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.

- 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.

Description of fractures

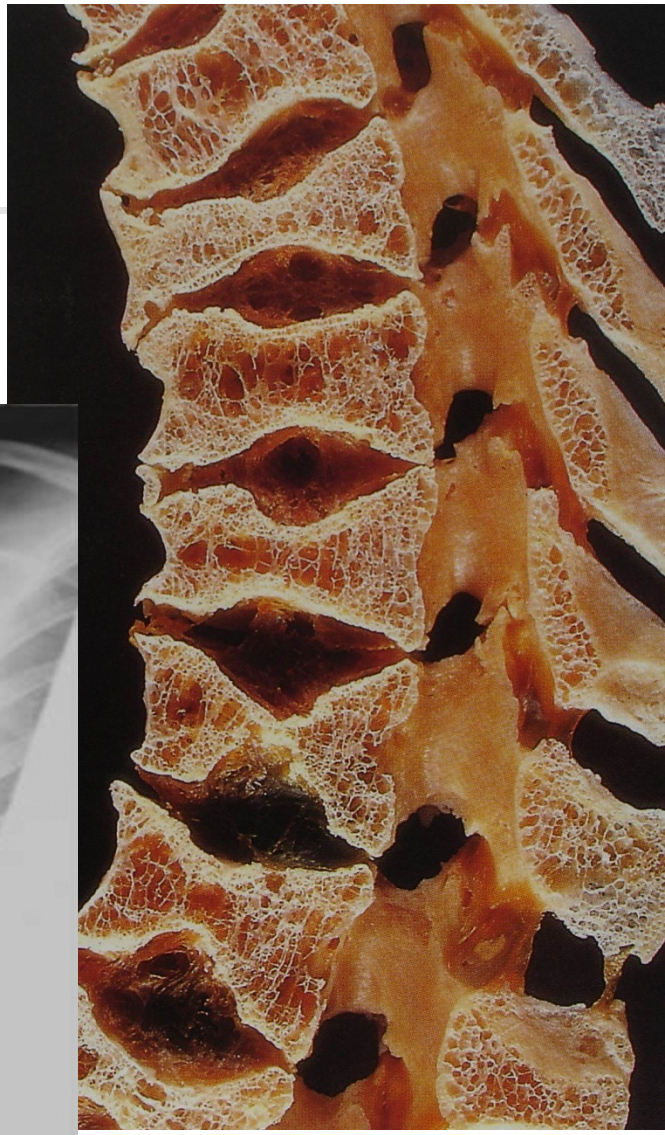
- Fracture: discontinuity of bone.
- Fractures can be categorized in several ways, pathologic or traumatic, stress, location in bone, mechanism of injury, status of soft tissue…etc.

Pathologic fractures.

- 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)


H
Department of Radiology
General University Hospital
and
First Faculty of Medicine
Charles University
in
Prague
R
L
F

Fig 1A



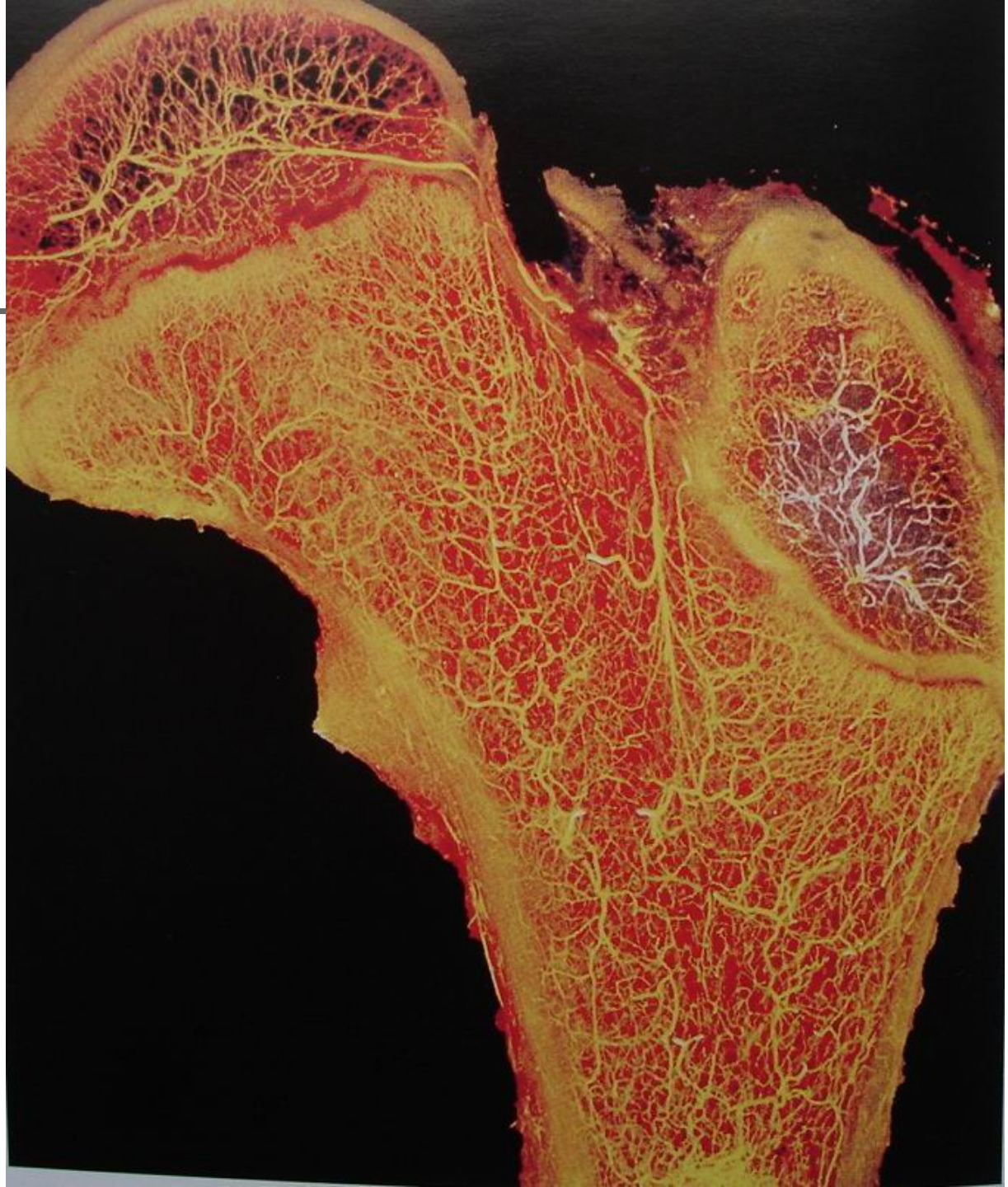
Stress fractures

- 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.


R
R
E.P.

Classification by anatomical location.

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



Epiphysis:

difficult reduction.

intracapsular.

intraarticular.

joint stiffness.

- Intracapsular:

haemarthrosis: affects union, arthritis, tamponade effect, pain, blood supply.


R
FJG

metaphysis

- Good blood supply.
- Malunion rather than nonunion

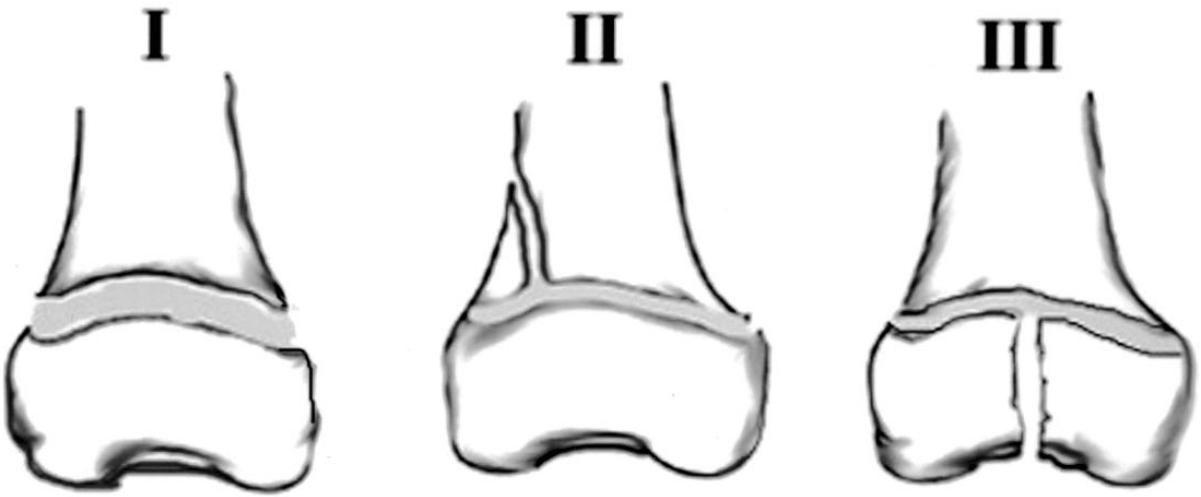
diaphysis

Unstable

Need fixation.

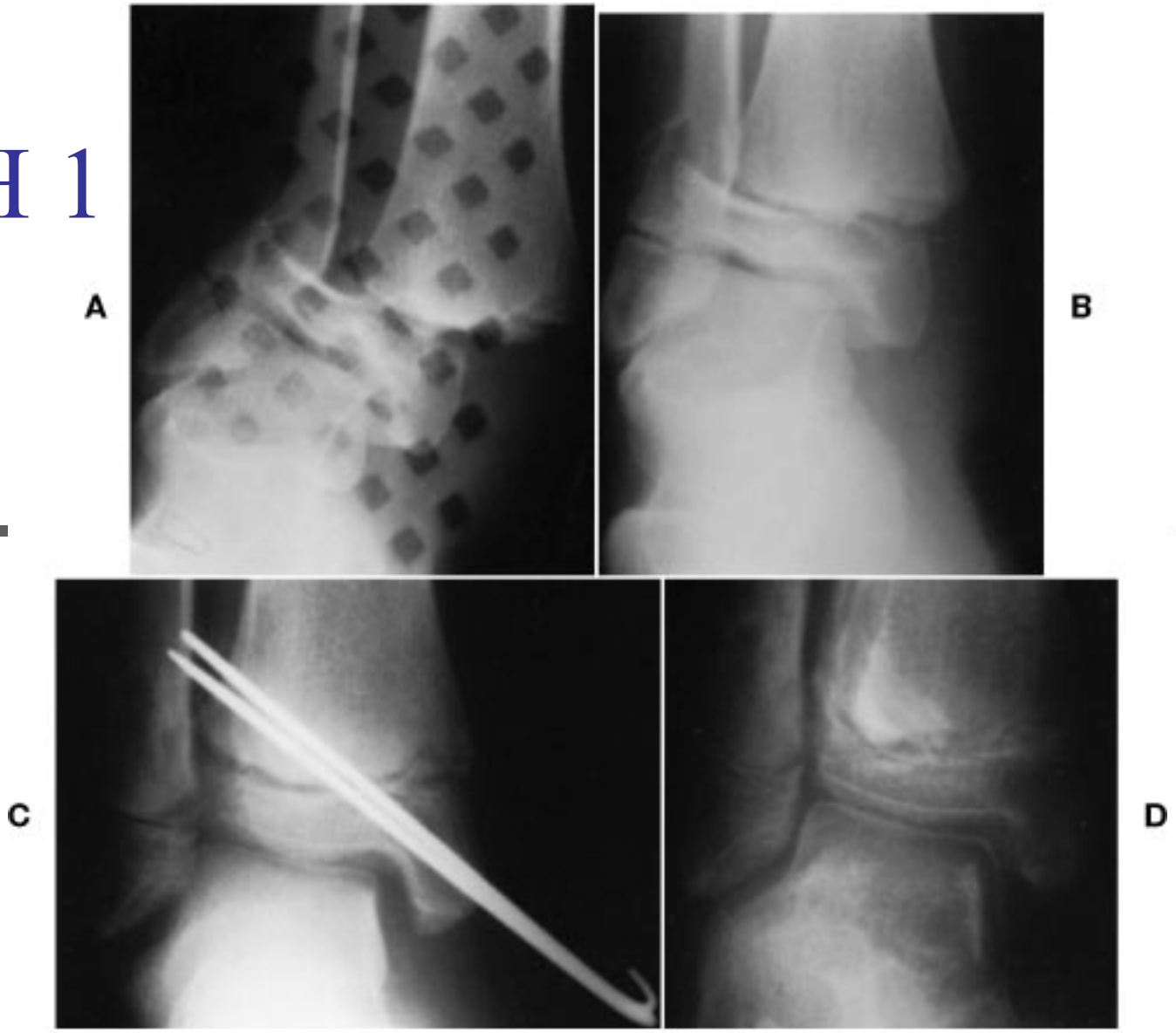
Growth plate injury

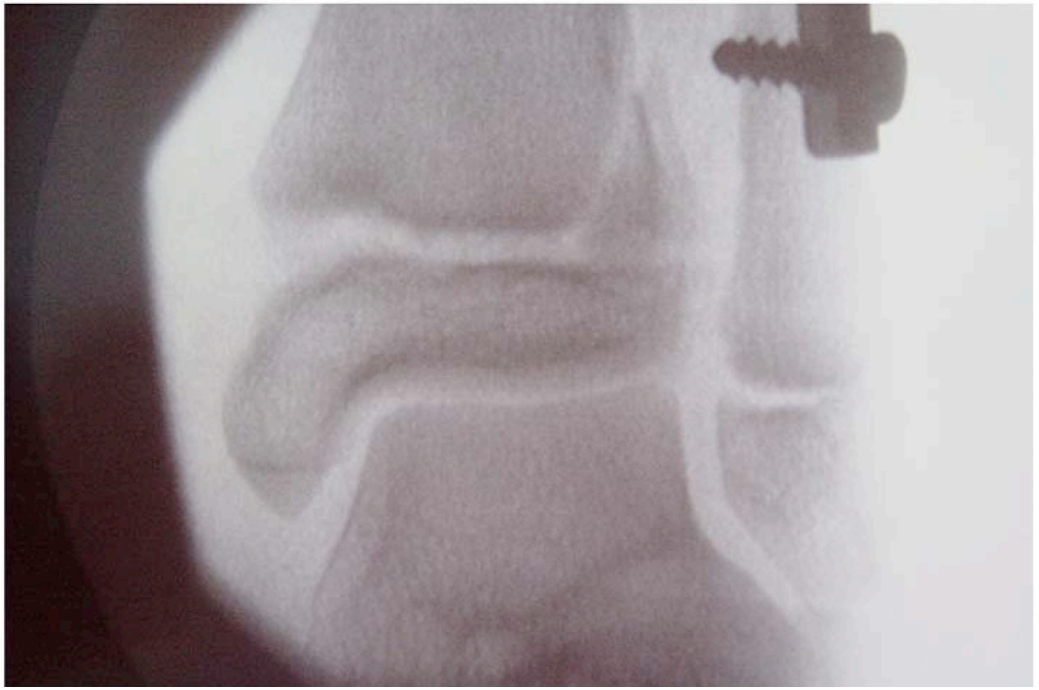
- Salter-Harris classification.
- Deformity.
- Prognosis.



Salter-Harris classification.

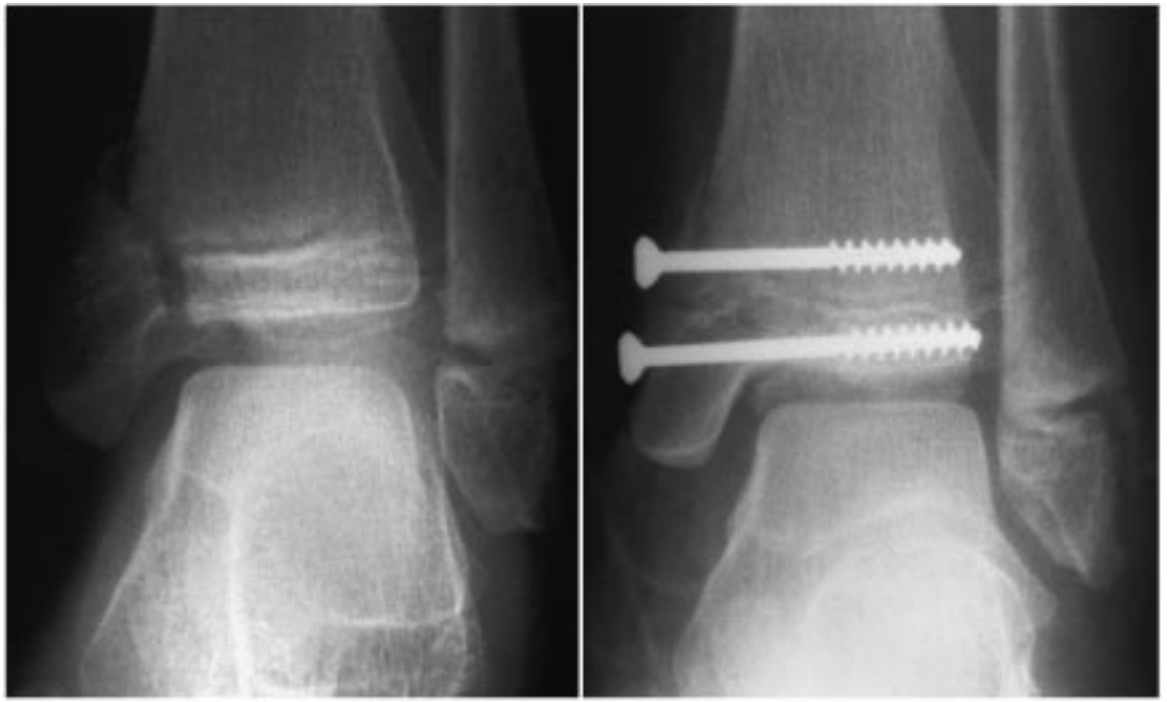
SH 1





SH

SH 4



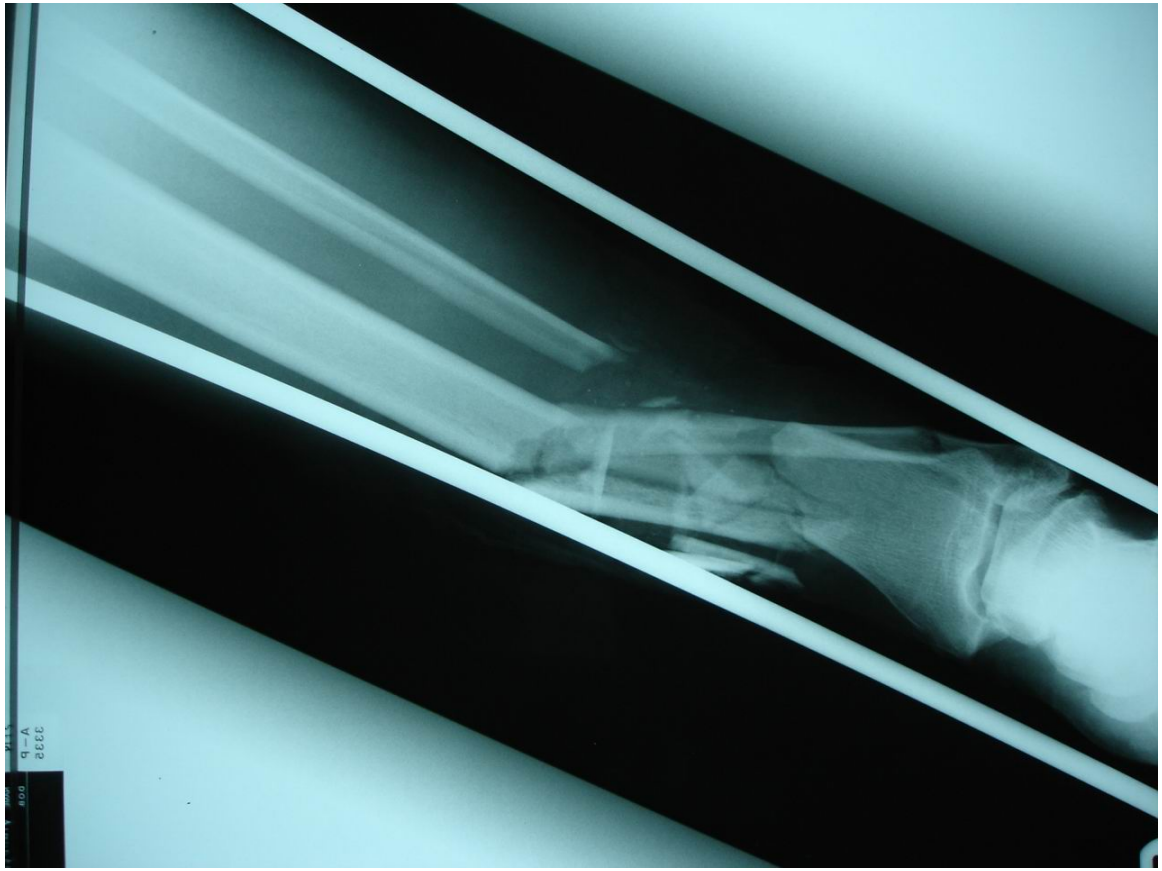
Mechanism of injury

- Therapeutic implications.
- Direct trauma:

Tapping #: small force acting on small area.
transverse # of one bone in leg or forearm.

Crush #: large force acting on large area.
extensive soft tissue damage, transverse or comminuted.


3R



Day 0

Direct trauma:

- Penetrating #:

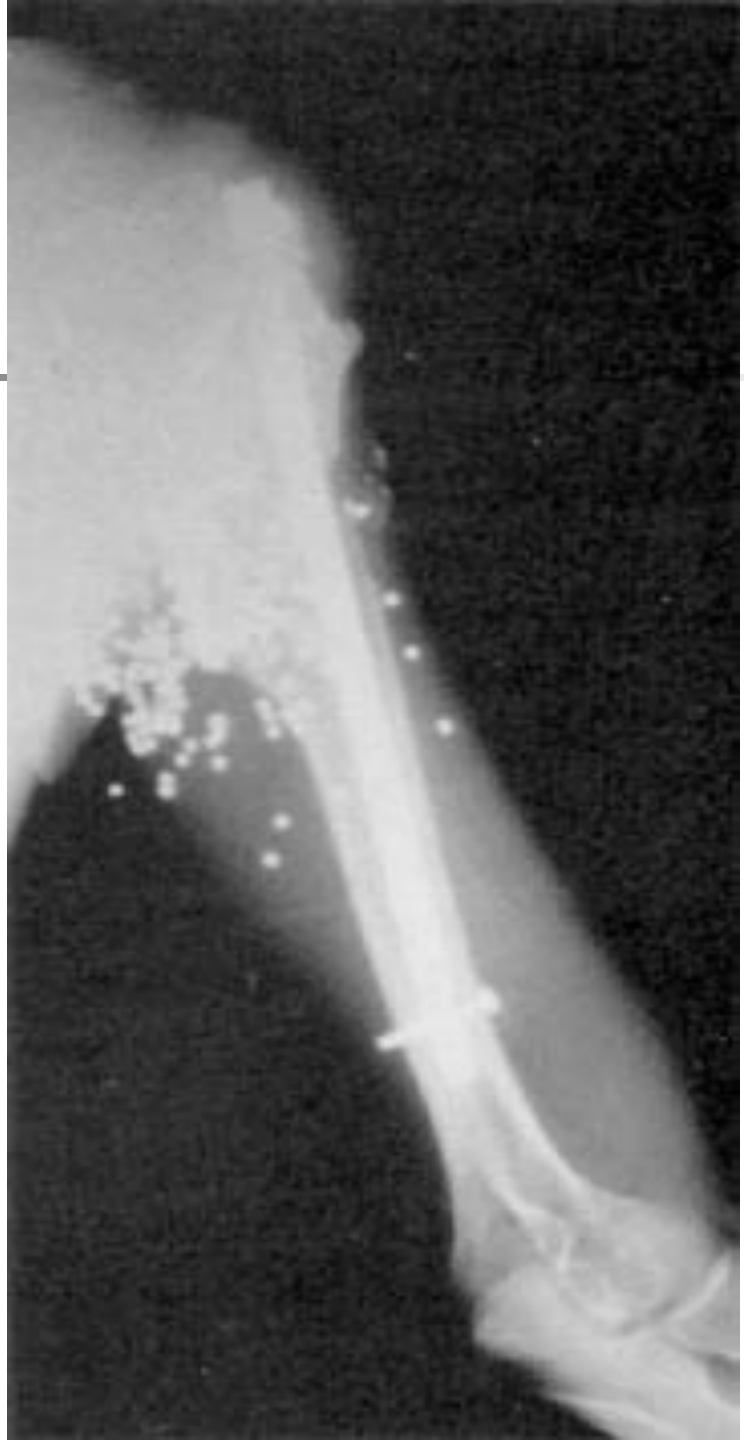
  large force acting on small area.

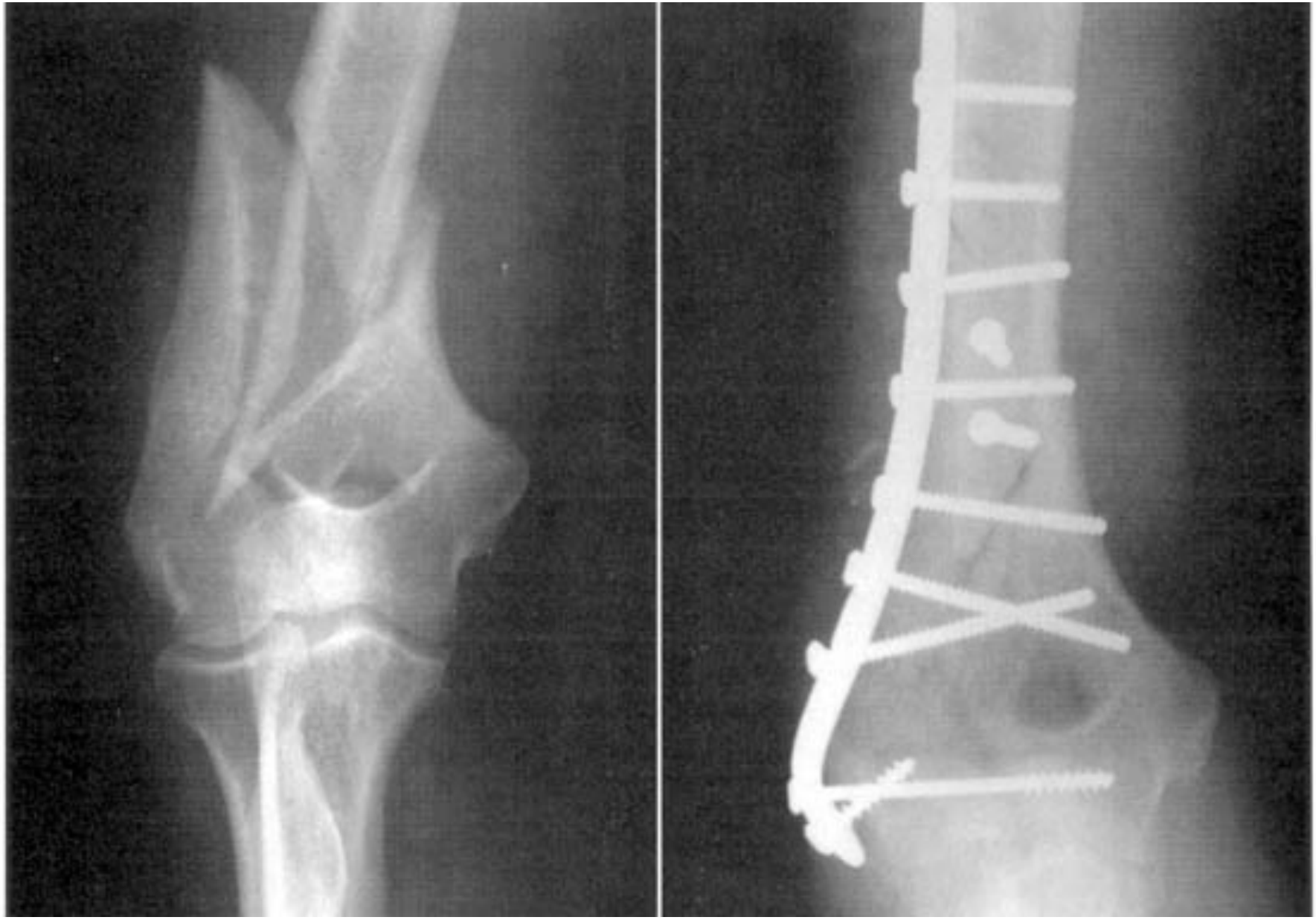
  low velocity, high velocity.

  1800 ft/s, 2000ft/s, 2500ft/s.

  M16 3250ft/s.

  velocity more important than mass.





A

B

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).

The condition of the surrounding soft tissue

- Gustilo and Anderson(1976, 1984):

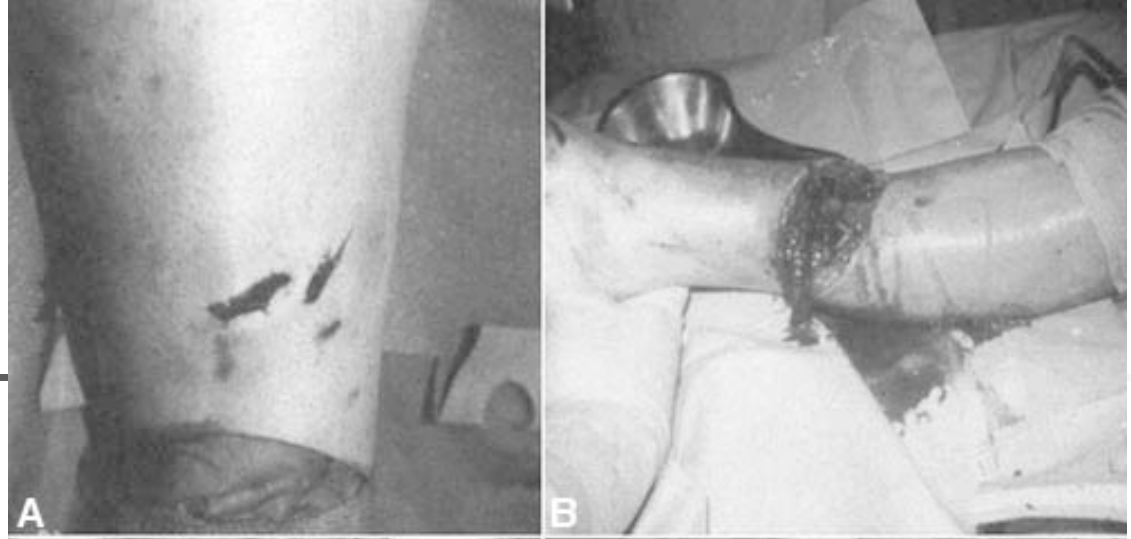
I : clean wound < 1 cm.

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.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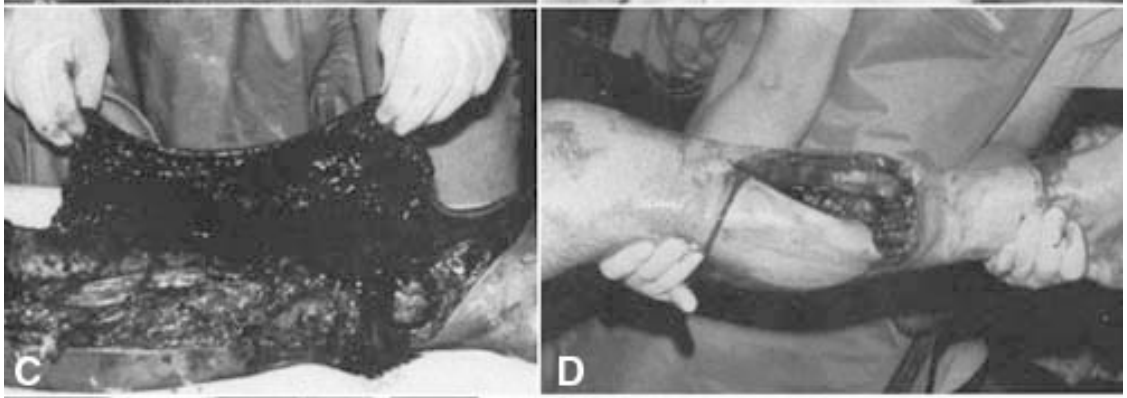
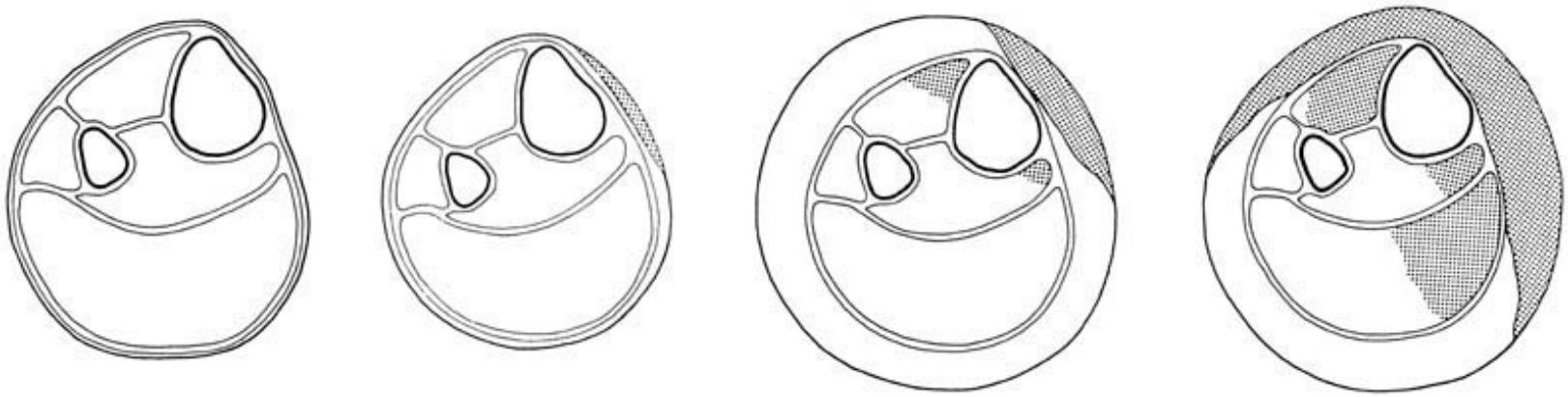

C
D


E

ATLS.
Analgesia.
Anti tetanus toxoid.
Antibiotics.
Adequate Irrigation.

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

- **Reduction**: any dislocation is an emergency.

  closed or open.

  anatomical or functional

- **Immobilization**:

  traction, cast, external fixation, internal

  fixation.

- **Rehabilitation**.

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.**

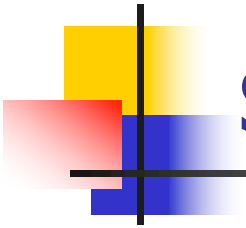
-**Malunion**.

- AVN.

Complications

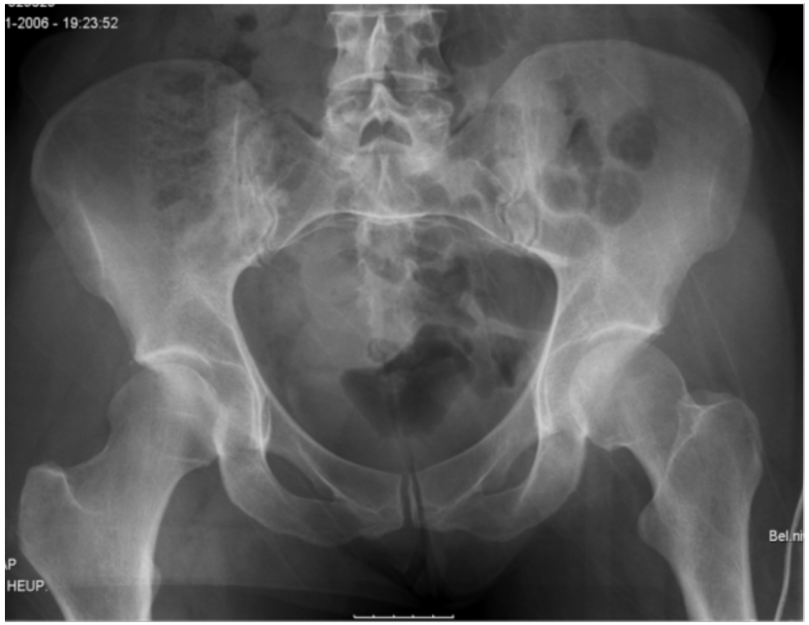
- Infection.
- Soft tissue injuries:

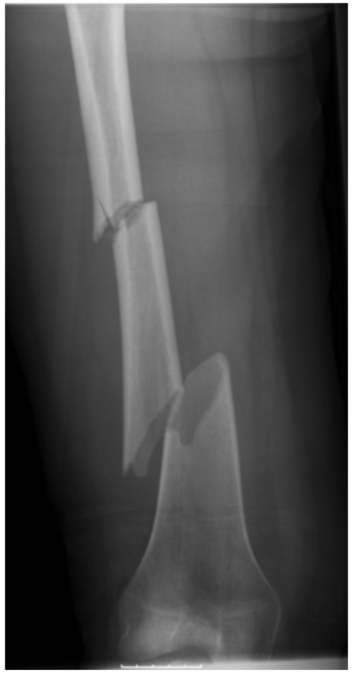
  arterial, nerve injuries, compartment syndrome.
- Pulmonary complications: PE, FE, ARDS.
- Bleeding disorders.
- Others: CRPS(RSD), MO, OA.



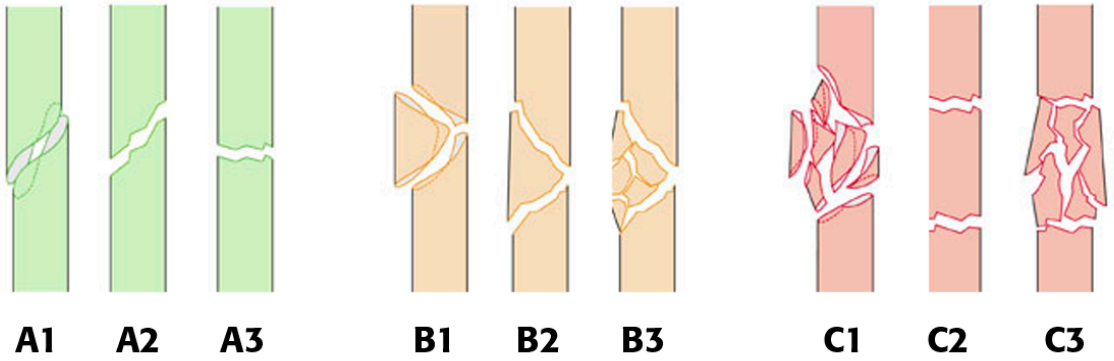
summery

- Comparison with case 1
- Severity





32-C3



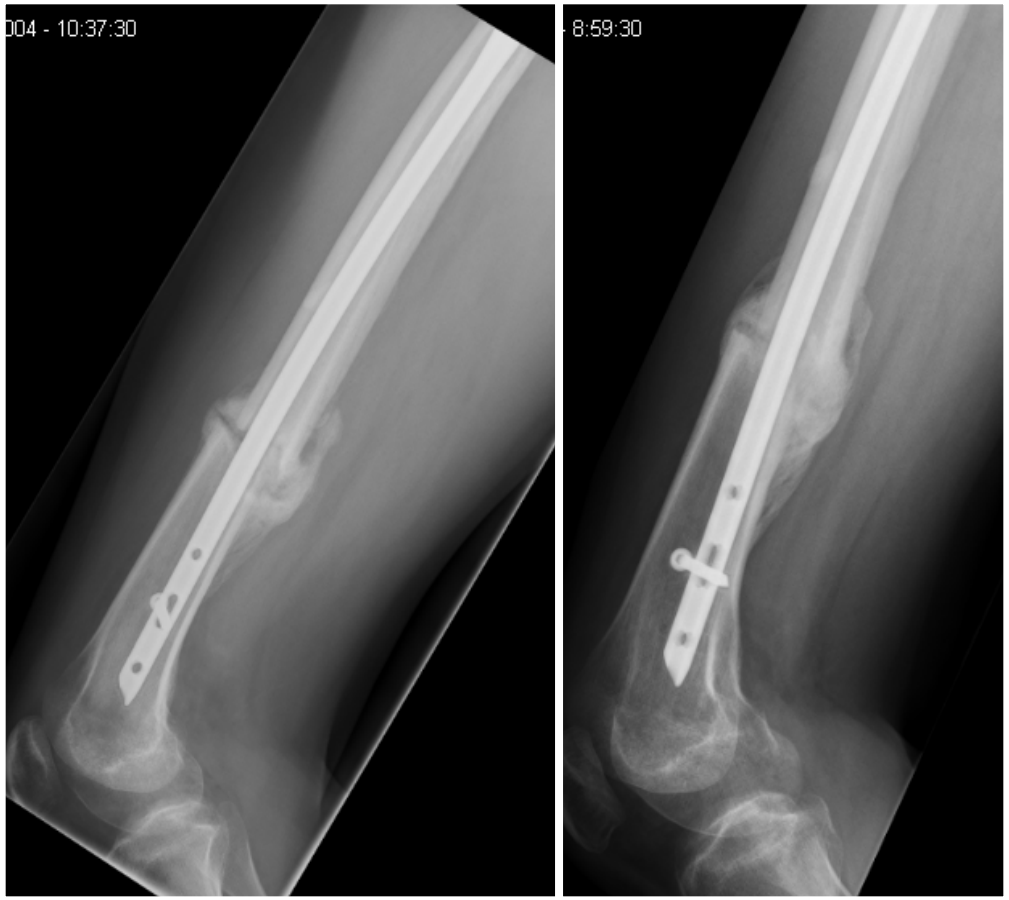
30-year-old male crashed Ferrari through tree

One hour:

- VS stable
- Painful right leg,
- No wound
- NV intact
- Closed olecranon

42 weeks posttrauma, activities as pretrauma

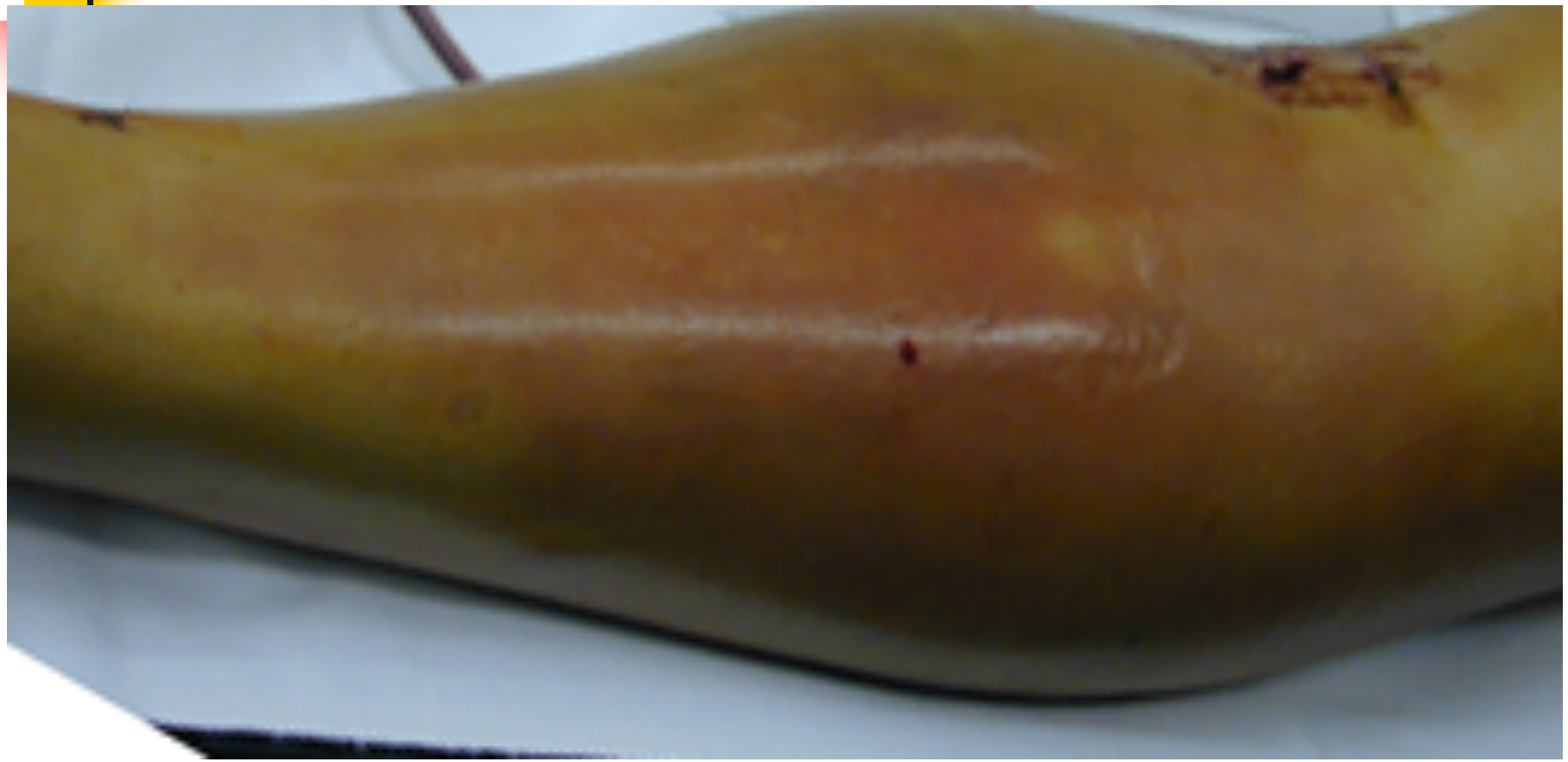
18 weeks 24 weeks



18 weeks 24 weeks

Follow–up after 10 days

- Soft tissue
- Stability



43-year-old male, smoker, twisting injury from skiing

- Isolated trauma
- Grade I open injury
- NV intact

Postoperative x-rays

- Stability
- Lag screw
- Neutralization plate
- Locking head screws

27-year-old male

Polytrauma

Closed injury

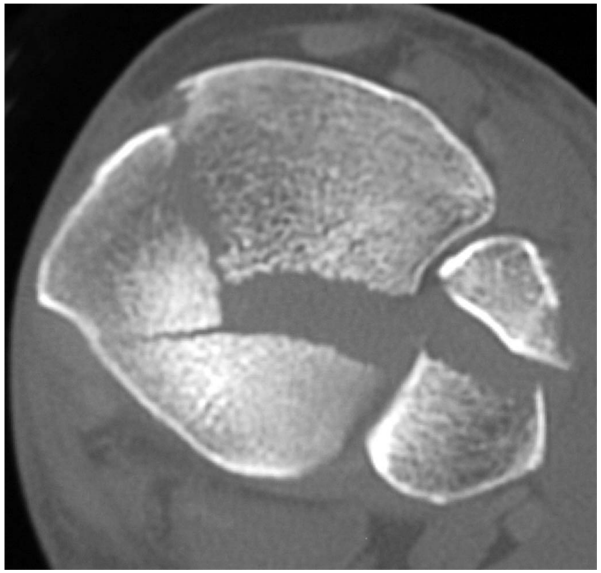
□□ - □□

Which group?

- A1: Ulna fractured, radius intact
- A2: Radius fractured, ulna intact
- A3: Radius and ulna fractured

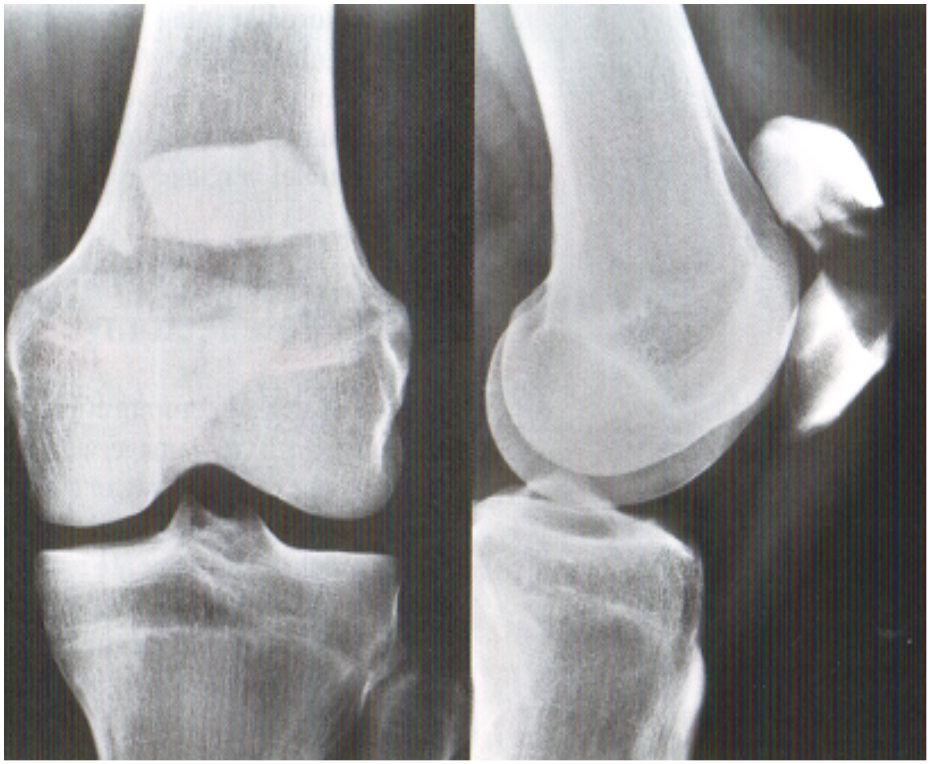
Classification?

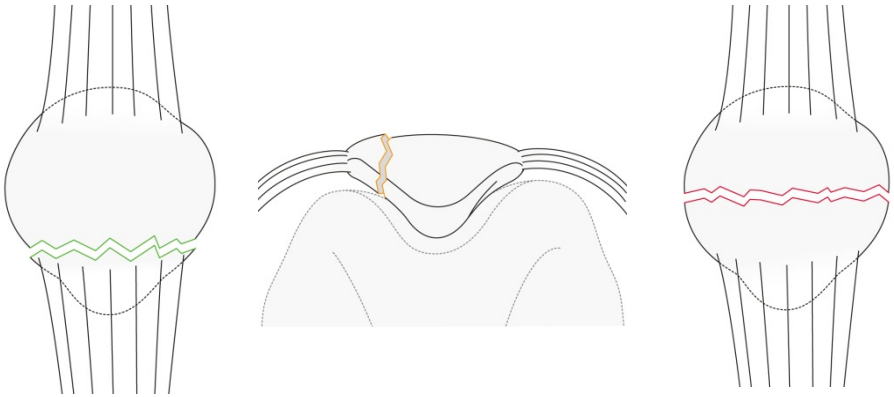
4 4 - B 3



51-year-old female cyclist, hits small post

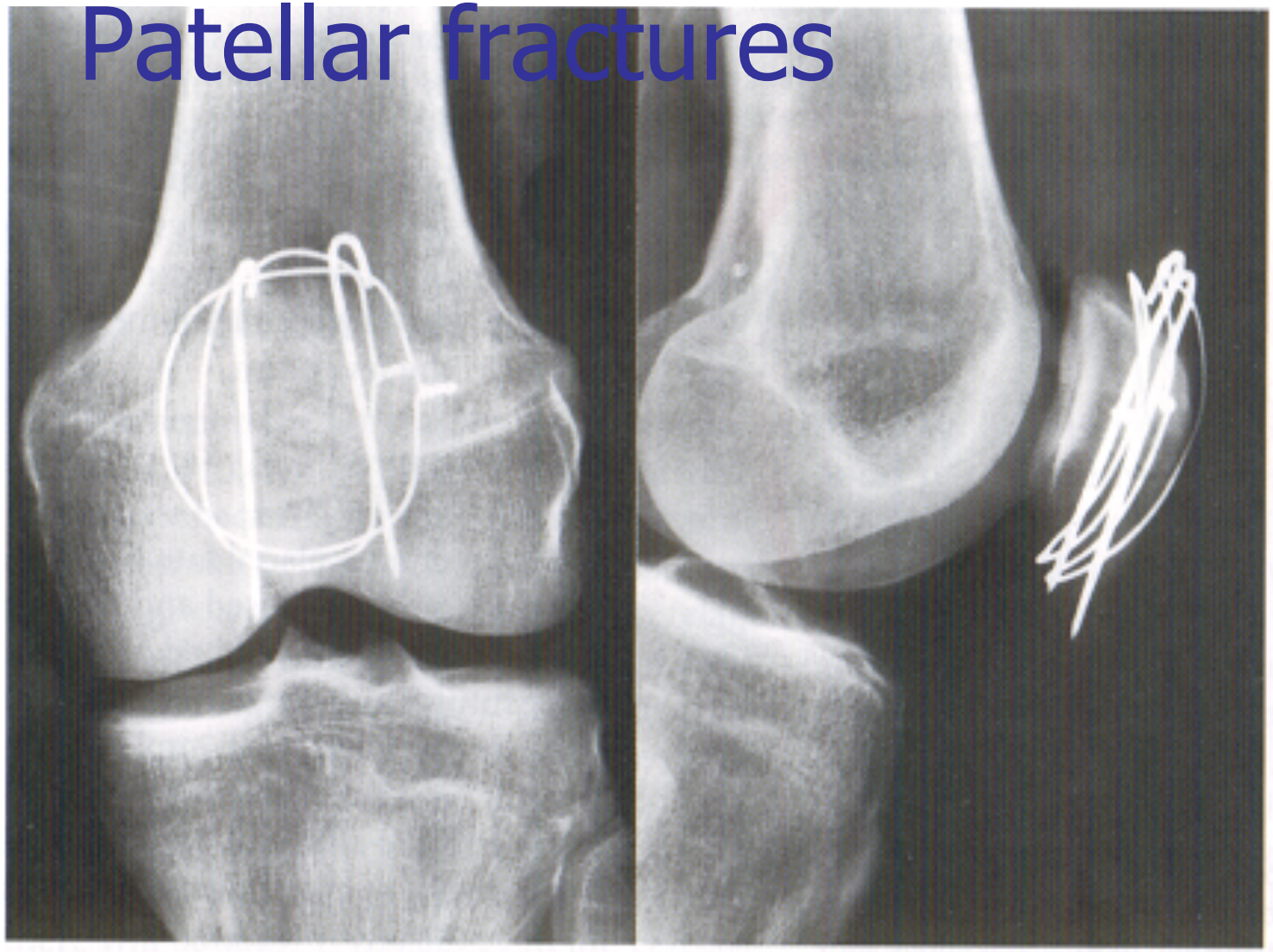
- Closed injury
- Small skin abrasion





45-A1 45-B1 45-C1

Patellar fractures



21-B1

Case 7:
Closed femoral fractures

- Male
- 41 years

- Car accident

- Isolated injury
- Closed

42-B3 fracture

Postoperative x-ray

2-year-old male, fell off trampoline

- No other injuries

2-year-old male, fell off trampoline

~~No other injuries~~

x-rays 3 months posttrauma


Day 1

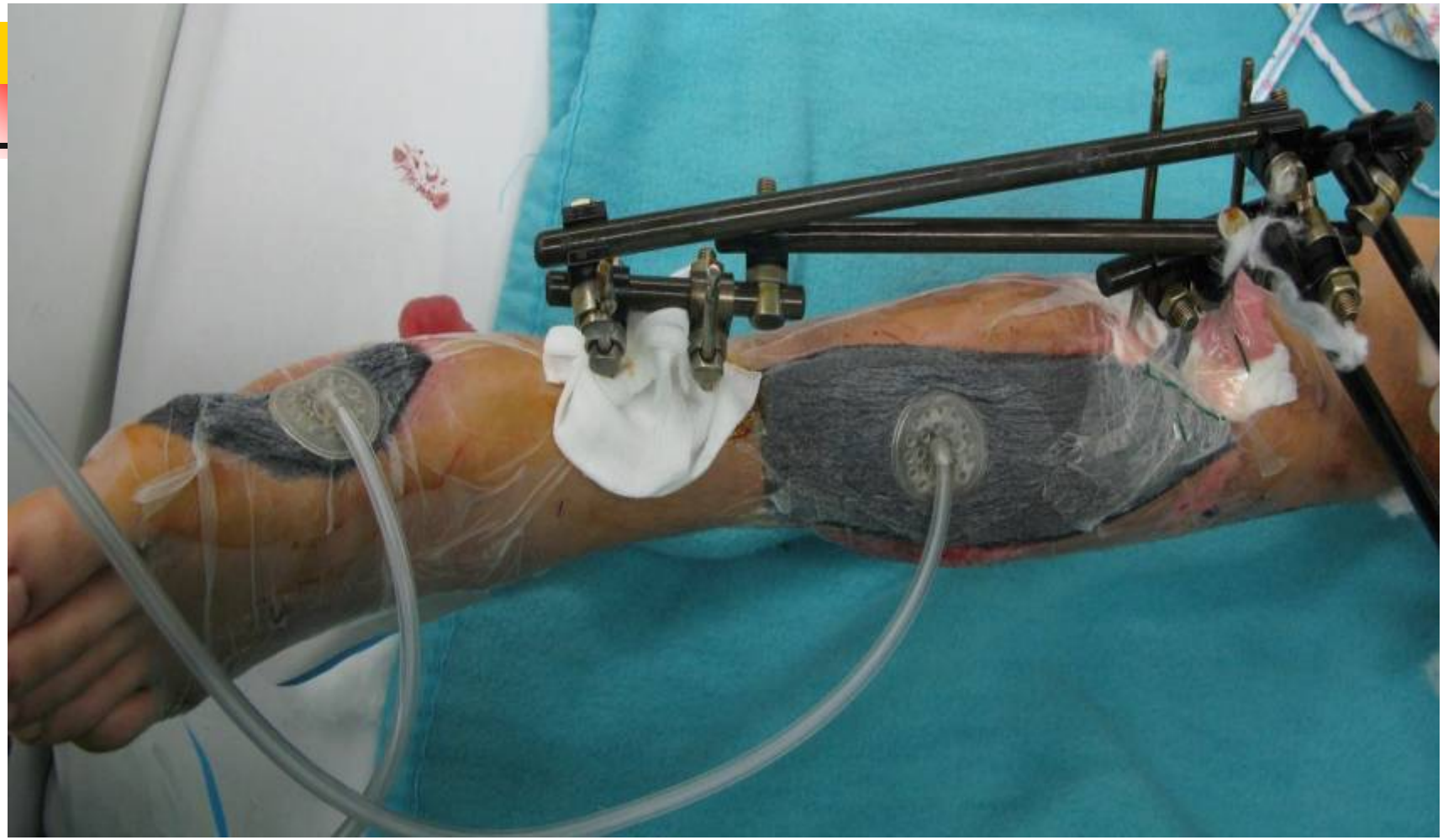
- 44-year-old male
- Fall 7 meters while cutting branches
- Closed isolated injury
- NV intact

Day 0

34-year-old male, traffic collision
No other injuries; distal NV good

How to manage this wound and fracture ?

VAC dressing and external fixator



Barrier dressing from the hospital environment until appropriate soft-tissue reconstruction