

# Evaluation of Intraoperative Fluoroscopic Techniques to Estimate Femoral Rotation: A Cadaveric Study

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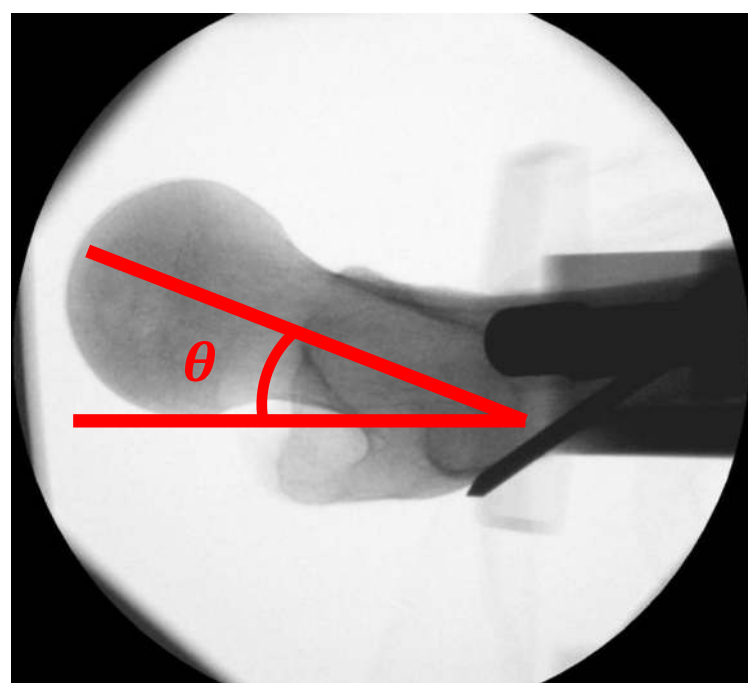
## Background

- Intraoperative evaluation of femoral rotation (FR) utilizing fluoroscopy is an inexact science
- Several methods described for use during femoral nailing
- Minimal data exists comparing different techniques

## Methods

- **10 cadavers with 20 intact femurs** with pre-mortem CT
- Mid-diaphyseal osteotomy created in each right femur
- **Four surgeons used 3 techniques** to match fractured femur rotation with intact contralateral side
- NH and TL techniques also used by each surgeon to estimate femoral version of intact femur
  - Estimation compared with CT measured rotation as “gold standard”
- *After obtaining a perfect lateral of the distal femur with the fluoroscopic beam perfectly parallel to the floor, the rotation of the proximal femur was assessed as described below:*

### Neck Horizontal (NH) Angle Method



The fluoroscopic beam angle is not changed, and a lateral of the femoral neck is obtained. The angle subtended between the femoral neck and the horizontal is the estimated FT

## Measured FR vs CT of Intact Femur

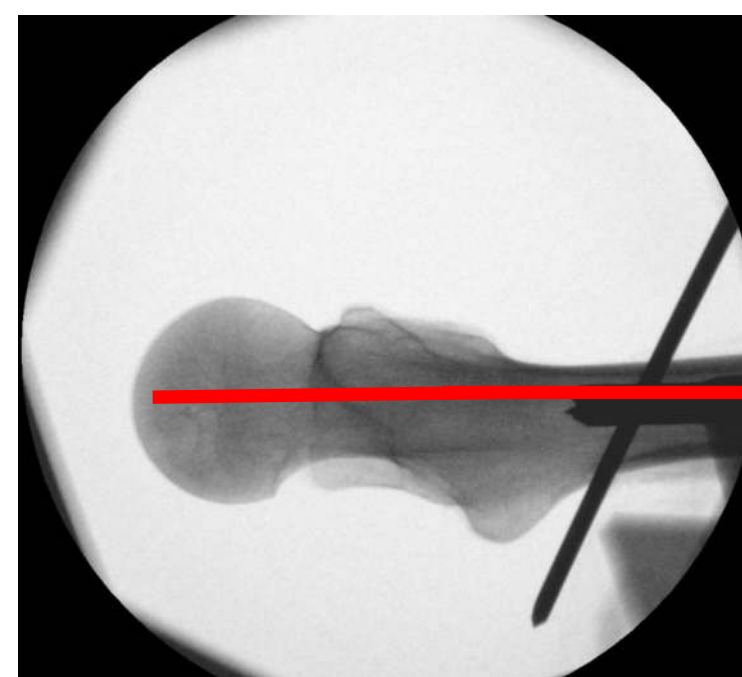
	Absolute Mean Error (95% CI)	Interobserver Agreement (95% CI)
NH method	4.4° (3.3 – 5.4)	0.72 (0.39 – 0.91)
TL method	8.2° (6.5 – 10.0)	0.69 (0.27 – 0.91)

## Measured FR of Fractured vs Intact Femur

	Mean Rotational Error	Malrotation rate*
NH method	6.6°	2.5%
TL method	6.0°	2.5%
LTP method	8.5°	20%

\*Malrotation defined as rotational error >15°

### True Lateral (TL) Method

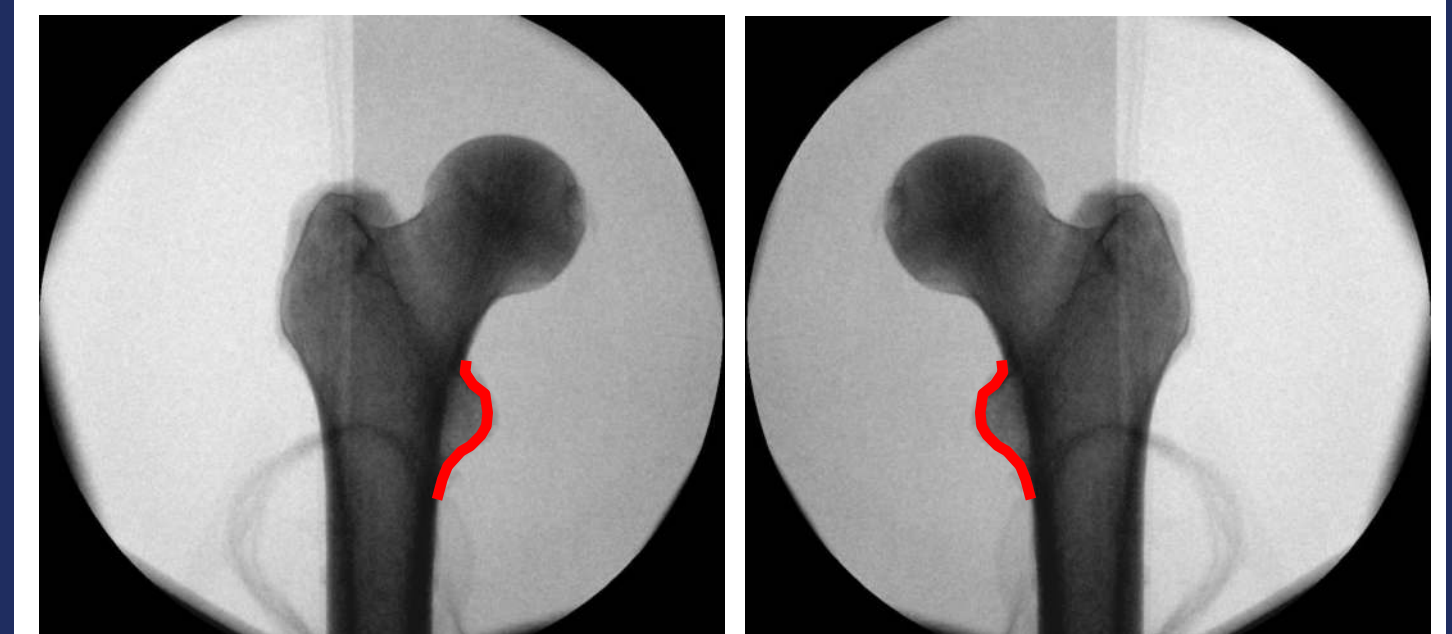


A “true” lateral of the femoral neck is obtained by rotating the fluoroscopic beam up until the image shows the femoral neck and shaft in parallel. The angle the fluoroscopic beam has rotated up to obtain this view is the estimated FT.

## Discussion/Conclusions

- For estimating the native FR of an intact femur:
  - The **NH method was more accurate vs TL method** when using CT as gold standard measurement
- In the fractured femur model:
  - **Mean rotational error was similar between all methods** and within accepted clinical margin of error
- The **LTP method malrotation rate → 20%**
  - NH and TL methods → 2.5%
- LTP method → higher rate of malrotation and thus the NH and TL may more suitable for estimating FR during intramedullary nailing of comminuted midshaft femur fractures.

### Lesser Trochanter Profile (LTP) Method



The beam is rotated 90 degrees (perpendicular to the floor) and an image of the proximal femur is obtained. The rotation of the femur is adjusted until the profile of the lesser trochanter matches the similar image obtained from the uninjured side