Principles Of External Fixators

By
Dr/ Mohammed Attia

Indications

- External fixation has a vital role in both provisional and definitive fracture fixation.

- In provisional stabilization, the surgeon must consider the impact of the fixator on the patient's care (wound and hygiene) and definitive management.

1- Fractures With Soft-tissue Damage

- Closed ,open fractures and after fasciotomy

Closed fracture with severe soft-tissue injury, joint-bridgi external fixator

Open fracture

Skin wrinkling after 7 days

Open fracture, redislocation at second look operation

2- Polytrauma—Damage Control Surgery

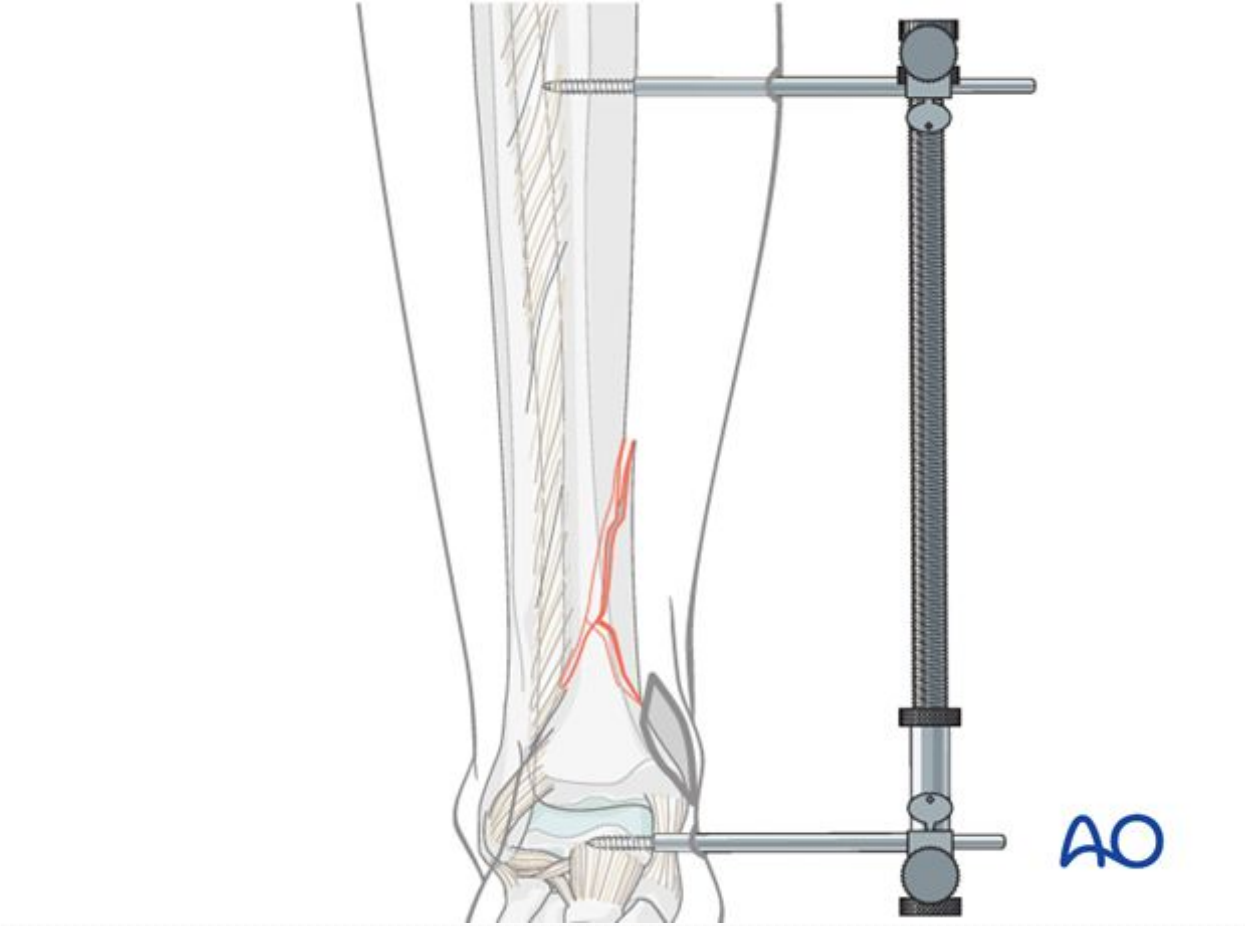
- Provisional application of external fixator as fast as possible to stablise the patient and save life and limb.

3- Skeletal Infection

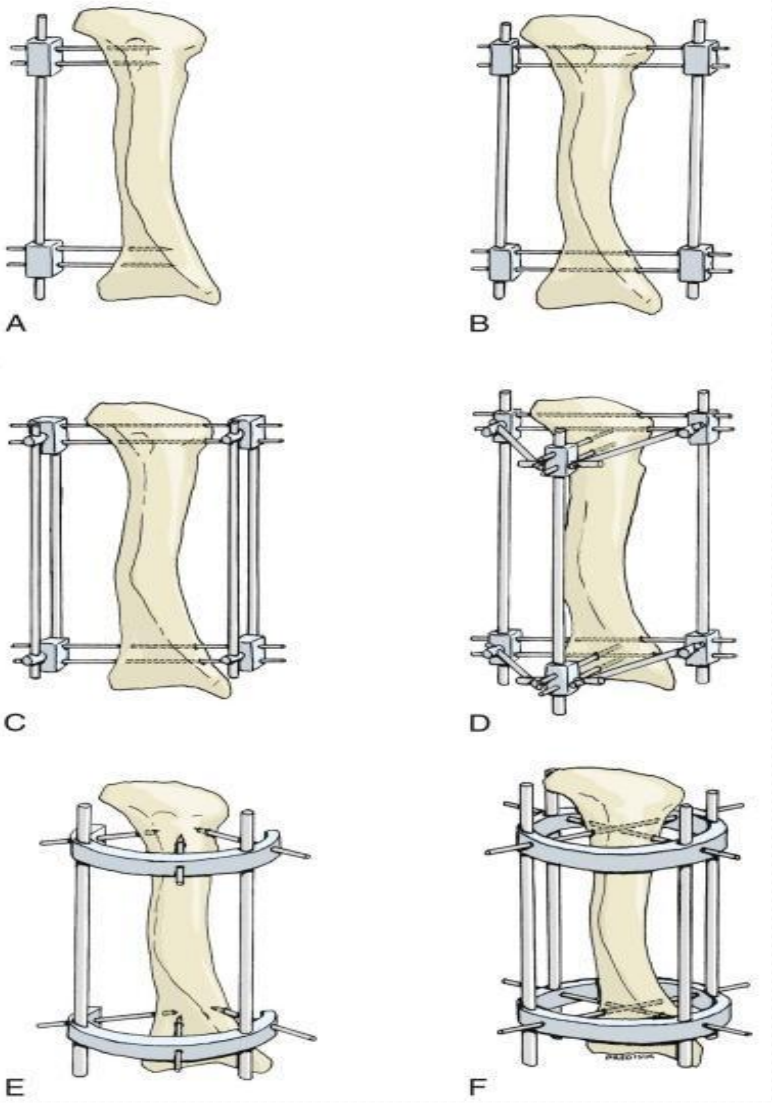
4- Corrective Surgery And Bone Transport

5- Arthrodiastasis and Joint Fusion

6- Indirect Reduction By Ex fix or Distractor



Frame Configuration



A- Unilateral.

B- Bilateral.

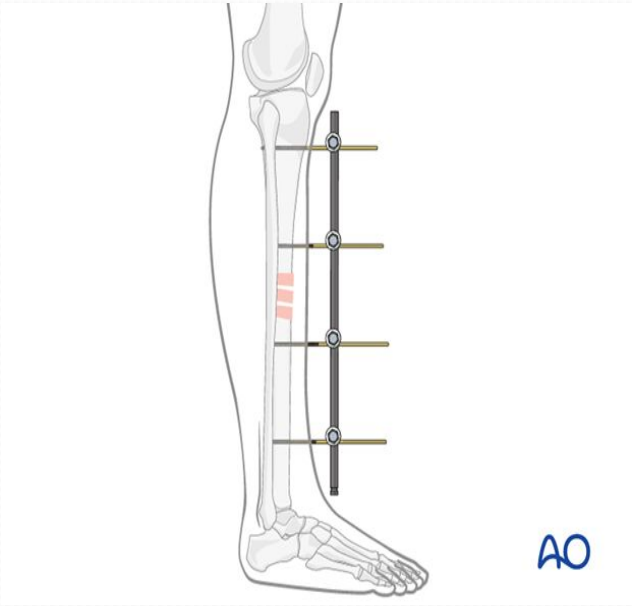
C- Multiplanar(quadrilateral)

D- Multiplanar (deltaconfiguration).

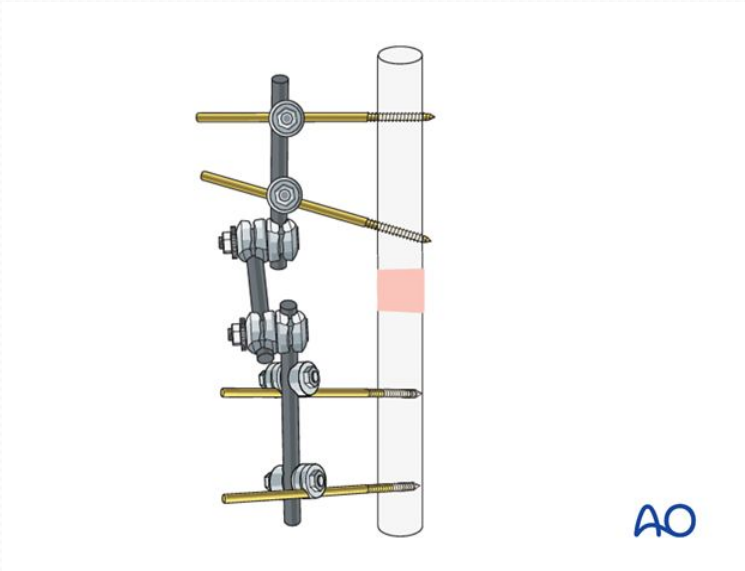
E,F- Ring fixator

Types

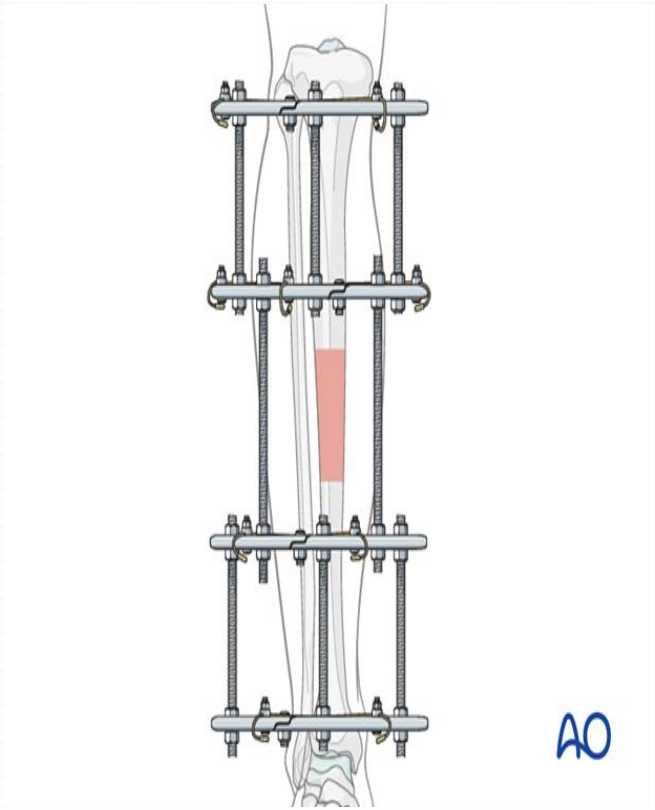
1- Single Tube



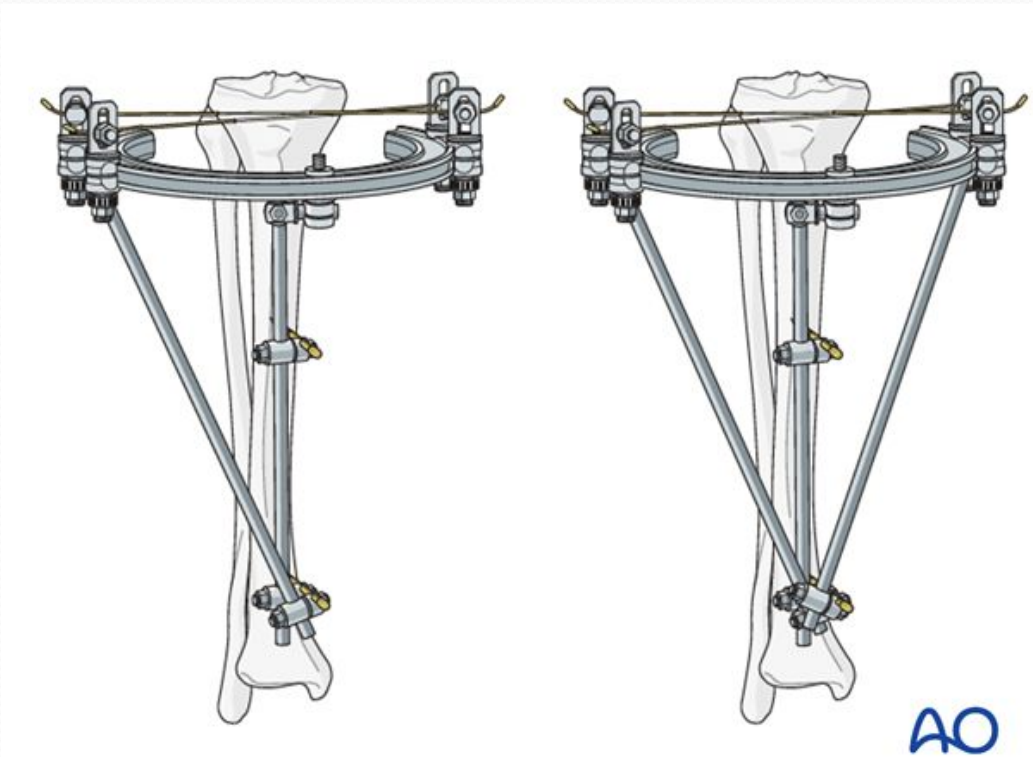
2- Modular



3- Ring



4- Hybird



5- Monolateral Dynamic

Lrs and ball joint spaning orthofix

Basic Implants

1- Schanz Screws

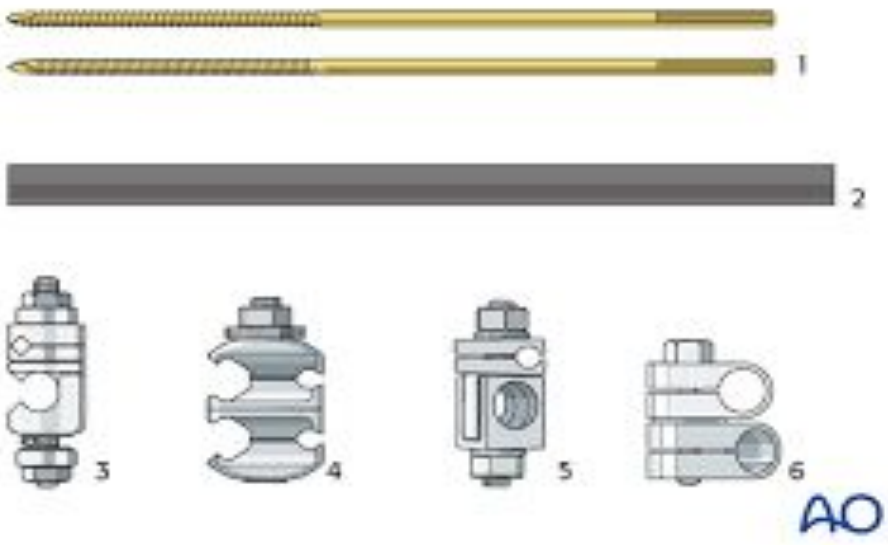
- Size never use more than one third of bone diameter
- Pin bending strength is increased to the fourth power of the increase in the pin's radius
- 5-6 mm for femur and tibia
- 4-5 mm for humerus
- 4 mm for forearm
- 2-3 in hand and foot
- Avoid thermal necrosis

Preloading ,irrigation and t handle insert

- Avoid skin damage

Use asleeve

- Know the safe zones well.



2- Clamps

3- Rods

Safe Zones

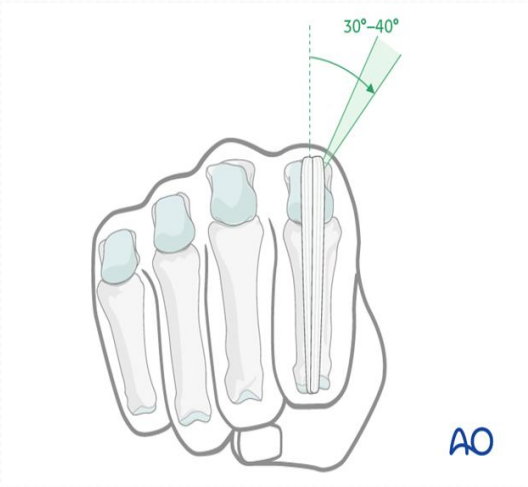
Humerus

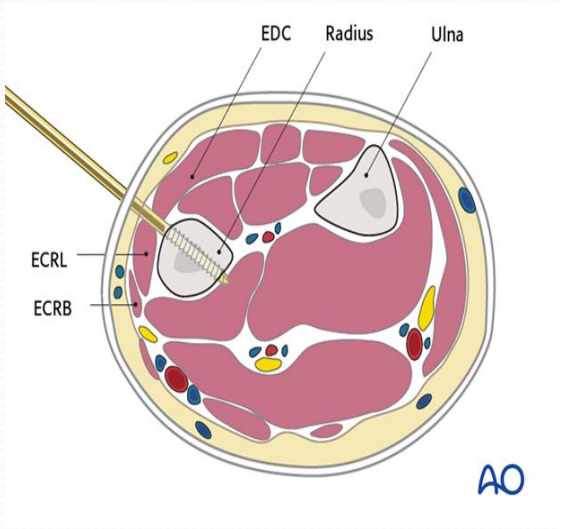
- Pins (5 mm) are placed anterolaterally in the proximal humerus, taking care to avoid damage to the axillary and radial nerves, and posterolaterally (4 to 5 mm) in the distal humerus, avoiding the olecranon fossa .

Femur

- Femoral shaft fractures are stabilized using pins (5 mm) placed anterolaterally or directly lateral .

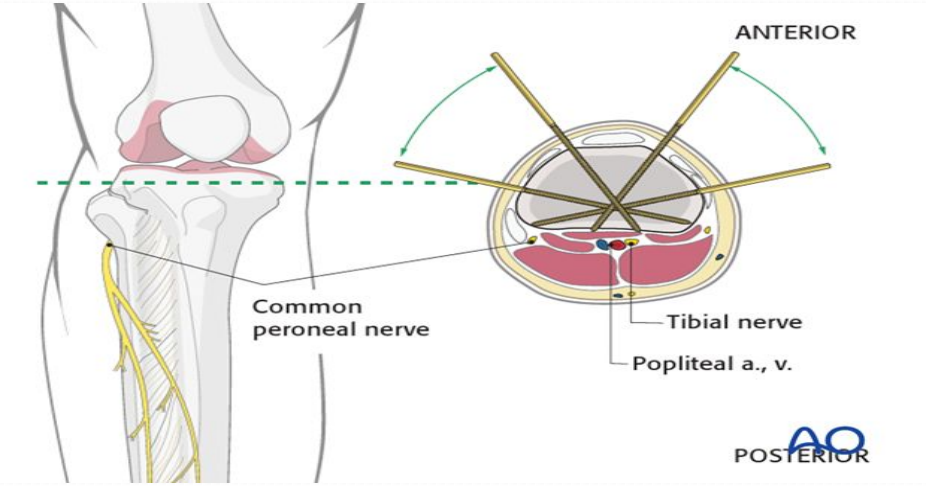
Wrist





- 30°-40° in relation to the sagittal plane to avoid transfixing the extensor tendon/hood
- The proximal two pins should be inserted proximal to the muscle bellies of abductor pollicis longus (APL) and extensor pollicis brevis (EPB), and should not penetrate them.

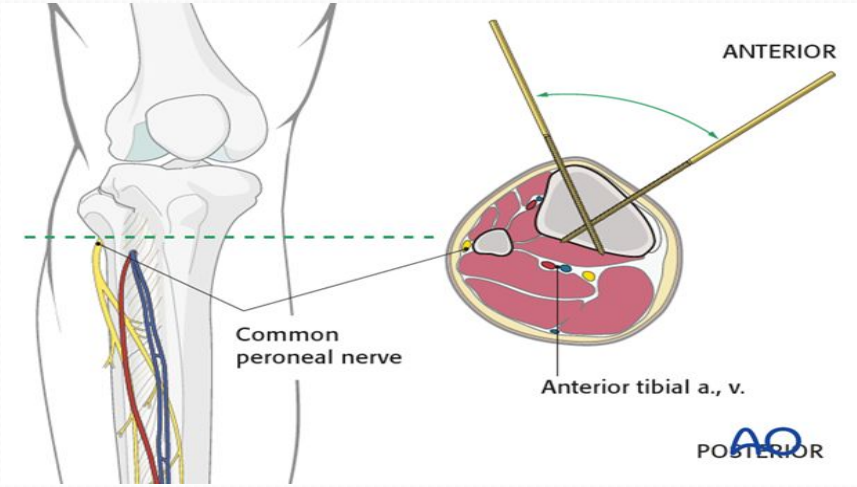
Tibia



Proximal tibial head

2CM distal to tibial plateau and avoid patellar tendon

. transfixion



Distal of the tibial tuberosity

Tibial crest and the medial face of the tibia

Factors Adding To Stability Of External Fixationl

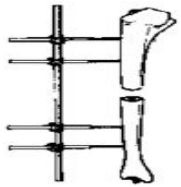
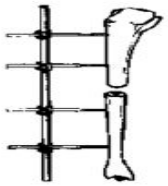
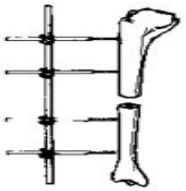
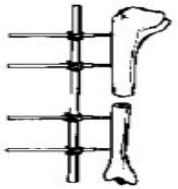
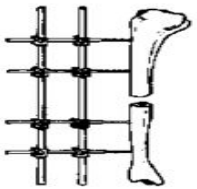
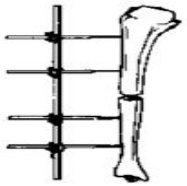
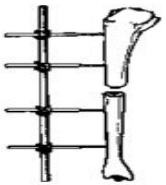
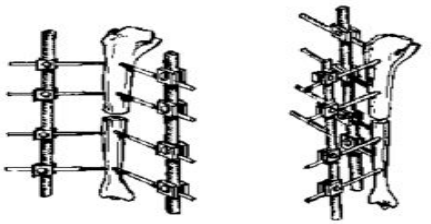
1- The stiffness of the frame increases with the thickness of a screw.

2- The thread design will define the holding strength in the bone.

3- It is better to insert a pin as close as possible to the fracture site.

4- Through larger distances between the pins in a fragment, the holding strength increases.

5- Also, a second rod will additionally increase the stiffness.

Method of Increasing Stability	Less Stable Construct	More Stable Construct
Controlling both near and far ends of each bone segment		
Decreasing the distance between the rod and the bone		
Increasing the number of connecting rods		
Increasing the diameter of the pins		
Using multiplanar fixation		

Postoperative care

The goal of post-operative care is to remove any debris, such as crusts or exudates

Pin-site infections

- virulent *Staphylococcus aures* and E.coli

Table 2

Pin-tract Infection Classification and Treatment[40]

Grade	Appearance	Treatment
1	Slight erythema, little discharge	Improved pin care
2	Erythema, discharge, and pain in soft tissue	Topical and/or oral antibiotics
3	Grade 2 but no improvement with antibiotics	Remove pin and change antibiotic regimen
4	Soft-tissue infection involving several pins	Remove any loose pins
5	Grade 4 and radiographic evidence of bone involvement	Remove entire fixator construct and curettage pin tract
6	Infection after fixator removal (clinical and radiographic)	Débridement, irrigation, and systemic antibiotics