

ORIGINAL RESEARCH**The role of proximal femoral nail in the management of inter trochanteric femur fracture and its functional outcome: A prospective study from Southern India****¹Dr. Sushant Balakrishnan, ²Dr. Momin Bin Latheef, ³Dr Rohan Thomas Roy**^{1,2}Assistant Professor, ³Senior Resident, Department of Orthopedics, Sree Uthradom Thirunal Academy of Medical Sciences, Thiruvananthapuram, India**Corresponding author**

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ABSTRACT

Background: The most common hip fracture is an intertrochanteric femur fracture, which is more likely in older population with osteoporotic bones and with a male preponderance. The proximal femoral nail (PFN), developed by the AO/ASIF group, has demonstrated its stability as an implant in femoral fractures with peritrochanteric, intertrochanteric, or subtrochanteric fractures [6]. So, the current study was conducted with the aim of assessing the role of proximal femoral nail in the management of intertrochanteric femur fracture and its functional outcome.

Methods: The Department of Orthopaedics at Sree Uthradom Thirunal Academy of Medical Sciences Hospital, Thiruvananthapuram, Kerala, South India, undertook this current prospective cohort study from January 2021 to June 2022. On the basis of predefined inclusion and exclusion criteria, a total of 48 patients were included in present study. A pretested questionnaire was used to record patient details such as age, gender, type of fracture, time period of union of fracture in open and closed reduction, complications and functional outcome. The Boyd and Griffin classification was used to classify intertrochanteric fractures. Patients were followed up at 3, 6, and 12 weeks and finally at 6 months postoperatively for functional outcome as assessed by Kyle's criteria. The statistical tests were considered if P value was <0.05.

Results: In our study, an aggregate of 48 patients were enrolled, male patients predominated (n=32) the study and there were 16 female patients. The mean age of patients was 48.57±8.13 years. In our study, Type I fracture were 4.1%, Type II fracture were 66.7%, Type III fracture were 6.3% and Type IV fracture were 22.9%. The difference in the time taken for union for fracture approached via closed and open reduction technique was not significant (p>0.05). In our study, the postoperative complications were screw failure (12.5%), and varus malalignment (4.2%). The functional outcome as excellent was enhanced as it was 20.8% at 3 months and 33.3% at 6 months.

Conclusion: Before being used by an orthopaedic surgeon, all latest implants and instrumentations must undergo a rigorous assessment. In our study, the proximal femoral nail, which was made use of to treat intertrochanteric fracture, achieved good results in terms of both functional and radiographic performance.

Keywords: Femur, Fracture, Bone, intertrochanteric, proximal femoral nail

INTRODUCTION

The most common hip fracture is an intertrochanteric femur fracture, which is more likely in older population with osteoporotic bones and with a male preponderance. About 50% of all hip fractures brought on by low intensity trauma are intertrochanteric femur fractures [1,2]. Early mobilization is required as the main treatment focus is in order to prevent further secondary complications. Intertrochanteric fractures have been treated using a variety of surgical techniques and implants. Gamma nail, proximal femoral nail (PFN), and dynamic hip screw (extramedullary fixation) are three different types of treatment options [3,4]. The hip screw was once thought to be the best option; but it has been linked to complications like leg shortening and femoral neck collapse, which can result in hip offset loss. While some of this sliding is to be expected, significant shortening is unfavourable to hip function [5,6].

When compared to a dynamic hip screw, the PFN significantly reduces the lever arm distance, and its intramedullary location offers support against lateral movement and minimizes bending strain on the implant. The proximal femoral nail (PFN), developed by the AO/ASIF group, has demonstrated stability as an implant in femoral fractures with peritrochanteric, intertrochanteric, or subtrochanteric fractures [6]. So, this study was conducted with the aim to assess role of proximal femoral nail in treatment of intertrochanteric femur fracture and its functional outcome.

MATERIALS and METHODS

The Department of Orthopaedics at Sree Uthradam Thirunal Academy of Medical Sciences Hospital, Kerala, South India, undertook this current prospective cohort study during January 2021 to June 2022. The study was approved by the Institutional Ethical Committee (IEC). Proximal Femoral Nail was used to treat patients who were diagnosed with intertrochanteric fractures on presentation in the outpatient or emergency ward. On the basis of predefined inclusion (age > 18 years) and exclusion criteria (polytrauma and multiple fractures, serious co-morbid conditions such as neoplastic diseases/stroke, rheumatoid arthritis, psoriatic arthritis, or any other type of arthritis) after obtaining the informed consent, an aggregate of 48 patients were included in present study.

A pretested questionnaire was used to record the patient details such as age, gender, type of fracture, time period of union of fracture in open and closed reduction, complications (Screw failure, Varus malalignment, Fracture lateral cortex, Z effect, Joint stiffness, Shortening, Postoperative Infection, and Postoperative DVT) and functional outcome. A thorough history and clinical examination was done to rule out any polytrauma and numerous fractures, especially in young patients, for whom high energy trauma is more likely to be the underlying cause. Anteroposterior view and cross-table lateral view X-rays of the hip were used to confirm the diagnosis of inter trochanteric fracture. Osteoporosis is one of the major causes of intertrochanteric fractures in elderly people after trivial trauma, hence X-rays were also used to check for its existence.

The intertrochanteric fractures were classified using the Boyd and Griffin classification which is based on the involvement of subtrochanteric region i.e., type I: linear intertrochanteric, type II: with comminution of trochanteric region, type III: with comminution associated with the subtrochanteric component and type IV: oblique fracture of the shaft with extension into the subtrochanteric region. First dose of intravenous antibiotics (second generation cephalosporin, that is, Cefuroxime) was given just before the procedure preoperatively and was continued till 3 days postoperatively.

Patients were followed up at 3, 6, and 12 weeks and finally at 6 months postoperatively for functional outcome as assessed by Kyle's criteria (Excellent: No or Minimum Limp, Absence

of Pain, Rarely using a cane; Good: Mild limp, Mild occasional pain, Full range of motion, Using a cane; Fair: Moderate limp, Moderate pain, Limited range of motion, Using 2 canes or walker, Poor: Wheelchair bound, Pain on any position, Non-ambulatory).

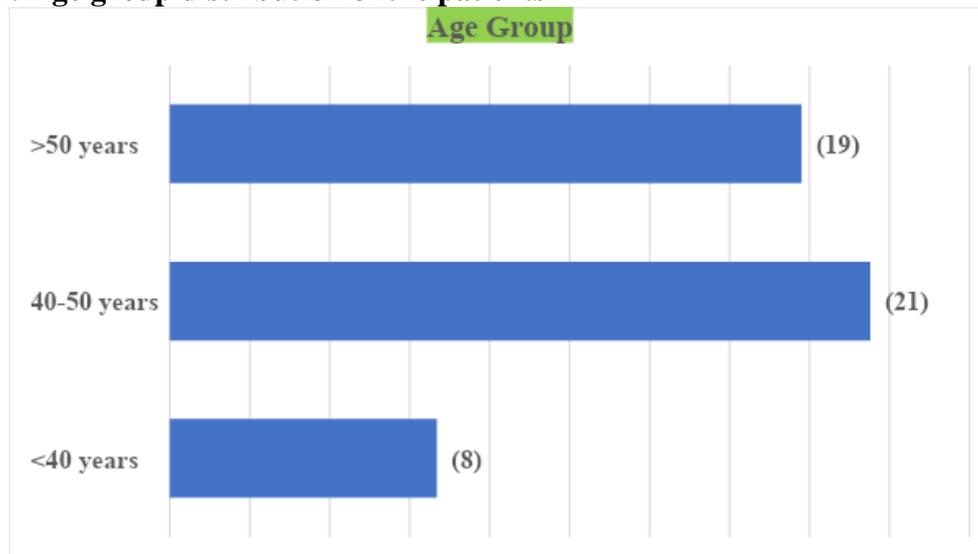
DATA ANALYSIS

The collected data was entered in the MS excel Sheet and was analysed using the same. The discrete variables were presented using frequency and percentage (%) while continuous variables were presented using mean and standard deviation (SD). The statistical tests were considered if P value was <0.05.

RESULTS

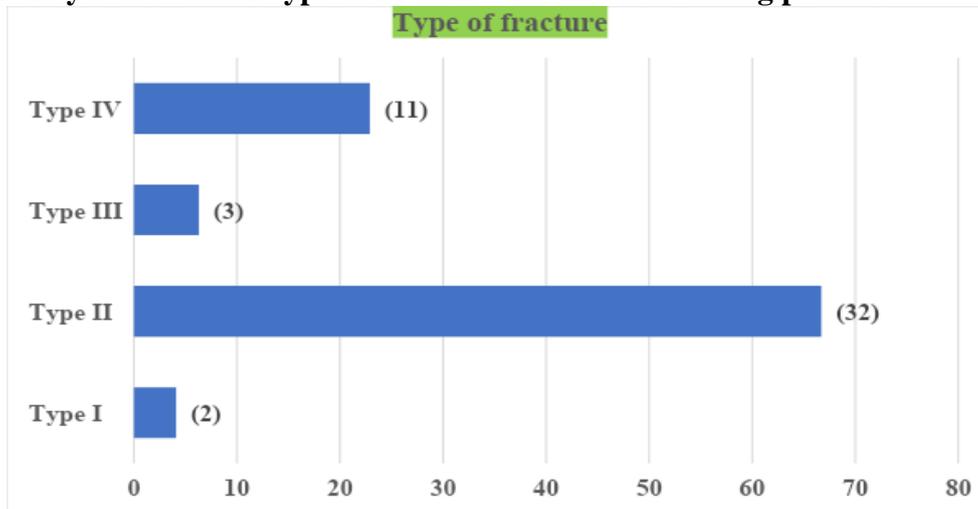
In our study, a total of 48 patients were enrolled and males' patients predominated (n=32) the study and there were 16 female patients. The patient with age <40 years were 16.7%, patient with age 40-50 years were 43.8% and patient with age >50 years were 39.5%. The mean age of patients was 48.57 ± 8.13 years (Figure 1).

Figure 1: Age group distribution of the patients



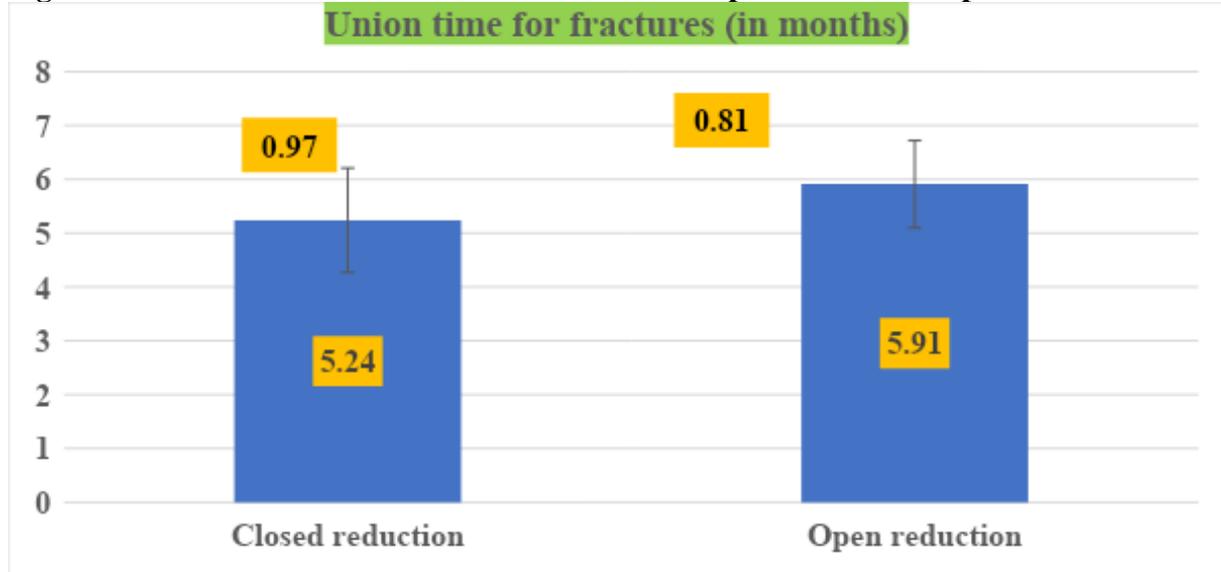
In our study, the intertrochanteric fractures were classified using the Boyd and Griffin classification, so Type I fracture were 4.1%, Type II fracture were 66.7%, Type III fracture were 6.3% and Type IV fracture were 22.9% (Figure 2).

Figure 2: Boyd and Griffin type of fracture classification among patients



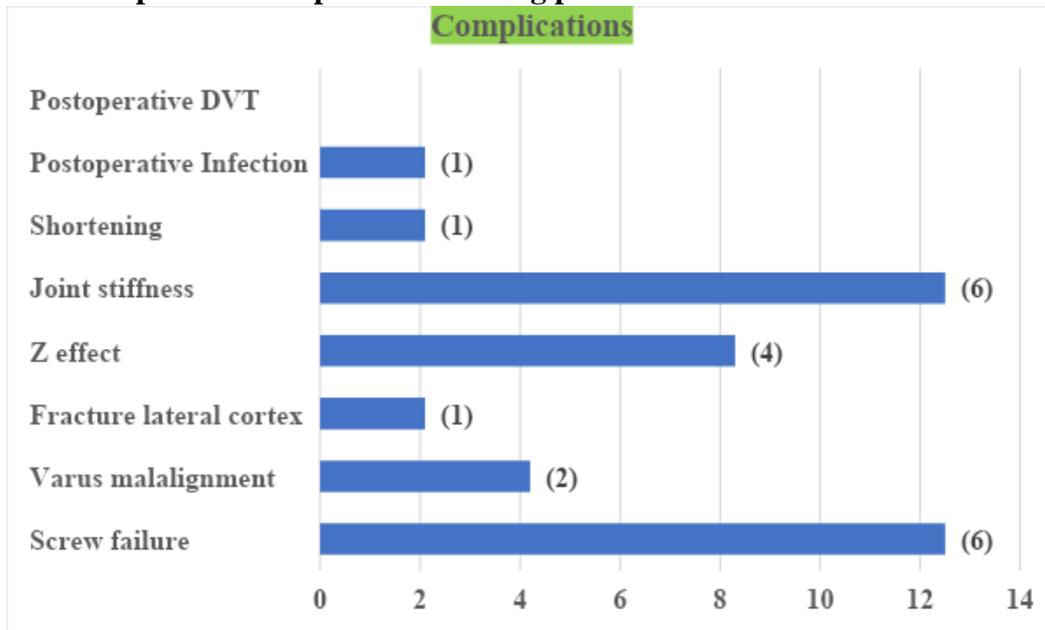
The fracture was approached using closed or open reduction technique where required. The time taken for union for fracture operated using closed reduction technique was 5.24 ± 0.97 months and time taken for union for fracture operated using closed reduction technique was 5.91 ± 0.81 months. The difference in the time taken for union for fracture approached via closed and open reduction technique was not significant ($p > 0.05$) (Figure 3).

Figure 3: Time of union of fractures for closed and open reduction in patients



In our study, the postoperative complications following proximal femur nailing include screw failure (12.5%), varus malalignment (4.2%), fracture lateral cortex (2.1%), Z effect (8.3%), joint stiffness (12.5%), shortening (2.1%), and postoperative infection (2.1%) (Figure 4).

Figure 4: Postoperative complications among patients



In our study, the functional outcome among patients following PFN was based on Kyle's criteria and it was observed at 3 months functional outcome was 4.2% at both at 3 months and 6 months. The functional outcome as fair was seen in 12.5% at 3 months and 10.3% at 6 months. The functional outcome as excellent was enhanced as it was 20.8% at 3 months and 33.3% at 6 months (Table 1).

Table 1: Functional outcome among patients based on Kyle's criteria

Functional outcome	Completed 3 months Frequency (%)	Completed 6 months Frequency (%)
Poor	2 (4.2)	2 (4.2)
Fair	6 (12.5)	5 (10.3)
Good	30 (62.5)	26 (54.2)
Excellent	10 (20.8)	16 (33.3)

DISCUSSION

Low energy trauma causing intertrochantric fractures commonly affect older and osteoporotic bones. The significance of conservative treatment for intertrochantric fractures is restricted because malunion, non-union, and delayed union are common. The use of implants like the dynamic hip screw or the dynamic condylar screw for extramedullary fixation of these fractures has the potential disadvantages of extended exposure, increased blood loss, issues with fracture union, and implant failure.

Since this implant is implanted following closed reduction utilising a less invasive approach, intramedullary fixation is more biological. Because it is located intramedullarily, the proximal femoral nail has a smaller lever arm. The proximal femoral nail serves as both a load-bearing mechanism and as an internal splint. This enables the patient to begin bearing weight early. It is less intrusive and causes less blood loss because it is done through a smaller surgical incision. The head and neck screws of the proximal femoral nail have been reported to be cut off, and the proximal screws have also been shown to migrate laterally (Z effect).

In our study, the mean age of patients was 48.57 ± 8.13 years. The studies done by Kumar et al., and Amini et al., reported a similar mean age of 52.66 years and 45 years respectively [6,7]. The studies done by Aithala et al., and Korkmaz et al., reported a higher mean age of 71.39 years, and 77.66 years [8,9]. Other authors Alpantaki et al., and Gangadharan et al., who had more cases secondary to fall as an etiology for intertrochanteric fractures had reported a relatively higher mean age of the affected cases [10,11].

In our study, the postoperative complications following proximal femur nailing include screw failure (12.5%), varus malalignment (4.2%), fracture lateral cortex (2.1%), Z effect (8.3%), joint stiffness (12.5%), shortening (2.1%), and postoperative infection (2.1%). In a study by Kumar et al., reported proximal screw failure in 10% of patients, distal screw failure in 3% of patients, fracture lateral cortex in 3% of patients, joint stiffness hip joint in 10% of patients, knee joint in 3% of patients, Z effect in 3% of patients, shortening in 3% of patients and varus malalignment 3% of patients [6]. Endigeri et al., study reported superficial infection in 4% of patients, proximal screw failure in 2% of patients, distal screw failure in 2% of patients, shortening in 1% of patients, and Z effect in 2% of patients. They had lesser incidence of these complications as compared to our study [12]. Study done by Chidanand et al., showed superficial infection in 4.5% cases and Z effect in 2.2% [13]. In our study, no cases of postoperative DVT were noticed. Reska et al., reported an incidence of deep vein thrombosis in 1.2% [14].

In our study, the functional outcome was found to be excellent as it was 20.8% at 3 months and 33.3% at 6 months. Kumar et al., reported an incidence of 53%, excellent grade at 6 months, which is higher when compared to our study results [6]. Higher excellent outcome following PFN was also reported in the studies by Jonnes et al., and Mallya et al., and Endigeri et al., [12,15,16]. While study done by Nithin et al., reported excellent outcome at 6 months in only 20% patients which was lower when compared with our study results [3]. Study done by Ghilzai et al., found excellent outcome in 45.1% patients at 3 months [17].

In our study, the functional outcome among patients following PFN was based on Kyle's criteria and it was observed at 3 months functional outcome was 4.2% at both at 3 months and 6 months. The functional outcome as fair was seen in 12.5% at 3 months and 10.3% at 6 months. Rathore et al., showed that excellent to good results were seen in 73% patients 18% patients had a fair outcome, 7.7% had poor, and 2% patients had very poor outcome [18].

CONCLUSION

Before being used by an orthopaedic surgeon, all latest implants and instrumentations must undergo a rigorous assessment. In our study of proximal femoral nail, which was used to treat intertrochanteric fracture, achieved good results in terms of both functional and radiographic performance. In our study, union rates and mobility scores were comparable to those found in previous research. Without any issues associated to the implant, the PFN demonstrated outstanding and good functional results in our study.

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