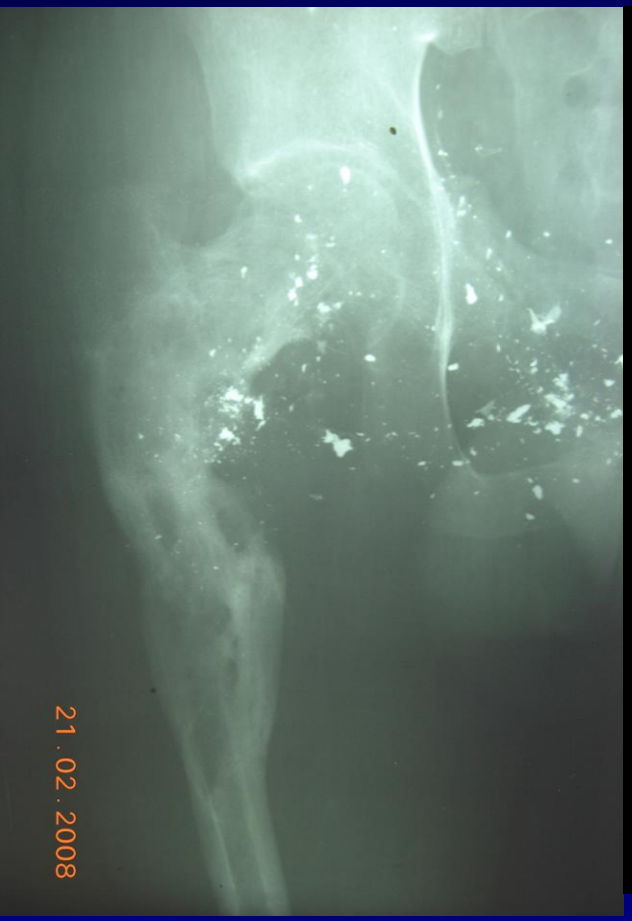




Late 3: **MALUNION**

fragments that are joined in an unsatisfactory position

- Factors:-
  - failure to reduce the fracture
  - failure to hold the reduction while healing proceed
  - gradual collapse of comminuted / osteoporotic bone

A malunited femur fracture with limitation of movement in both Rt. hip & knee joint





Complex regional pain syndrome (CRPS)

- also known as **reflex sympathetic dystrophy** (**RSD**), describes a painful conditions that are characterized by a continuing regional pain that is seemingly disproportionate in time or degree to the usual course of any known trauma or other lesion. Usually starting in a limb, it manifests as extreme pain, swelling, limited range of motion, and changes to the skin and bones.

X- ray: patchy osteoporosis.

Treatment:

- **Physical and occupational therapy.**
- **Pain relief.**
- **Sympathetic and somatic nerve blocks.**
- **Antidepressants and anticonvulsants.**
- **Transcutaneous electrical nerve stimulation .(TENS)**
- **Lidocaine and ketamine have been used.**

3) Late soft tissue complication

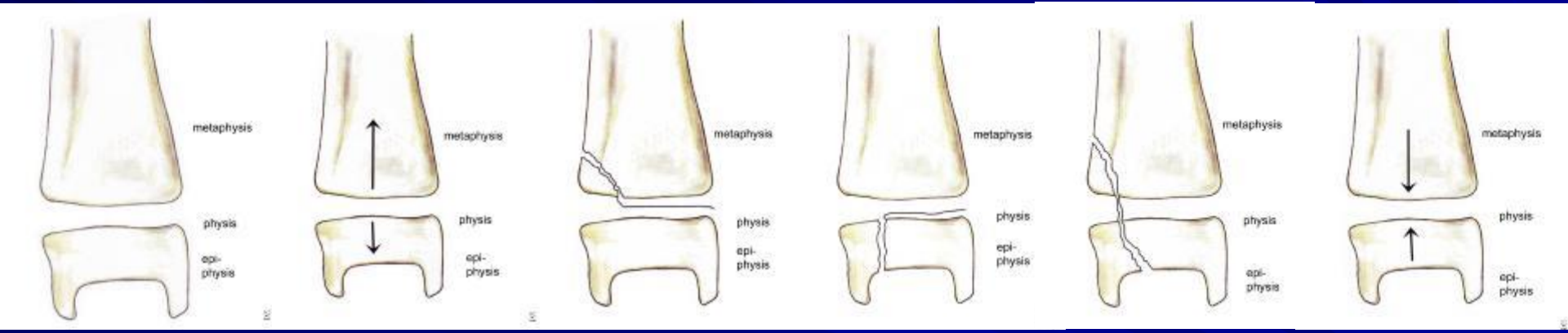
1) Joint stiffness,
2) Muscle contractures
3) Hetrophic ossification (Myositis ossifican)
4) Nerve entrapment
5) Tendon rupture.
6) Nerve compression

THE INJURIES OF THE PHYSIS

Special problems to children. They may cause growth abnormalities.
The children bones grow on their ends through an *epiphyseal plate* (also called ***physis)*** that lay down new bone in both directions towards the joint and that part is called ***epiphysis***, and toward the shaft and that part is called ***metaphysis***. The shaft itself is called ***diaphysis***.
The epiphyseal plate appears radiolucent on x ray because they are mainly of cartilage. This growing plate will stop growing, gradually ossifies and disappears around the time of skeletal maturity.
Each plate disappears at different time during life. Injuries and fractures at the region of epiphyseal plate carry the bad and serious complications of disturbing or stopping bone growth of all or part of the epiphysial plate giving rise later to shortness or deformities of the involved limb or joint.

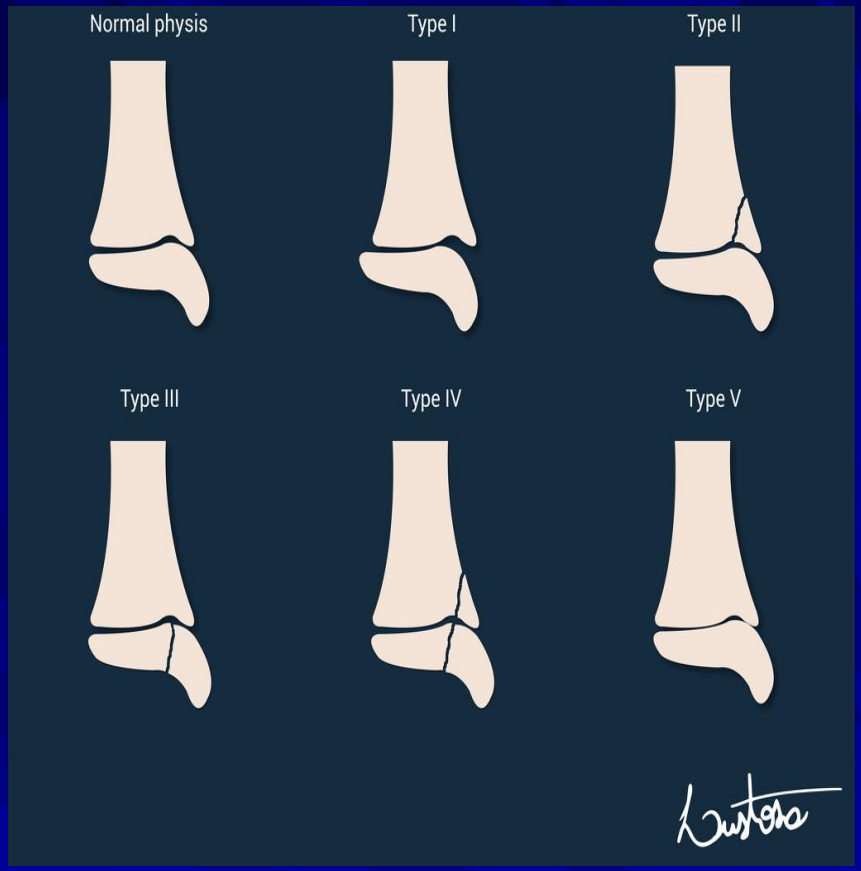
EPIPHYSEAL INJURIES (Salter-Harris Fractures) :

These are fractures through a growth plate; they are unique to pediatric patients. Several types of fractures have been categorized by the involvement of the physis, metaphysis, and epiphysis. The classification of the injury is important because it affects the treatment of patient and provides clues to possible long-term complications.



EPIPHYSEAL INJURIES

The classification of Salter-Harris fractures is used to describe the extent & site of the epiphyseal injuries



Type I

A type 1 fracture is a transverse fracture Through the hypertrophic zone of the physis. In this injury ,the width of the physis is increased or there will be a transverse separation of the physis from the metaphysis .The growing zone of the physis usually is not injured, and growth disturbance is uncommon .

On clinical examination the child has point tenderness at the which is suggestive of a type I fracture epiphyseal plate,

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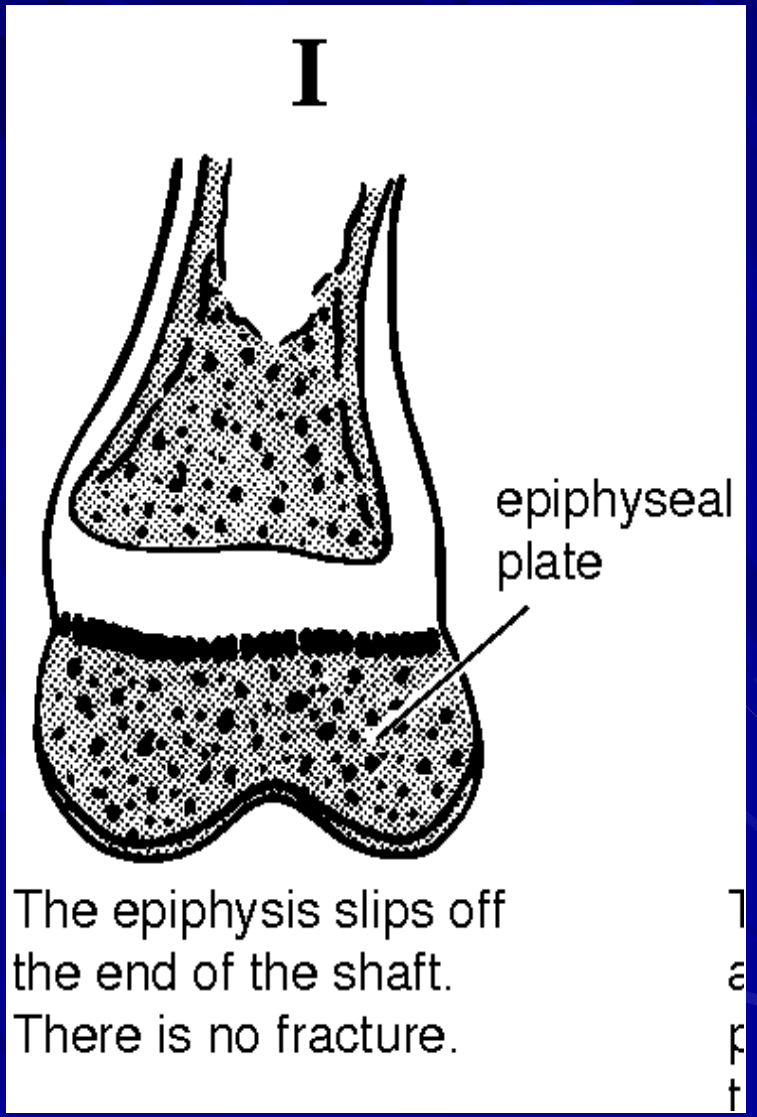
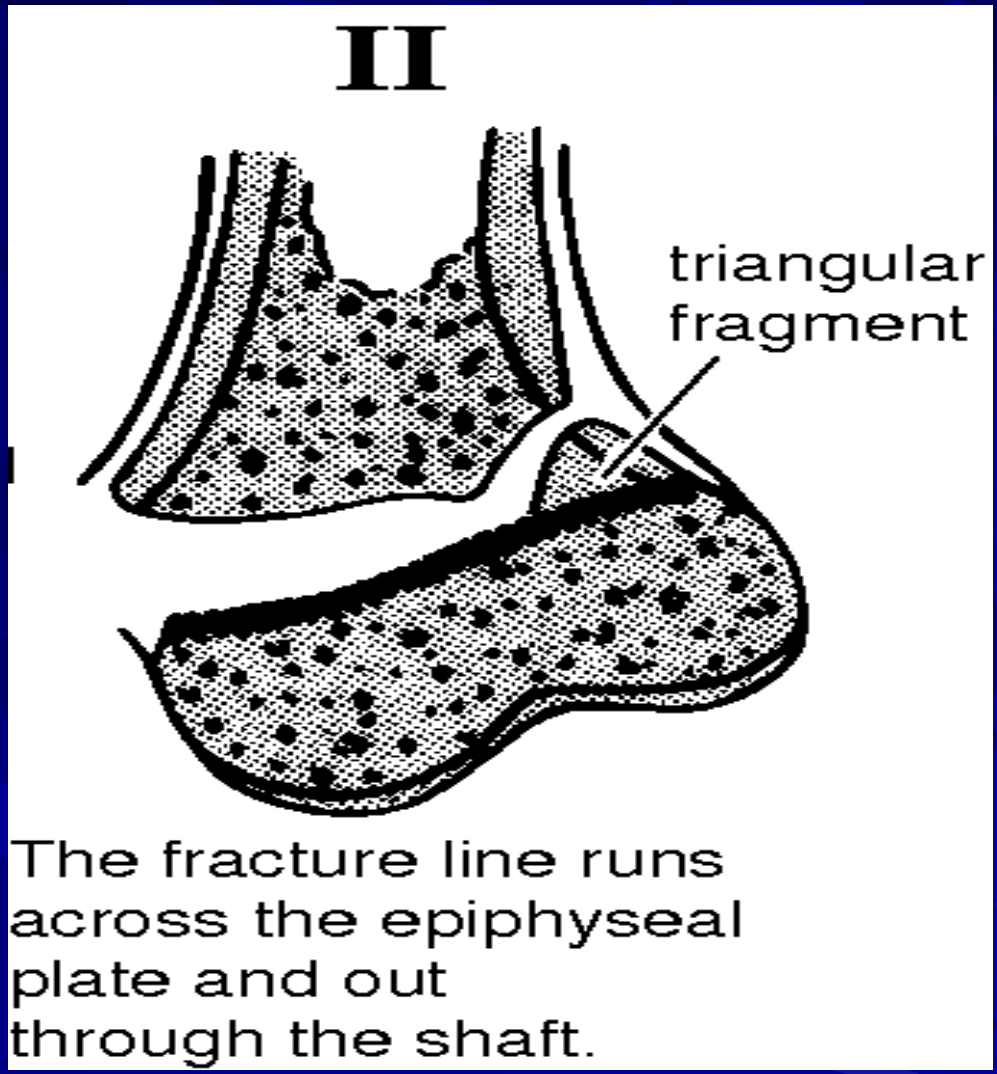


Type II

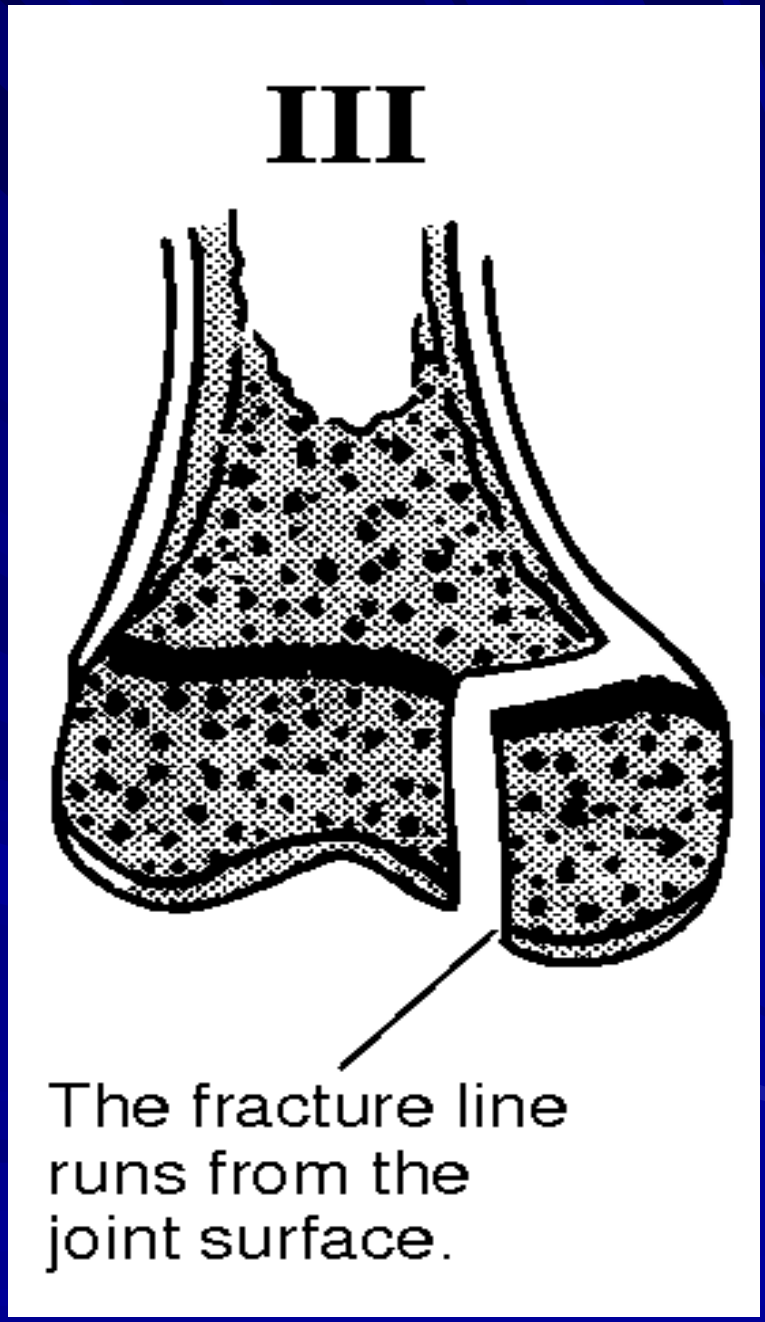
A type II fracture is a fracture through the physis and the metaphysis, but the epiphysis is not involved in the injury.

These fractures may cause minimal shortening, however the injuries rarely result in functional limitations **Type II is the most common type of Salter-Harris fracture**

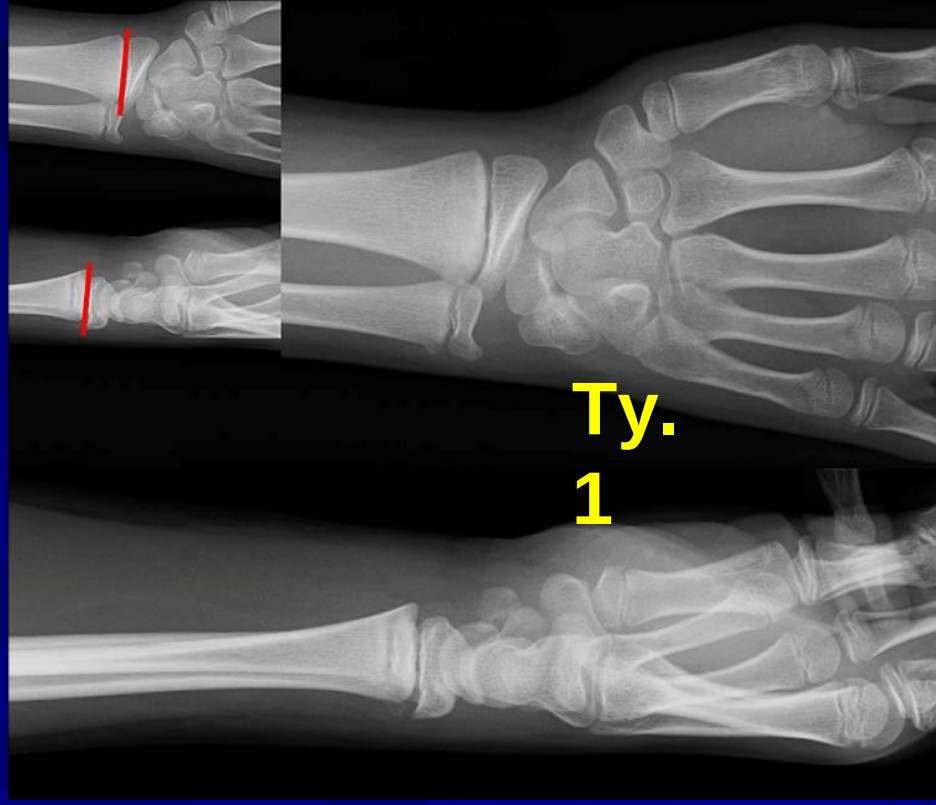


Type III

A type III fracture is a fracture through the physis and the epiphysis. This fracture passes through the hypertrophic layer of the physis and extends to split the epiphysis, inevitably damaging the reproductive layer of the physis.
This type of fracture is prone to chronic disability because by crossing the physis, the fracture extends into the articular surface of the bone.
However, type III fractures rarely result in significant deformity; therefore, they .have a relatively favorable prognosis The treatment for this fracture is often surgical



Ty. 2



Ty. 1

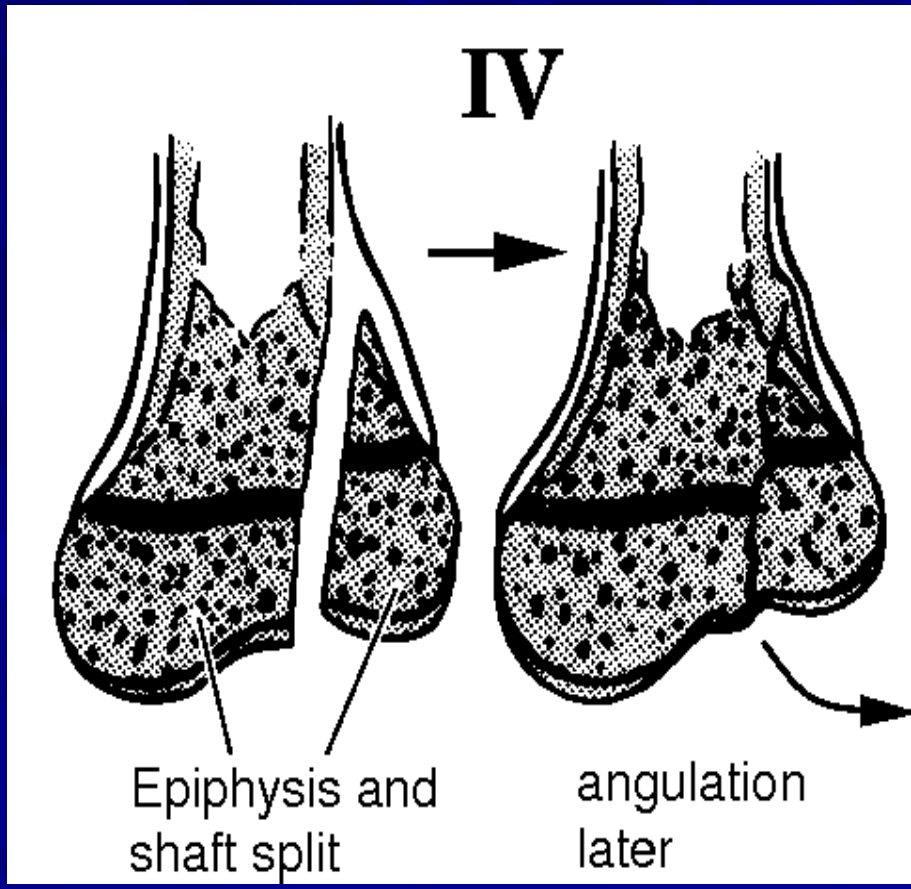
Ty. 3

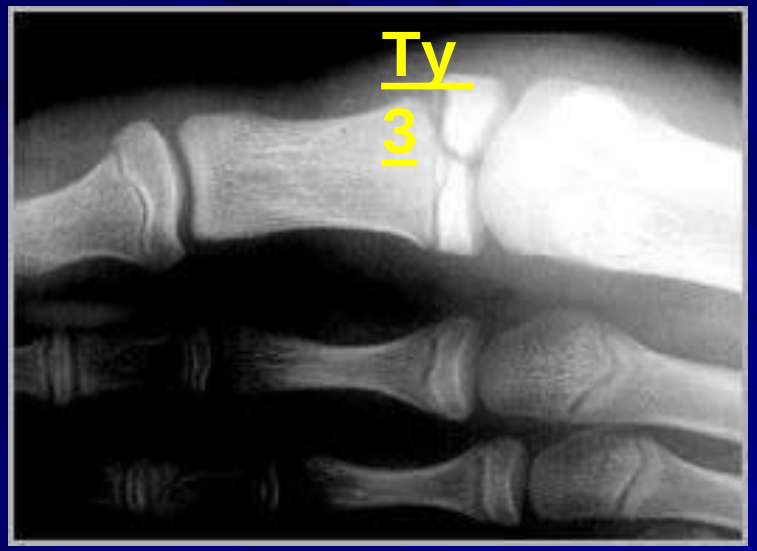
Type IV

fracture involves all 3 elements of the bone: The fracture passes through the epiphysis, physis, and metaphysis.

A type IV fracture is an intra-articular fracture; thus, it can result in chronic disability

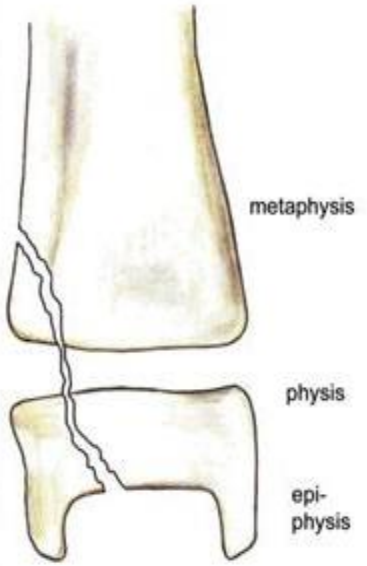
By interfering with the growing layer of cartilage cells, these fractures can cause premature focal fusion of the involved bone. Therefore, these injuries can cause deformity of the joint




Ty
3

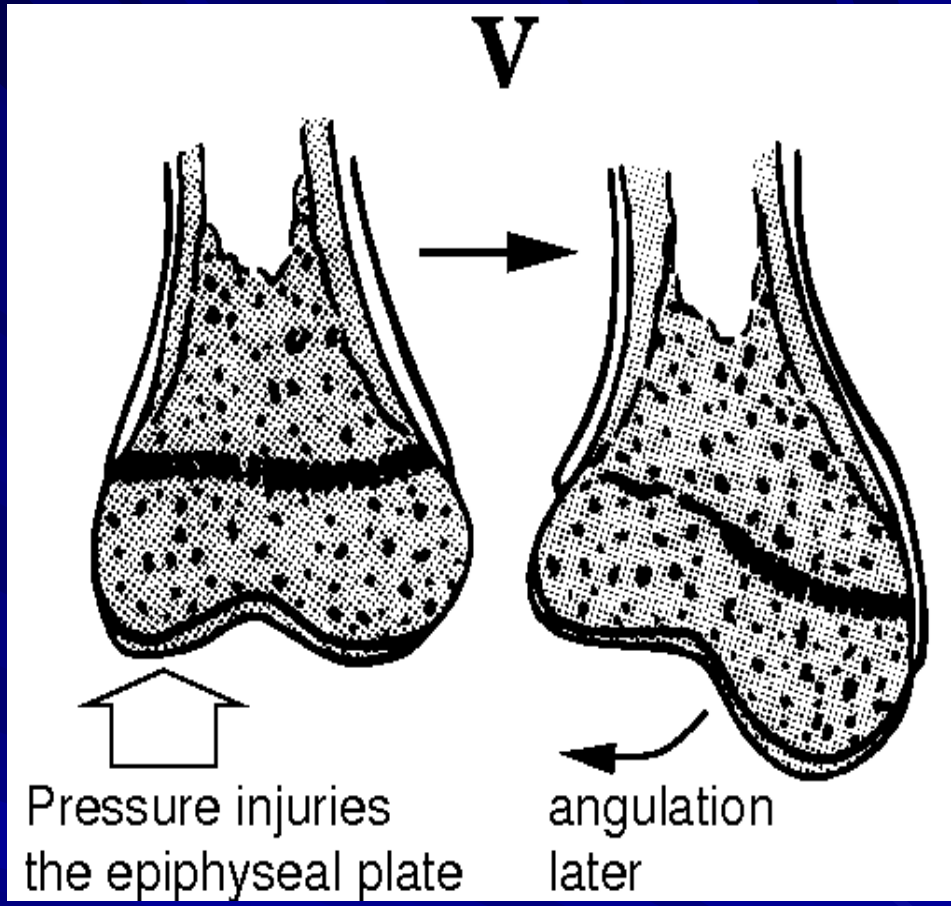

Ty 4


Salter-Harris IV


metaphysis
physis
epi-
physis

Type V

injury is a compression or crush injury of the epiphyseal plate with no associated metaphyseal fracture. This fracture is associated with growth disturbances . Initially diagnosis may be difficult, the diagnosis depend mainly on clinical features of premature closure of physis ..& A typical history of an axial load injury.. These injuries have a poor functional prognosis.



clinical features:

pain , swelling ,deformity

X-ray It is difficult to assess as the physis is radiolucent and the epiphysis is incompletely ossified.

1. The physeal widening of the gap
2. Tilting of the epiphysis
3. Repeating X ray within few days
4. Comparing the injured side with the normal

Treatment

1) Undisplaced → cast for 2-4 weeks

2) Displaced → reduce efficiently either by closed or open reduction and internal fixation (it should be with smooth wires or pins)

Complications

1. Deformities 2. Premature fusion (once the epiphyseal line is closed that limb will remain short)

Male patient 13 years of age who had a bullet injury in the antero –medial side of the Lt. Knee a partial damage in the upper epiphysis causing genum varum

THANK YOU