

## Imaging of the Distal Femur

<sup>1</sup>Dr. Kshitij Z Badade, MBBS, MS Orthopaedics, Assistant Professor Orthopaedics Department MGM Medical College & Hospital, Navi Mumbai, Maharashtra, India.

**Corresponding Author:** Dr. Kshitij Z Badade, MBBS, MS Orthopaedics, Assistant Professor Orthopaedics Department MGM Medical College & Hospital, Navi Mumbai, Maharashtra, India.

**Citation this Article:** Dr. Kshitij Z Badade, “Imaging of the Distal Femur”, IJMSIR- November - 2022, Vol – 7, Issue - 6, P. No. 92 – 98.

**Type of Publication:** Original Research Article

**Conflicts of Interest:** Nil

### Abstract

The knee, one of the body's major load-bearing joints, is susceptible to damage to the joint or articular surfaces or fractures of the long bones in the event of high-energy trauma. Although positioning for imaging can be difficult due to the position of the contralateral leg, good posture and technique should allow for the demonstration of the interventional area. The various orthopaedic procedures connected to the distal femur are covered in this essay. Each procedure includes photos demonstrating the positioning of the C-arm, patient, and surgical instruments, along with supporting radiographs that display the final views.

Plain radiography is still the mainstay for locating and diagnosing distal femoral fractures. However, a CT scan is typically helpful because the majority of distal femoral fractures are intra-articular.

An MRI might be helpful if concurrent meniscal tears or ligament injury are suspected.

Usually, a fracture will have a radiolucency or cortical rupture. Depending on how they are shifted, features like overlay or impaction may exist.

The Hoffa fracture is a prevalent distal femoral condyle fracture.

On plain radiographs of supracondylar and intercondylar femur fractures, the "Hoffa fracture" is a coronal plane fracture of the femoral condyle that is frequently overlooked. The lateral condyle is affected more often than the medial condyle. Identification is essential because it may affect surgical planning and essentially demands screw fixation in the anteroposterior plane.

When Nork et al. looked at 202 supracondylar-intercondylar distal femoral fractures, they found that 38% of them had concurrent coronal plane fractures. According to the authors, CT scans should be performed on all supracondylar and intercondylar fractures.

**Keyword:** C-arm, CT scans, Hoffa fracture

### Introduction

Fluoroscopic visualization of anatomical fracture reduction and appropriate implant placement for the distal femur can be significantly enhanced by the following views:

#### Standard views

1. AP view
2. Lateral view
3. 25° External rollover view
4. 10° Internal rollover view
5. Notch view

With the patient in a supine position, the following images show ideal imaging.

For patients positioned in lateral decubitus, the relationship between the distal femur and the image intensifier remains the same. However, the C-arm's orientation must be adjusted appropriately.

Pearl: Use adhesive tape to mark the C-arm's footprints where the perfect views were obtained.

### 1. AP view of the distal femur

#### Positioning for optimal view

To obtain the optimal AP view of the distal femur:

1. Set the leg in full extension and neutral rotation.
2. Align the beam such that it is perpendicular to the femur's axis.

The AP pictures recorded with the leg fully extended and the knee in 30° flexion won't differ significantly. An AP view is not possible when the knee is flexed at 90 degrees.

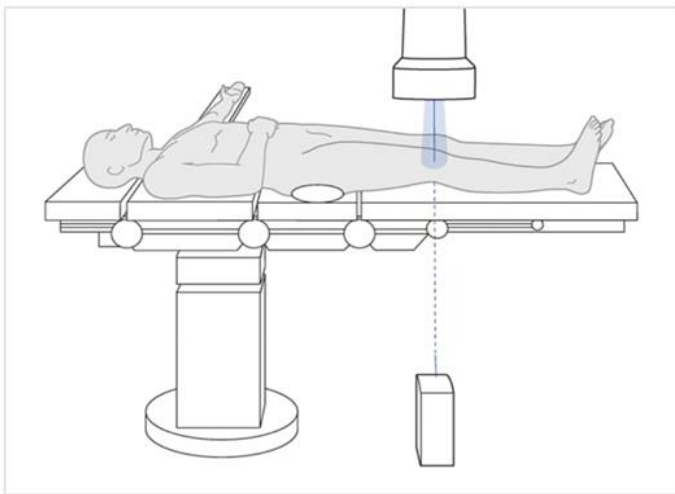


Fig 1: Positioning for optimal AP view

#### Verification of optimal view

The optimal AP view of the distal femur is obtained when

1. The patella is centred over the femoral notch.
2. There is 1/4 to 1/3 overlap of the fibular head and the lateral edge of the tibia (there may be individual anatomical variations).

3. The distal femur is centred on the screen.



Fig 2: Optimal AP view

#### Anatomical landmarks and lines

The following lines and landmarks can be observed in the AP view of the distal femur:

1. The femoral notch
2. Adductor tubercle
3. Medial condyle
4. Lateral condyle
5. Proximal tibia
6. Patella
7. Fibular head

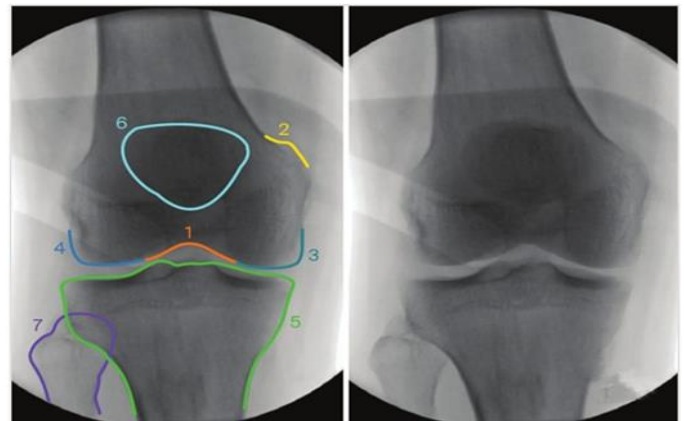


Fig 3: Anatomical landmarks and lines in AP view

#### What can be observed?

The AP view of the distal femur is particularly useful to identify:

1. Excessive internal or external rotation of the articular block.

2. Varus/valgus deformity of the articular block.

3. Mal reduction.

The correct angle between the distal femoral joint line and the femoral axis is 79-83°.

Images of the contralateral side is beneficial as a reference.

### Paradoxical notch view

If the AP view of the distal femur yields an apparent notch view (increase height of the intercondylar notch), there may be a recurvatum deformity of the distal fragment

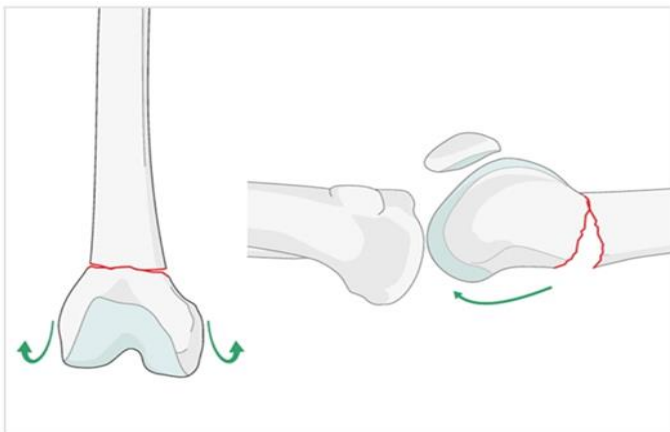


Fig 4: Paradoxical notch view

## 2. Lateral view of the distal femur

Positioning for optimal view

To obtain the optimal lateral view of the distal femur:

1. Flex the leg to elevate the knee.

Sustain neutral leg rotation.

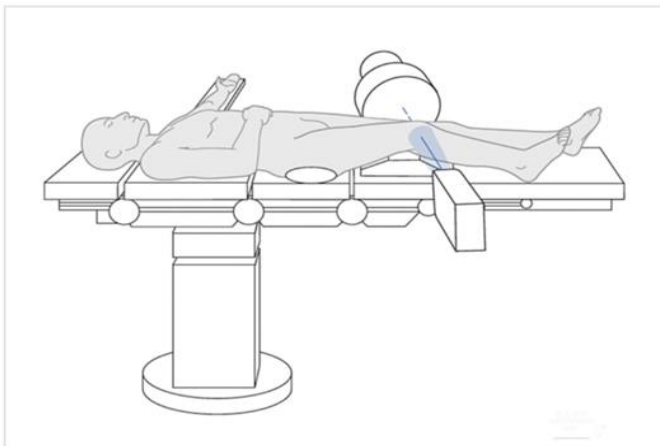


Fig 5: Imaging distal femur

1. Place the beam parallel to the knee joint plane (this is around 79-83° to the anatomical axis of the femur).

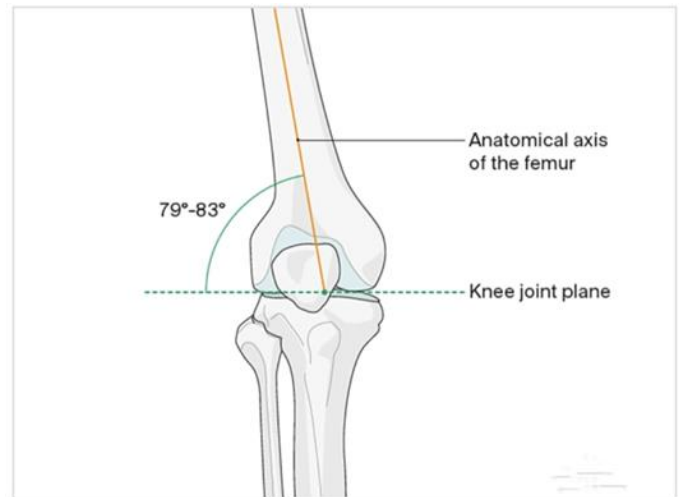


Fig 6: Anatomical axis of the femur

### Verification of optimal view

The optimal lateral view of the distal femur is obtained when:

1. The femoral condyles are superimposed in the anterior, distal and posterior aspects.
2. The femoral condyles are centred on the screen.



Fig 7: Optimal lateral view of distal femur

### Anatomical landmarks and lines

In the lateral view of the distal femur, the following lines and landmarks are seen:

1. Blumensaat's line

2. Outline of the condyles
3. Distal femoral shaft

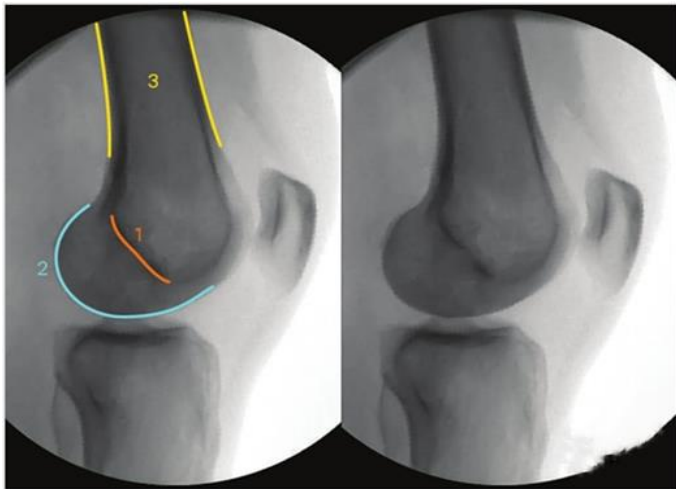


Fig 8: Anatomical landmarks and lines lateral view of distal femur

If the femur is rotated internally, you will see the lateral femoral condyle anterior to the medial condyle (and vice versa).



Fig 9: Optimal view of distal femur

#### What can be observed?

The lateral view of the distal femur is particularly useful to identify:

1. Intraarticular screws.
2. The correct placement of lateral plates.
3. Recurvatum or antecurvatum of the articular block.
4. Malreduction of intraarticular fractures (e.g Hoffa fractures) and extraarticular fractures.

### 3. 25° External rollover view

#### Positioning for optimal view

To obtain the optimal external rollover view of the distal femur:

1. Start from the optimal AP view and rotate the C-arm externally until the optimal external rollover view is achieved (25°).
2. Alternatively, rotate the femur 25° internally.

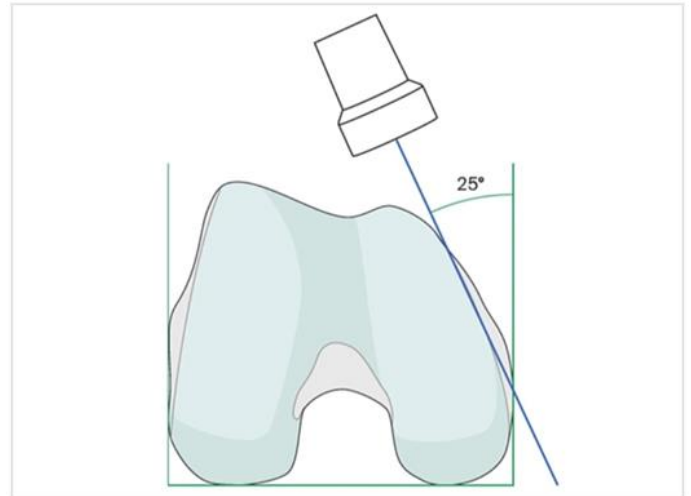


Fig 10: Positioning for optimal 25 degrees external rollover view

#### Verification of optimal view

The optimal external rollover view is obtained when:

1. The medial wall of the medial femoral condyle projects as one dense line.
2. The distal femur is centred on the screen.



Fig 11: Imaging distal femur



Fig 12: As reference, here the AP view of the same patient is given.

#### Anatomical landmarks and lines

The following lines and landmarks can be observed:

1. The medial wall of the medial femoral condyle

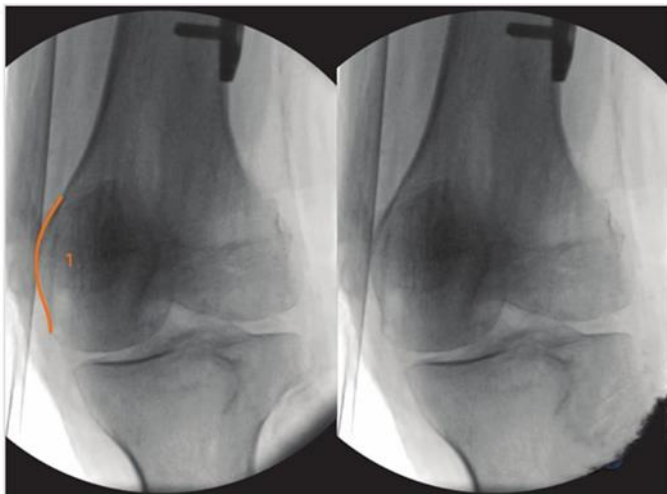


Fig 13: Anatomical landmarks and lines in the 25° External rollover view of the distal femur.

#### What can be observed?

The external rollover view is particularly useful to identify:

1. Medial screw/guidewire penetration.
2. Malreduction of a fracture projecting into the medial aspect of the distal femur.

#### 4. 10° internal rollover view

##### Positioning for optimal view

To obtain the optimal internal rollover view of the distal femur:

1. Start from the optimal AP view and rotate the C-arm internally until the optimal internal rollover view is achieved (10°).
2. Alternatively, rotate the femur 10° externally.

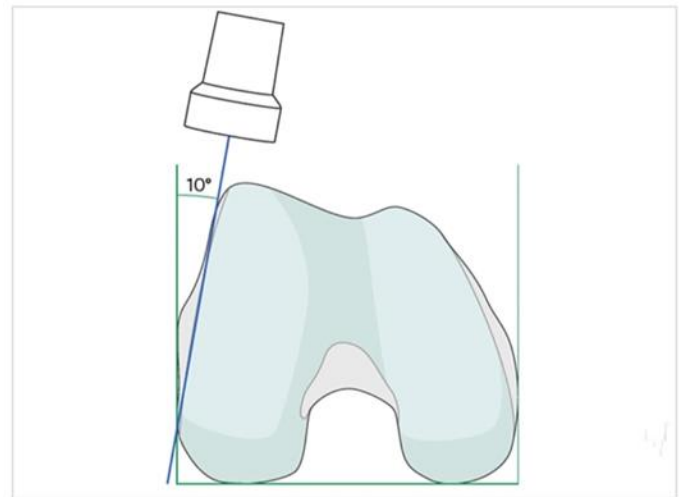


Fig 14: Positioning for optimal 10° internal rollover view

#### Verification of optimal view

The optimal internal rollover view is obtained when:

1. The lateral wall of the femoral condyle projects as one dense line.
2. The distal femur is centred on the screen.



Fig 15: Verification of optimal 10° internal rollover view

#### Anatomical landmarks and lines

The following lines and landmarks can be observed:

1. The lateral wall of the femoral condyle

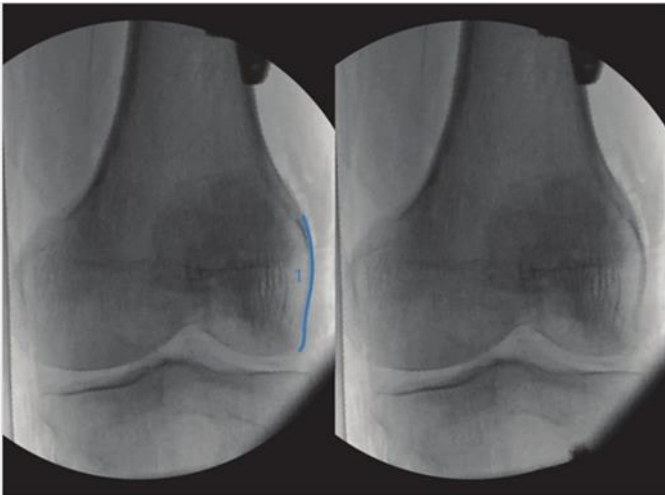


Fig 16: Anatomical landmarks and lines in the optimal 10° internal rollover view

**What can be observed?**

The internal rollover view is particularly useful to identify:

1. Correct lateral plate placement (LISS, VA-LCP).
2. Malreduction of a fracture projecting into the lateral aspect of the distal femur.

**5. Notch view**

**Positioning for optimal view**

To obtain the optimal notch view of the distal femur, start from the optimal AP view, rotate the C-arm caudally until the optimal is obtained (25°).

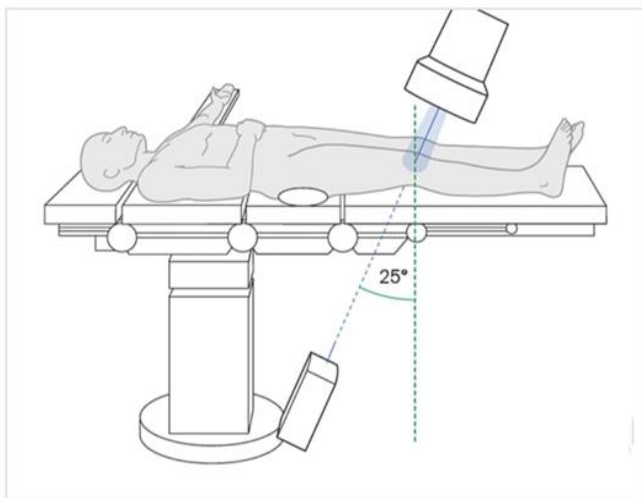


Fig 17: Positioning for optimal notch view

**Verification of optimal view**

The optimal view is obtained when the:

1. Maximal height of the notch is reached.
2. Cortex of the notch projects as one dense line.
3. Beam is centred at the distal femur.



Fig 18: Verification of optimal notch view

**Anatomical lines and landmarks**

The following lines and landmarks can be observed:

1. Patella
2. Femoral notch
3. Medial condyle
4. Lateral condyle
5. Medial and lateral tibial spine

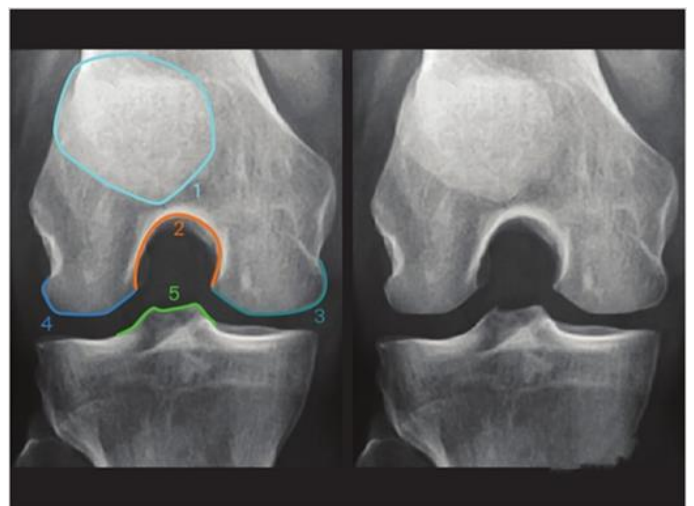


Fig 19: Anatomical landmarks and lines in the notch view

**What can be observed?**

This view is particularly useful to identify screws in the Inter-condylar notch

**Declarations**

**Informed consent**

Informed consent was obtained for experimentation with human subjects. The privacy rights of human subjects must always be observed.

**“Institutional Ethical Committee Approval”**

Taken from Institutional Ethical Approval Committee, MGM Medical College & Hospital, Navi Mumbai, Maharashtra, India.

**Availability of data and materials**

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