

## FUNCTIONAL OUTCOME OF PERITROCHANTERIC FRACTURES TREATED WITH PROXIMAL FEMORAL NAIL

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### ABSTRACT

The incidence of peritrochanteric fractures have increased significantly during the recent decades and will probably continue in the near future due to rising average age of the population. Over the past 50 years, a wide variety of implants have been utilised, but till today there exists a surgeon's discretion in selecting an implant due to various surgeon-related factors. We, therefore, attempted to address this problem by assessing the functional outcome of peritrochanteric fractures treated with proximal femur nail and compared the same with fractures treated with dynamic hip screw reviewed in the literature. During this period, we have assessed various preoperative and postoperative factors that has influenced the overall functional outcome of peritrochanteric fractures in selected patients. The results were analysed and compared with standard studies. It was found that proximal femoral nail requires a steep learning curve, sophisticated equipment and very little margin of error. This alone could not be a limiting factor in offering this procedure in peritrochanteric fractures compared to dynamic hip screw, which is a relatively easy extramedullary procedure, but associated with more complications and suboptimal end results.

### METHODS

21 consecutively patients with peritrochanteric fractures at our hospital between April 2010 and May 2012 were enrolled in the study.

### RESULTS

According to BOYD and GRIFFIN classification no of patients with type 1 is 2 (9.5%), type II is 7 (33.3%), type III is 3 (14.3) and type IV is 9 (42.9). The mean age of male patients is 58.7 years and in female patients is 67.5 years. The preoperative mobility status of the patient was assessed by PARKER AND PALMER MOBILITY SCORE.<sup>1</sup> The mean preinjury score was 8.10. The spinal anaesthesia was used in all patients. The average length of incision was 5 cm. Blood loss was counted intraoperatively by number of mops used during surgery.

### CONCLUSION

The data was assessed, analysed, evaluated and the following conclusions were observed. We attribute the good results as a result of the following factors less operating time.

### KEYWORDS

Intertrochanteric Fractures, Femoral Calcar, Dynamic Hip Screw.

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**INTRODUCTION:** The incidence of peritrochanteric fractures has increased significantly during the recent decades and will probably continue in the near future due to rising average age of the population. Over the past 50 years, a wide variety of implants have been utilised. The treatment

of choice of peritrochanteric fractures should be operative and the goals<sup>2</sup> of operative treatment are:

- 1) Strong and stable fixation of fracture fragments.
- 2) Early mobilisation.
- 3) Restoration of the patient to his preoperative status at the earliest.

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**The variables that determine the fracture fragment-implant stability are:**

- 1) Bone quality.
- 2) Fragment geometry.
- 3) Reduction.

- 4) Implant design.
- 5) Implant placement. Of the five elements, the surgeon can control the quality of reduction, implant selection and placement.

**Two broad categories of internal fixation devices are commonly used for peritrochanteric fractures:**

- 1) Sliding compression hip screw with a side plate assembly.
- 2) Intramedullary fixation device.

The preferred type of device is controversial. There are many inconclusive studies that show the preferred choice of implant over other. The main aim of the study is to assess the functional outcome of proximal femoral nailing in peritrochanteric fractures and compare the same with patients treated by dynamic hip screw in the literature.

**MATERIALS AND METHODS:** 21 consecutively patients with peritrochanteric fractures at our hospital between April 2010 and May 2012 were enrolled in the study.

The inclusion criteria are an age of >60 years with community ambulatory with or without a cane before surgery. Patients with a pathological fracture or severe medical co-morbidities were excluded. The approval was given by the institutional review board of our institution and informed consent was obtained from all patients who participated in this study. Prior to commencing the study, surgical procedure and rehabilitation protocols were standardised and discussed with patients.



**Fig. 1**

**Operative Technique:** In all 21 patients, only spinal anaesthesia was used. All patients were positioned using a fracture table to obtain and maintain an indirect fracture reduction thus obviating the need for excessive soft tissue stripping and saving intraoperative time. In addition, a biplanar fluoroscopy can be used throughout the case without the need for manipulating the fracture extremity. Once positioned, patient is immediately secured with a safety belt to prevent potentially catastrophic fall. A well-padded perineal post is applied in a manner to impinge on the normal hip ischial tuberosity in order to maintain ASIS at the same level. The foot was placed securely in a well-padded foot holder. The heel was padded and

circumferentially taped. Raising the padded metatarsal bar will dorsiflex the ankle and stabilise the transverse tarsal joints ultimately locking the foot into a position that can transmit strong longitudinal traction and rotational forces to the fracture. After the operative leg has been stabilised, the contralateral leg was positioned in flexion and abduction over a thigh post to allow unimpeded fluoroscopic visualisation of the involved hip. The affected hip was slightly adducted to allow access to the trochanter region. Because no counter traction is applied to the well leg sometimes the pelvis can rotate around the perineal post if strong traction is applied leading to hip abduction and compromised insertion site access. This position is usually preferred not only because acute intertrochanteric fractures require limited traction, but also because it typically offers an unimpeded access of C-arm for proper imaging of the affected hip.

However, the unaffected leg could also be positioned in extension allowing for counter traction and therefore added stability to the pelvis. The position is particularly useful when dealing with obese patients, patients with stiff hips, complex fractures or in situations with injuries to both legs. The lateral plane image, however, is somewhat difficult to interpret.

**Fracture Reduction:** The focus on anatomic reduction is paramount to success and should be on anteromedial cortex reduction.<sup>3</sup>

1. After attachment to the foot positioner with an attached perineal post over the opposite ischial tuberosity, posterior sag is corrected with a help of a bar or a crutch by manipulating the distal fragment from posteroanterior direction and maintain after correcting the sag.
2. Flex the leg through the foot holder 20<sup>0</sup>-30<sup>0</sup> from neutral maintaining the posterior to anterior reduction force at the hip.
3. Apply traction in line with the body to restore the length. No varus.
4. Rotate the leg to align with proximal fragment, 0-15<sup>0</sup> of internal rotation for peritrochanteric fractures.
5. The quality of the reduction is assessed by fracture displacement, neck-shaft angle, anteversion and femoral shaft sag.
6. The fracture is provisionally fixed with a 3.2 mm K-wire in an anatomically reduced position away from path of definitive fixation.

If a closed reduction cannot be achieved after one or two attempts, percutaneous and limited open reduction is used.

**Procedure:** Incision started at an intersection point between an imaginary line from ASIS and from tip of trochanter. Incision is followed distally 5 cm. Tip of the trochanter is exposed and is then opened with a curved awl. A guide wire is;

**ENTRY PORTAL:**



**Fig. 2**

Inserted 10-15 mm just medial to the tip of the greater trochanter on AP C-arm and centered on a lateral C-arm view. The guide wire is inserted 10-15 mm into the trochanter.

A normal guide wire is exchanged with a ball-tipped guide wire. A correct trajectory is formed i.e. the guide wire parallels the anterior lateral cortex of the proximal femur and allows nail juxtaposition against a solid cortical structure. Once correct trajectory is established, proximal femur canal is prepared. The proximal femur is reamed using a cannulated rigid reamer approximating the proximal nail diameter and was introduced over the guide wire through the tissue protective sleeve. The reamer is directed towards a point projected in the centre of the medullary canal just distal to the region of the lesser trochanter. Advance the reamer stepwise confirming the trajectory. For long nails, the guide wire is inserted distally up to subchondral area and centered on AP and lateral views.

Ream the diaphyseal region up to 1 mm over the desired nail size. Ream up to 2 mm for excessive anterior bow. Remove the reamer, exchange the ball-tipped guide wire with normal guide wire and insert the selected nail. Remove the guide wire to proceed with interlocking.

After inserting the nail, the distal screw of the proximal targeting guide is inserted along the femoral calcar within 5 mm of inferior femoral neck centered on lateral C-arm view within 5 mm of subchondral bone.

Through the proximal targeting guide attached to the nail, insert the most proximal guide pin that will be close to centre position of the femoral head parallel to the first guide pin and confirm its position with the C-arm. Remove the inferior guide wire, drill and ream for the selected lag screw size and insert the inferior screw. Next, repeat the same steps for proximal screw, release the traction before final tightening of the lag screw to allow fracture compression. Proceed with distal interlocking with a free hand image-guided technique, wound closed in layers with a drain in situ.

**Post-operative Protocol:**

- IV antibiotics were continued for first 48 hours and then it was shifted to oral.
- Patients are advised physiotherapy immediately, non-weight bearing, walking with the help of walker by 2nd day.

- Sutures were removed on 12<sup>th</sup>-14<sup>th</sup> postoperative day.
- Partial weight bearing is started at about 6 weeks postoperatively.
- Full weight bearing was allowed after achieving complete radiological and clinical union.

**RESULTS:** According to BOYD and GRIFFIN classification, no of patients with type 1 is 2 (9.5%), type II is 7 (33.3%), type III is 3 (14.3%) and type IV is 9 (42.9%). The mean age of male patients is 58.7 years and in female patients is 67.5 years. The preoperative mobility status of the patient was assessed by PARKER AND PALMER MOBILITY SCORE.<sup>[13]</sup> The mean preinjury score was 8.10. The spinal anaesthesia was used in all patients. The average length of incision was 5 cm. Blood loss was counted intraoperatively by number of mops used during surgery. One complete blood soaked mop equalled approximately 50 mL of blood loss. The mean operative blood loss was 100 mL. Mean operation time was 170 minutes.

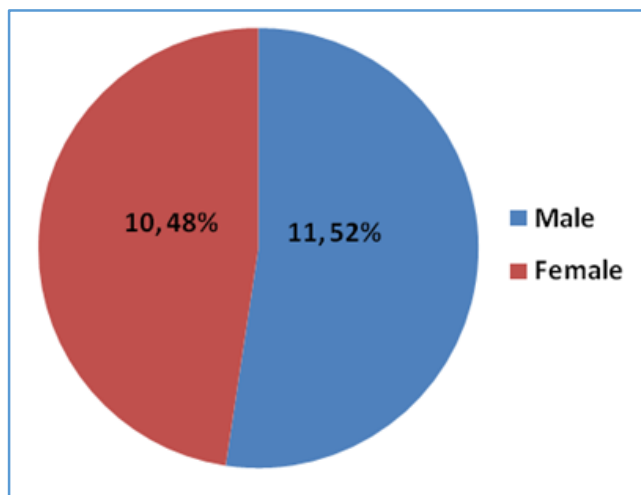
Intraoperatively, procedure was prolonged in 1 patient because of placement of lag screw in incorrect position. The average intraoperative shortening after fixation was 0.65 cm. The mean time of radiation exposure was 2 minutes. The mean neck-shaft angle achieved is 128°.

Postoperatively, all patients kept closed suction drainage of the wound. Complications like superficial infection were seen in 2 patients and no deep infection. The average duration of hospital stay was 3 days. All patients were taught quadriceps strengthening exercise, ankle pump exercise, deep breathing exercise and back care during the hospital stay. Patients were permitted to get out of the bed and sit in a chair on 3<sup>rd</sup> postoperative day. Patients were made toe-touch weight bearing by day 5. Weight bearing with the help of a walker by 21<sup>st</sup> day.

Patients were evaluated at one, three and six months postoperatively. Mobility was assessed with the score of Parker and Palmer, the range of motion was recorded. Pain about the hip and in mid portion of thigh was graded on a 4-point scale (1 point indicated no pain; 2 slight pain that did not affect the ability to walk or necessitate the use of analgesics; 3 moderate pain that affected the ability to walk or necessitated the use of analgesics and 4 severe intractable pain even in bed).

Plain radiographs were made at each followup examination. Any change in screw position was noted as were union of the fracture and shortening of the femur. Anatomical and functional results were evaluated after expected time of union (i.e. 16 weeks) by using KYLE'S criteria and were graded as excellent, good, fair and poor.

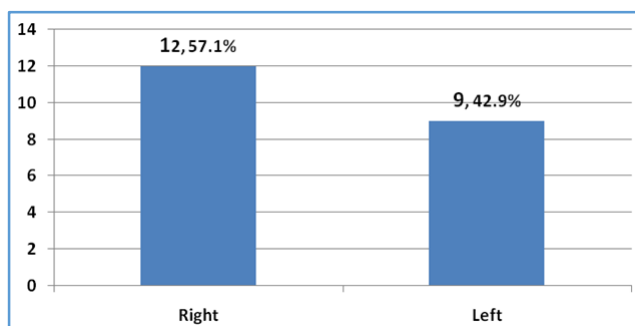
Results	No. of patients (%)
Excellent	70
Good	25
Fair	5
Poor	
<b>Table 1: Kyle's Criteria Results</b>	



**Chart 1: Showing Gender Distribution in 21 Patients**

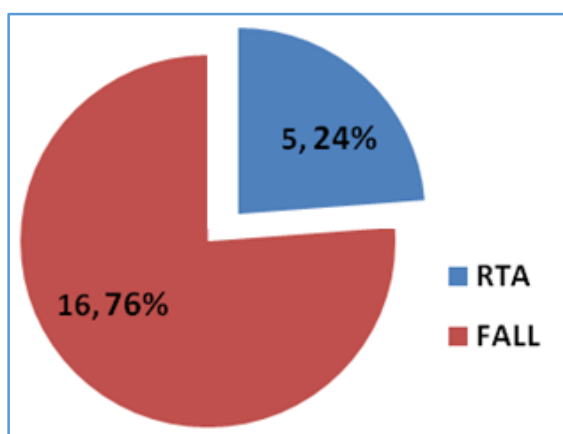
The following diagram shows the Gender distribution of the fracture in our study.

In our series, 52% of the patients were females and 48% were males.



**Chart 2: Showing Side Distribution in 21 Patients**

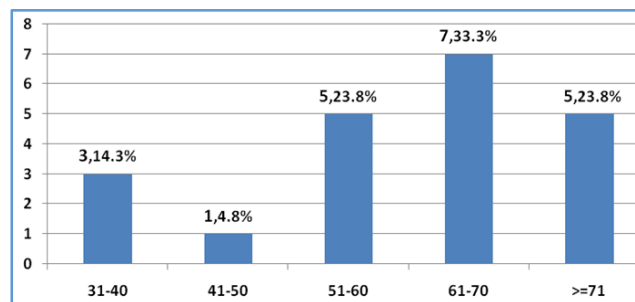
In our study, right side was predominantly involved, i.e. 12 (57.1%) than left side 9 (42.9%).



**Chart 3: Showing Mechanism of Injury Distribution in 21 Patients**

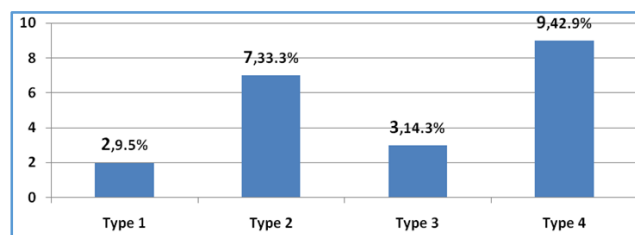
The following diagram shows distribution of mechanism of injury.

16 (76%) cases attained fracture due to trivial fall, 5 (24%) cases attained fracture due to RTA. Trivial fall is the most common mechanism of injury.



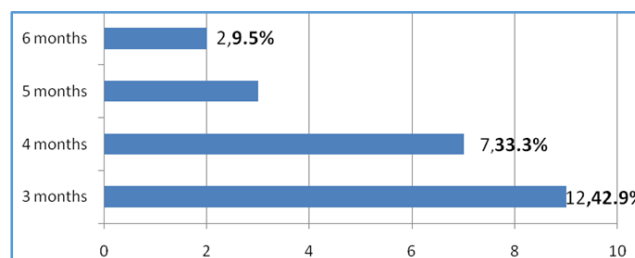
**Chart 4: Showing Age Wise Distribution of Fractures in 21 Patients**

**Age:** In our series, majority of cases i.e. 7 (33.3%) were in the age group of 61-70 years followed by two age groups i.e. 51-60 and >=71 (23.8%) years. The oldest patient was 86 years and the youngest patient was 33-year-old.



**Chart 5: Showing the Fracture Distribution in 21 Patients**

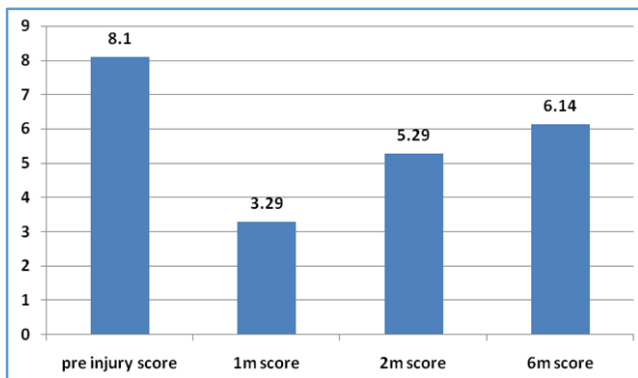
**Boyd and Griffin Types:** In the present study, majority of the cases i.e. 9 (42.9%) patients classified as type IV fractures followed by 7 (33.3%) patients classified as type II fractures.



**Chart 6: Showing Union Time in 21 Patients**

**No. of Patients:** The following bar diagram shows the time taken for union and the distribution of cases in each group. The average time taken for fracture union in stable fractures was 3.33 months and in unstable fractures 4.33 months.





**Chart 7: Showing the Mean Preinjury Score and Mean Post-injury Score**

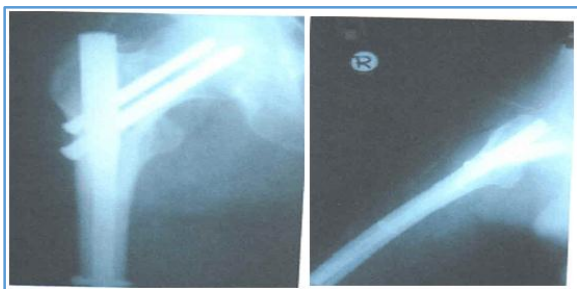
**Duration in Months:** The following bar diagram shows the progression of the mean mobility score of parker and palmer at each followup interval. The mean preoperative score was 8.1 and the patients reached their near normal preoperative mobility score of 6.14 by 6 months following the surgery.

**STATISTICAL ANALYSIS:** The Independent t-test, Paired t-test, ANOVAs test and Pearson chi-square test were used for statistical analysis.

**CASE 1:**



**Pre-op**



**Post-op**



**3-Months Followup**



**Sittingcross Legged**

**Squatting**



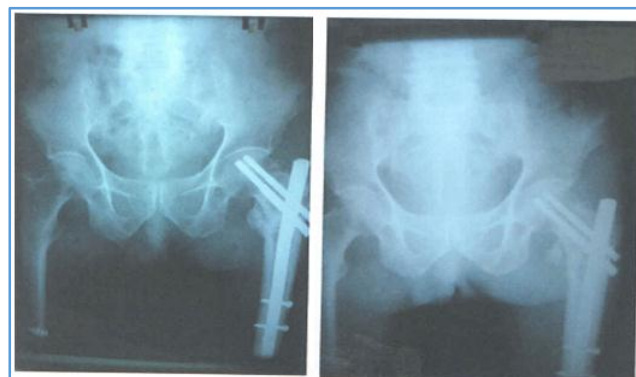
**SLR**

**FLEXION**

**CASE 2:**



**PRE-OP**



**Post op**

**3 months post -op**

**Clinical Pictures:*****SLR******Flexion******Sitting Cross Legged***

**DISCUSSION:** We report our results of the use of proximal femur nail to treat peritrochanteric fractures in a predominantly elderly group.

Our patients comprised a high percentage of type IV (42.9%) fractures with posteromedial comminution. We are

interested in the performance of this device in fractures that historically have proven challenging for nail plate, screw plate and intramedullary devices.

The present results are comparable to standard studies reviewed in literature.

According to D. C. R. Hardy et al<sup>4</sup> in a prospective randomised study of one hundred patients, the mean preoperative mobility score was 5.2+/-3.3 and postoperative score was 5.3+/-3.03. In our study, the mean preoperative mobility score was 8.10 and postoperative score was 6.14. The better early mobility score found in the nail group was also reported in some trial that compared the result of treatment with a gamma nail with that of compression hip screw. The better mobility after treatment with proximal femur nail maybe explained by the fact that these patients had less limb shortening (mean shortening-0.65 cms), this was particularly true for those who had an unstable fracture. 2 cm or more of shortening is not uncommon after treatment of a comminuted intertrochanteric fracture with a compression hip screw and this shortening may have prevented these patients from recovering the ability to walk.

Mean operative time in minutes observed in patients treated with proximal femur nail was 71+/-28.9. In our study, the mean time was 170 mins. This major difference was due to different levels of surgeons experience in our study and the prolonged learning curve for insertion of intramedullary implant have also affected the operative time.

The average blood loss in the PFN group was 144+/-120.5. In our study, it was 100 mL. The blood loss in DHS group was 198+/-82.9. Even though, there was decreased blood loss, it did not affect the blood transfusion in the postoperative period, hence it is insignificant.

The mean limb-length discrepancy after treatment with PFN was 1.0+/-0.40 cm. In our study, it was 0.65 cm whereas in patients who underwent CHS the mean limb length discrepancy was 1.6+/-0.63 cm. This difference is due to less sliding of the lag screw after the PFN procedure. The nail stops the telescoping displacement of proximal aspect of the femur. Thus, less subsequent shortening of the affected limb in PFN treated patients.

Another study was conducted in the year 1998 by Michael R Baumgartner et al. The goal of the study was to determine whether there is a difference between a sliding hip screw and intramedullary nail in treatment of intertrochanteric fractures. According to Baumgartner in a prospective study of 135 patients who were treated with a sliding hip screw or an intramedullary nail the intramedullary device was associated with 23% less surgical time and 44% less blood loss. The complication rate was similar in both the groups where 3 had lateral shaft fracture in group of patients treated with nail, 2 had screw cut out in plate group. In our study, we had only one screw back out due to wrong entry portal taken in the lateral cortex of the femur. There was no significant difference between 2 groups with regard to functional recovery. The author did not recommend the intramedullary nail for treatment of stable fractures, but

because of decreased operative time and blood loss, it might be implant of choice for unstable intertrochanteric fractures.

J Pajarinen et al<sup>5</sup> randomised study of 108 patients with low energy extracapsular peritrochanteric fractures who underwent PFN or DHS. After 4 months, they found the patients in PFN group were more likely to have regained their preoperative level of mobility than those with DHS treated group. However, their ability to walk was the same. They suggested that the impaction of the fracture in the DHS group led to femoral neck shortening and a mechanical disadvantage compared with PFN. Conversely, Saudan et al<sup>6</sup> reported a reduction in mobility after one year in patients treated with a PFN compared with those treated with a DHS group. Some studies have demonstrated a longer operative time in association with nail fixation.<sup>7</sup> We agreed with Pajarinen et al as our study showed the same results.

Our study also shows that the time taken to mobilise with a walker is shorter with proximal femur nail than with DHS fixation observed in literature. The reason for this may be any combination of postoperative factors: Pain, muscle dysfunction and small incision above the greater trochanter. The entry point causes less damage to the superior gluteal nerve and gluteus medius muscle than other entry points in the piriformis fossa.<sup>8</sup>

There were no postoperative femoral shaft fractures as the PFN had a small distal shaft diameter, which reduces stress concentration at the tip.<sup>9</sup> Only one patient had screw back out because of impaction of the fracture<sup>10</sup> rather than migration.

There were no screw cut out case in our study, although the cut out rate with a PFN is reportedly 0.6 to 8%.<sup>5,11</sup> This is because, as the PFN is fixed with 2 screws, the larger (lag) screw is designed to carry most of the load and the smaller screw (the hip pin) is to provide rotational stability was fixed in a manner that the mechanical load transfer was directed over the lag screw. In our study, we maintained a minimum of 5 mm shorter length of hip pin when compared to the lag screw length and this may have prevented overloading the hip pin and cut out in all cases. It was reported that when the hip pin was 10 mm shorter than the lag screw, the percentage of the total load carried by the hip pin ranged from 8 to 39% (mean 21%).<sup>12</sup>

**CONCLUSION:** The data was assessed, analysed, evaluated and the following conclusions were observed. We attribute the good results as a result of the following factors,

1. Less operating time.
2. Closed procedure.
3. No blood loss.
4. Since fracture haematoma is not disturbed, union is early.
5. Lesser chances of infection.

We are aware that PFN requires a steep learning curve and sophisticated equipments and very little margin for error. This alone could not be a limiting factor in offering this procedure as the standard procedure in peritrochanteric fractures compared to DHS, which is a relatively easy

extramedullary procedure, but associated with more complications and suboptimal end results.

Hence, we conclude that "PFN is the method of choice in the surgical management of peritrochanteric fractures."

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