Principles of fractures

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Introduction:

- Trauma remains the leading cause of death in the first four decades of life (1-44 years).
- Surpassed only by cancer & atherosclerosis as the major cause of death in all age groups.

Introduction:

- 60 million injuries / year in the U.S.
- 30 million (50%) require medical care.
- 3.6 million (12% of 30 million) require hospitalisation.
- 9 million are disabling (at least 24 hr off work).
- 300.000 permanently, 8.7 million temporarily.
- Trauma-related costs 400 billion $/year.

No patient ever died of a broken bone

- While the expert and expeditious care of orthopaedic trauma directly bears upon the patients morbidity and eventual functional recovery, the question of patients survival must be addressed prior to any orthopaedic consideration.

- Life, limb, wound, fracture.

ATLS program.

TEAM → for medical students and interns
T rauma
E valuation
A nd
M anagement

- Treat the greatest threat to life.
- The lack of definitive diagnosis should never impede the application of an indicated treatment.
- Detailed history was not essential to begin the evaluation and treatment.
- ABCDE.

Trimodal death
3 peaks of death in trauma
① Immediate (seconds, mins) → prevention
② hrs (ABCDE) → ATLS
③ weeks → -ve nitrogen balance, malnourishement, infections → they need specialized trauma centers

Description of fractures

- wound → discontinuity of skin
- ulcer → discontinuity of epithelium
- fistula → abnormal opening b/w 2 epithelized surfaces
- sinus → blind-ended
- laceration → discontinuity of organ or capsule
- contusion → ...

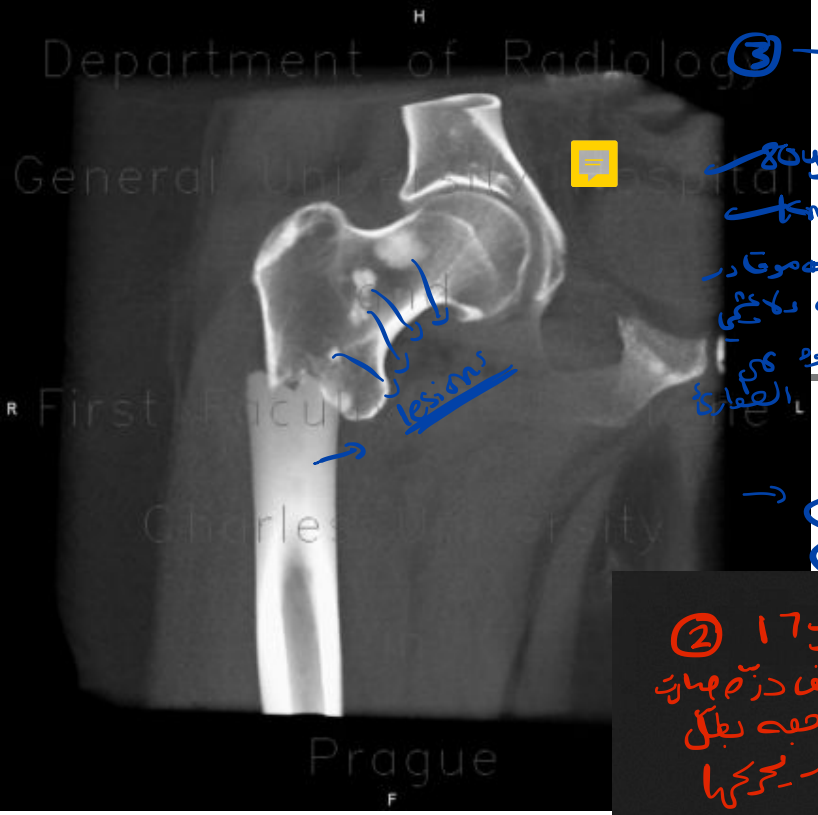
- Fracture: discontinuity of bone.
- Fractures can be categorized in several ways, pathologic or traumatic, stress, location in bone, mechanism of injury, status of soft tissue…etc.

1. adult, peds
2. complete, incomplete
3. shape
4. Simple, compound
5. displaced or not
6. open, closed

Pathologic fractures.

weakened bone

- A bone is broken through an area weakened by pre existing disease, by a degree of stress that would have left a normal bone intact.
- Dx by Hx.
- Underlying cause.
- Osteoporosis, metabolic, infection, malignancy…etc.
- Insufficiency fracture.(Pentecost et al,1964)

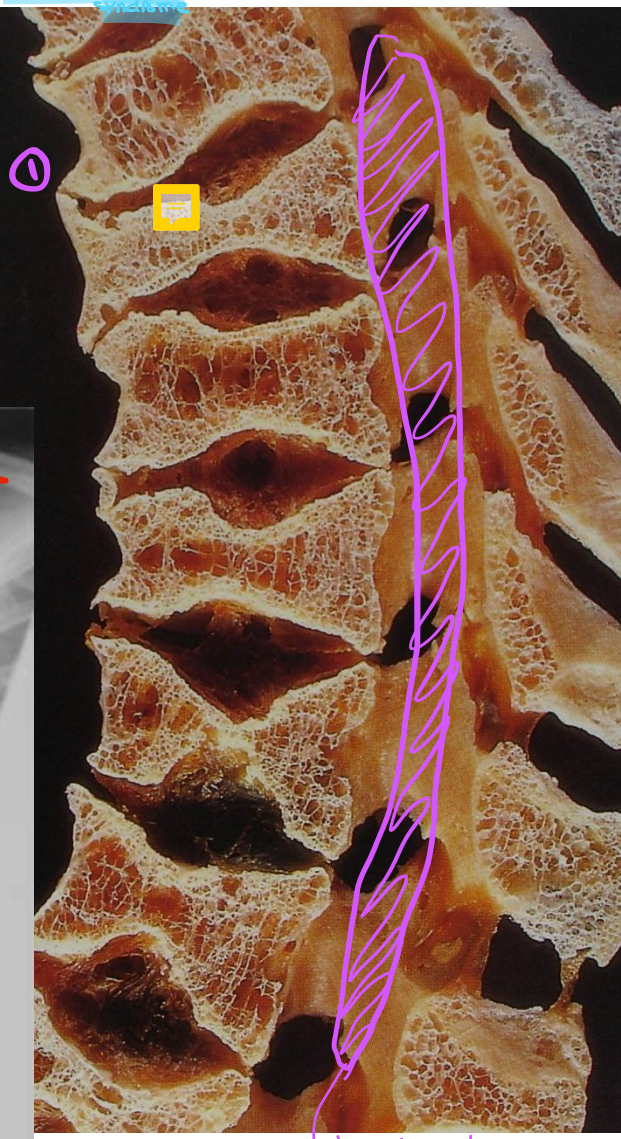


③ → multiple hyperdense lesions (mets)

80yr old
known case of CA prostate

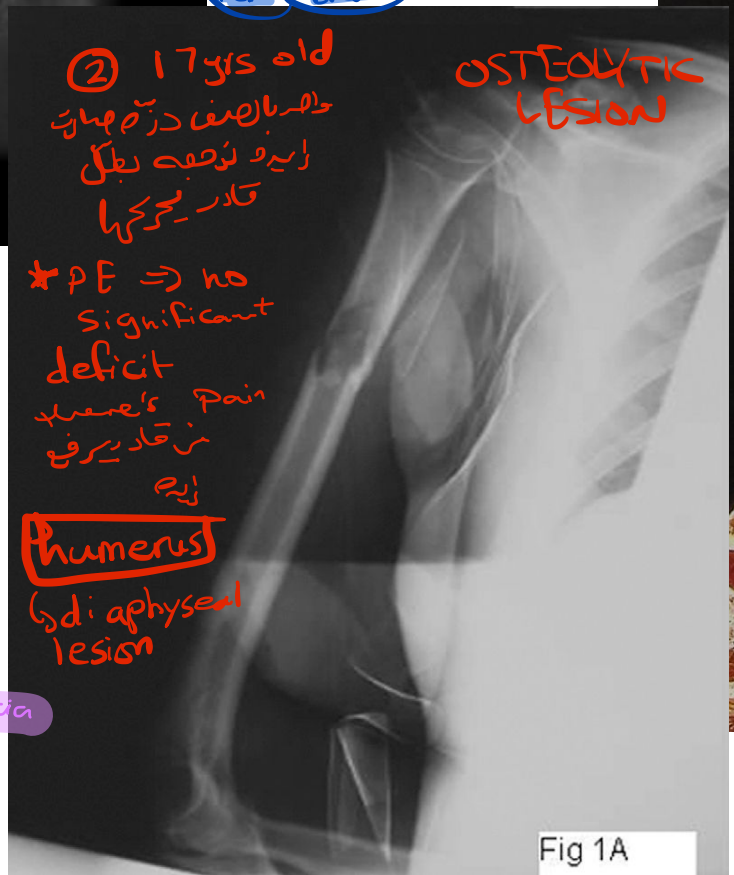
Male
Prostate
Renal
Breast
and lung

mets → osteoblastic, osteolytic, mixed
malignant cells → secrete substances → affect locally
→ paracrine



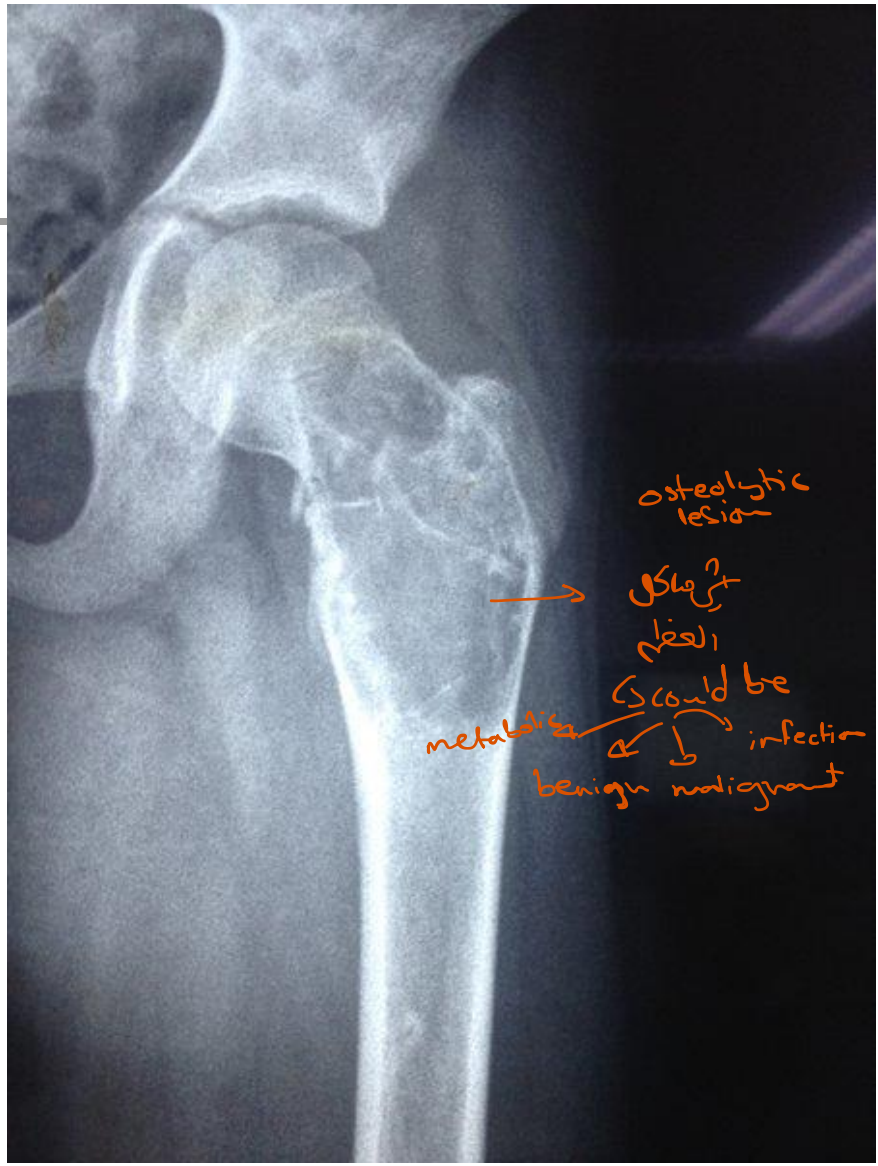
① 70yrs old
Kyphosis
chronic backpain
constipation
hyperpara

→ osteoporosis or osteomalacia
systemic disease
multiple vertebral fractures due to weakened bone



② 17yrs old
* PE → no significant deficit
Humerus
diaphyseal lesion


أي هيكل العظم
most likely malignant


osteolytic lesion
أي هيكل العظم
could be
metabolic
infection
benign
malignant

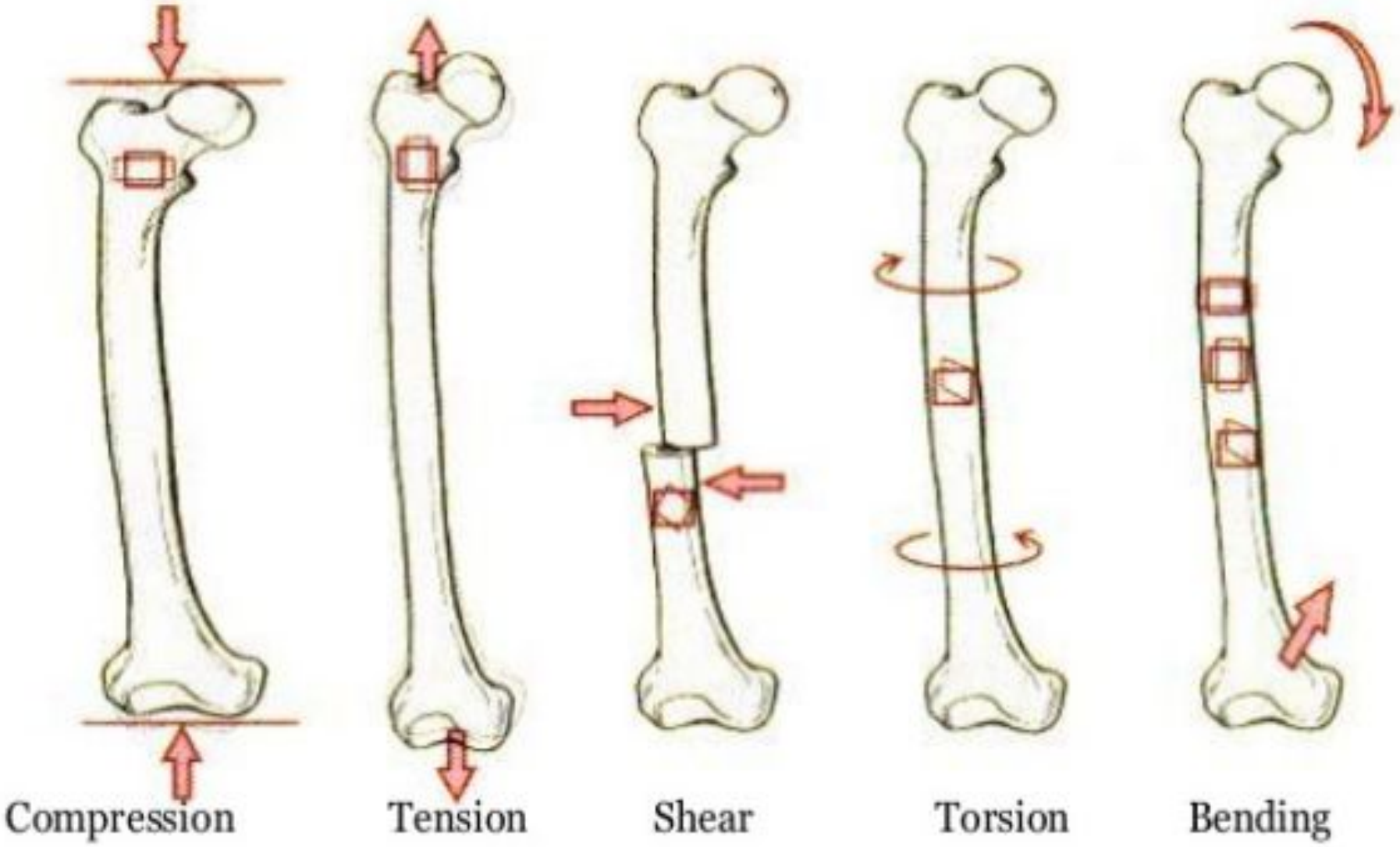
Stress fractures

- Bone reacts to repeated loading. on occasion, it becomes fatigued and a crack develops, which may lead to a complete fracture.
- Military installations, ballet dancers, athletes.
- Backer et al, JBJS,54A 1972, stress fractures occur only after muscle fatigue, and the absence of functioning muscles allows abnormal stress concentration.

stress fracture

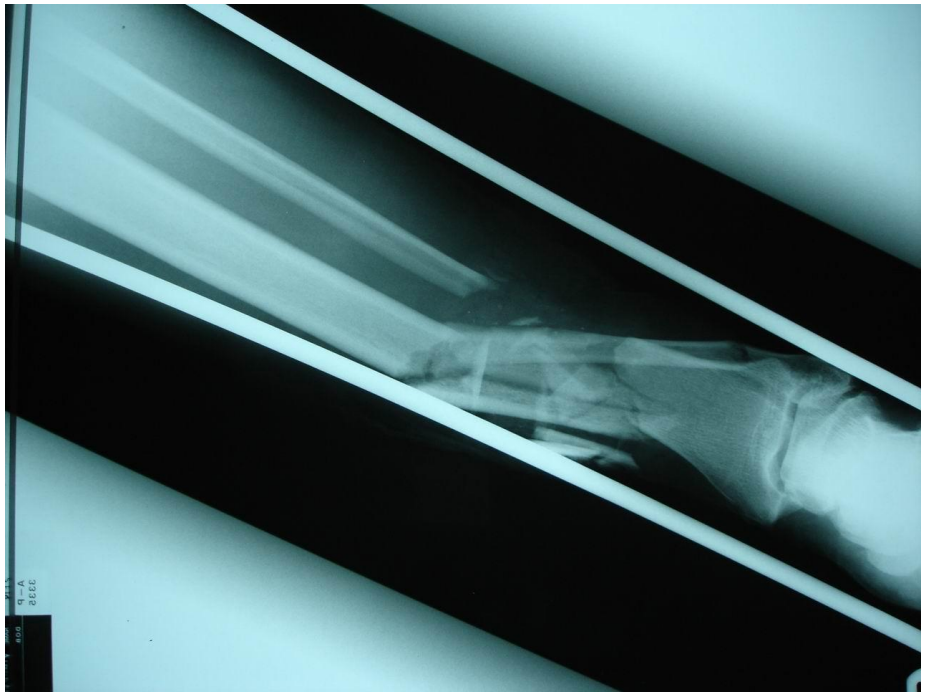

R
R
E.P.
stress
fracture

Mechanical Loading of Bone



Shape of fracture

- Simple.
- Multi-fragment. (comminuted).

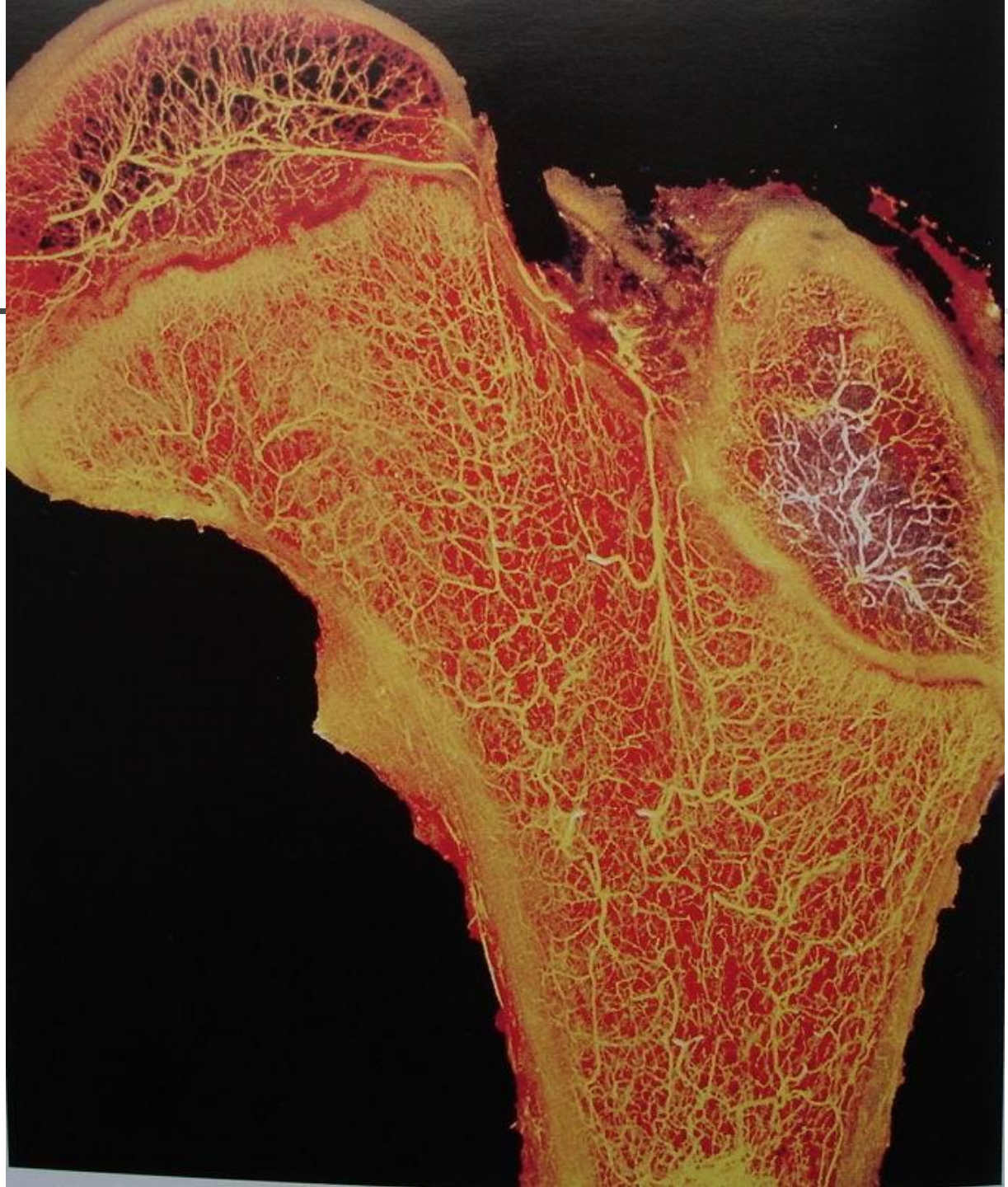


Shape of fracture

- Transverse. → diameter of fracture = diameter of bone
- Oblique. → in 1 plane
- Spiral. → in more than one plane

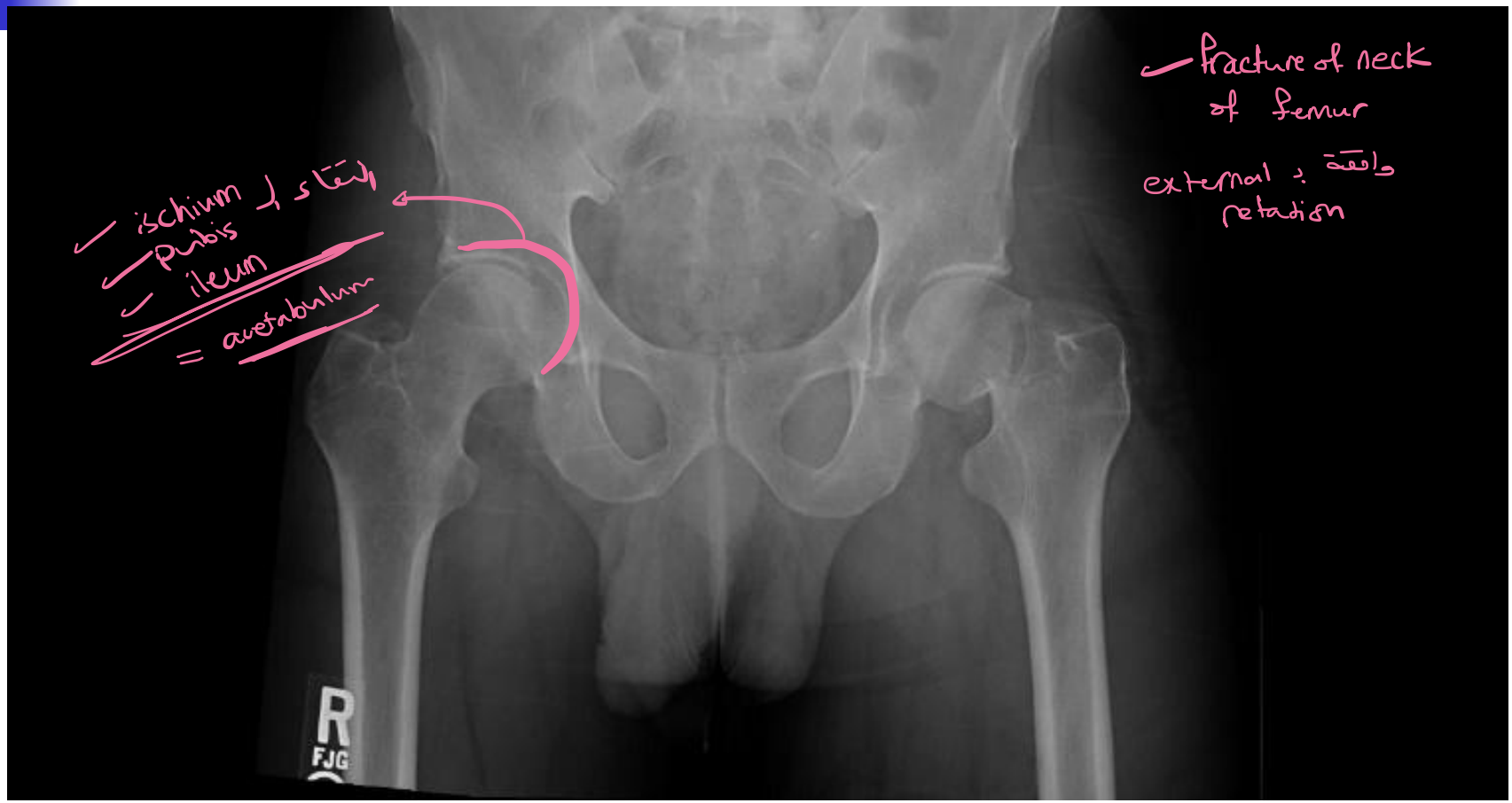
Classification by anatomical location.

- Epiphysis.
- Metaphysis.
- Diaphysis.
- Capsule.
- Articular surface.
- Growth plate.



- Epiphysis:
  - difficult reduction.
  - intracapsular.
  - intraarticular.

  - **joint stiffness.**

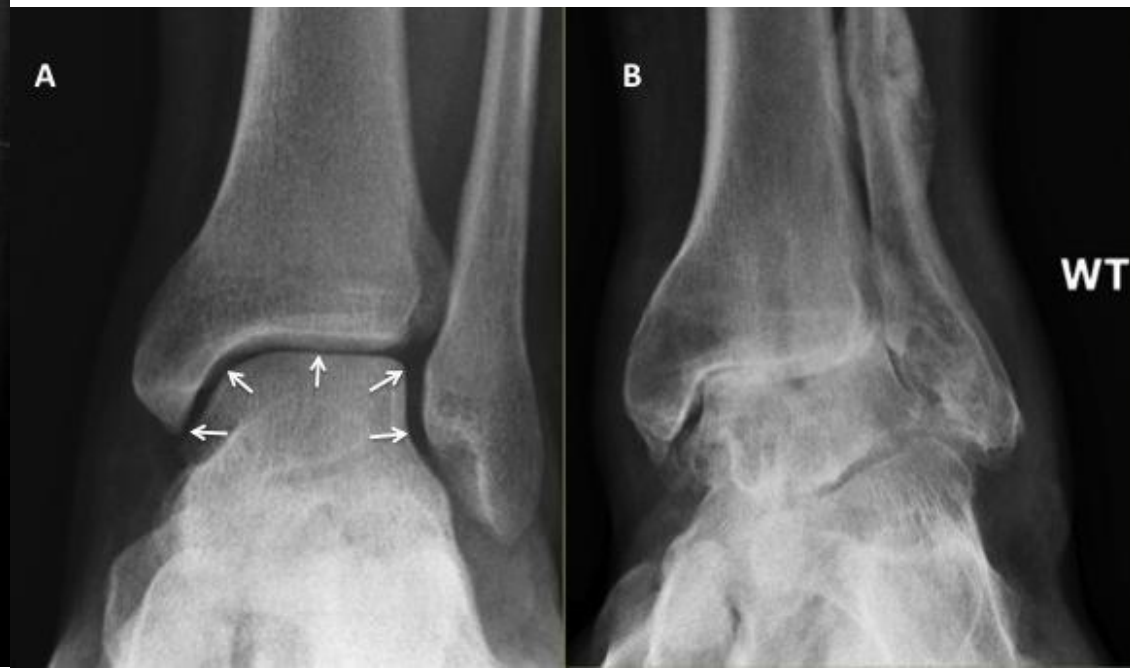

ischium
pubis
ilium
= acetabulum
fracture of neck of femur
external rotation
R
FJG

dislocation → joint

displacement → fracture

Extraarticular Intraarticular

- Joint stiffness.
- 2ry Osteoarthritis.



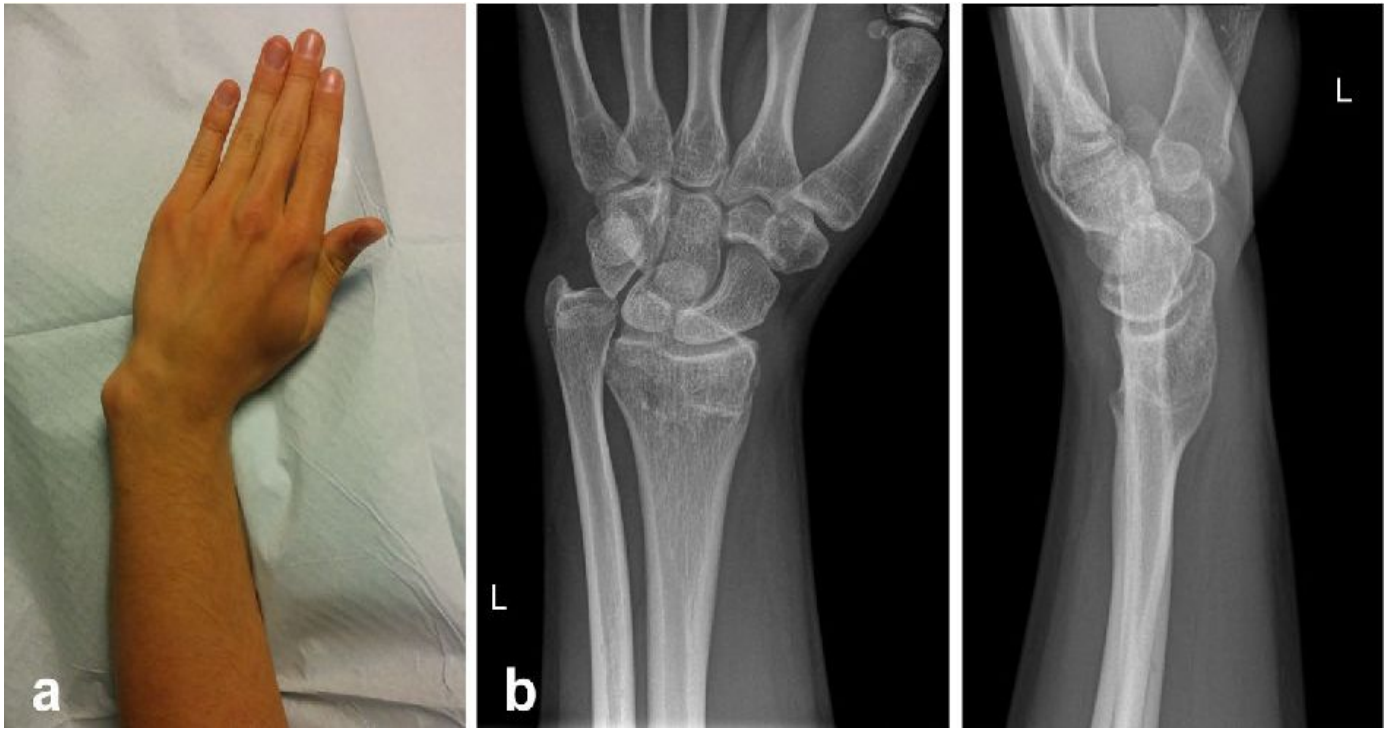
metaphysis

Malunion
nonunion
Delayed union

- Good blood supply.
- Malunion rather than nonunion.

bcz a lot of
① muscles

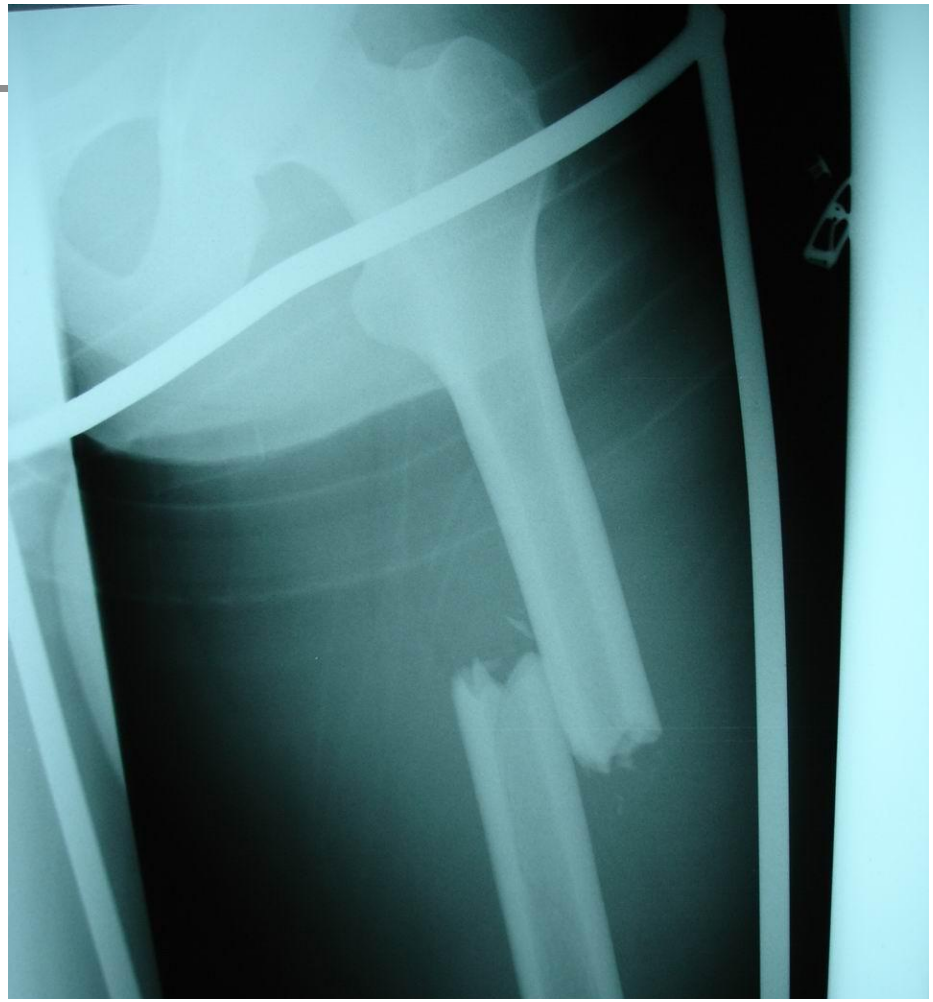
② and the bone is weak



diaphysis

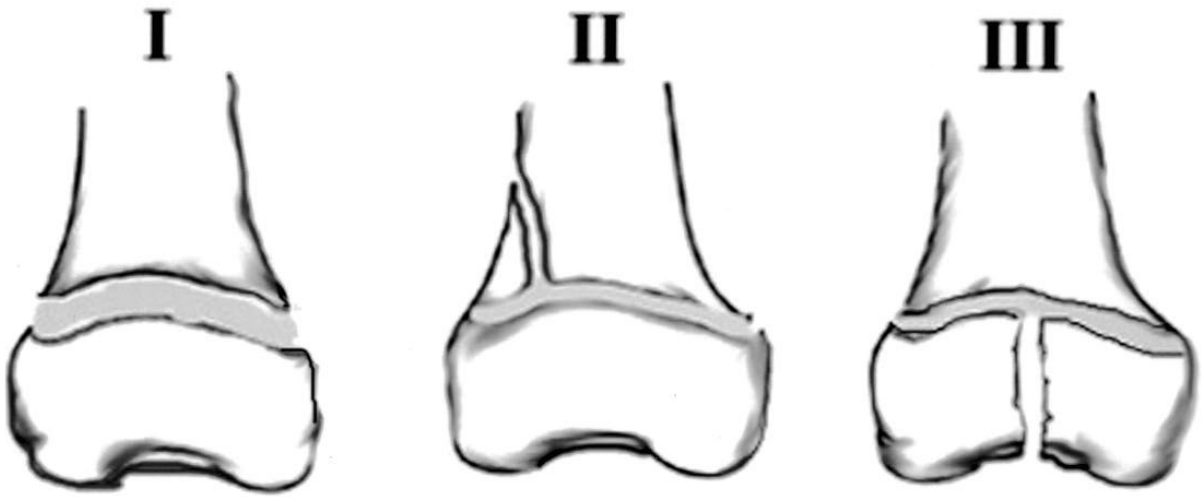
Unstable

Need fixation.



Growth plate injury

- Salter-Harris classification.
- **Deformity.**
- Prognosis.

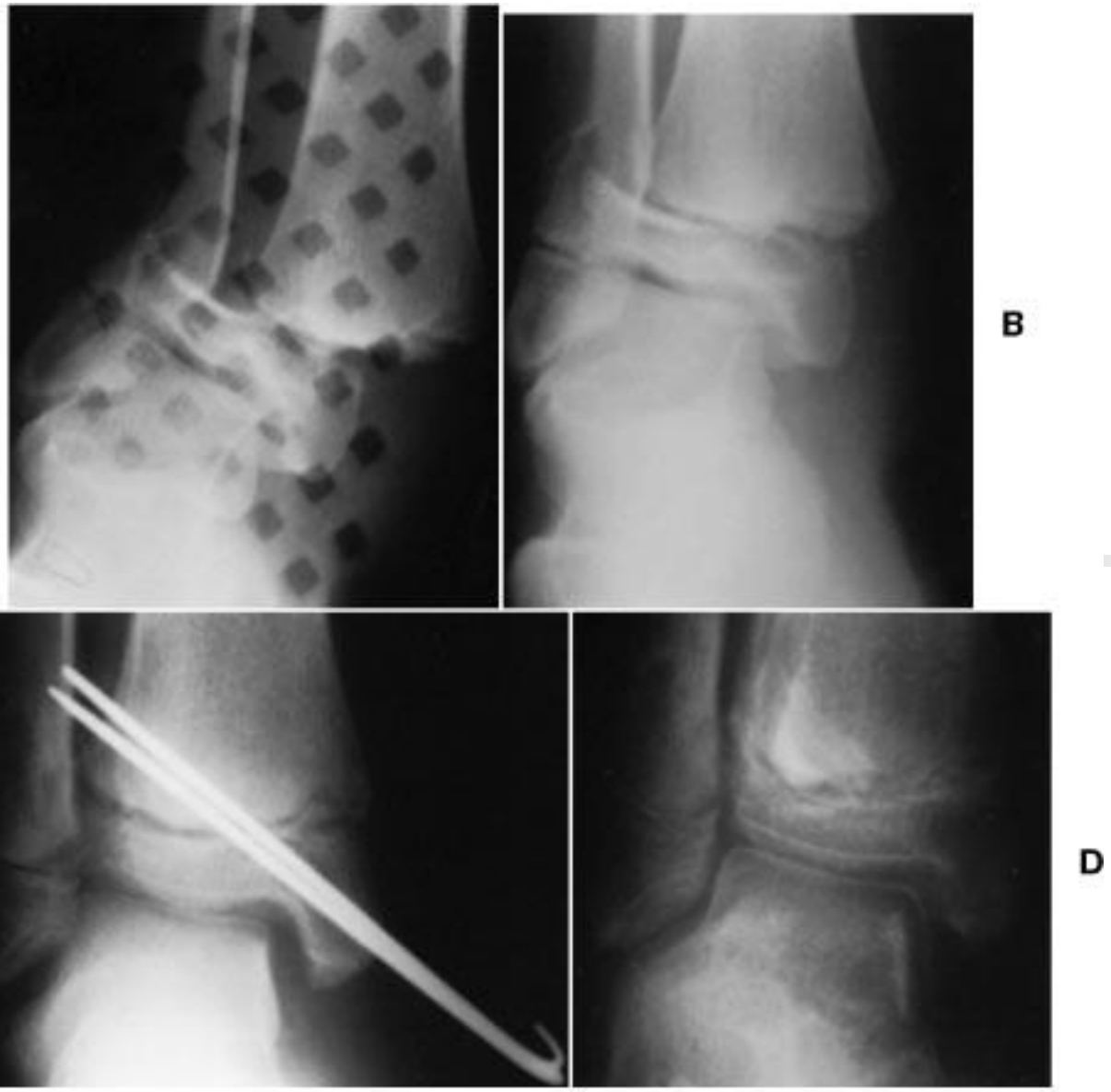


Salter-Harris classification.

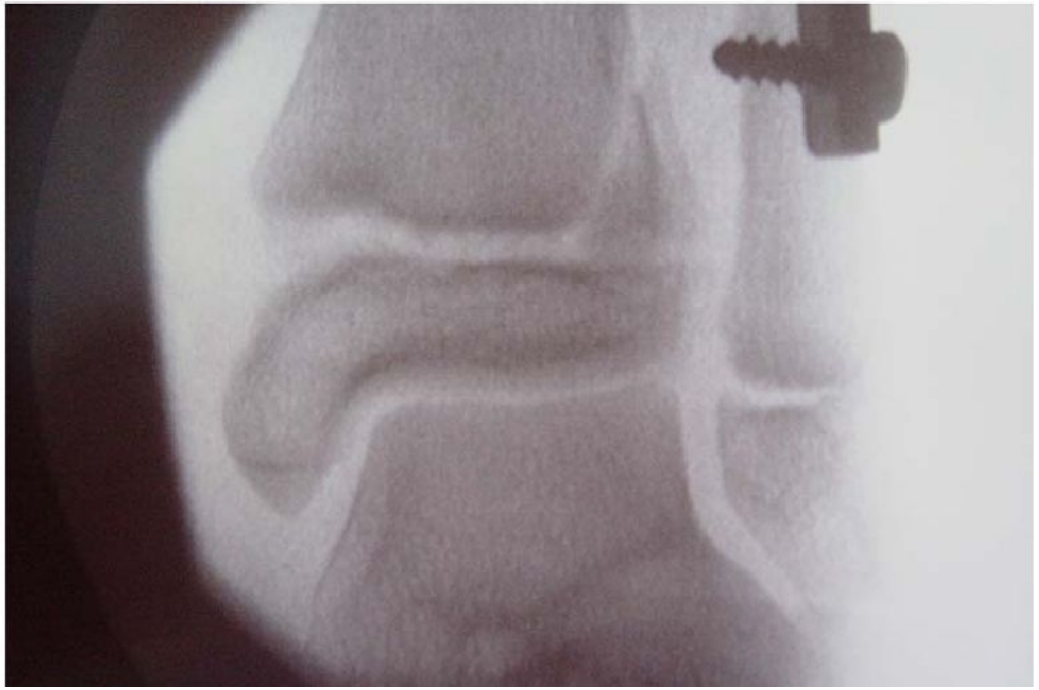
I II III IV V

worse

SH 1

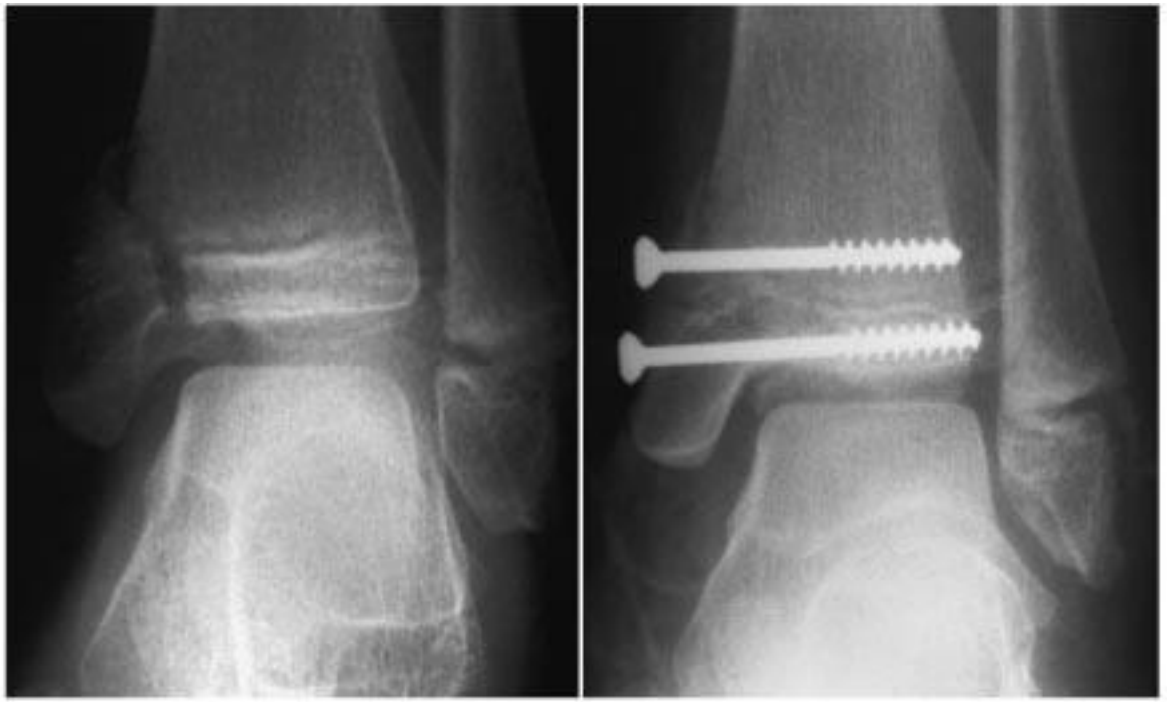


SH2



SH3

SH 4



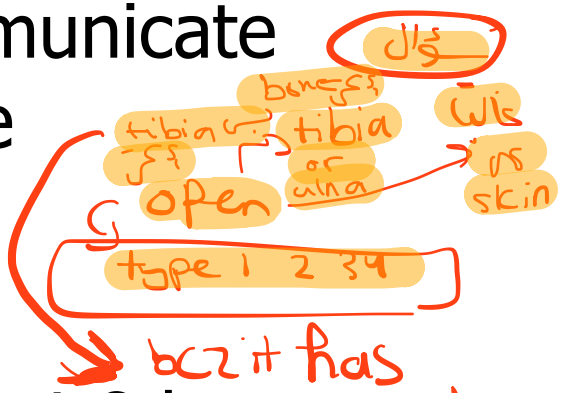
The condition of the surrounding soft tissue

- Open fractures by definition communicate through a traumatic wound to the surrounding environment.
- Tetanus prophylaxis.
- Irrigation and debridement within 4-8 hrs.
- Antibiotic prophylaxis:

  first generation cephalosporine,

  + aminoglycoside (high energy),

  +penicillin (barnyard).



ولد صغير كان يتمرجح

fracture in humerus ① (metaphysis)
↳ malunion
② open (infection)
③ growth plate (deformity)

Diaphysis → unstable

Metaphysis → malunion

intra-articular → 2ry osteoarthritis

open → infection

The condition of the surrounding soft tissue

- Gustilo and Anderson(1976, 1984):

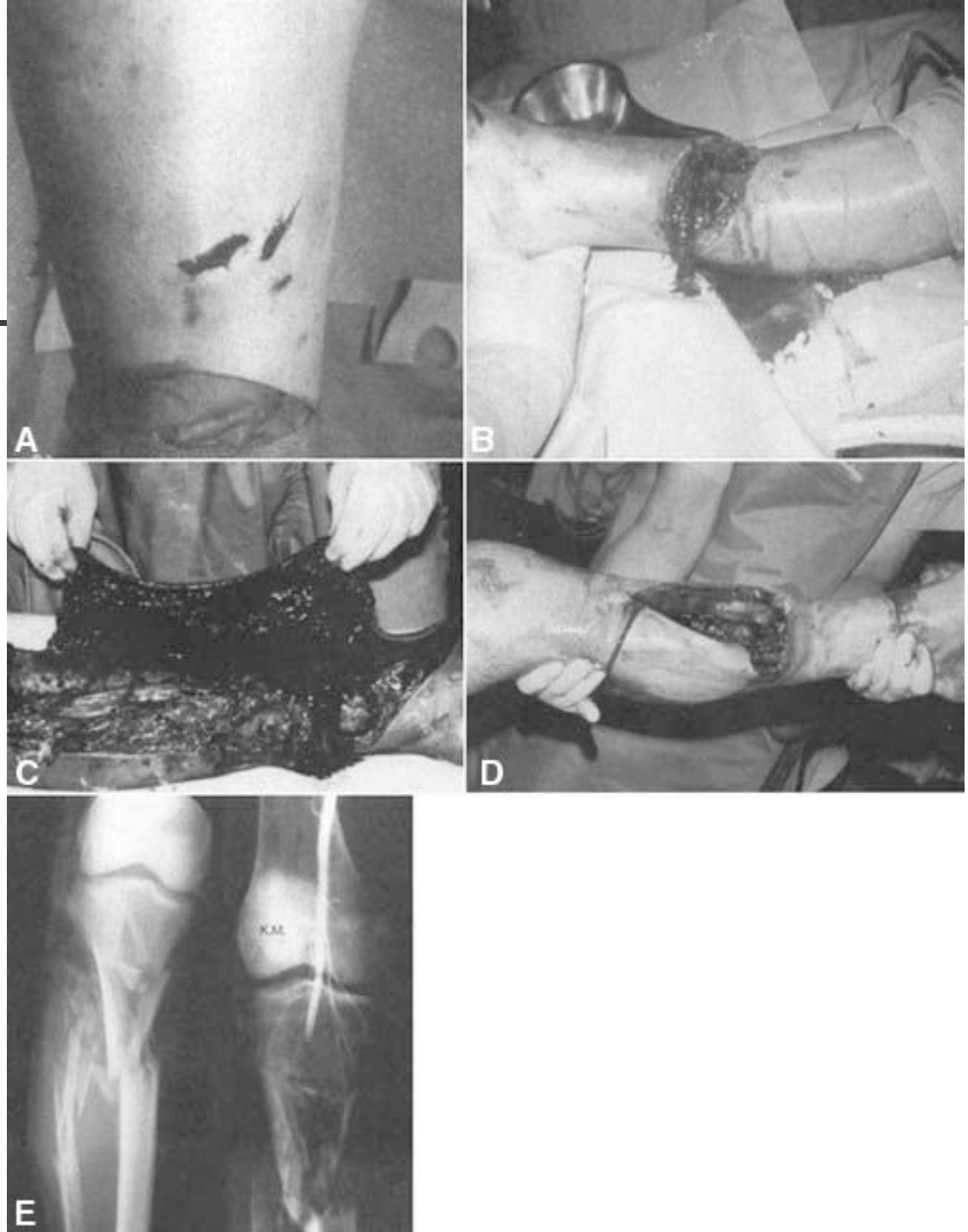
I : clean wound < 1 cm.

II : >1 cm without extensive soft tissue damage, skin flaps, or avulsion.

IIIA : extensive soft tissue damage or flaps but maintains adequate coverage. **high energy**.

IIIB : periosteal stripping and bony exposure.

IIIC : vascular injury.


A
B
C
D
E

• how to treat open fractures in emergency?

ATLS. (life, limb, wound, fracture)

Analgesia.

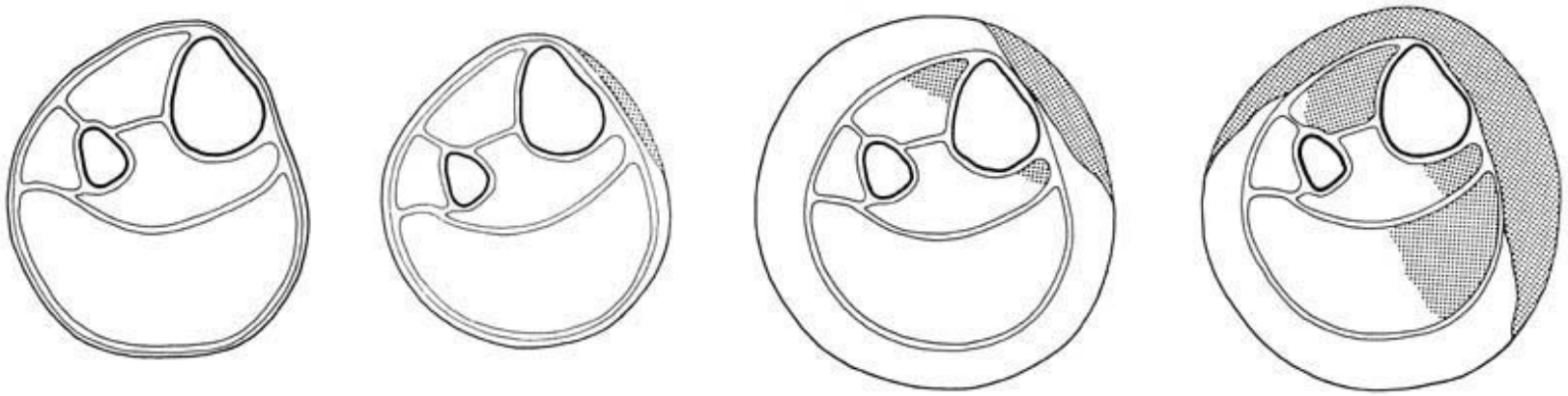
Anti tetanus toxoid.

Antibiotics. → the most important factor to prevent infection

Adequate Irrigation.

↳ Dilution of bacteria

Soft tissue injuries in closed



- Tscheme & Gotzen 1984.
- 0 : little or no soft tissue injury.
- 1 : superficial.
- 2 : deep abrasion.
- 3 : Crushing.

Description of the deformity:

- Distal segment.
- 3 planes: axial, Sagittal, coronal.
- Displacement and angulation.
- 2 views, 2 joints, 2 limbs, 2 positions, 2 occasions.
- Initial X-ray: personality of the fracture.

Clinical features of fractures:

- Pain and tenderness.
- Loss of function.
- Deformity.
- Attitude.
- Abnormal mobility and crepetus.
- Neurovascular injury.
- X-ray findings.

Emergency management of

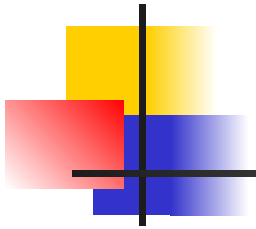
- London P.S (injury,3:225-238 1972):
  one of the most highly touted and least frequently obeyed maxims in emergency care is “splint them where they lie”.
- Crews often said that with a journey that was usually short they did not think that the time spent on applying splints was justifiable.

Emergency management of

- Prevent further soft tissue damage.
- Pain relief.
- Decrease the incidence of clinical fat emboli and shock.
- Facilitates patient transport and radiographic studies.
- 3 As: analgesia, antibiotics, antitetanus toxoid.

Treatment

There is danger inherent in the mechanical efficiency of our modern methods, danger lest the craftsman forget that **union cannot be imposed** but may have to be **encouraged**. Where bone is a plant, with its roots in soft tissues, and when its vascular connections are damaged, it often requires, not the technique of a cabinet maker, but the patient care and understanding of a **gardener**.



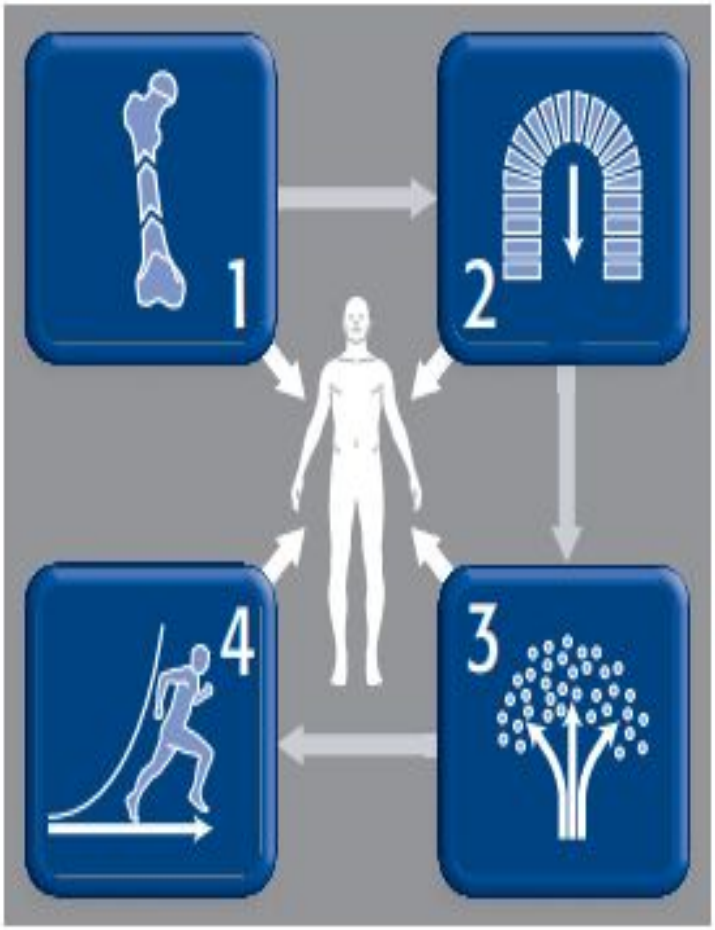
- Personality of fracture.
- Personality of soft tissue.
- Personality of the patient.
- Personality of the doctor and hospital.

Treatment

1. **Reduction**: any dislocation is an emergency.
   - closed or open.
   - anatomical or functional
2. **Immobilization**: traction, cast, external fixation, internal fixation.
3. **Rehabilitation**.

The AO principles of fracture management

Fracture reduction and fixation to restore anatomical relationships.



Fracture fixation providing absolute or relative stability, as required by the "personality" of the fracture, the patient, and the injury.

Early and safe mobilization and rehabilitation of the injured part and the patient as a whole.

Preservation of the blood supply to soft tissues and bone by gentle reduction techniques and careful handling.

Internal fixation:

- Apley A.G, Rowly JBJS 74B 1992 (editorial) Fixation is Fun.

  they thought that open reductions were done because orthopaedists enjoyed doing them.

  they believed that surgeons who treat fractures should be equally adept in both methods.

Healing calendar.

Upper limb, child:	3 weeks.
lower limb:	X2
adult:	X2
femur:	X2
consolidation:	X2
Smoker:	X2

Complications

- Bone healing abnormalities:

-**Delayed union.**

-**Nonunion.**

-**Malunion**.

- AVN.

Complications

- Infection.
- Soft tissue injuries:

  arterial, nerve injuries, compartment syndrome.
- Pulmonary complications: PE, FE, ARDS.
- Bleeding disorders.
- Others: CRPS(RSD), MO, OA.

summery

- A fracture is a break in the structural continuity of bone.
- "a **soft tissue injury complicated** by a break in the bone."
- Life, Limb, wound, fracture.
- Traumatic or pathological.

summery

- Simple or comminuted.
- Open ---------- infection.
- Growth plate ------deformity.
- Epiphysis----------joint stiffness.
- Intra articular -----osteoarthritis.
- Metaphysis---------malunion.
- Diaphysis----------unstable.

summery

- Reduction
- Immobilization.
- Rehabilitation.