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Imaging of the Proximal Femur

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Abstract

Elderly osteoporotic patients frequently get proximal femoral fractures, which can be brought on by a simple fall. They are more frequently brought on by high-energy trauma in younger people. Shortening and outward rotation of the injured leg are the traditional clinical manifestations of a proximal femoral fracture.

Keyword: Rotation, Trochanter, Fluoroscopic

Introduction

A proximal femoral fracture has the following features:

1. The exorotation of the leg makes it easier to identify the lesser trochanter
2. A hazy thick line (or "white") in an impacted fracture
3. Femoral head/neck bone trabeculation disruption and
4. Shenton line disruption

Following are the several categories of proximal femoral fractures:

1. Intracapsular fracture of the femoral neck
2. A fracture of the per- and inter-trochanteric bones
3. Greater and lesser trochanter fractures that is isolated
4. Subtrochanteric fracture

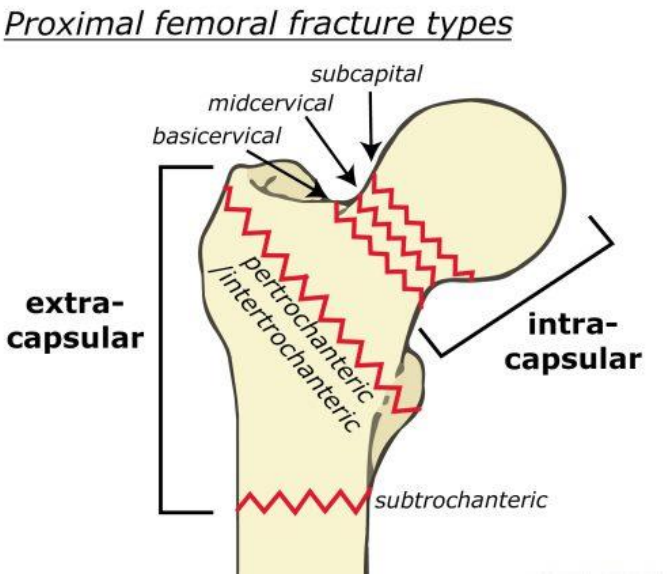

Figure 1: Overview of proximal femoral fracture types

Fluoroscopic visualization of anatomical fracture reduction and correct implant placement for the proximal femur can be significantly facilitated using the following views:

- AP view of the proximal femur
- Axial view of the proximal femur
- Lateral view of the proximal femur

The lateral view does not correctly reflect the implant position in the head-neck fragment.

An axial view is therefore necessary.

1. AP view of the proximal femur

Positioning for optimal view

- The beam is placed perpendicular to the femoral shaft and the coronal plane
- The leg is internally rotated with the patella facing upward

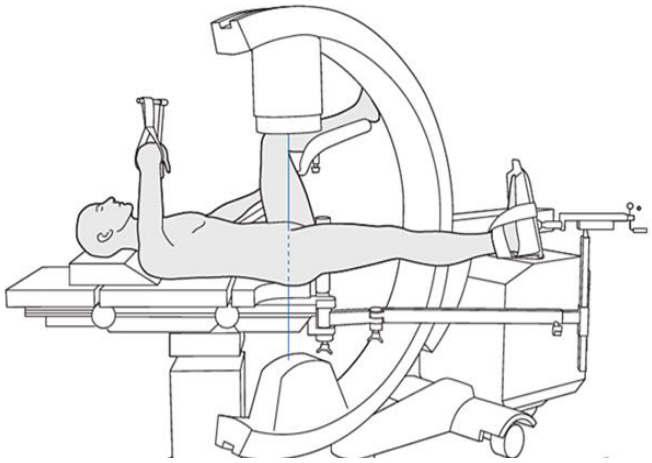

Figure 2: Positioning for optimal view

Verification of optimal view

The optimal view is obtained when:

- Trochanteric area is in the center of the screen
- Both the femoral head (including the hip joint) and shaft are visible

Figure 3: Verification of optimal view

Anatomical landmarks and lines

In the AP view of the proximal femur (here with a trochanteric fracture), the following landmarks and lines can be observed:

1. Femoral head
2. Femoral neck
3. Medial line
4. Lesser trochanter
5. Greater trochanter
6. Femoral shaft
7. Intertrochanteric line (anterior) superimposed with the intertrochanteric crest (posterior)

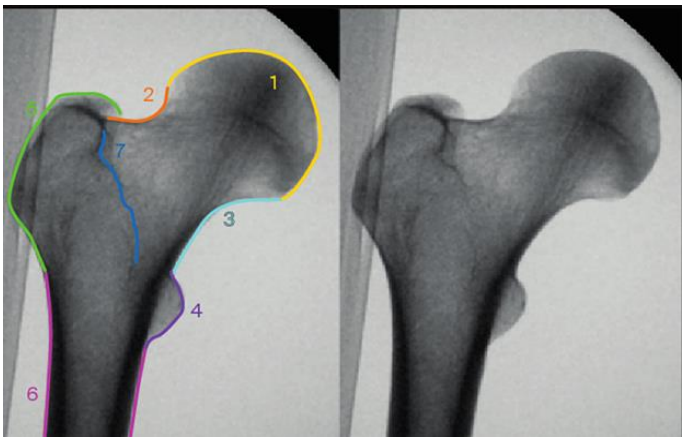

Figure 4: Anatomical landmarks and lines

What can be observed?

- Varus or valgus malalignment
- Rotational malalignment
- Translational displacement
- Correct guide-wire insertion

Figure 5: A. Correct implant positioning

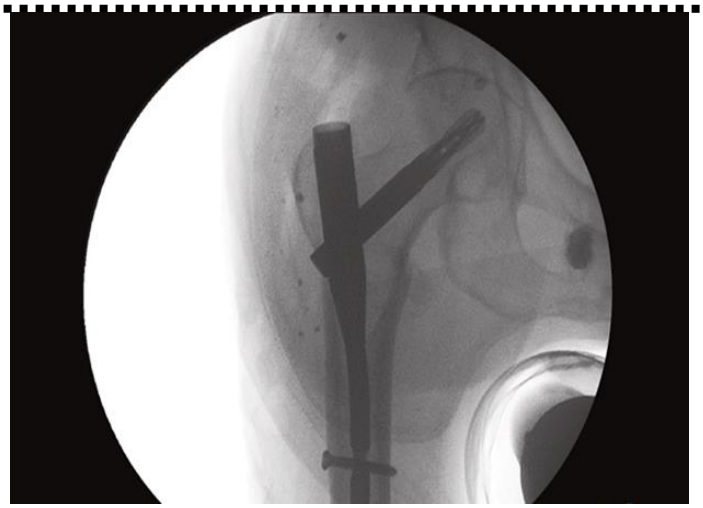

Figure 6: B. Correct implant positioning

2. Axial view of the proximal femur

Positioning for optimal view

- The beam track should avoid the contralateral hip
- A hemi-lithotomy position of the patient, scissoring, or abduction of the contralateral leg may be helpful to optimally place the C-arm
- The beam is rotated externally by approximately 15° off the coronal plane

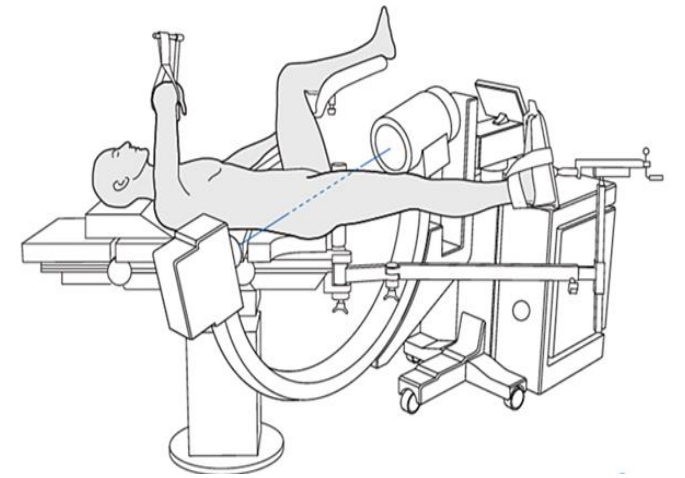

Figure 7: Positioning for optimal view

- The beam is positioned 30°–45° to the longitudinal axis of the injured leg

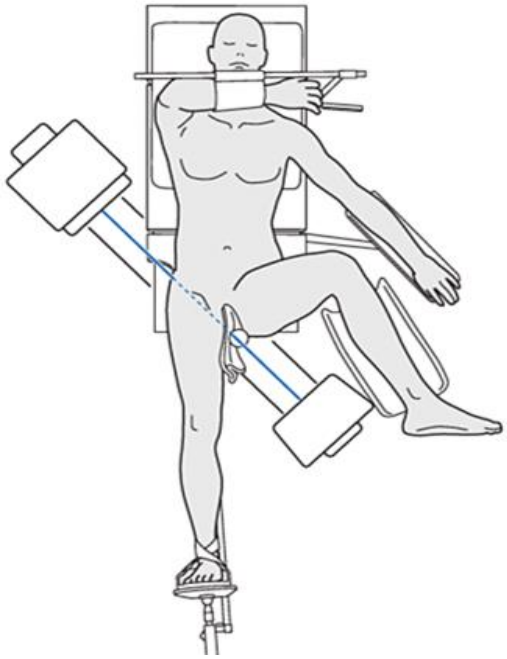

Figure 8: longitudinal axis of the injured leg

Verification of optimal view

The optimal view is obtained when:

- Centered image showing head, neck, and proximal end of shaft
- Head-neck axis is in line with the femoral shaft (within the range of 170° and 190°)
- Contralateral hip is not obstructing the view

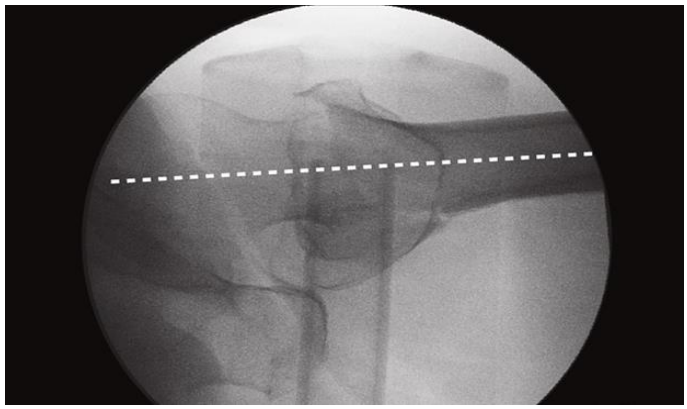

Figure 9: Verification of optimal view

Anatomical landmarks and lines

In the axial view of the proximal femur, the following landmarks and lines can be observed:

1. Lesser trochanter
2. Greater trochanter

3. Femoral head
4. Posterior line
5. Anterior line
6. Capsule insertion (intertrochanteric line)

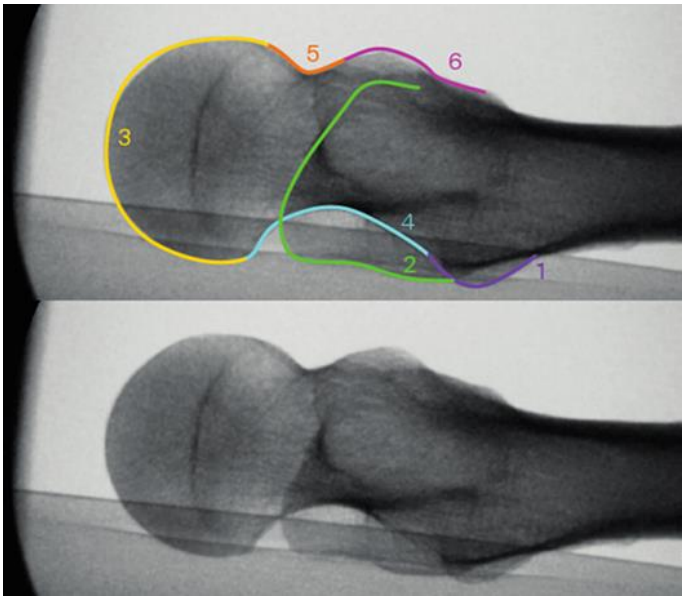

Figure 10: Anatomical landmarks and lines

What can be observed?

- Quality of reduction
- Head-neck and shaft axis alignment
- Correct guide-wire insertion

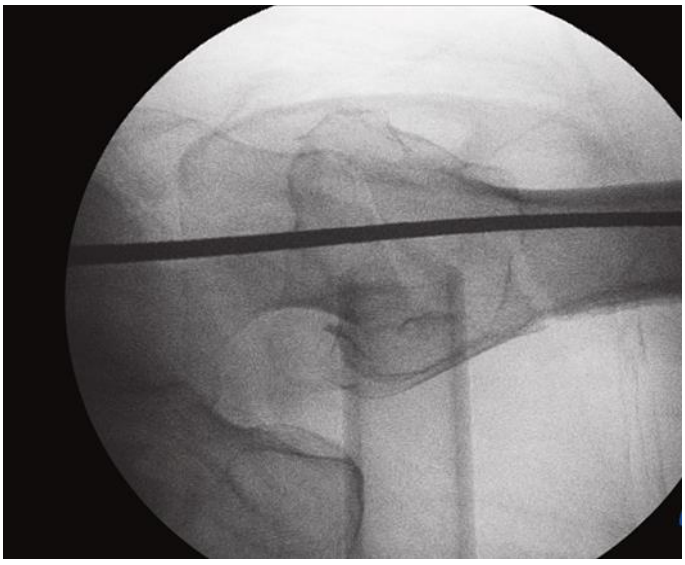

Figure 11

Acceptable implant positioning (center-center).

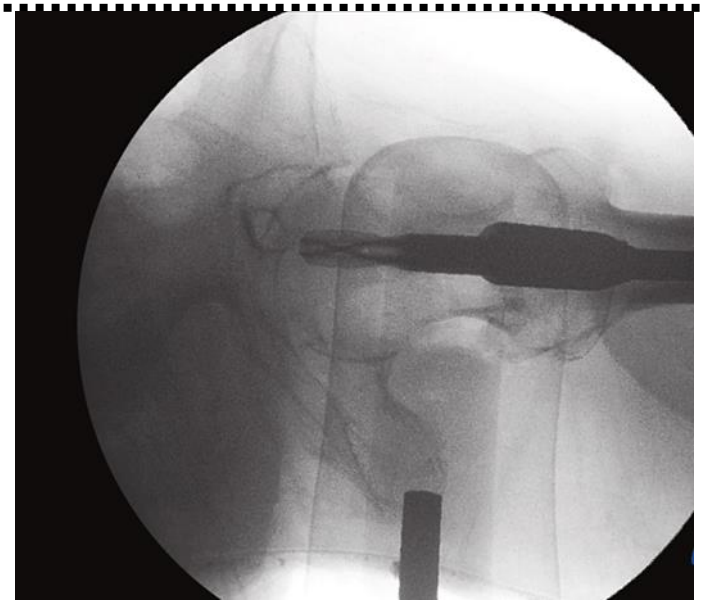

Figure 12

3. Lateral view of the proximal femur

The lateral view shows the ante-version of the head and neck.

Positioning for optimal view

- The beam track should avoid the contralateral hip
- A hemi-lithotomy position of the patient, scissoring, or abduction of the contralateral leg may be helpful to optimally place the C-arm

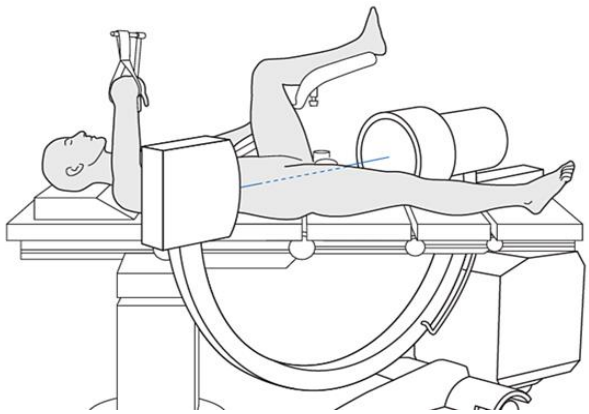

Figure 13

The beam is positioned horizontally, 30°–45° to the longitudinal axis of the leg and in the coronal plane.

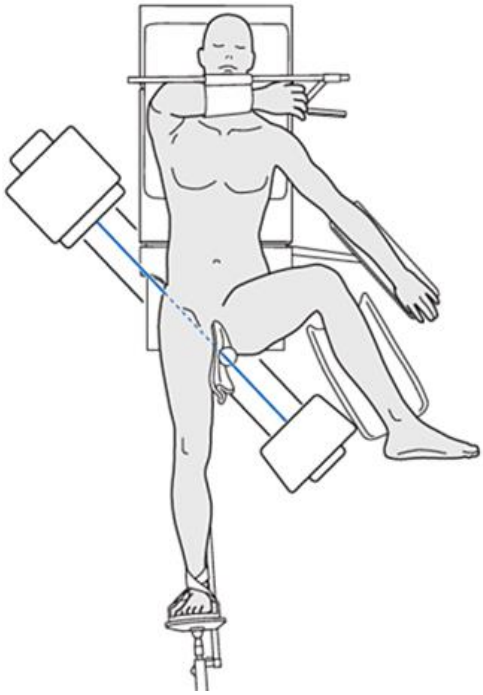

Figure 14

Verification of optimal view

The optimal view is obtained when:

- Centered image showing head, neck, and proximal end of shaft
- Normal ante-version between head-neck axis and femoral shaft is visible
- Trochanteric area is centered in image
- Contralateral hip is not obstructing the view

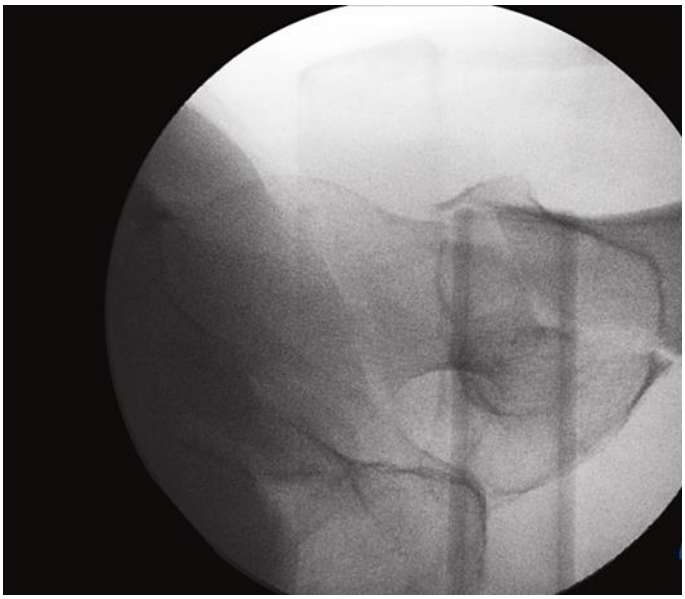

Figure 15: Verification of optimal view

Anatomical landmarks and lines

In the lateral view of the proximal femur (here with a trochanteric fracture), the following landmarks and lines can be observed:

1. Greater trochanter
2. Femoral head
3. Posterior line
4. Anterior line
5. Capsule insertion (part of the intertrochanteric line)

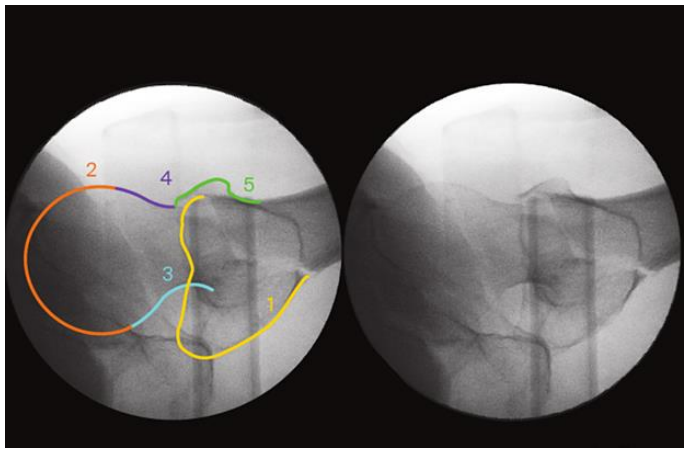

Figure 16: Anatomical landmarks and lines

What can be observed?

- Quality of reduction
- Ante-version

The lateral view is not optimal to confirm implant position (E g. Centre-center of neck screw/blade).

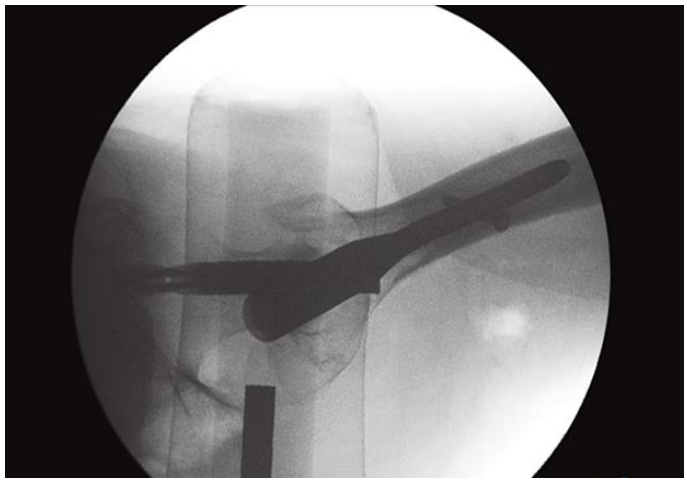

Figure 17: On behalf of all authors, the corresponding author states that there is no conflict of interest.

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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