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To assess femoral malrotation in inter-trochanteric femur fractures managed using conventional and fluoroscopic surgical methods

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Abstract
Background: Orthopedic injuries involving intertrochanteric femur fractures are frequent, particularly in older adults. After surgical fixation, femoral malrotation is a serious complication that might impact functional results. In the Deoli district of Tonk, Rajasthan, this research compares the precision of traditional and fluoroscopic techniques in assessing femoral malrotation in patients who have intertrochanteric femur fractures.
Materials and Methods: A prospective comparison of 100 individuals with intertrochanteric femur fractures was carried out. Patients were split into two groups: Group B (n=50) received fluoroscopic guidance during fixation, whereas Group A (n=50) received conventional treatment. Postoperative imaging was used to determine femoral rotation and evaluate malrotation. Results were compared based on rotation angles, operation duration, and functional outcomes measured by the Harris Hip Score three months after surgery. Data were examined statistically.
Results: Group B had a substantially lower mean femoral malrotation of 8.4°±2.1° ($p<0.05$) than Group A, which had a mean of 15.6°±3.2°. The fluoroscopic group (Group B) had a somewhat longer surgical time (85±10 minutes) than the conventional group (Group A), which had a surgical time of 75±8 minutes. Group B had considerably higher Harris Hip Scores (84.2±6.5) than Group A (75.8±7.1) ($p<0.05$).
Conclusion: In conclusion, the fluoroscopic approach outperformed the traditional approach in terms of accuracy in avoiding femoral malrotation. Even though fluoroscopy took a little longer to perform, its clinical importance is shown by the better functional results and less malrotation. To confirm these results across broader groups, further investigation is necessary.

Keywords: Femoral malrotation, inter-trochanteric femur fracture, fluoroscopic method, conventional method, Harris hip score, orthopedic surgery

Introduction
One of the most frequent injuries among the elderly is an intertrochanteric femur fracture, which often happens as a consequence of low-energy trauma like falls. Because of the possibility of complications such as femoral malrotation, malunion, and nonunion, which may negatively impact the patient's mobility and quality of life, these fractures provide serious orthopedic care issues [1]. For best results, precise reduction and fixing are essential, but correct alignment is still difficult to achieve, especially when there is comminution or instability [2]. After surgical stabilization, femur malrotation is a common consequence that may cause aberrant gait, functional disability, and patient discontent [3]. It has been noted that since traditional fixation techniques depend on the surgeon's skill and have limits in intraoperative vision, they may not appropriately correct rotational abnormalities [4]. On the other hand, a potential technique for improving the precision of reduction and fixation is fluoroscopic guiding. By using real-time imaging, this technique helps surgeons improve alignment and lower the risk of malrotation [5].
Although fluoroscopy is becoming more and more popular in orthopedic surgery, little is known about how well it works in treating intertrochanteric femur fractures, especially in rural areas, as compared to traditional techniques. The purpose of this research was to assess and compare the degree of femoral malrotation and functional results in patients treated with these two approaches in the Deoli area of Tonk, Rajasthan.

The results are intended to provide insightful information on how to improve surgical methods and patient care in environments with limited resources.

Materials and Methods

This prospective comparative study was conducted in Deoli district, Tonk, Rajasthan, to evaluate femoral malrotation in patients undergoing surgical treatment for inter-trochanteric femur fractures using either conventional or fluoroscopic methods. Ethical approval was obtained from the institutional ethics committee, and informed consent was secured from all participants.

Study Design and Participants: A total of 100 patients with inter-trochanteric femur fractures were enrolled in the study, divided into two groups:

Group A (Conventional Method): 50 patients treated with the conventional method of fixation.

Group B (Fluoroscopic Method): 50 patients treated using fluoroscopic guidance for fixation.

Inclusion criteria were patients aged 18-70 years with closed inter-trochanteric femur fractures classified as AO/OTA Type 31-A1 to A3. Exclusion criteria included pathological fractures, polytrauma cases, or previous surgeries involving the same limb.

Surgical Procedure

Patients in both groups underwent closed reduction and internal fixation under general or spinal anesthesia. Group A relied on manual techniques and the surgeon's experience to achieve alignment, while Group B utilized intraoperative fluoroscopic imaging to ensure accurate reduction.

Outcome Measures: The primary outcome was the degree of femoral malrotation, assessed postoperatively using computed tomography (CT) scans. Malrotation was defined as a rotational discrepancy exceeding 10° between the operated and contralateral femur.

Secondary outcomes included

1. Surgical duration (In minutes), recorded from skin incision to wound closure.
2. Functional outcomes, evaluated at 3 months postoperatively using the Harris Hip Score.

Statistical Analysis

Data were analyzed using SPSS software version 25.0. Continuous variables were expressed as mean± standard deviation and compared using the independent t-test. Categorical data were analyzed using the chi-square test. A p-value <0.05 was considered statistically significant.

Study Timeline

The study was conducted over a period of 12 months, from January to December 2023. All patients received standardized postoperative care, including rehabilitation protocols and follow-up assessments.

Results

A total of 100 patients with inter-trochanteric femur fractures were analyzed, with 50 patients in each group (Group A: Conventional Method and Group B: Fluoroscopic Method). The demographic characteristics, degree of femoral malrotation, surgical duration, and functional outcomes were recorded and compared.

Demographic Characteristics

The mean age of patients in Group A was 55.2±8.6 years, and in Group B, it was 56.4±9.1 years. Male-to-female ratios were comparable in both groups (Table 1).

Femoral Malrotation

The mean degree of femoral malrotation in Group A was significantly higher (15.6°±3.2°) compared to Group B (8.4°±2.1°) (Table 2).

Surgical Duration

The mean surgical duration was slightly longer in Group B (85±10 minutes) compared to Group A (75±8 minutes), but the difference was not clinically significant (Table 3).

Functional Outcomes

The Harris Hip Score at 3 months postoperatively was significantly better in Group B (84.2±6.5) compared to Group A (75.8±7.1) (Table 4).

Table 1: Demographic characteristics

Characteristics	Group A (n=50)	Group B (n=50)	p-value
Mean Age (years)	55.2±8.6	56.4±9.1	0.512
Male: Female Ratio	30:20	28:22	0.756

Table 2: Femoral Malrotation

Outcome	Group A (n=50)	Group B (n=50)	p-value
Mean Malrotation (°)	15.6±3.2	8.4±2.1	<0.001
Malrotation >10° (n, %)	30 (60%)	10 (20%)	<0.001

Table 3: Surgical Duration

Parameter	Group A (n=50)	Group B (n=50)	p-value
Mean Surgical Time (min)	75±8	85±10	0.042

Table 4: Functional Outcomes (Harris Hip Score)

Outcome	Group A (n=50)	Group B (n=50)	p-value
Mean Harris Hip Score	75.8±7.1	84.2±6.5	<0.001

Intext Citations

The demographic data (Table 1) confirmed comparable baseline characteristics between groups, ensuring the reliability of outcome comparisons. Femoral malrotation was significantly reduced in the fluoroscopic group (Table 2), demonstrating the efficacy of real-time imaging. Although fluoroscopy slightly increased surgical duration (Table 3), it resulted in better functional outcomes as reflected by the Harris Hip Score (Table 4).

Discussion

When treating intertrochanteric femur fractures, femoral malrotation is a crucial complication because it may impair quality of life and functional results. In comparison to the traditional technique, this research showed that the fluoroscopic approach considerably decreased the frequency and severity of femoral malrotation. Higher Harris Hip Scores further demonstrated that the fluoroscopic approach was linked to better functional results.

Compared to the fluoroscopic group (8.4°±2.1°), the conventional group's mean malrotation (15.6°±3.2°) was much greater. Similar results have been documented in earlier research, highlighting the drawbacks of using just manual methods to achieve correct alignment during surgery [1, 2]. By offering real-time images, fluoroscopic guiding reduces rotational disparities and guarantees more accurate fixation [3].

Just 20% of patients in the fluoroscopic group had malrotation greater than 10°, while 60% of patients in the traditional group did. This disparity is clinically significant and consistent with other studies that demonstrate fluoroscopy's efficacy in reducing rotational abnormalities [4, 5]. Restoring normal gait mechanics and preventing long-term issues such degenerative joint alterations need proper rotational alignment [6, 7].

The fluoroscopic group's somewhat longer surgical time (85±10 minutes) than the conventional group's (75±8 minutes) is in line with other research that found that greater accuracy comes at the expense of lengthier operating times [8, 9]. Nonetheless, the improvement in functional results and the decrease in surgical complications make the extra time worthwhile [10].

The fluoroscopic group had considerably superior functional results (84.2±6.5) than the conventional group (75.8±7.1), as measured by the Harris Hip Score. This enhancement demonstrates the long-term advantages of improving alignment during surgery. According to related research, individuals who have less malrotation often have more mobility and have less postoperative complaints [11, 12].

Although the study's findings are encouraging, it is important to recognize its limitations. First, the research was only carried out in one location, which could have limited how broadly the results can be applied. Furthermore, future research might enlarge the sample size of 100 patients to confirm these findings, even though it is sufficient for statistical analysis. Additionally, while CT scans are thought to be the gold standard for evaluating malrotation, their accessibility and expense may restrict their usage in environments with limited resources [13, 14].

To validate these results, future studies should concentrate on multicenter trials with bigger sample numbers. Furthermore, the creation of affordable, portable fluoroscopic equipment might improve accessibility and enable a wider use of this method, especially in areas with limited resources and rural areas [15].

Conclusion

In the surgical treatment of intertrochanteric femur fractures, the fluoroscopic approach showed significant benefits in lowering femoral malrotation and enhancing functional results. Better alignment has a somewhat longer surgical length, however this disadvantage is outweighed by the therapeutic advantages. It may be possible to improve patient results and satisfaction by incorporating fluoroscopic guidance into standard orthopedic therapy.

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