TECHNICAL NOTE

Trans-Table Intraoperative Fluoroscopic Technique for Obtaining a True Lateral View of the Proximal Femur in the Lateral Decubitus Position

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Received: 4 May 2023 *Accepted: 17 June 2023*

Abstract

The management of proximal femoral fractures, especially comminuted subtrochanteric ones, poses a surgical challenge. It is relatively easier to perform the open reduction of these fractures in the lateral position on a standard radiolucent table, but obtaining an accurate lateral view of the femoral head and neck remains difficult. This study presents a method that overcomes the limitations of fluoroscopy in the lateral decubitus position and improves the accuracy of obtaining a true lateral view. The technique involves positioning the patient in the lateral decubitus position with the unaffected hip flexed at a 45° angle. Additionally, the C-arm is tilted 30-35° cephalad, eliminating the need for position changes or leg manipulation. This method reduces the risk of losing reduction, particularly in cases involving obese patients or complex fractures. By simplifying proximal femur fixation in the lateral decubitus position, this technique can potentially improve patient outcomes.

Level of evidence: V

Keywords: C-Arm, Fluoroscopy, Fracture table, Lateral decubitus, Proximal femur fracture, Subtrochanteric

Introduction

Proximal femur fractures, also known as hip, trochanteric, subtrochanteric, pertrochanteric, intertrochanteric, basal, and transcervical femoral neck fractures, are challenging orthopedic surgeries that affect the elderly population more frequently.[1] This type of fracture is the most life-threatening in the elderly population, which is expected to rise to 2.6 million by 2025.[2]

The fixation of proximal femoral fractures, especially comminuted subtrochanteric ones, is a challenging aspect of orthopedic surgery practice. Using open or closed reduction, these fractures are stabilized with intramedullary nails, various types of plates, and screws.

Proximal femur fractures can be fixed using various positions during surgery, including the supine position on a fracture table (which is the most common position) or a radiolucent table and the lateral decubitus or prone position on a radiolucent table.[3,4] Surgery on a fracture table provides continuous longitudinal traction and eliminates the need for an assistant surgeon. However, it poses certain challenges, such as difficulty in finding the entry point, particularly in obese patients, manipulating the proximal fragment, and other issues related to the fracture table.[3,5]

The lateral decubitus position offers several benefits, including easier reduction and better access to the pertrochanteric area and piriformis fossa, particularly in obese patients. Some techniques have been proposed to address this issue, but they require changing the patient's and the bed's positions, making it difficult to maintain reduction, especially in comminuted fractures.[3,6-8] Therefore, fluoroscopy in this position is still challenging and remains a knowledge gap.

In this study, we propose a method for intraoperative fluoroscopy for proximal femur fractures that can be performed in the lateral decubitus position without requiring a change in the leg's or table's position. This approach aims to address the current knowledge gap and provide a more efficient and effective method for imaging during surgery in the lateral decubitus position.

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Surgical Technique

We introduce a method for optimizing intraoperative imaging during proximal femoral fracture fixation in the lateral decubitus position on a standard operation table without changing the leg position to obtain a true lateral view of the proximal femur.

Position

In our proposed approach, the patient is positioned in the lateral decubitus position on a radiolucent operating table. The contralateral (unaffected) hip is flexed to approximately 45°, and the patient is secured with anterior and posterior lateral support. The fibula head of the unaffected limb is well-padded, and the fractured limb is placed on a large pillow. To ensure stability, the patient is secured with three straps: one on the torso, and two on the pillow that supports the fractured limb [Figure 1].

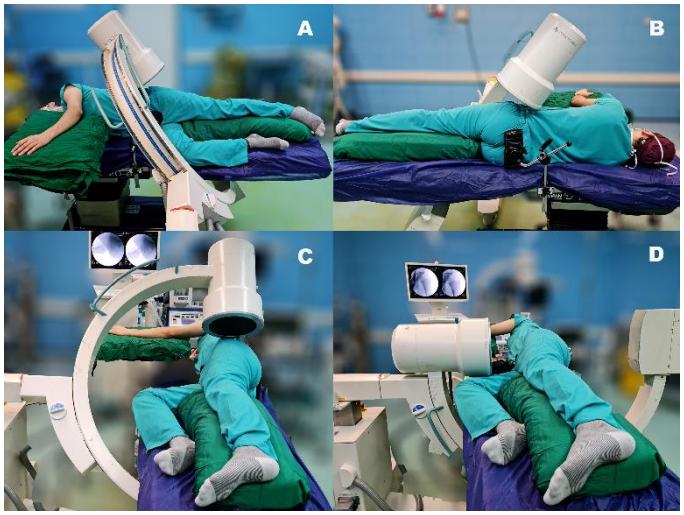

Figure 1. Patient in the lateral decubitus position with an unaffected hip 45° flexed. A, B, C: For true lateral fluoroscopy, the C-Arm was tilted 30-35° cephalad. D: The C-arm was rotated underneath the table for an anteroposterior view

Fluoroscopy Technique

The C-arm is positioned on the opposite side of the surgeon at a 90° angle to the table's long axis. To obtain a true lateral view, the image intensifier is positioned over the patient, and the radiation beam is aligned with the axis of the femoral neck. To achieve this, the C-arm intensifier is tilted 30-35° cephalad, which is the same as what is done in cross-table radiography. Contralateral hip flexion is necessary to prevent the right and left hip images from superimposing [Figure 2]. By following this technique, we can obtain a true lateral image of the hip without changing the patient's position or manipulating the leg. Additionally, we obtain the anteroposterior view by rotating the C-arm underneath the table 90° and placing the intensifier in front of the injured hip.

Patients

Case I: A 19-year-old male athlete (BMI=32.1) had a subtrochanteric femoral fracture due to a vehicle accident. The fracture line was transverse (Russell-Taylor type IA), and the proximal fragment was in flexion, abduction, and external rotation, while the distal fragment appeared noticeably shortened [Figure 3].

Case II: A 49-year-old male (BMI=29.7) had a simultaneous tibia fracture and a comminuted subtrochanteric fracture due to a vehicle accident. The fracture was comminuted without involving the piriformis fossa (Russell-Taylor type IB), and the proximal fragment was in flexion, abduction, and external rotation [Figure 4].

Both patients underwent surgery at our center using the position and fluoroscopy technique described above.

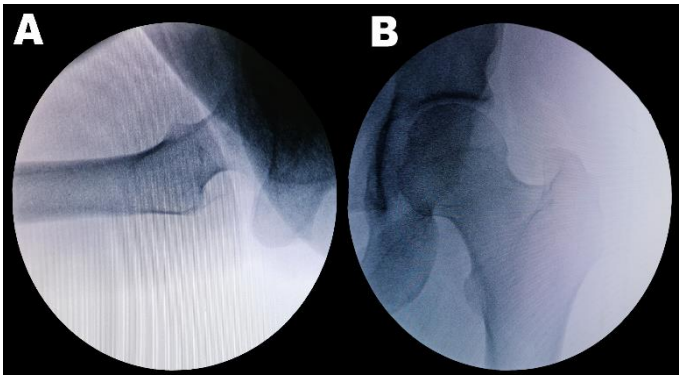

Figure 2. A: True lateral view of the proximal femur. B: Anteroposterior view of the proximal femur

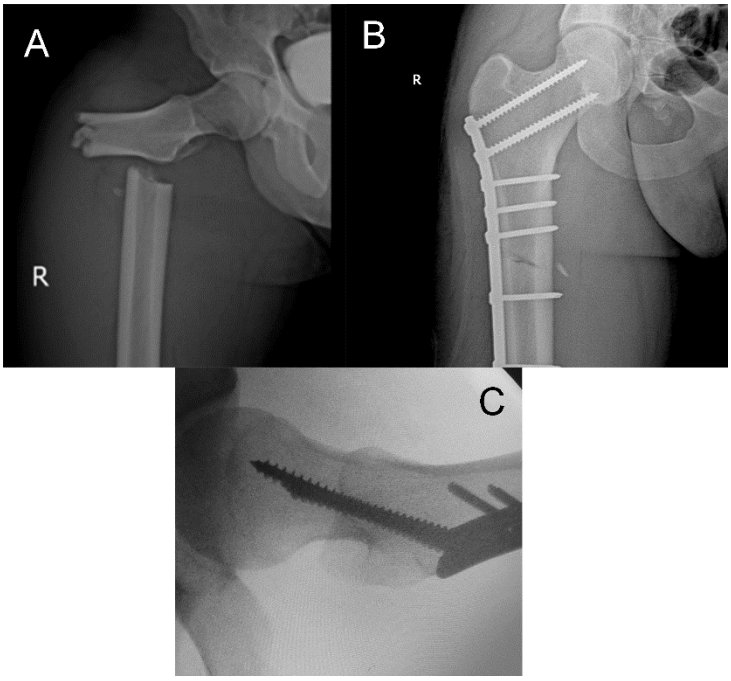

Figure 3. A: Pre-operative radiography of a femoral subtrochanteric fracture. B: Early post-operative anteroposterior X-ray. C: Intraoperative true lateral view of the hip at the lateral decubitus position

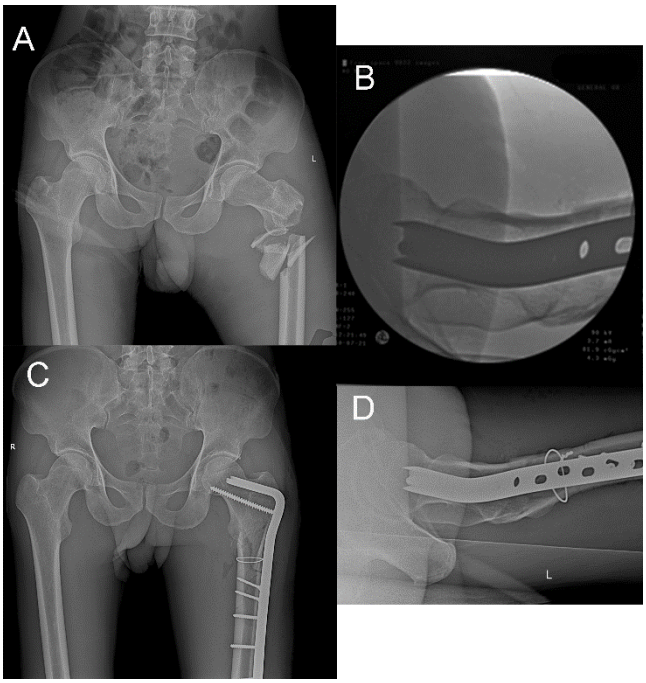

Figure 4. A: Preoperative anteroposterior view of the left comminuted subtrochanteric fracture. B: Intraoperative true lateral view of the hip at the lateral decubitus position. C, D: Early post-operative radiographers

Expected Outcomes

At our institution, we have performed surgery on a number of patients in this position and have found it a safe and effective approach for treating complex proximal femur fractures. This approach reduces the duration of surgery for several reasons. Firstly, patient preparation in the lateral position requires less time. Secondly, obtaining a true fluoroscopic image with this method is generally easier and quicker. Additionally, the reduction of the proximal segment is easier, especially in cases of displaced comminuted fractures. The approach also offers advantages for obese patients, as access to the fracture site is easier and locating the entrance for intra-medullary nail insertion is simpler. Lastly, in patients with high muscular mass, the relaxation of the iliotibial band can facilitate reduction.

In this article, we have presented two patients in Figures 3 and 4 to illustrate our experience with this method. Our experience shows that despite the complexity of fractures treated with this method, the total surgery time, including positioning, is shorter, compared to the use of fracture tables. Moreover, the approach of maintaining limb stability during the surgery significantly lowers the risk of reduction loss, which is a crucial factor in achieving successful outcomes in fracture treatment.

Discussion

We have presented a surgical fluoroscopic technique to optimize intraoperative imaging for proximal femoral fracture fixation in the lateral decubitus position without the need to alter the limb or table position. This technique can enhance surgical success by reducing the duration of the operation, simplifying treatment for patients with obesity or high muscular mass, and minimizing the risk of reduction loss.

Malreduction in the proximal femur is a significant cause of fixation failure and non-union in these fractures, which can be eliminated by achieving anatomical reduction. Various studies have emphasized the importance of anatomical reduction in this area, especially in subtrochanteric fractures.[9,10] An anatomical reduction requires sufficient exposure and relaxed muscles, and the lateral position provides an advantage for controlling deforming forces due to the relaxed muscles around the hip.[8]

Another advantage of the lateral decubitus position is that it can be utilized for patients who have a simultaneous ipsilateral hip or knee flexion contracture, an ipsilateral tibia fracture, and an ipsilateral below or above knee amputated limb. Despite all these advantages, many surgeons avoid using this position for fixation due to the challenges of performing fluoroscopy during surgery, especially to obtain a true lateral view of the proximal femur. Prior studies have presented several approaches for utilizing fluoroscopy in proximal femur surgery performed in the lateral position. However, none of these techniques can be accomplished without altering the patient's limb or adjusting the position of the surgical table.[3,7,8]

Using the proposed method, true lateral fluoroscopy can be achieved with a very simple modification in the patient's positioning and without the need for any changes in the patient's or table's position during the surgery.

Surgery in this position has some disadvantages as well. The first is the difficulty of maintaining the patient in the correct position during the surgery, which can be eliminated using lateral support for the operating table. The second issue is that prepping and draping can be more challenging in the lateral position.

Finally, considering the physical condition of the patient and the type of fracture, the lateral position may be appropriate for certain cases without posing challenges to the fluoroscopy approach, as described with the aid of this technique.

Acknowledgement

We would like to express our sincere gratitude to Morteza Kalhor for his invaluable guidance and teaching in the field of orthopedics throughout these years. His expertise and dedication have been instrumental in shaping our knowledge and skills in this specialized area of medicine. We feel fortunate and privileged to have had the opportunity to learn from him, and his mentorship will continue to inspire and guide us in our future endeavors.

Conflict of interest: None

Funding: None

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