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Lateral imaging technique of the femoral neck in a supine-semilithotomy position without a fracture table

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Abstract

Treatment of proximal femoral fractures in the supine position poses has certain challenges, especially due to difficulties in lateral imaging of the femoral neck in cases where there is no fracture table, such as prolonging the surgery time and increasing the dose of radiation exposure. The purpose of this study is to present the lateral imaging technique of the femoral neck by fluoroscopy on the conventional operating table in the treatment of proximal femoral fractures. We applied proximal femoral nail by positioning the healthy leg in a semilithotomy position to facilitate lateral imaging of the femoral neck by fluoroscopy while the patients were in the supine position. The study analyzed 22 patients (12 women, 10 men) with femoral pertrochanteric and basicervical fractures with the following types of fractures (9 patients had AO type 31-A1, 9 patients had AO type 31-A2, 4 patients had AO type 31-B2.1), and with a mean age of 62.1 years (33-75 years). The preparation time of the supine-semilithotomy position was about 2 minutes, and the reduction was finished within 9 intraoperative fluoroscopy exposure times. No patient suffered from a postoperative complication. The mean surgery time was 20 minutes (18-22 minutes), the average number of scopy shots was 8 (7-9), and the mean hospital stay duration was 2 days (2-2 days). We believe that the supine-semilithotomy technique is a suitable treatment option for proximal femoral intramedullary nailing and cannulated screw application. Since the lateral view of the femoral neck is obtained quickly and clearly with this technique, fluoroscopy does not need to be performed repeatedly, so fluoroscopy time and the number of shots are reduced, and the time spent by the patient and the surgical team in the surgery is shortened.

Keywords: Fluoroscopy, proximal femoral fracture, lateral view, trauma,short surgery time, supine-semilithotomy position.

Introduction

Proximal femoral fractures have started to occur more frequently with the increase in the elderly patient population with osteoporosis. Intertrochanteric, pertrochanteric, and subtrochanteric femoral fractures make up more than half of the proximal femoral fractures [1]. Proximal femoral fractures are more common, and the mortality and morbidity rates are also higher in women [2]. Various treatment methods such as conservative treatment by traction, open or closed reduction, various implants for internal fixation,orarthroplasty have been used in the treatment of these fractures [3]. The routinely used method in closed reduction and fixation of hip fractures is surgery performed on the fracture table in the supine position using fluoroscopy [4]. However, setting up and using the fracture table is both times consuming and does not allow for the reduction of ipsilateral tibial fractures within the same session.

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Also, the use of a fracture table may lead to complications such as pudendal nerve neuropraxia, erectile dysfunction, and perineal sloughing [5,6].

The treatment option that minimizes soft tissue dissection to reduce the risks such as bleeding and infection is proximal femoral nails (PFN) in the treatment of proximal femoral fractures. Proximal femoral nails are used more commonly, especially in unstable pertrochanteric femoral fractures [7]. One of the challenges of this implantation technique is to obtain a lateral view of the screw delivered to the femoral neck by fluoroscopy on the conventional operating table.

In addition to all these side effects and complications, the lack of a fracture table in some clinics brings to mind the question of what can be done with the available facilities. In the present study, we tried to present the lateral imaging technique of the femoral neck in the treatment of proximal femoral fractures in the supine position without a fracture table.

Materil and Methods

This study was carried out with the approval of the local ethics committee of clinical research with the decision numbered 2020/234. In the present study, we used TALON DISTALFIX SLN-Nail (ODI, Orthopedic Designs North America USA) cannulated PFN made of titanium alloy with 6 talons with a proximal curvature of 4° and distal outward fixation design. The talons in the nail are opened from the proximal thanks to a shaft passing through the medulla of the nail. The proximal part of the nail is 15.5 mm, and the distal part is 11 mm in diameter. The neck-shaft angle of the nail has neck screw options of 120°, 125°, and 130°. It has the feature of fixing the neck screw to the nail with the neck fixing screw passing through the nail. There are 4 talons with a neck screw of 11 mm in diameter, 70-120 mm in length, and from the distal outward fixation design. This talon system is a system that opens from the lateral with a shaft system passing through the neck screw and allows for a compression of 5 mm.

All operations were performed within 2 days after fractures occurred, and a closed reduction was achieved in all cases. We classified the acceptability of reduction as anatomical (<5° varus, valgus, anteversion, or retroversion), acceptable (5-10°), or poor (>10°) [8].

In the early postoperative period, it was ensured that all patients performed regular hip and knee movements and isometric exercises. Patients were allowed toweight-bearing as much as they could tolerate 3 weeks after surgery. All patients were called for regular physical examinations and radiographic follow-ups. The patients were followed up for a mean period of 12 months (10-14 months). The mean age of our patients was 62.1 years (33-75 years). Among 22 proximal femoral fractures, 9 patients were AO type 31-A1, 9 patients were AO type 31-A2, and 4 patients were AO type 31-B2.1.

Surgical Technique

The patients were placed in a radiolucent conventional operating table in the supine position. A femoral intramedullary nailing maneuver was facilitated by placing a booster pad under the gluteal region of the limb that is planned to be operated. To obtain the lateral view of the femoral neck, the leg part of the operating table on the side of the healthy limb was removed. Then, the healthy limb was placed in the leg holder in a semi-lithotomy position with knee flexion of 90°, hip flexion of 90°, and hip abduction of 45° (Figure 1). A soft pad was placed under the leg, which was in the semi-lithotomy position, to reduce popliteal pressure. In this way, we were able to apply the full adduction required for nail entry in the femoral intramedullary nail application and also achieved the advantage to create the area required for fluoroscopy maneuver to obtain a lateral view of the femoral neck. After the necessary decontamination and covering of the surgical site, the reduction was applied to the broken limb by manual traction (Figure 2). Following the reduction, the PFN entry site was detected by anteroposterior (AP) fluoroscopy image by performing full adduction to the injured limb. After access to the cannula with the aid of an awl, the guidewire was delivered through the awl. After it was determined by the fluoroscopy image that the guidewire had an intramedullary course, the PFN entry site was prepared with the help of the proximal drill. The length of the PFNs was determined by the type and location of the fracture, and the diameter by the intramedullary diameter of the limb. In all cases, the nails (TALON DISTALFIX SLN-Nail, ODI, Orthopedic Designs North America USA) were inserted anterogradely with trochanteric entry. A K-wire was then placed on the femoral neck before the drill procedure to insert the proximal screw. Traction was applied by an assistant until the K wire was placed. To confirm that the K wire that was delivered to the femoral neck was moving within the neck, the C-arm fluoroscopy was rotated under the operating table to obtain a full lateral view of the femoral neck (Figure 3). After it was determined that the K wire centered the femoral neck, drilling was performed through the K wire for the proximal screw location. Then, for distal locking, fixation was achieved with 6 talons opened from the proximal with a shaft system that passes throughthe medulla of the nail. After the proximal screw was placed, fixation was achieved with 4 talons opened from the lateral with a shaft system that passes through the neck screw under C-arm fluoroscopy. Finally, adequate proximal compression was performed.

Results

There was an acceptable reduction in three patients and anatomical reduction in the rest of the patients. The preparation time of the supine-semilithotomy position was about 2 minutes, and the reduction was finished within 9 intraoperative fluoroscopy exposure times. No patient suffered from a postoperative complication. The mean Harris hip score was 85.22 (range: 72-100). Ten patients had excellent to good results, 12 patients had fair results based on the Harris hip score. None of our patients had poor results.

Figure 1. (a),(b) Antero-posterior fluoro scopic imaging of the patient in supine-

semi litoto my position. (c),(d)Lateral flu oroscopic imaging of the patient in supine-semi litoto my position

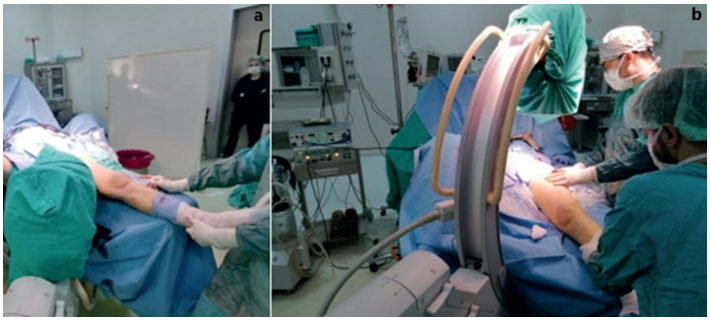

Figure 2. (a) The C-arm is placed to take an lateral view for the proximallags crew insupine-semi litoto my position (b)The C-arm is placed to take an AP view for the femoral entry point insupine-semi litoto my position.

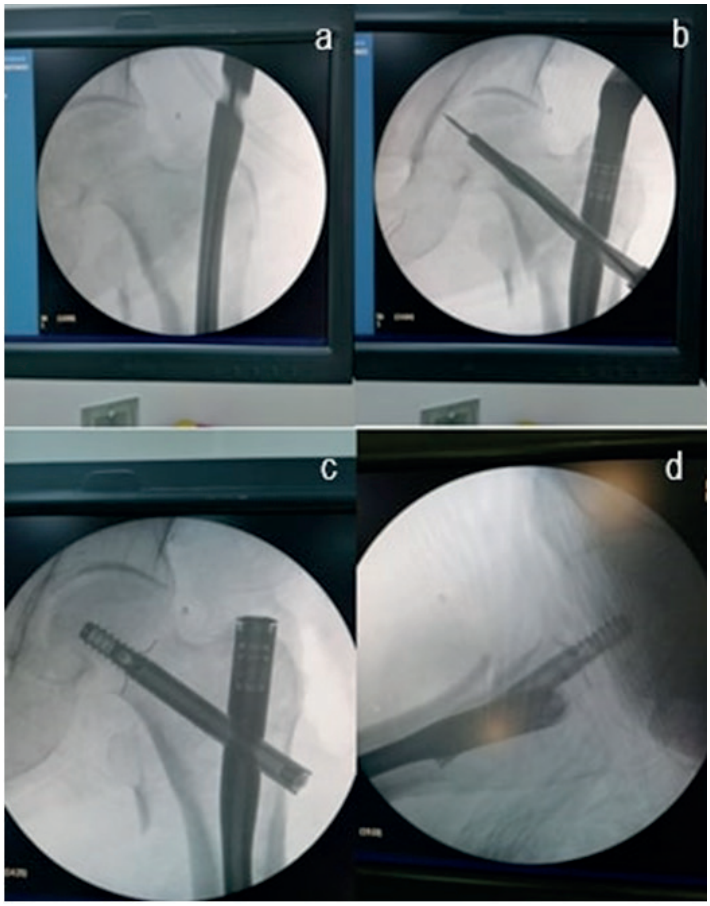

Figure 3. (a) Placement of PFN antero grade with trochantericentry. (b) Dirilization forlags crew over K wire (c),(d) Intra operative anteroposterior-lateral flu oroscopic images.

Discussion

Currently, one of the treatment options for proximal femoral fractures is PFN. Short surgery time, minimal soft tissue dissection, achieving biological fixation, low blood loss, and protection from fracture hematoma are among the advantages of this technique [9]. Also, studies have shown that intramedullary nails reduce bone stress by 25-30% more than extramedullary implants by directing forces to the femoral neck [10,11].

The proximal femoral nailing technique is usually applied to the fracture table with continuous traction. Continuous and long-term traction applied to the fracture table may cause complications such as pudendal nerve neuropraxia, erectile dysfunction, and pressure necrosis [5,6]. The use of a traction table can facilitate the job of an orthopaedist during surgery; however, it also has disadvantages such as complication risks and the fact that setting up the table prolongs the duration of surgery. Also, since the traction table may not be used in the treatment of proximal femoral fractures in amputated patients, a radiolucent table should be used. It is the most difficult part of the intramedullary nailing techniques to confirm by fluoroscopy the location within the neck of the screw to be delivered to the femoral neck. Due to the high cost of the fracture table, it may not be provided by every clinic; therefore, various techniques have been described to facilitate full insertion of the proximal lag screw delivered to the neck in femoral intramedullary nailing.

Zhao et al. have defined the prone position in intramedullary nailing of subtrochanteric fractures. They stated that the prone position is advantageous for providing an appropriate access site especially in obese patients and for obtaining a full image in both anterior-posterior and lateral imaging [12]. Bishop et al. described the lateral decubitus position in femoral intramedullary nailing. They showed that this position eliminates the need for a fracture table, facilitates the transition to open surgery, and is safer in terms of complications [13].

The prone position defined by Zhao et al. has some disadvantages. The lateral fluoroscopy view requires the C-arm to be rotated over the top of the patient. It may be difficult for the technician at the beginning to maneuver the C-arm into this position. Close attention should be paid to maintain sterility of the C-arm, especially since the machine must repetitively be moved over the top of the patient and the surgical field. Also, this position creates difficulties for the anesthesiologist. Because the airway is not so easy to access during the operation in this position and adverse cardiopulmonary events are extremely difficult to manage urgently when the patient is positioned prone, careful preoperative evaluation is significant [12]. There are some limitations for the lateral decubitus position defined by Bishop et al. The first one is that it is difficult for the anesthesiologist to reach the patient and intervene since the patient is in a lateral position. The lateral position may not be suitable for trauma patients with spinal injuries or lung injuries [13]. Apart from these, the lateral position does not allow for intervention in patients with ipsilateral limb injuries within the same session.

We describe an alternative technique for treating proximal femoral fractures using intramedullary fixation. Positioning the patient in the supine position on the flat radiolucent table has several advantages. The preparation time is about 10 minutes in our experience, less than the time spent in the supine position with the traction table. This condition shortens the surgical time. The major advantage of using a radiolucent table is exerting intermittent manual traction, thus preventing complications associated with continuous traction.

Another advantage of the supine-semilithotomy position we have described is that it provides easy access to obtain excellent intraoperative imaging. The intraoperative fluoroscopy technique is very important for the proper insertion of the proximal lag screw. Both anteroposterior and full lateral view can be obtained with

the supine-semilithotomy position. Especially since the C-arm is rotated from the lower part of the operating table to obtain a lateral view, the lateral view will be obtained with a simple maneuver and the sterility will largely be preserved since the feet of the scopy do not move.

Another advantage of the supine-semilithotomy position is that the patient is in a supine position, making it easier for the anesthesiologist to intervene. Also, in ipsilateral limb injuries such as accompanying tibia fractures, intervention may be applied to the patient in the same session without the need to change position. Other than these, the distal locking mechanism of the PFN we applied is achieved with the talons opened with the proximal mechanism, but in the femoral intramedullary nailing with distal locking by screws, lateral view of the screw holes for distal screw locking can be easily obtained as the healthy limb is in the semilithotomy position.

The supine-semilithotomy position also has some limitations. The technique requires the use of an operating table with the function of individual leg plate adjustment and longitudinal shift. Also, stronger manual traction may be needed in the treatment of subtrochanteric fractures.

Conclusion

In conclusion, the supine-semilithotomy technique makes it easier to obtain a lateral view of the proximal femur, thereby shortening the time of surgery and fluoroscopy. Therefore, we believe that this technique is a suitable treatment option for proximal femoral intramedullary nailing.

Conflict of interests
No benefits in any form have been or will be received from a commercial party related directly or indirectly to the subject of this manuscript.

Financial Disclosure
Payment completed

Ethical approval
This study was carried out with the approval of the local ethics committee of clinical research with the decision numbered 2020/234.

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