Distal Femur Fractures

Christopher Haydel, MD
Department of Orthopaedic Surgery and Sports Medicine

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Introduction

- Prior to 1970 treated non-operatively causing many complications
  1. Malunion
  2. Knee stiffness
  3. Illness due to recumbence

- Since then operative techniques and implants have improved leading to better outcomes

Introduction

Goals of Treatment

1. Anatomic reduction of the articular surface
2. “functional” reduction of the metaphysis restoring length, alignment, and rotation
3. Stable fixation
4. Early range of motion

Potential road blocks

1. Poor bone quality
2. Comminution

Assessment

Mechanism of injury

- Axial load with varus, valgus or rotational forces

- Bimodal distribution
  - Young patients with a high energy mechanism
  - Elderly patients – ground level fall with a flexed knee

- Predictable deformity

Assessment

Associated Injuries

- Usually associated with high energy mechanism

- Associated fractures
  - Ipsilateral proximal femur, tibia or ankle

- Open injuries occur in 5-10%
  - Early administration of antibiotics with a thorough debridement and irrigation is of utmost importance

  - Transfer to definitive tertiary care center

  - Temporizing with external fixation may be necessary

Assessment

Associated Injuries

- Vascular Injury
  - More common with penetrating injury
  - Indications for arteriography/CT angiogram
    1. Diminished or absent pulse
    2. Expanding hematoma
    3. Diminished Ankle-Brachial Index (ABI)
    4. Persistent arterial bleeding
    5. Damage to surrounding nervous structures
  - Reperfusion must be done to avoid ischemia times greater than 6 hours
    1. Shunt or repair
    2. Fracture reduction and stabilization (order controversial)
    3. Prophylactic fasciotomies

Assessment

Associated Injuries

- Ligament Injuries
  - Uncommon
  - Usually not diagnosed preoperatively
  - ACL most commonly injured
- Periprosthetic Fractures
  - Occur with TKA 0.3-2.5%
  - Prosthetic integrity must be determined

Assessment

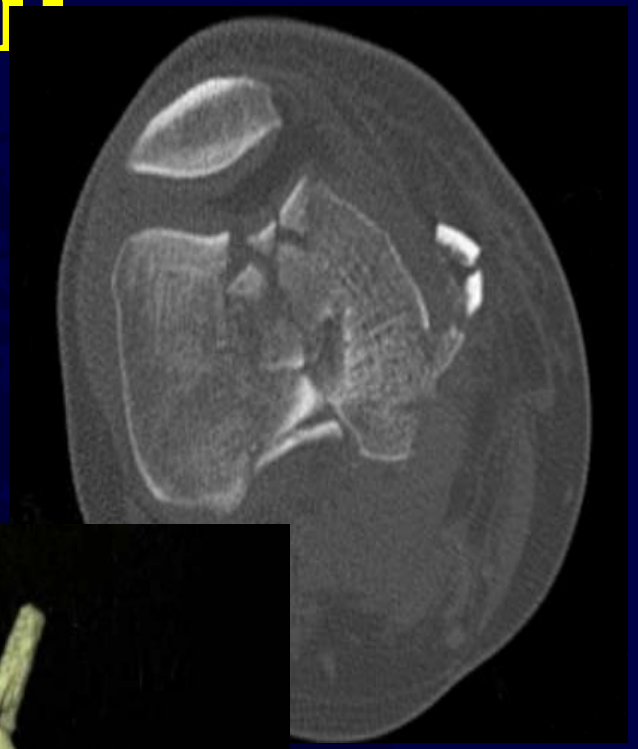
Signs and Symptoms

- Physical Exam
  - ABC's of Traur
  - Deformity
  - Skin Integrity
  - Neurovascular exam

Assessment

Imaging

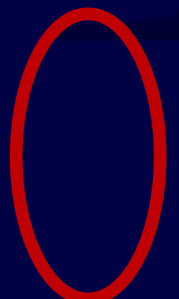
- X-rays
  - Orthogonal views
  - Joint above and bel
- CT scan
  - Shows intra-articula involvement



Assessment

Classification AO/OTA

- Femur – 3
- Distal portion – 3
- Extra-articular – A
- Partial Articular – B
- Complete Articular - C



Assessment

Hoffa Fragment

- Coronal plane fracture
- Often missed
- Advanced imaging (CT) may be necessary
- Requires separate fixation outside of laterally or medially based plates

Double Density on AP

Fracture line on lateral or oblique film

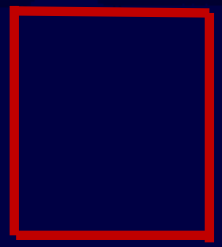
Quantify on CT

Applied Anatomy and Pathoanatomy

Distal femur

- Zone from the articular surface to the meta-diaphyseal junction

- Approximately 15 cm from the articular surface



Applied Anatomy and Pathoanatomy

Normal Anatomy

- Trapezoidal shape
  - Medial aspect of trochlear groove is lower
  - Incorrect hardware placement will cause joint penetration
- Posterior portion is wider than the anterior portion

Applied Anatomy and Pathoanatomy

Normal limb alignment

- Anatomic Lateral Distal Femoral Angle (aLDFA) is 80-84 degrees

- Knee is in 6-10 degrees of valgus

Applied Anatomy and Pathoanatomy

Influence of soft tissues on fracture displacement

- Gastrocnemius pull distal fragment into recurvatum
- Hamstrings and quadriceps cause shortening

Treatment Options

Nonoperative

- Reliable patients with a nondisplaced fracture
- Nonambulatory patients
- Patients with significant underlying medical disease

Treatment Options

Operative

- Plate osteosynthesis
- Retrograde IM nail

Plate Osteosynthesis

- Locked plating systems typically used
  - a construct composed of all locking screws should be avoided
  - Nonunion of the near cortex will occur if the construct is too stiff
- Articular reduction done under direct visualization
- Minimally invasive techniques can be used to span metaphyseal comminution

Plate Osteosynthesis

Surgical Approaches

1. Lateral (standard or minimally invasive)
2. Anterolateral articular
3. Medial

Plate Osteosynthesis – Lateral Approach

- Most commonly used approach
- Iliotibial band incised to expose Vastus Lateralis
- Vastus elevated off of Lateral IM septum
- Perforators must be ligated

Plate Osteosynthesis – Anterolateral Articular Approach

- Can extend the lateral approach to perform a lateral arthrotomy

- Facilitates articular reduction

Plate Osteosynthesis – Medial Approach

- For fixation of medial condyle fractures
- L-shaped arthrotomy

Plate Osteosynthesis – Type A Fractures

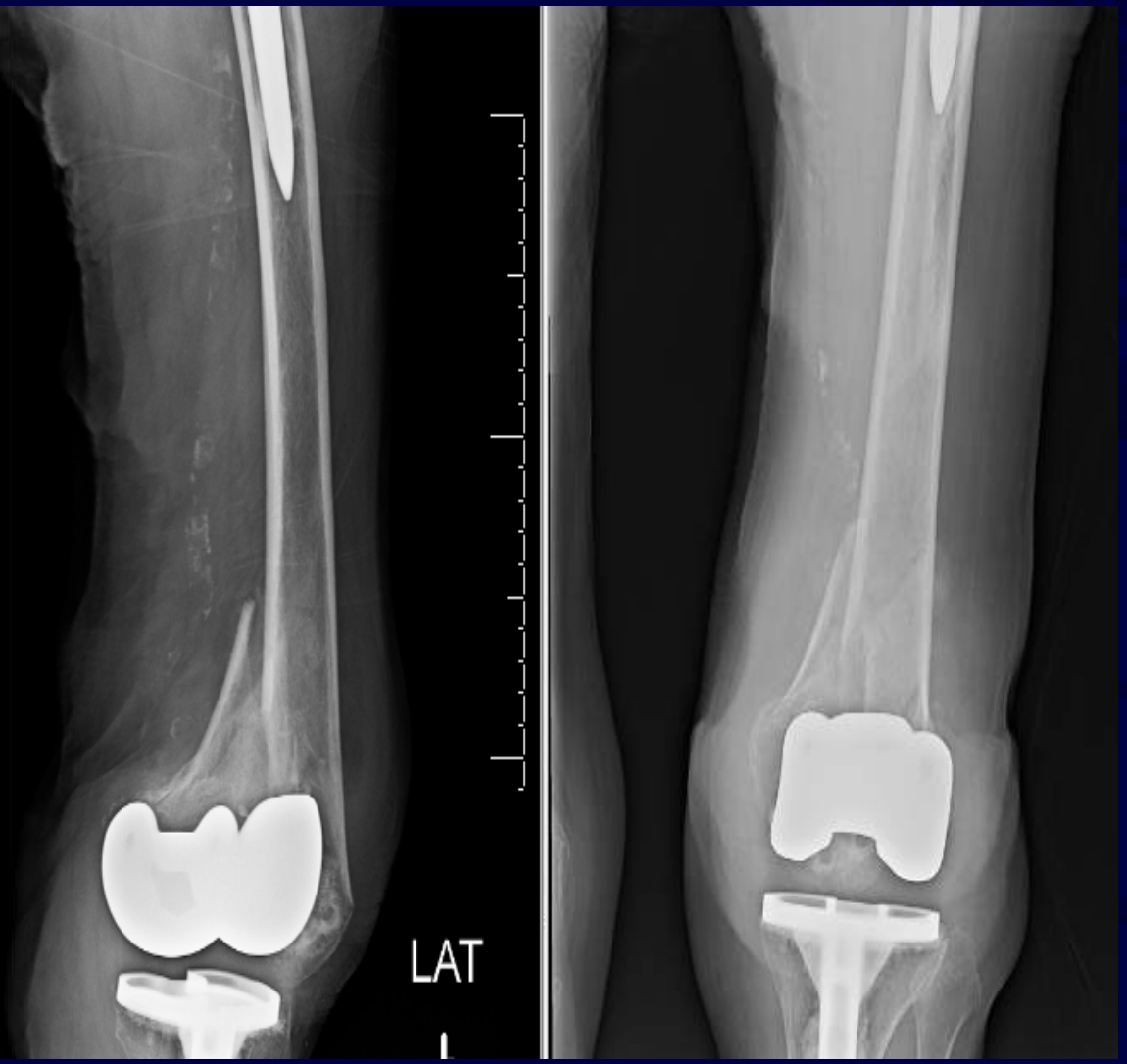


Plate Osteosynthesis – Type A Fractures

Plate Osteosynthesis – Type B Fractures

Plate Osteosynthesis – Type B Fractures

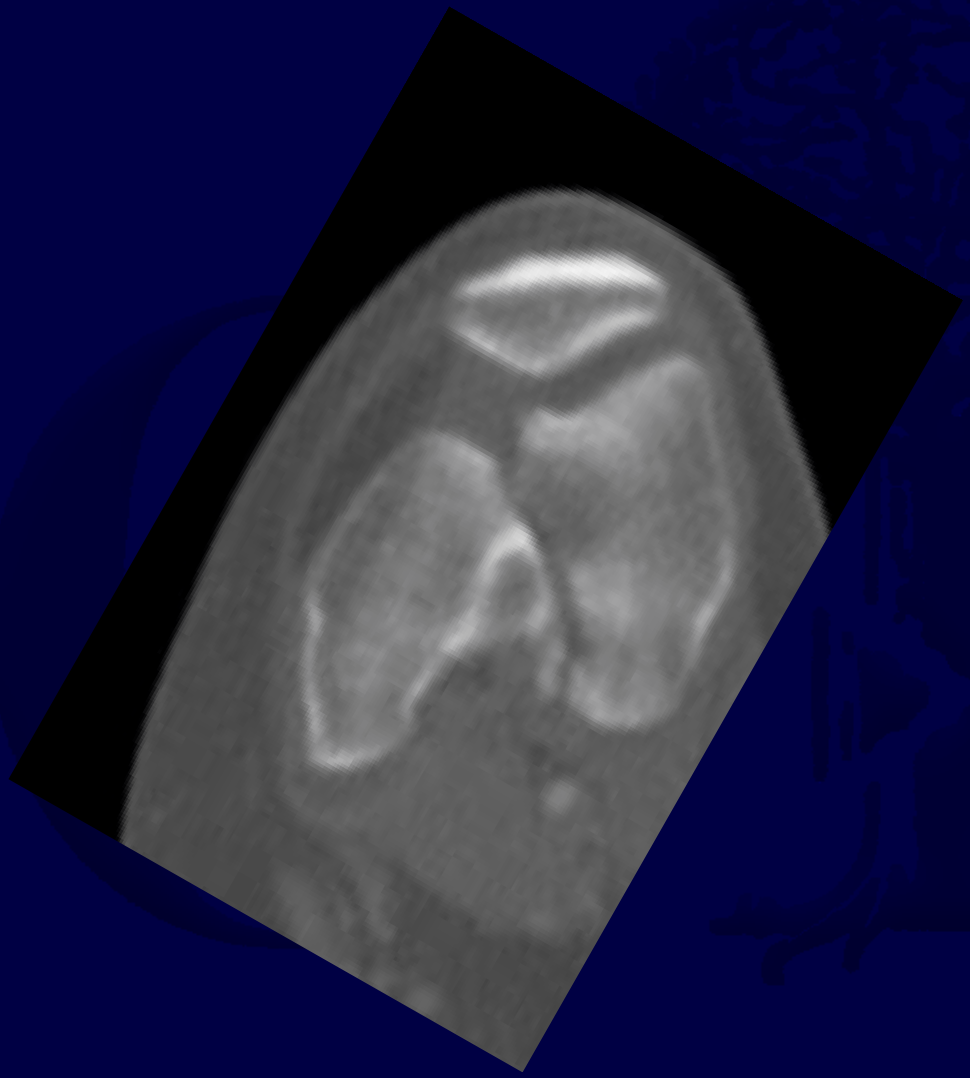
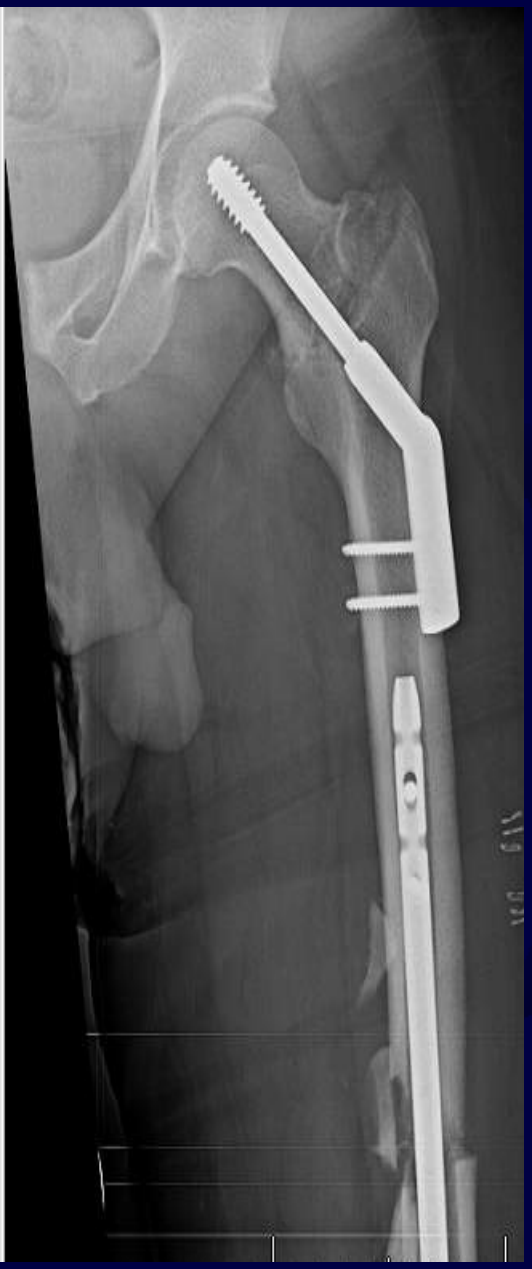


Plate Osteosynthesis – Type B Fractures



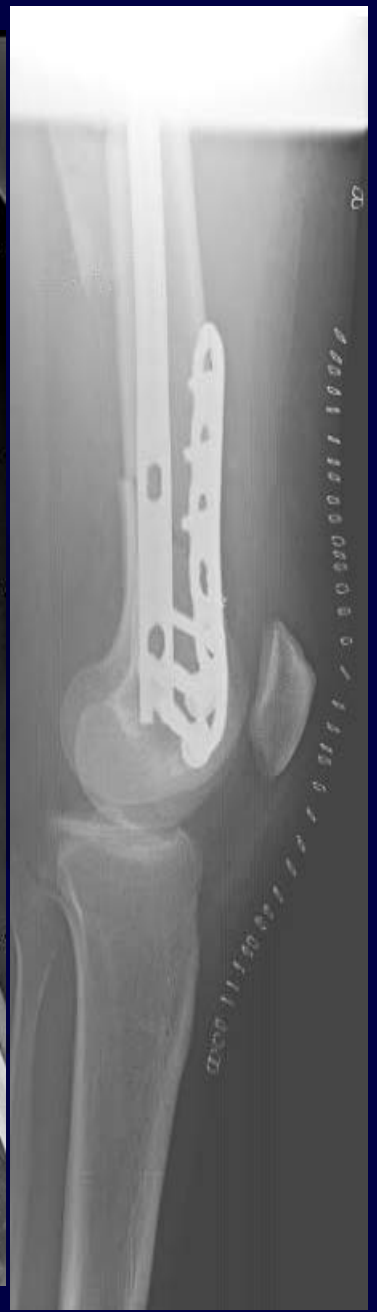


Plate Osteosynthesis – Type B Fractures (Hoffa)

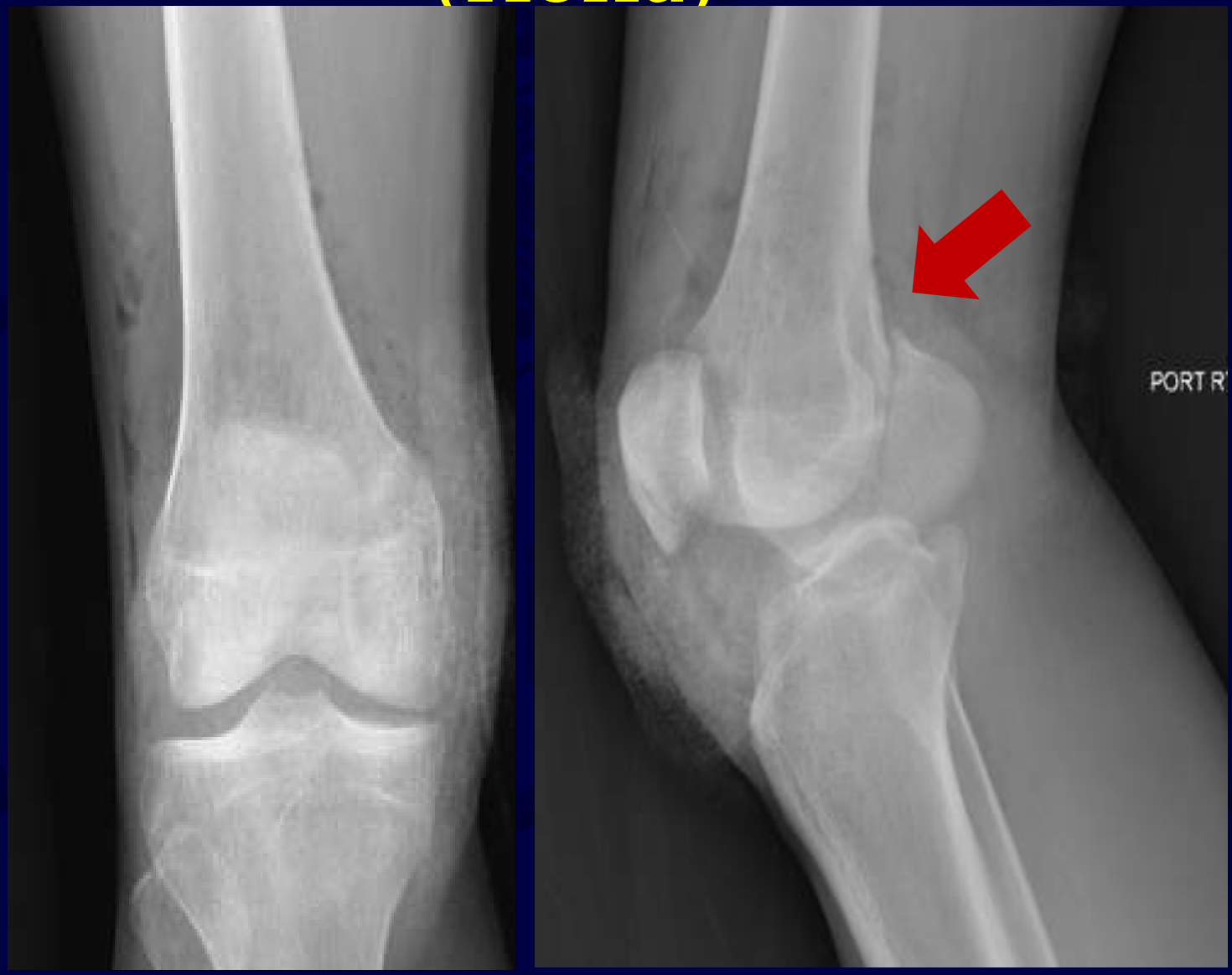


Plate Osteosynthesis – Type B Fractures (Hoffa)

Plate Osteosynthesis – Type C Fractures

Plate Osteosynthesis – Type C Fractures

Plate Osteosynthesis – Type C Fractures

Plate Osteosynthesis – Pitfalls

- Intra-articular placement of screws or prominent hardware
  - Due to trapezoidal shape of the distal femur
- Erroneous plate placement can cause malreduction

Retrograde IM nail

- Minimally invasive
- Good option for distal fracture with concomitant proximal femur fracture that will be treated with a separate device
- Must maintain the reduction throughout procedure

Retrograde IM nail

Traction Views

Retrograde IM Nail

Retrograde IM nail - Pitfalls

- Lack of reduction or poor hardware placement will cause malunuion

- Nail depth and screw placement must be correct to avoid prominence

Complications

- Malunion
  - Varus/valgus >5-10 degrees
  - LLD
  - Rotation > 15 degrees
- Nonunion
- Infection
- Knee Stiffness
- Post-Traumatic Arthritis

Summary

- Goals of surgery
  1. Anatomic reduction
  2. Stable fixation
  3. Preserve biology
  4. Early range of motion

- Plates or nails can be used to achieve these goal

- Preoperative planning will help avoid complications

- For questions or comments, please send to ota@ota.org