Intramedullary Pins, Interlocking Nails, and Orthopedic Wire in Fracture Management

Ann L. Johnson DVM, MS
Diplomate ACVS
Professor

Fracture Assessment Indications

- 8-10,4-7: Long oblique fractures, avulsion fractures
- **8-10, 4-7**: Metaphyseal or physeal fractures
- **4-7,0-3**: Comminuted fractures - use with ESF or plate

Fracture Assessment Indications

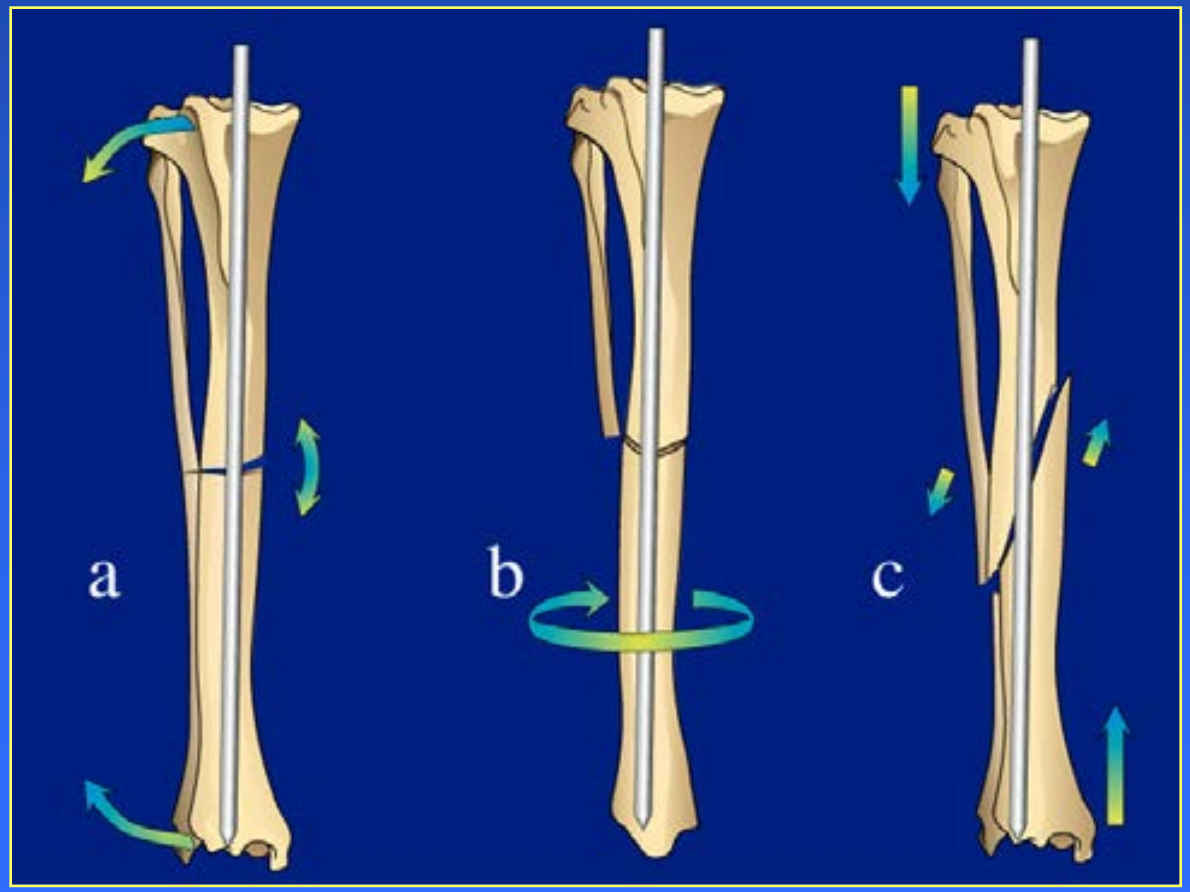
- 8-10,4-7,0-3: applicable for all fracture assessment indications

Indications for IM Pins

- Humerus, femur, and tibia
- Diaphyseal fractures
- Supplemented with orthopedic wire, ESF or plates
- Crossed pins for physeal or metaphyseal fractures

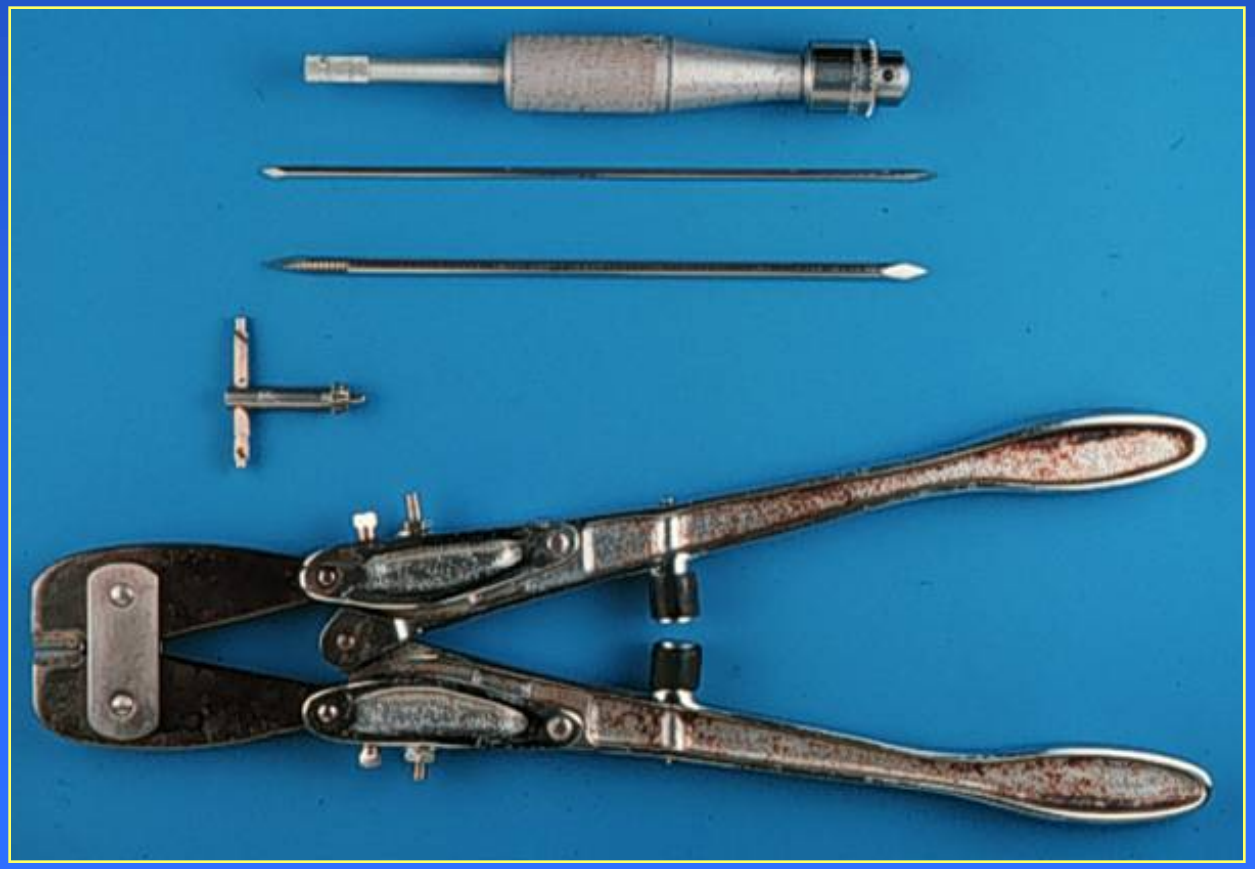
Mechanics of IM Pins

- Resists bending loads
- No resistance to axial or rotational load
- Movement leads to pin migration



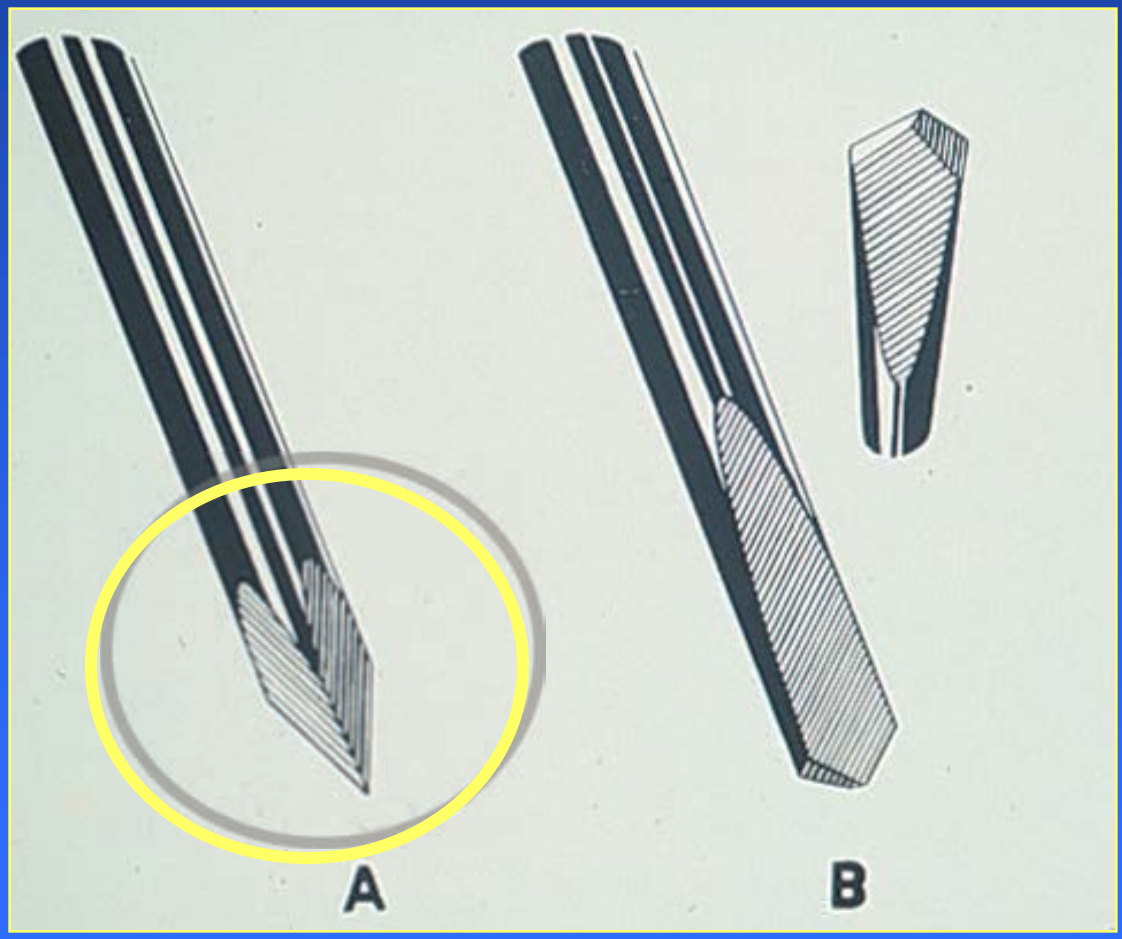
Equipment and Supplies

- Smooth, round, 316L stainless steel rods
- Inserted into the medullary cavity for fracture stabilization



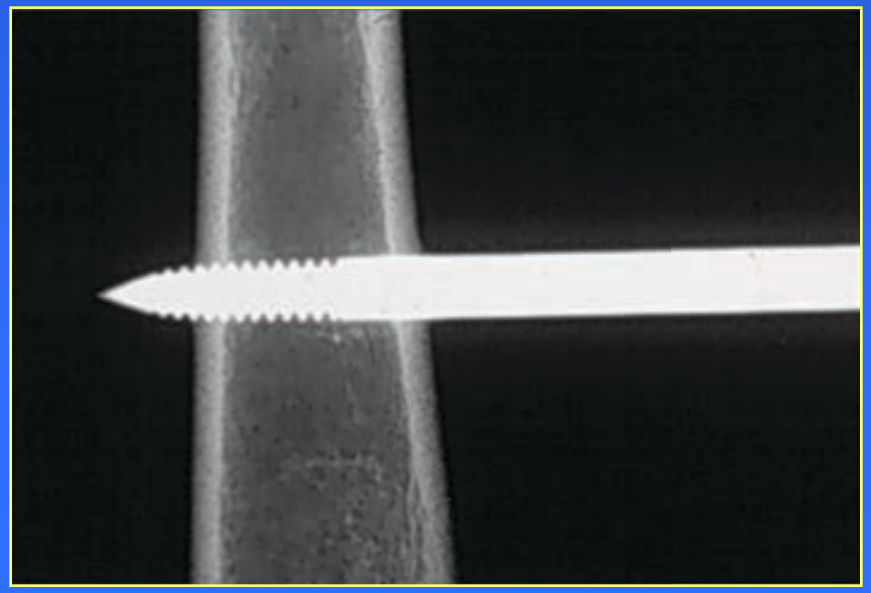
Intramedullary Pin Points

- A. Trochar points have a triple cutting edge and cut through cancellous bone easily
- B. Chisel points are slightly more effective in cutting through dense cortical bone

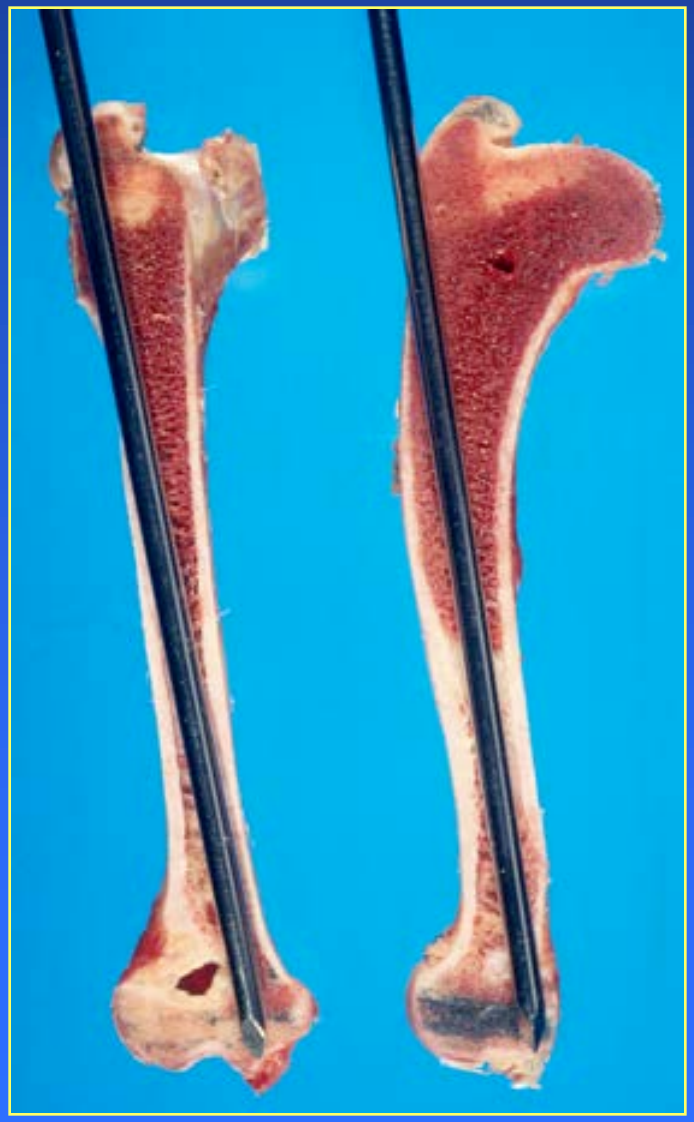


End-threaded Steinmann Pin

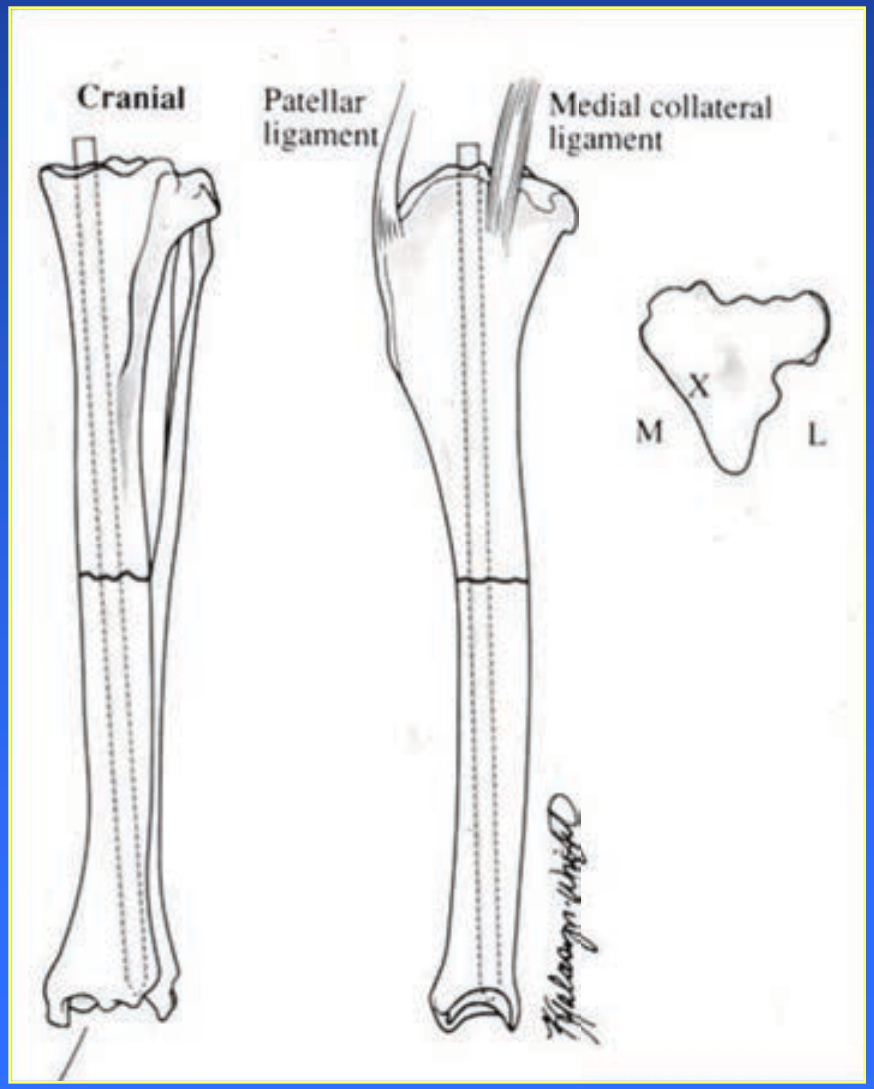
- Increased holding power in cancellous bone
- May prevent migration after bone fills into threads
- May not provide increased early holding power
- Negative profile threads act as a stress concentrator and may result in premature failure



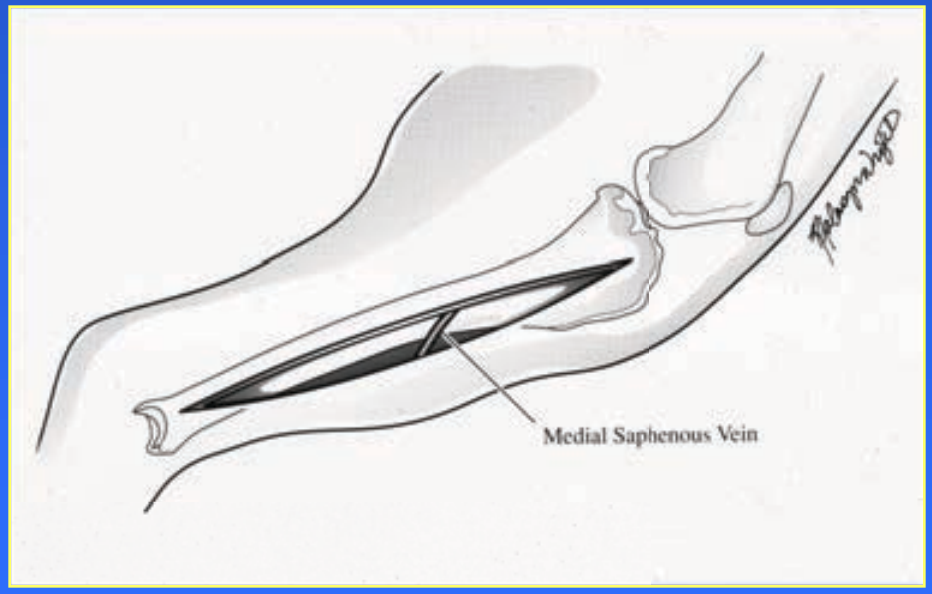
Application of IM Pins



Technique for IM Pin Application



Tibia



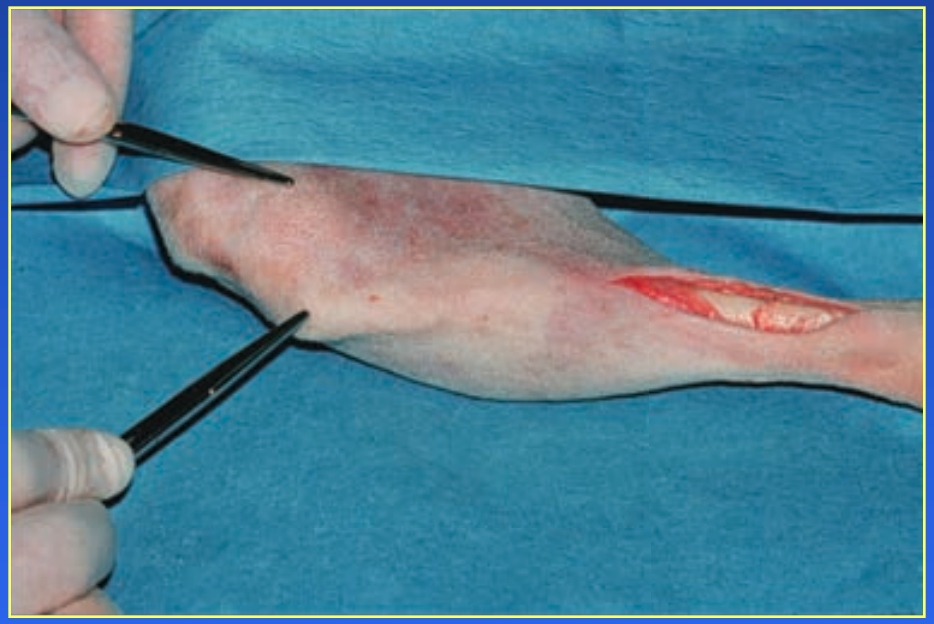
Technique for IM Pin Application

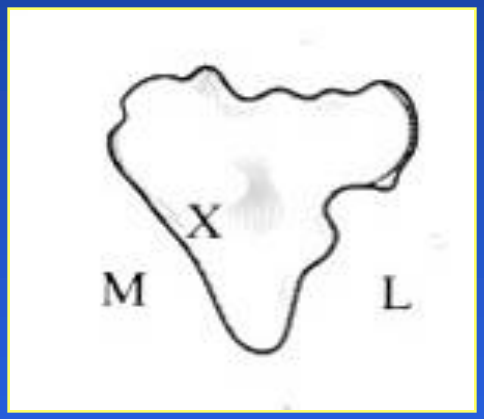
Pin size selected by observing medullary canal size radiographically and directly

IM Pin Size

- Canine bone is curved
- Select a pin which can safely traverse the canal and seat in the metaphyses without affecting reduction
- Pin generally 60-70% of canal width at the isthmus

Technique for IM Pin Application



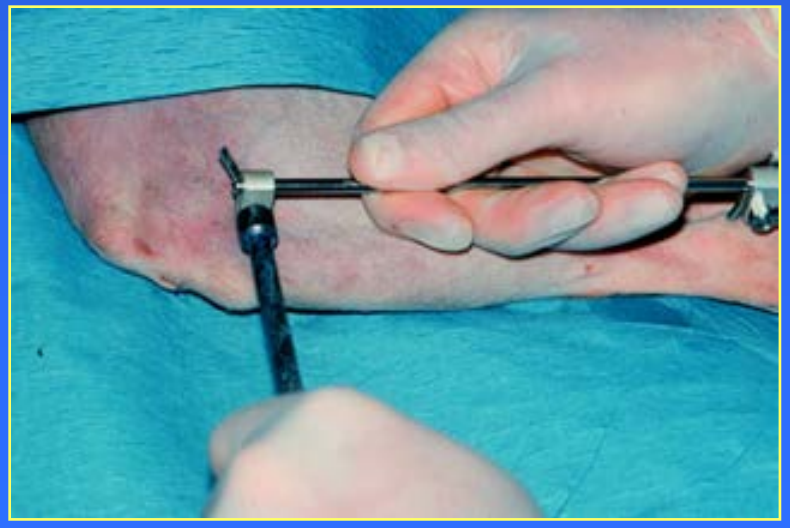


- Medial tibial plateau
- Halfway between the tibial tuberosity and the medial condyle

Technique for IM Pin Application

- Reduce fracture
- Seat pin distally
- Check pin length

Technique for IM Pin Application

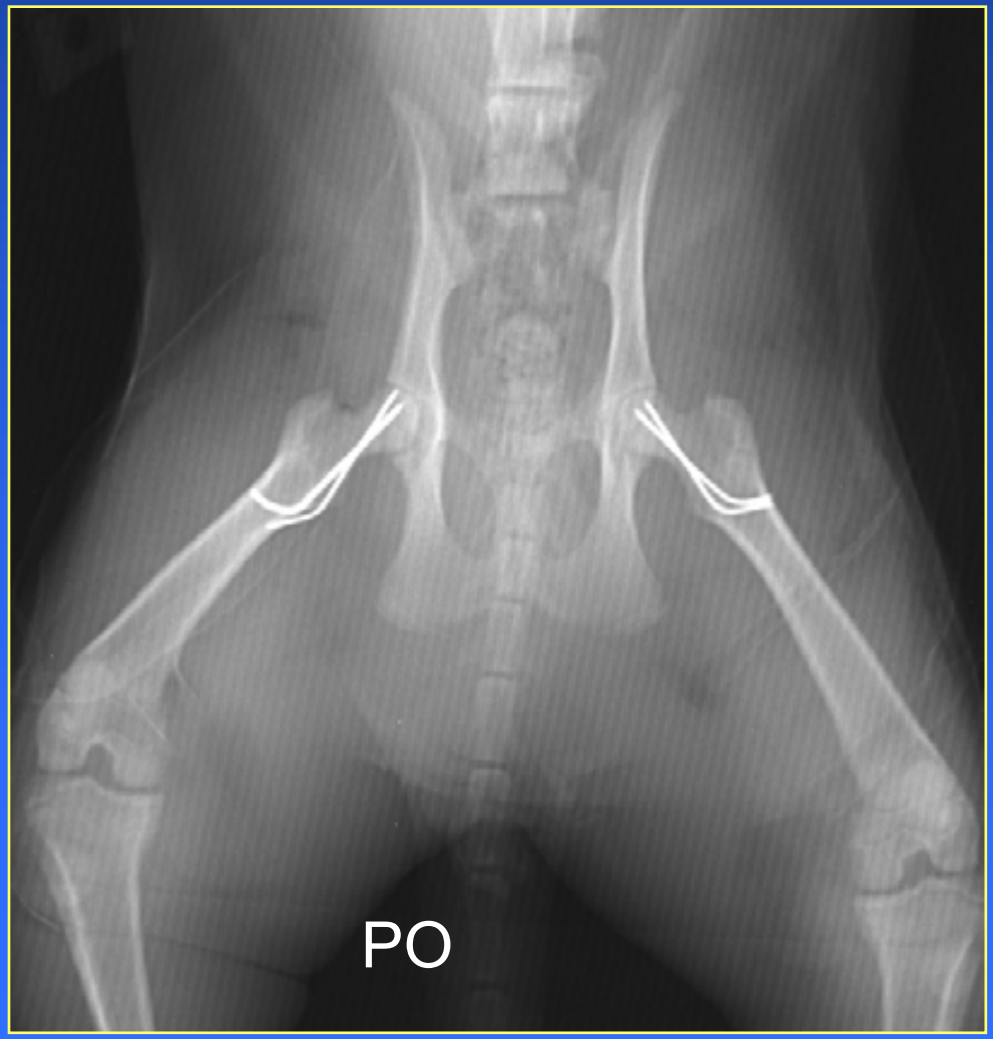


Check fracture stability

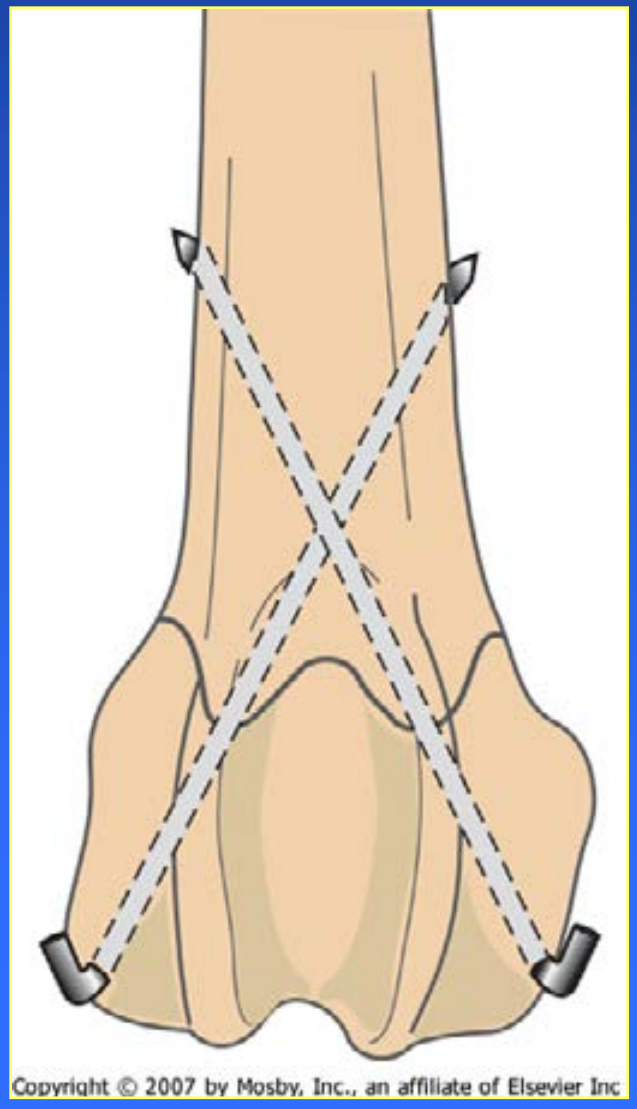
Multiple Pins or Wires

- Multiple crossed or divergent K wires (or pins) used for metaphyseal or physeal fractures in animals with high fracture assessment scores

Postoperative Evaluation



Application of Crossed Pins



Follow Up Evaluation

Postoperative Care for IM Pins

- Exercise limitations, no intensive aftercare
- Instability may result in limited limb function
- Pin removal after healing

Functional Period for IM Pins

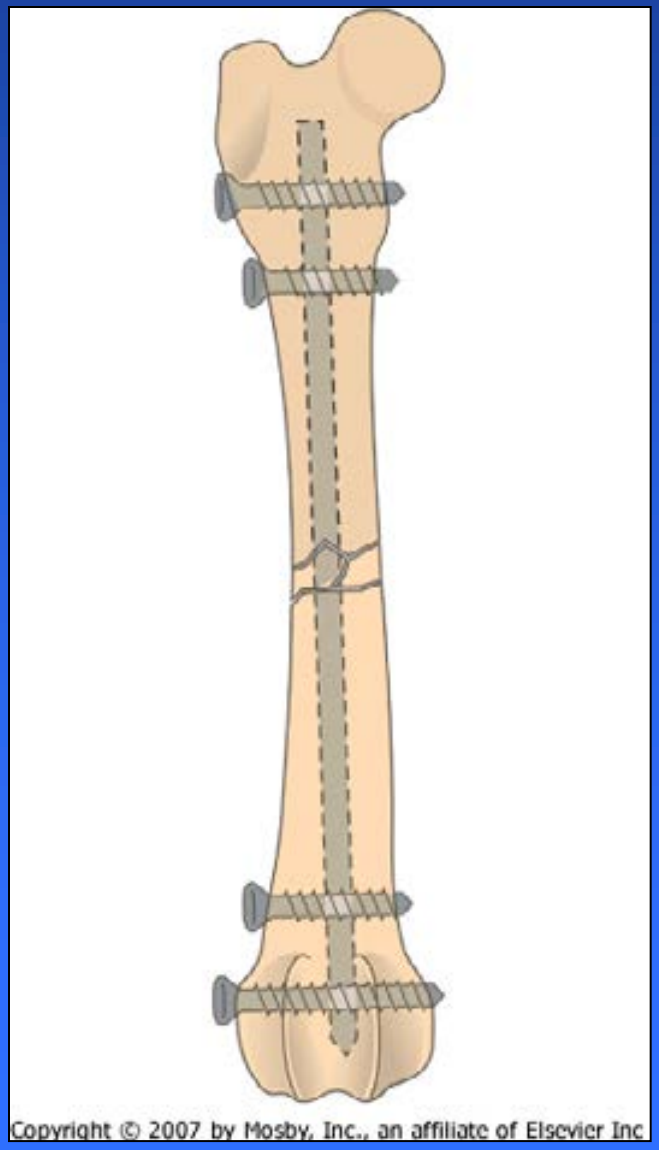
- Good stability for a short time, if the fracture is stable
- Friction between pin and bone prevents premature pin migration

Complications with IM Pins

- Stress associated with unstable fractures causes micro-motion at the pin-bone interface, bone resorption, and premature pin migration
- Sciatic entrapment

Interlocking Nail

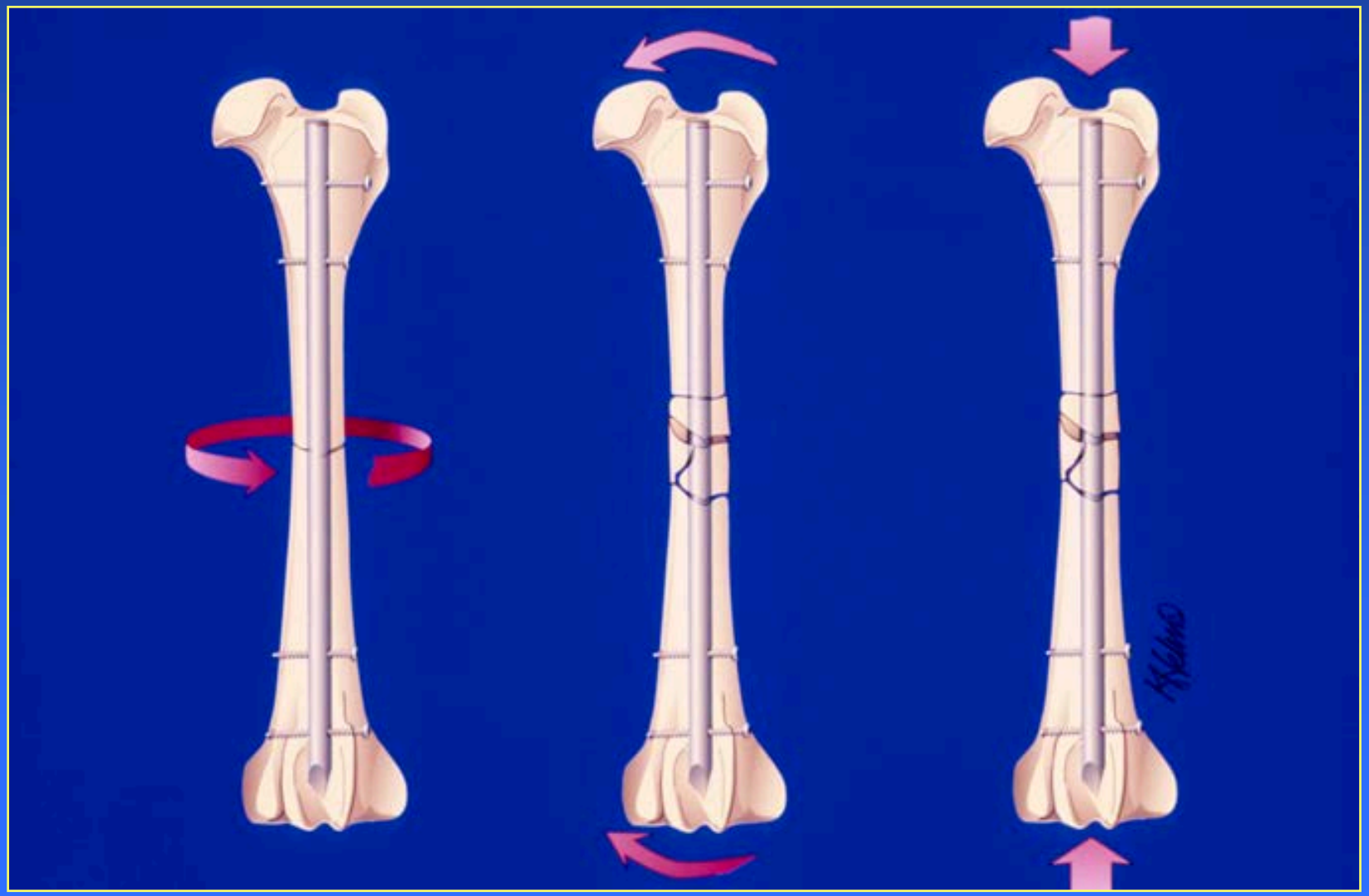
- Solves limitations of IM pins
- Resists compression
- Resists rotation
- Allows biological techniques



Indications and Mechanics

- Fractures of the humerus, femur, and tibia
- Interlocking screws allow implants to resist axial, bending and rotational forces
- Interlocking hold on the bone

Resistant to all forces

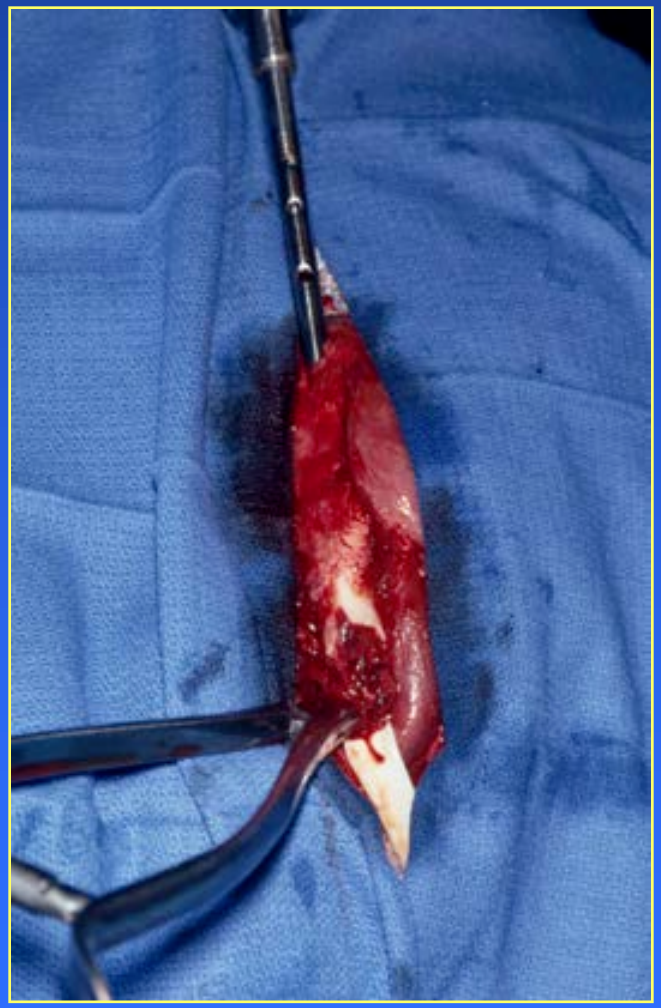


Equipment and Supplies

- Interlocking nails are smooth, round, 316L stainless steel rods with holes which allow screw fixation for fracture stabilization

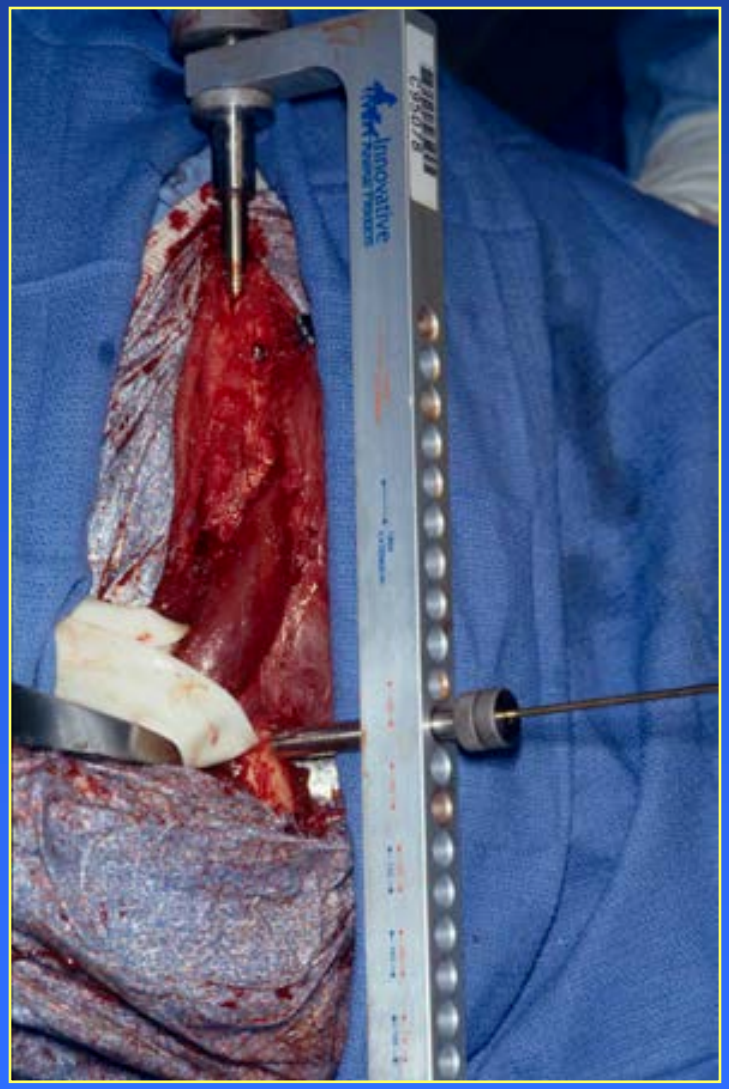
Application of Interlocking Nails

Reaming the medullary canal

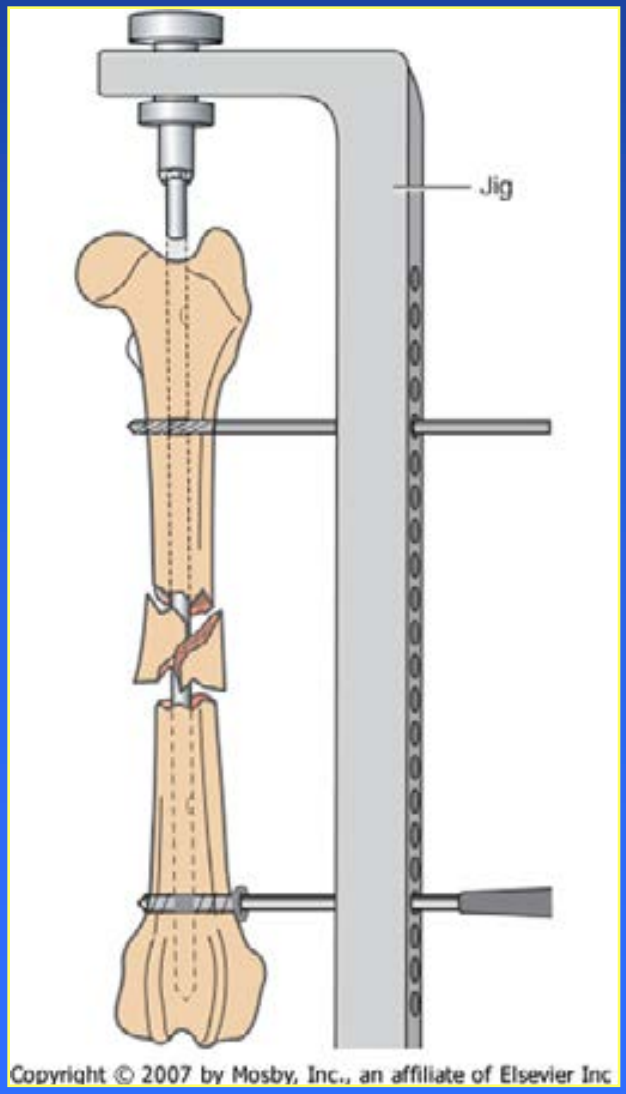


Inserting the nail

Application of Interlocking Nails



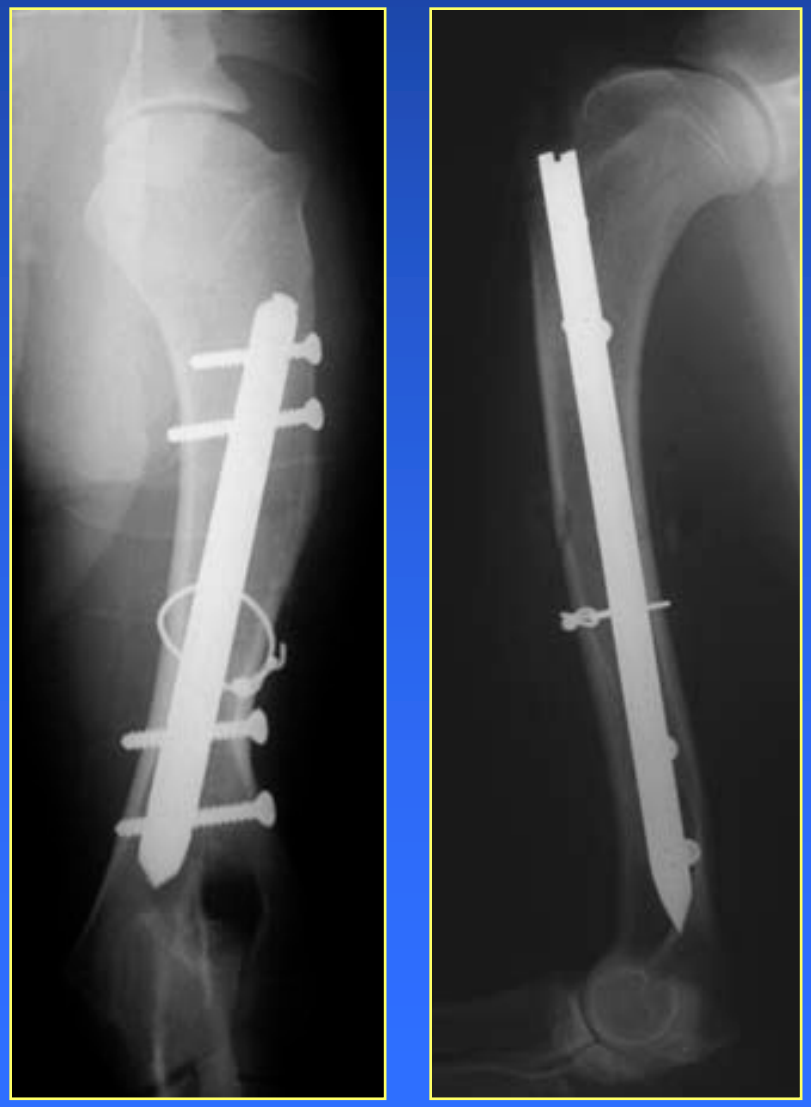
Preparing the hole



Inserting the screw

Postoperative Care and Functional Period for Interlocking Nails

- Exercise limitations, no intensive aftercare
- Implants left in place unless causing problems
- Good stability for a long time, especially if the fracture shares loadbearing

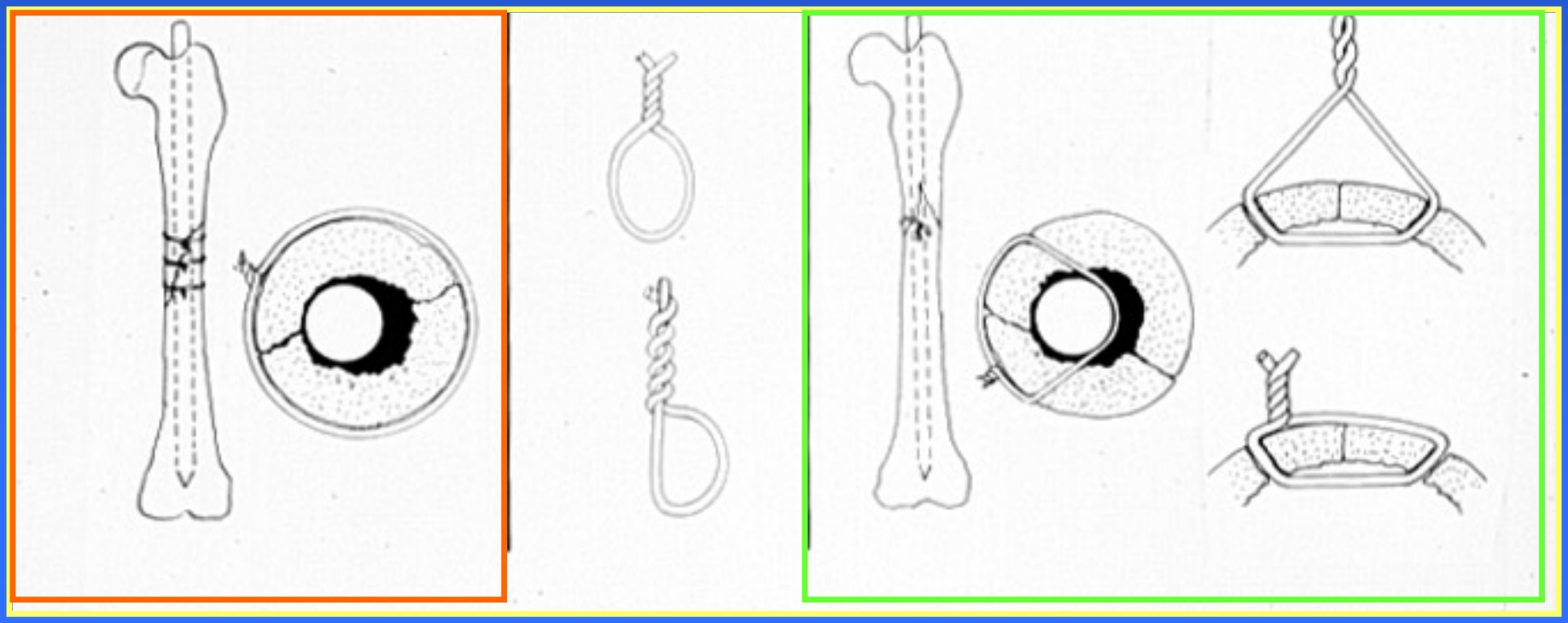


Complications with ILN

- Difficulty with guide
- Implant failure
- Infection
- Malunion
- Difficult to remove

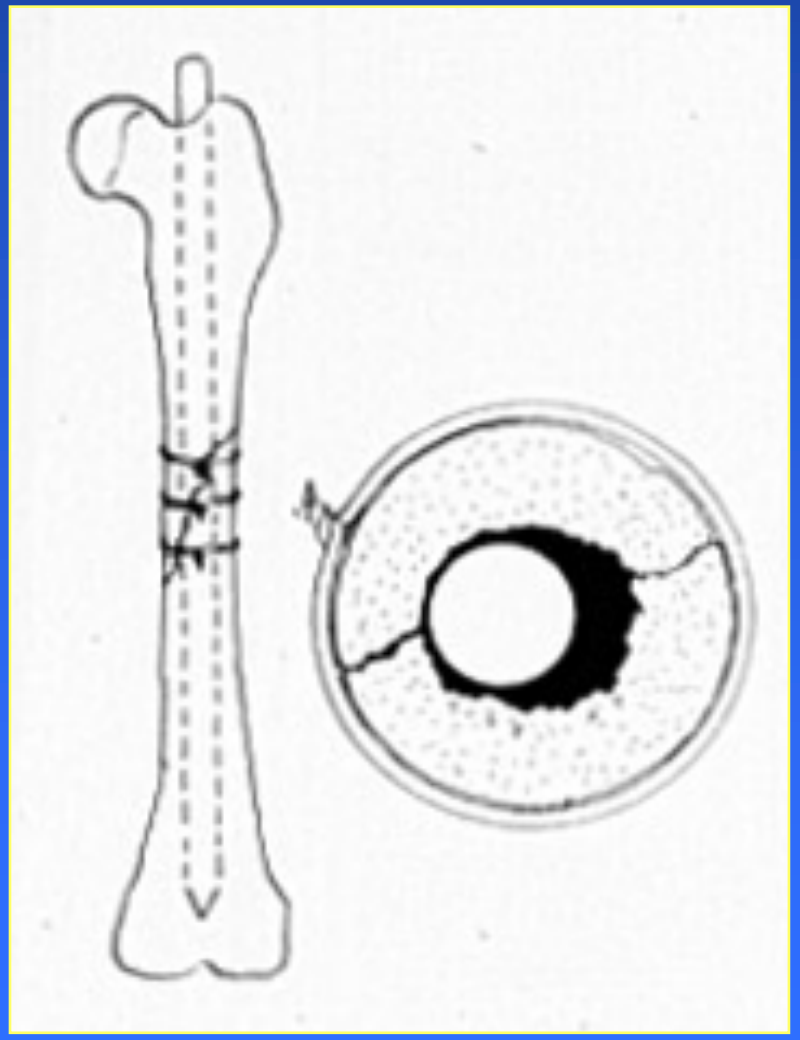
Orthopedic Wire

- Cerclage wire or hemicerclage wire applied to reconstruct long oblique fracture lines



Indications for Orthopedic Wire

- Adds stability to reconstructed long oblique or spiral fractures
- "Most commonly used implant and the most commonly misused implant in veterinary orthopedics“



Mechanics of Wire

- Supplemented with other implants to provide resistance to axial and rotational forces
- Friction generated at fracture lines resists axial, bending and rotational forces in reconstructed long oblique or spiral fractures

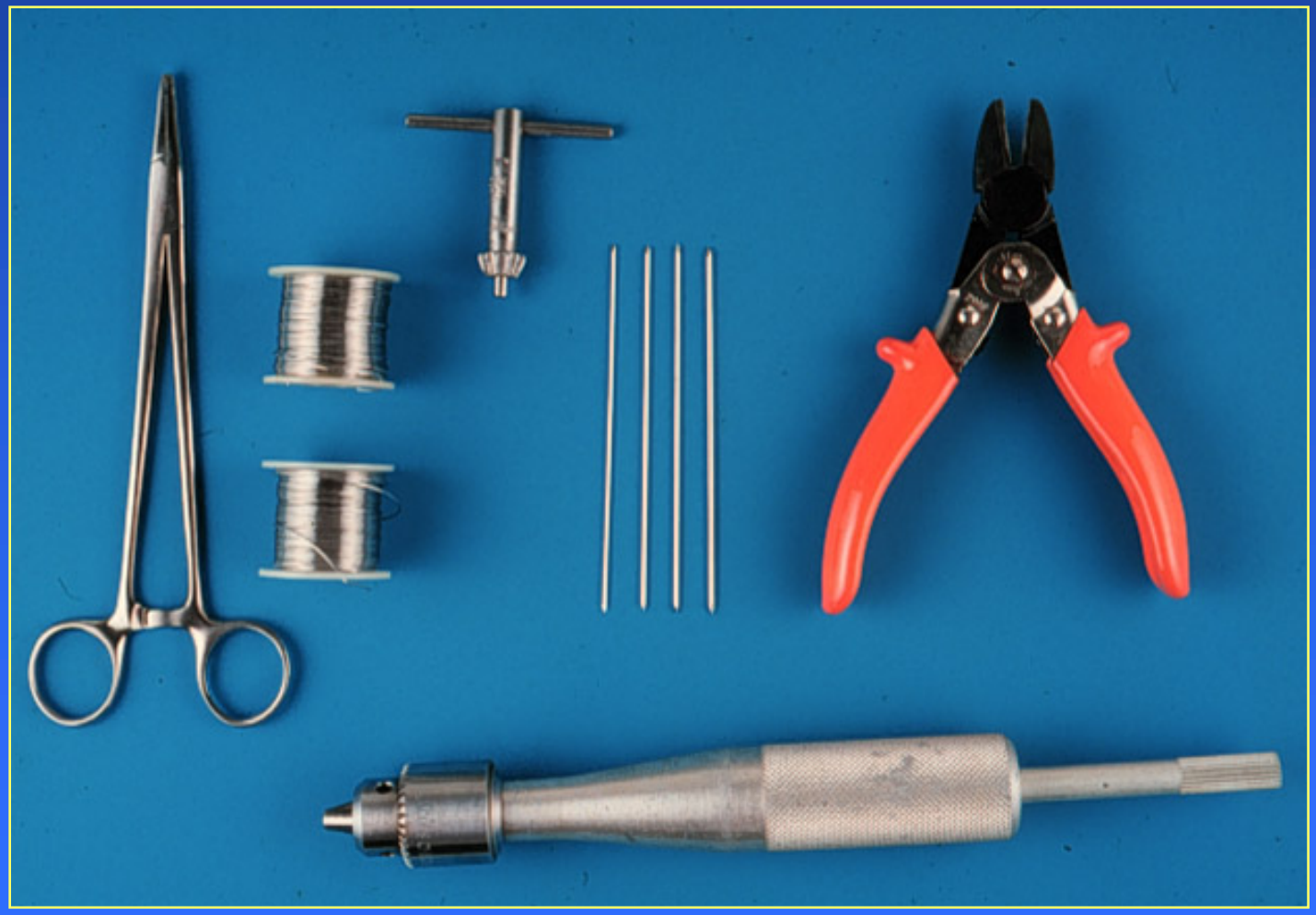
Wire for Stability

- Provides stability and resists loads
- Fracture length = 3 x medullary canal diameter
- Maximum of 3 (preferably only 2) fracture fragments
- Fracture anatomically reduced
- At least 2 and preferably 3 wires per fracture line

Wire for Adaptation

- Holds fracture fragments in place (adaptation), other implants provide stability to resist loads
- More than 2 to 3 fragments
- Fracture lines not sufficiently long
- Misuse leads to complications

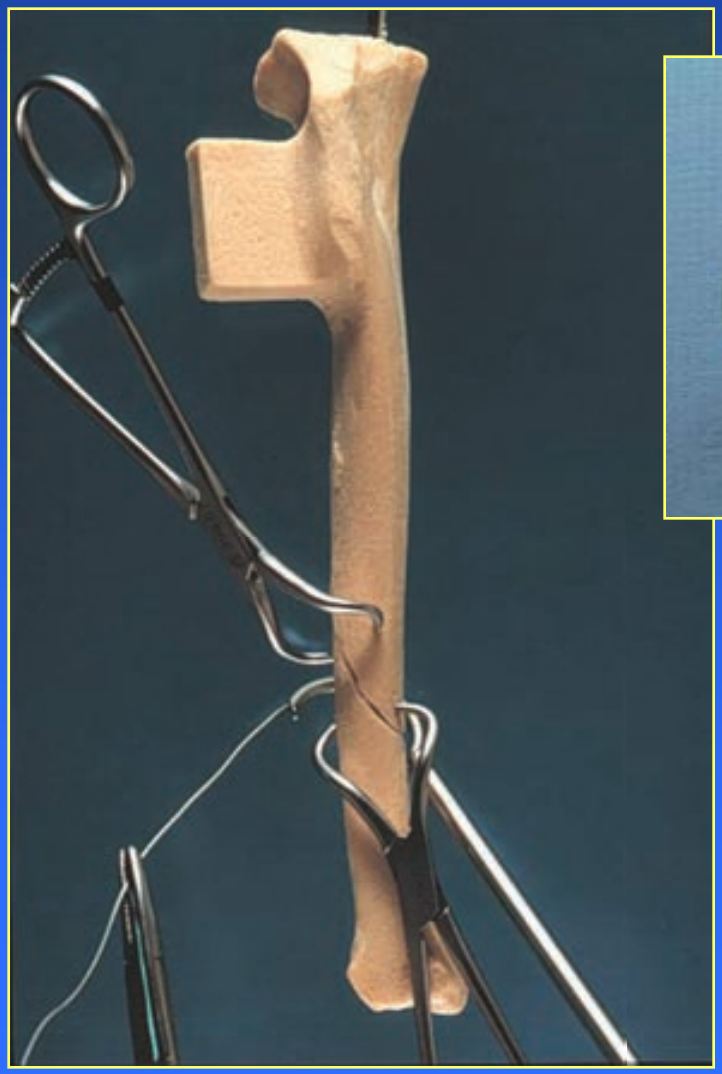
Equipment and Supplies



Application of Cerclage Wire

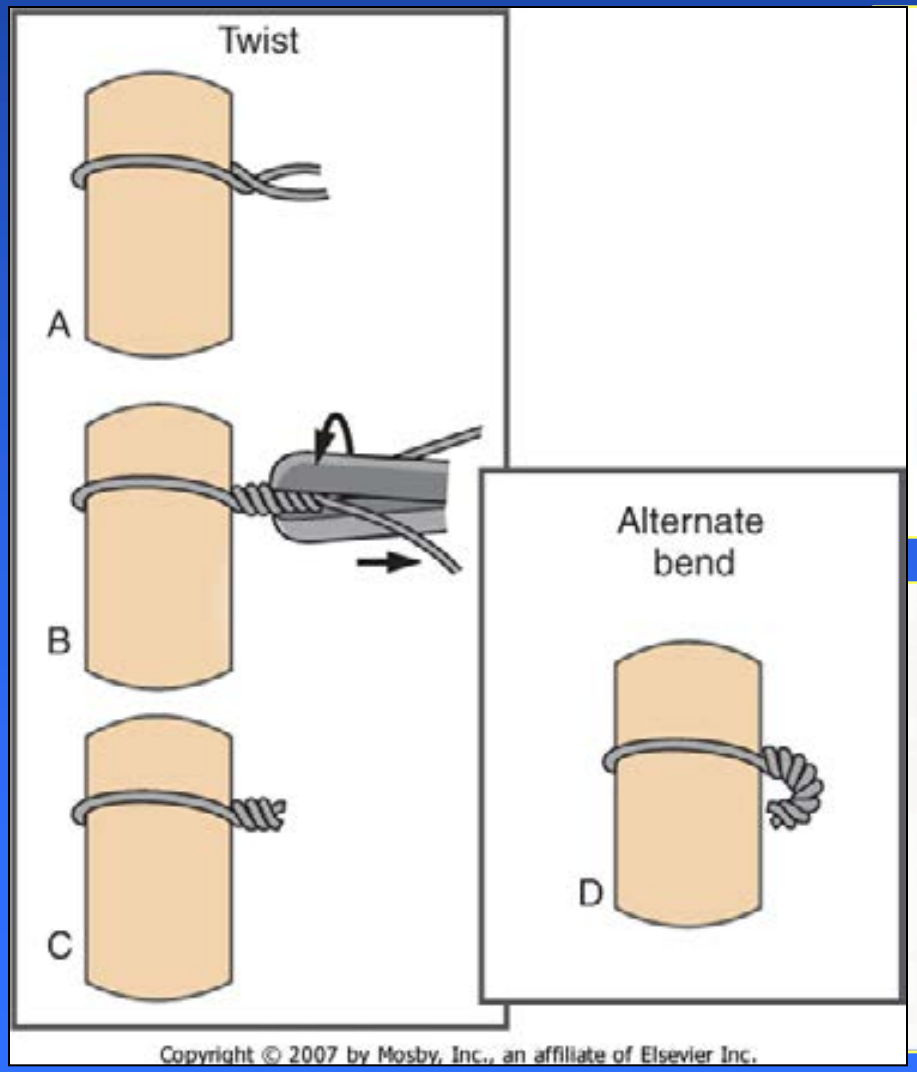
- Best used for stability
- Use largest wire possible
- Minimum of 2 wires per fracture
- Place wires ½ to 1 cm apart
- Start at least ½ cm from fracture end

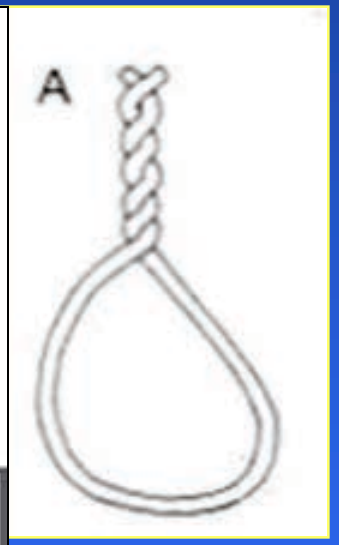
Application of Cerclage Wire



Application of Cerclage Wire

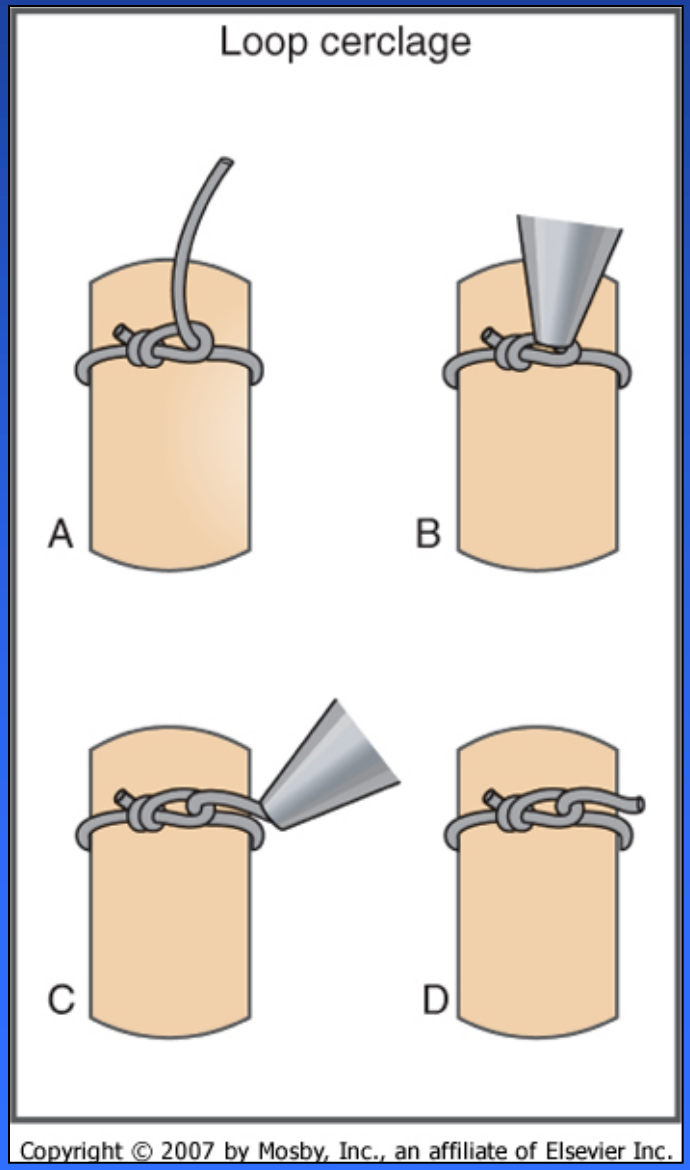
- Start twist
- Apply wire twisting pliers
- Pull and twist
- Twist should be even (A)
- Cut wire





Application of Cerclage Wire

Loop Wire and Tightener



Postoperative Care and Functional Period for Wire

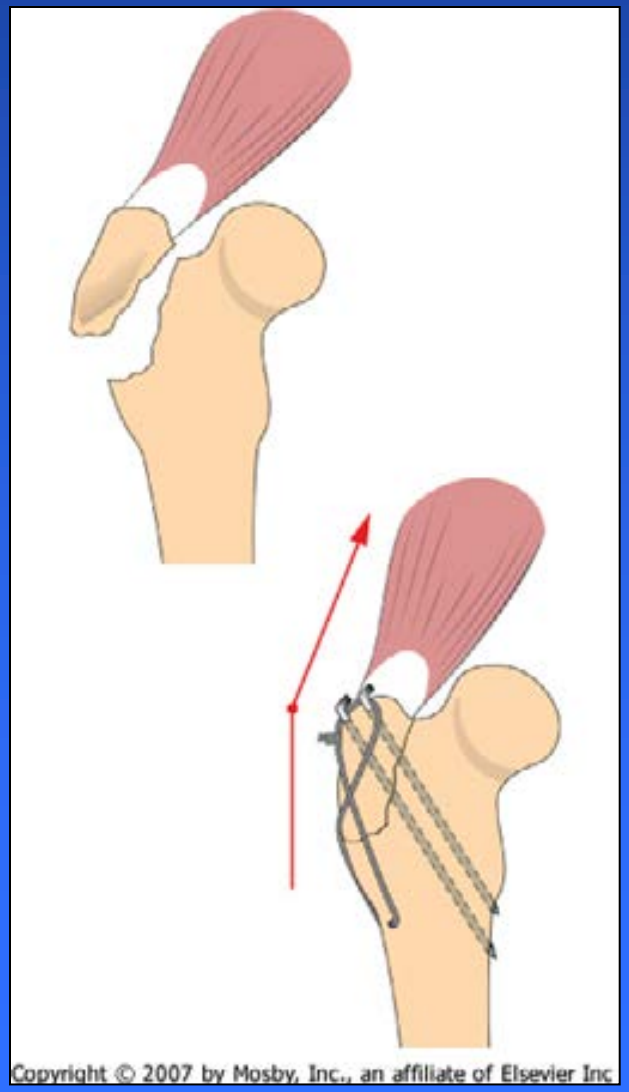
- Good stability for a short time, with reconstructed and stable fracture
- Friction between wire and bone prevents wire motion
- Rarely removed

Complication with Wires

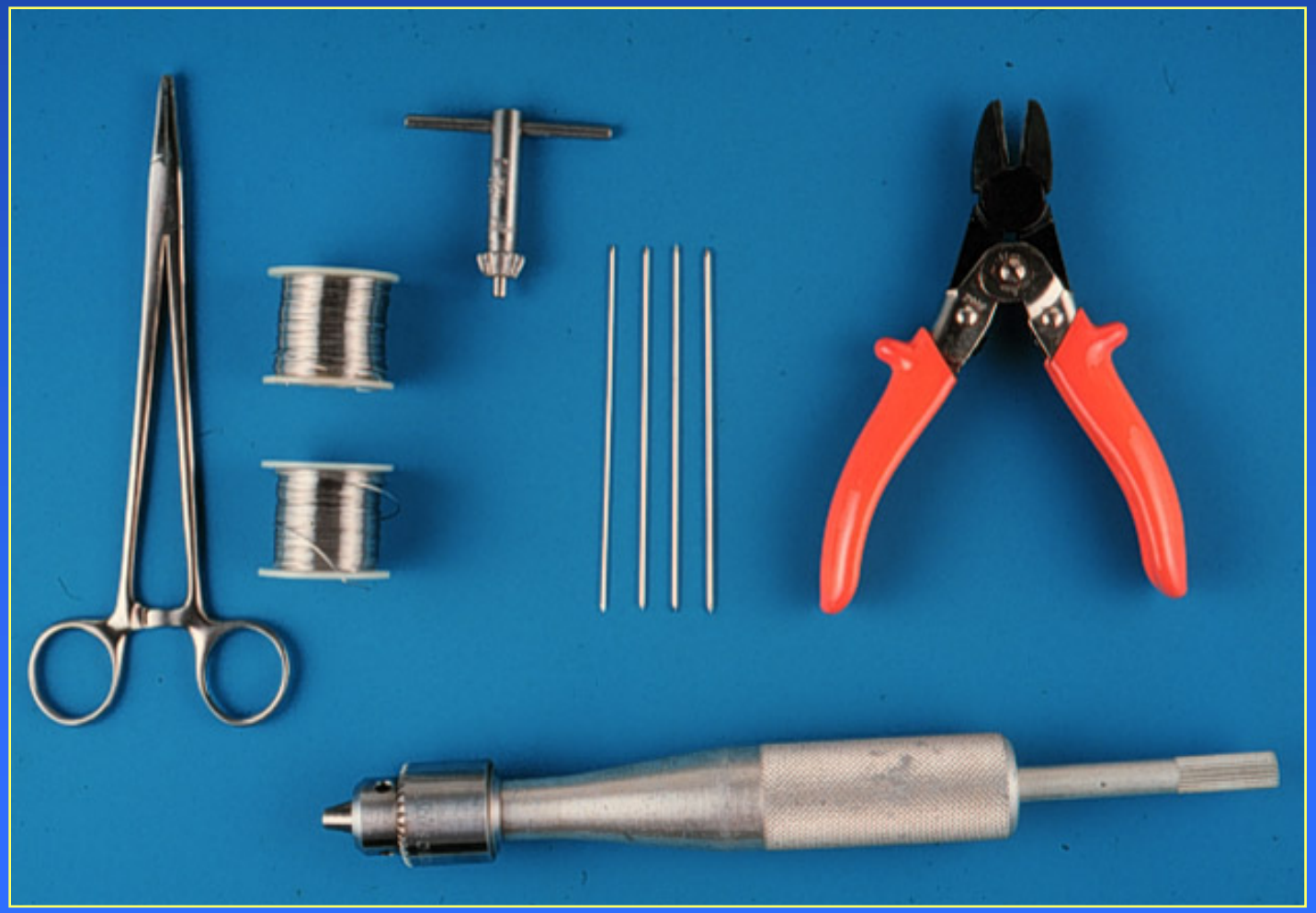
Fracture instability → Pin migration → Wire interferes with healing

Tension Band Wire

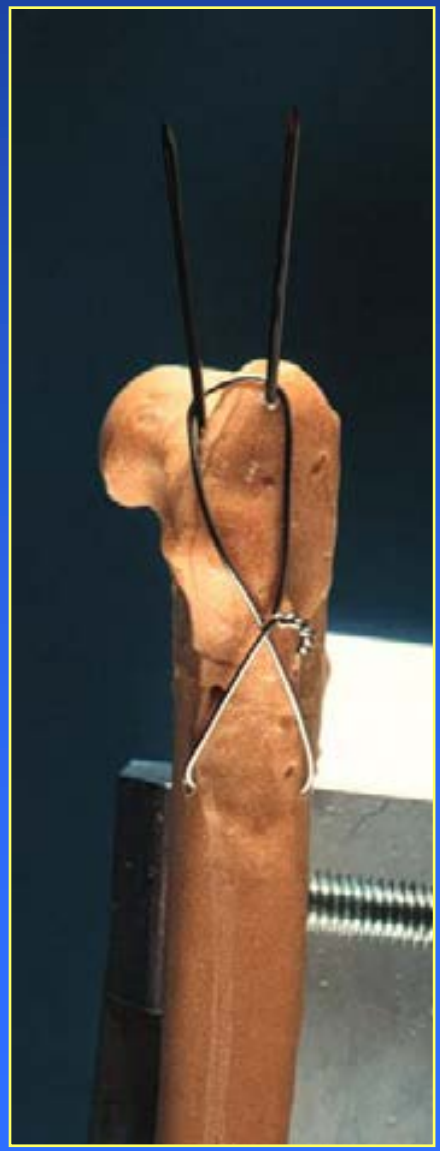
- Used to secure fragments under **tension** (avulsion fractures or osteotomies
- Converts **tensile** forces to **compressive** forces at the fracture



Equipment and Supplies



Application of Tension Band Wire



Postoperative Care

- Special post operative care not required
- Removal after healing if soft tissue irritation occurs