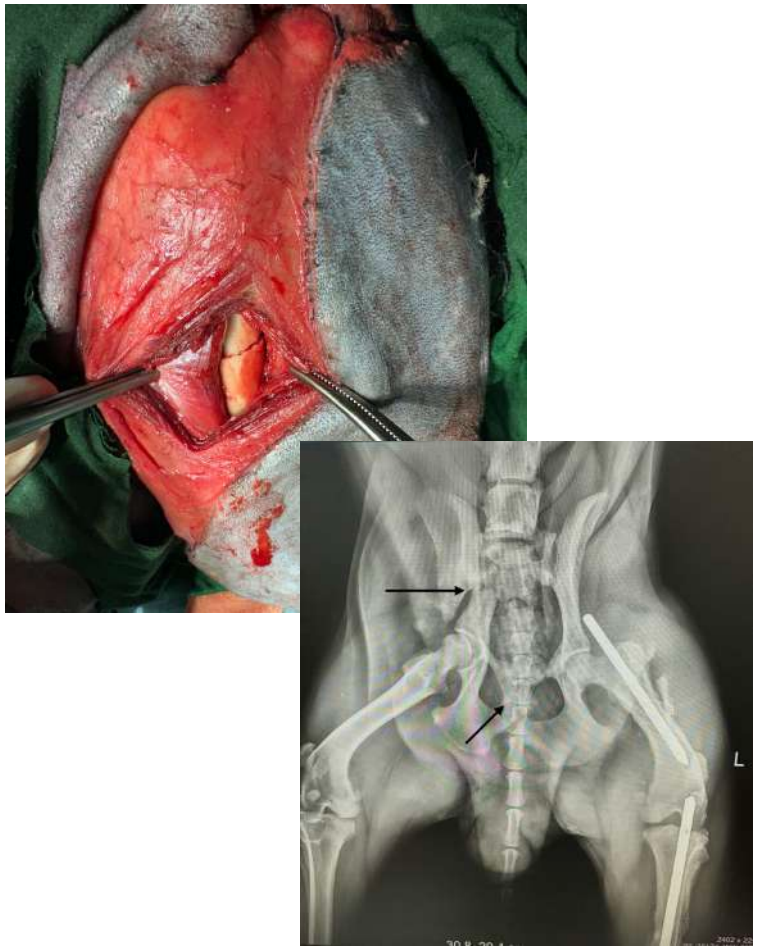
Long Bone Fracture and Internal Fixation Techniques in Dogs and Cats

Dr. Nima Wangdi
National Veterinary Hospital
Department of Livestock
BVSc, MVSc (Surgery & Radiology)

Common Causes of long Bone Fracture

1. Road Traffic Accidents

- Most common cause in both dogs and cats
- High-energy trauma leading to comminuted or multiple fractures
- Frequently associated with soft tissue injury and polytrauma



2. Falls and Accidental Trauma

- Falls from height (especially common in cats-“high-rise syndrome”)
- Slipping on smooth surfaces
- Jumping from elevated structures (roofs, balconies, furniture)

3. Bite Wounds and Animal Fights

- Dog bite injuries, particularly in small dogs and cats
- Crushing force of jaws may cause open (compound) fractures
- High risk of infection due to contamination

4. Improper Handling or Trauma by Owners

- Dropping of young animals or puppies/kittens
- Accidental stepping on limbs
- Mishandling during restraint

5. Abuse and Non-Accidental Injury

- Deliberate trauma
- Repeated or unexplained fractures, especially in young animals

Intramedullary Bone Pinning

- Commonly employed internal fixation technique
- Stabilization of long bone fractures
- Maintain alignment during fracture healing

Indication

- Diaphyseal fractures of long bones (femur, tibia, humerus, ulna)
- Simple transverse or short oblique fractures
- Fractures in young animals with good healing potential
- Temporary stabilization (RJB) prior to application of additional fixation methods

Contraindications

- Articular or metaphyseal fractures
- Comminuted fractures where length cannot be maintained
- Infected (open, contaminated) fractures
- Small bones where appropriate pin size cannot be accommodated

Principle of Fixation

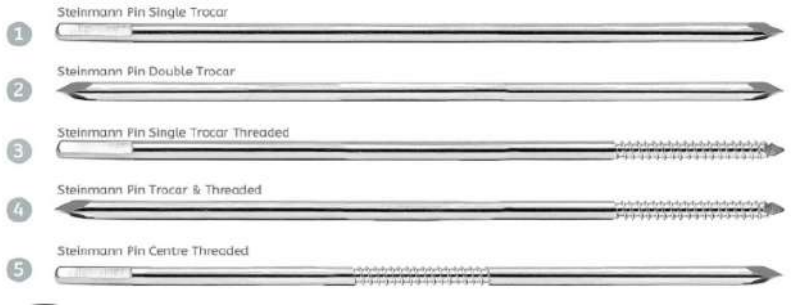
- IM pin occupies approximately **60–70%** of the diameter of the medullary canal at its narrowest point.
- Pin primarily resists bending forces

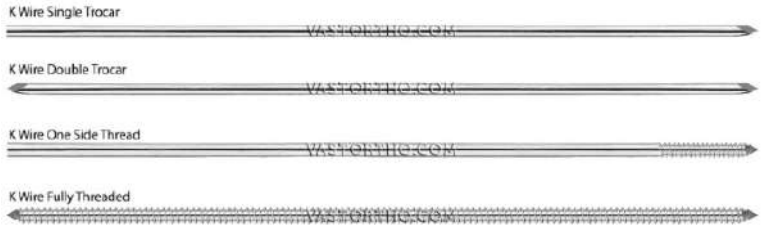
Disadvantage

- Poor control of rotation and axial compression

Types of pins

- **Steinmann pins** – commonly used in medium to large dogs
- **Kirschner wires (K-wires)** - preferred in cats and small dogs
- **Threaded pins (negative profile)** - reduce pin migration
- Materials are usually stainless steel or titanium.





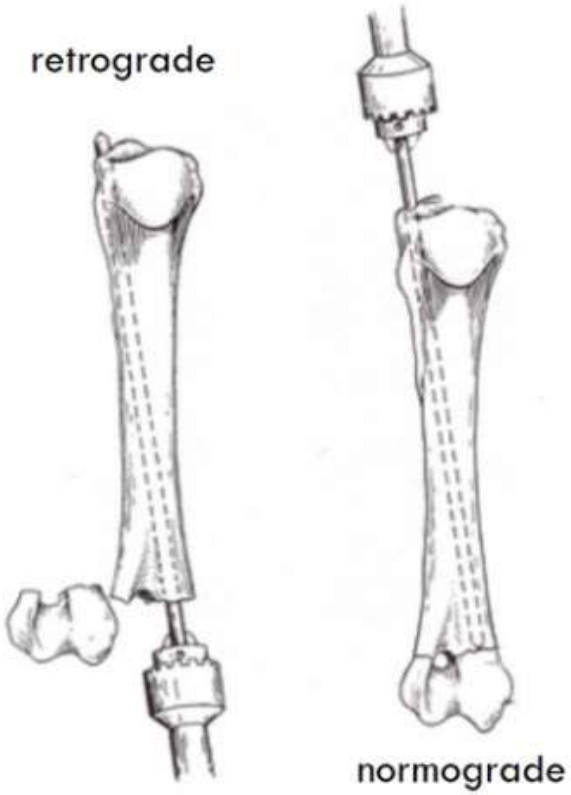
Techniques For Pin Insertion

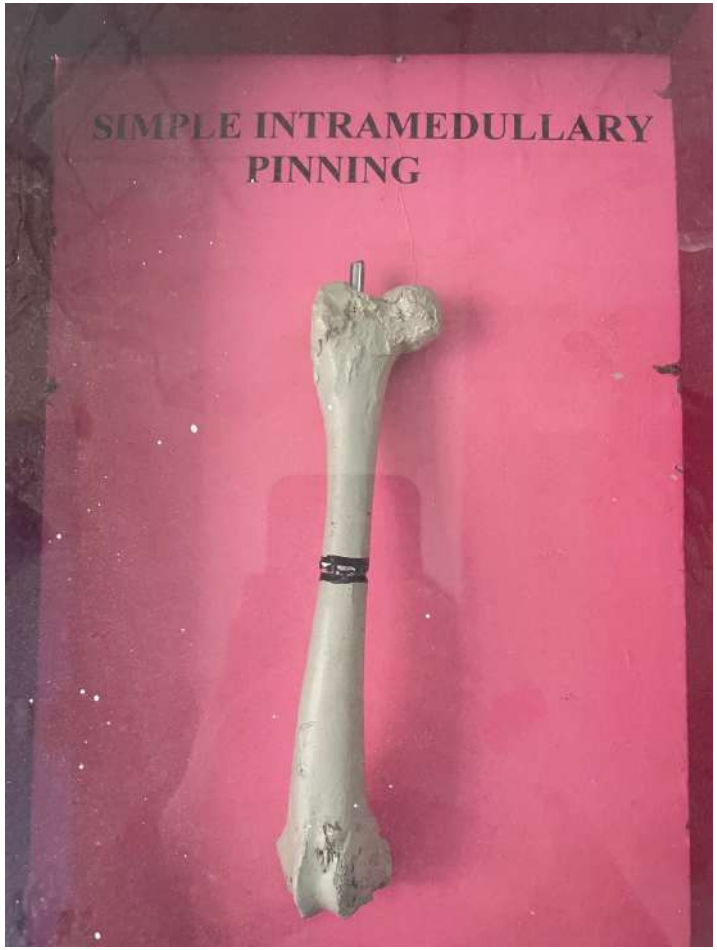
1. Normograde pinning

- Pin inserted from the proximal end of the bone, exiting at the fracture site and advanced distally
- Provides better fracture alignment and less iatrogenic damage
- Technically more demanding

2. Retrograde pinning

- Pin inserted at the fracture site, advanced proximally, then redirected distally after reduction
- Easier and faster
- Increased risk of joint cartilage damage and malalignment


retrograde
normograde


SIMPLE INTRAMEDULLARY
PINNING


L


R

Advantages

- Simple and cost-effective
- Minimal implant requirement
- Preserves periosteal blood supply
- Suitable for field and referral settings

Disadvantages and Complications

- Poor control of rotation and shortening
- Pin migration (proximal or distal)
- Damage to joint surfaces
- Delayed union or malunion
- Infection or implant failure

Cross Pinning

- Widely accepted internal fixation technique for the management of supracondylar fractures of the distal humerus
- Placement of two intramedullary pins from the medial and lateral condyles in a crossed configuration to provide stable fixation of the distal fragment to the proximal humerus.

Indications

- Supracondylar fractures of the distal humerus
- Extra-articular fractures with an intact articular surface
- Fractures in young dogs and cats with good bone quality
- Closed or minimally contaminated fractures

Contraindications

- Intra-articular (condylar) fractures
- Severely comminuted fractures

Biomechanical Principles

- Provide resistance to bending, rotation, and shear forces
- Create a stable triangular construct between distal and proximal fragments
- Are particularly effective in preventing varus–valgus and rotational instability common in supracondylar fractures

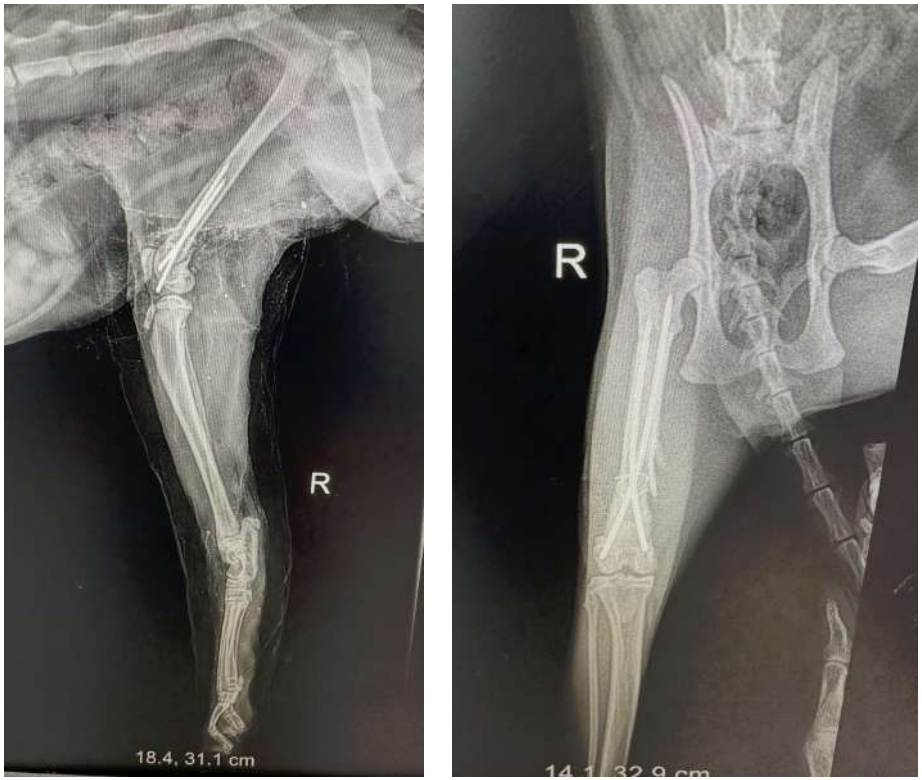
Implants used

- **Kirschner wires (K-wires)** – most commonly used
- **Steinmann pins** – in large breed dogs
- Smooth or negative-profile threaded pins

  Pin diameter is usually **30–40%** of the width of the medullary canal at the insertion site.

Pin Placement

- First pin inserted from the lateral condyle, directed proximomedially across the fracture
- Second pin inserted from the medial condyle, directed proximolaterally
- Pins should cross proximal to the fracture line within the humeral shaft



Advantages

- Simple and minimally invasive technique
- Good stability for supracondylar fractures
- Preserves articular surface when correctly performed

Complications

- Iatrogenic damage to articular cartilage during pin insertion
- Pin migration or backing out
- Malalignment leading to varus or valgus deformity
- Infection or delayed union

Bone Plating

- Standard internal fixation technique in canine orthopedics used to achieve rigid stabilization of fractures, correct deformities, and support bone healing
- Securing a metallic plate to the bone with screws to maintain anatomical alignment and provide load-bearing or load-sharing support

Indications

- Diaphyseal, metaphyseal, and certain articular fractures
- Comminuted fractures requiring anatomical reconstruction
- Fractures requiring precise alignment and length restoration
- Non-unions and malunions

Principles of Plating

- Anatomical reduction (especially for articular fractures)
- Stable fixation to permit early limb use
- Preservation of blood supply (biological osteosynthesis)
- Appropriate plate and screw selection

Types of bone Plates

1. Dynamic Compression Plate (DCP)

- Allows axial compression through eccentric screw placement

2. Limited Contact Dynamic Compression Plate (LC-DCP)

- Reduced plate–bone contact, improved periosteal blood supply

3. Locking Compression Plate (LCP)

- Locking screws create a fixed-angle construct
- Particularly useful in osteoporotic bone and comminuted fractures

4. Reconstruction Plate

- Easily contoured for irregular bone surfaces

5. T-plates and L-plates

- Used for metaphyseal and periarticular fractures

DCP

LC-DCP

2.7mm Locking Compression Plates

Screws Used

- **Cortical screws** – diaphyseal bone
- **Cancellous screws** – metaphyseal or epiphyseal bone
- **Locking screws** – used with LCP systems

Advantages

- Rigid fixation allowing early weight bearing
- Precise restoration of limb length and alignment
- Wide applicability across fracture types

Disadvantages/Complications

- Requires advanced surgical expertise
- Higher cost compared to pins or wires
- Risk of infection, implant loosening, or breakage
- Stress shielding and delayed healing if improperly applied


R
25.1, 33.3 cm


R

Cerclage Wire

- Auxiliary fracture fixation technique to provide fragment apposition and rotational stability
- Not a primary load-bearing method
- Must be combined with other fixation devices such as intramedullary (IM) pins & bone plates

Indications

- Long oblique or spiral fractures of long bones are present
- Fractures involve the femur, tibia, or humerus
- There are two or more large fracture fragments
- Bone diameter is sufficient to hold the wire securely

Contraindications

- Fracture is transverse or short oblique
- Bone fragments are comminuted or small
- There is severe soft tissue damage
- Used as the sole fixation method

Types of cerclage wiring

1. Full Cerclage Wire

- Wire encircles the entire bone circumference
- Most commonly used

2. Hemi-cerclage Wire

- Wire passes through pre-drilled holes in bone
- Prevents wire slippage

3. Interfragmentary Cerclage

- Used to secure individual bone fragments

Advantages

- Improves fracture alignment
- Enhances rotational stability
- Minimally invasive and economical
- Preserves blood supply when properly applied

Disadvantages/Complications

- Wire loosening or breakage
- Fragment displacement if improperly placed
- Soft tissue irritation
- Delayed union if blood supply is compromised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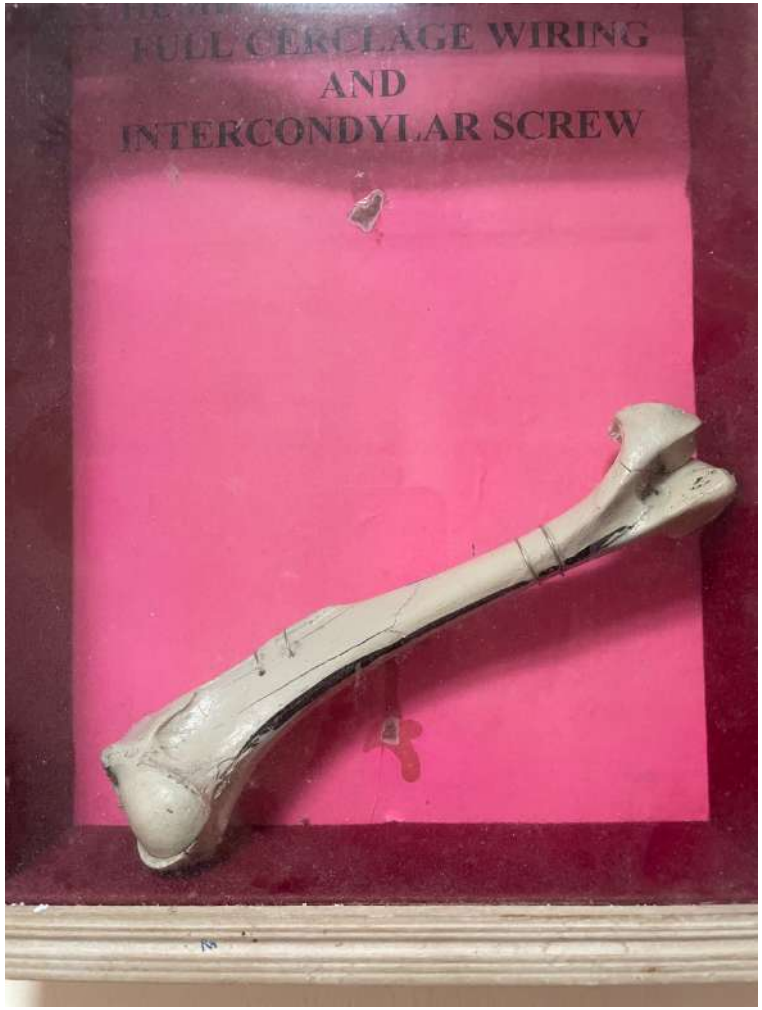
FULL CERCLAGE WIRING
AND
INTERCONDYLAR SCREW

THANK YOU