Journal of Advances in Medicine and Medical Research

28(7): 1-11, 2018; Article no.JAMMR.46700
ISSN: 2456-8899
(Past name: British Journal of Medicine and Medical Research, Past ISSN: 2231-0614, NLM ID: 101570965)

Outcomes of Proximal Femoral Nail in Subtrochanteric Femur Fractures"- A Case Series

Rohan R. Memon[1*], Neel M. Bhavsar[1], Pankaj Patel[1] and Nirav Patel[1]

[1]Department of Orthopaedics, NHL Medical College, VS General Hospital, Ahmedabad, India.

Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JAMMR/2018/46700
Editor(s):
(1) Dr. Ikem, Innocent Chiedu, Professor, Department of Orthopaedic Surgery and Traumatology, Obafemi Awolowo University, Ile-Ife, Nigeria.
(2) Dr. Thomas I. Nathaniel, University of South Carolina, School of Medicine-Greenville, Greenville, USA.
Reviewers:
(1) Danúbia da Cunha de Sá Caputo, Universidade do Estado do Rio de Janeiro, Brazil.
(2) Vijaya Krishnan, MGM College of Physiotherapy, India.
(3) Serghei Covantev, University of Medicine and Pharmacy "Nicolae Testemitanu", Republic of Moldova.
Complete Peer review History: http://www.sdiarticle3.com/review-history/46700

Original Research Article

Received 26 October 2018
Accepted 13 January 2019
Published 14 January 2019

ABSTRACT

Background: Subtrochanteric fractures are defined as those occurring below the lesser trochanter and extend distally up to 5 cm in the shaft of the femur: Subtrochanteric fractures of the femur remain some of the most challenging fractures facing Orthopaedic surgeons. Internal fixation of these fractures has gained widespread acceptance but the problems i.e. malunion, nonunion, implant failure, refracture and infection encountered after surgical treatment of these fractures have prompted continued development of new devices and treatment programs. We study the outcome of these fractures treated with long proximal femoral nail.
Aims: Here we present a study evaluating the results of subtrochanteric femur fractures treated with proximal femur nail.
Study Design: This is a prospective observational type of study.
Place and Duration of Study: The present study consist of the patients admitted in orthopaedics unit of VS General hospital Ahmedabad from June 2013 till August 2017.
Methodology: All patients above 16 years of age who presented to our emergency department with subtrochanteric fracture of the femur were included in the study. Radiographs were taken and all the fractures were classified according to the Seinsheimers classification. All patients underwent

**Corresponding author: E-mail: rhnmemon222@gmail.com;*

fixation with the proximal femoral nail. The functional outcomes of the patients were assessed using the Harris hip score.

Results: Most commonly seen fractures pattern in this study is Seinschemer's type III A. In our study 74.28% (26) patients did not require any support for walking and 5(14.28%) patients required canes for long walks and only one patient was mobilising with the help of crutch. Squatting was possible in 15(42.85%) patients with ease and with difficulty in 06 (17.14%) patients. 14 patients were unable to squat. In this study sitting cross legged with ease is possible in 18 (51.42%) patients. 10(28.57%) patients were able to sit cross legged but with difficulty.07 (17.14%) patients were unable to sit cross legged.

Conclusion: Proximal Femoral Nail is a good implant for the treatment of unstable subtrochanteric fractures of femur. In our study we had good results with the proximal femoral nail, it requires minimal exposure and achieves biological fixation. It allows early weight bearing which is beneficial and has fewer implant related complications. Proximal femoral nail is thus a choice of implant for fixation of subtrochanteric fractures.

Keywords: Proximal femur nail; subtrochnateric fractures; stresses; muscle forces.

1. INTRODUCTION

Fractures of the femur are commonly encountered in Orthopaedic practice. They account for 10 to 15% of all hip fractures [1]. Subtrochanteric fractures are defined as those occurring below the lesser trochanter and extend distally up to 5 cm in the shaft of the femur. Fielding and Magliato have defined it as fractures occurring between a line extending from the superior border of the lesser trochanter to a line 7.5 cm distal to it [2]. In younger patients, the fracture is more commonly caused by high energy trauma. In older age groups, the fractures occur with low energy trauma as in a simple fall [3] Management of this fracture is difficult because this zone of femur is subjected to maximum amount of mechanical stresses. Open reduction and Internal fixation of these fractures has gained widespread acceptance but the problems i.e. malunion, nonunion, implant failure, refracture and infection encountered after surgical treatment of these fractures have prompted continued development of new devices. The theoretical and biomechanical advantages of cephalomedullary implants over plate fixation are attributed to a reduced distance between the hip joint and the implant (Long proximal femur nail) [4]. These further results in a reduced bending movement across the implant and fracture site and allow the load to be transferred directly to the femoral shaft, bypassing the calcar femorale.

2. MATERIALS AND METHODOLOGY

The present study consist of 35 patients admitted in orthopaedics unit of VS General hospital Ahmedabad from June 2013 till August 2017. All patients who were above 18 years of age with fracture of subtrochanteric region of femur of traumatic origin and who were able to ambulate prior to the fracture were included in the study. Patients with pathological fractures, patients with associated neurological problems and polytrauma patients were excluded from the study. All patients who had a minimum follow up of at least one year, were included in the study.

Radiographs were taken and all the fractures were classified according to the Seinsheimer's classification. Patients were worked up and pre anesthetic checkup was done. Preoperatively antibiotics were given according to the hospital protocol. All patients underwent fixation with the proximal femoral nail.

2.1 Operative Technique

Move the patient to the Albees fracture table after anaesthesia A supine position or lateral position with bilateral foot traction with knees in extension with legs scissored is the optimal position. This position allows manipulation for traction and good roentgenographic control. A 3-4 cm linear incision put 3 cm proximal to Greater trochanter in the line of shaft of femur. Entry point taken with awl/guide pin over a protector sleeve (Figs. 1,2). It should be on the tip of the greater trochanter in AP, and lateral position Guide wire: 2.8 mm guide wire is inserted in to the femoral shaft and across the fracture site in 6º of valgus. Its position is checked in the C-arm. and the entry is widened with the awl Reaming of the proximal femur is done upto the proximal part of the nail to be introduced. Nail is fixed on the jig and the alignment is checked. Then the nail is inserted into the femur (Figs. 3). The position of

the holes for the hip screws is checked in the C-arm for the depth of the nail. Guide wires for the screws are inserted via the jig and the drill sleeve. The ideal position of the guide wires is parallel and in the lower half of the neck in AP views, in a single line in the centre of the neck in the lateral views. The guide pins are inserted up to 5 mm from the articular surface of the femoral head and size of the lag screw determined, reaming and tapping for lag screw done .Insertion of the screw: First the 8 mm hip screw is inserted after reaming over the distal wire and then the 6mm cervical screw (Figs. 4,5). The hip screw should be 5 mm away from the sub-chondral bone. Distal screws: one or two static or dynamic 4.9 mm interlocking bolts are inserted in to the distal part of the nail (Fig. 6). Out of which one is a static and another is a dynamic hole. It should be done after removing the traction along with the tightening of the proximal screws. It is done free hand with the help of IITV and the jig is removed.

2.1.1 Post operative care

Operated limb was elevated for a day, Broad spectrum antibiotics were given for 5 days and than shifted to oral antibiotics. Iv fluids were given till the patient started orally. Static quadriceps exercises were begun on 2nd postoperative day. Active quadriceps exercises and hip flexion exercises were started on 4th postoperative day..Sutures were removed on 12th day (alternate) and complete suture removal was done on 14th postoperative day. Partial weight bearing was started after reviewing clinically and radiographically 6 weeks postoperatively, Full weight bearing allowed after confirmation of clinical and radiological union.

Patients were discharged 5 days postoperatively.

2.1.1.1.1 Follow up

All the patients were followed up every month. On follow up following points were noted xray with both hip AP-view and lateral view of operated hip were looked for:

- Signs of union
- Neck shaft angle
- Failure of fixation
- Failure of implant

FUNCTIONAL RESULTS OF SURGERY

Assessed based following hip scoring system adopted Table 1.

Table 1. Grading of Harris Hip Score

Harris hip score	Functional outcome
90-100	Excellent
80-90	Good
70-79	Fair
<70	Poor

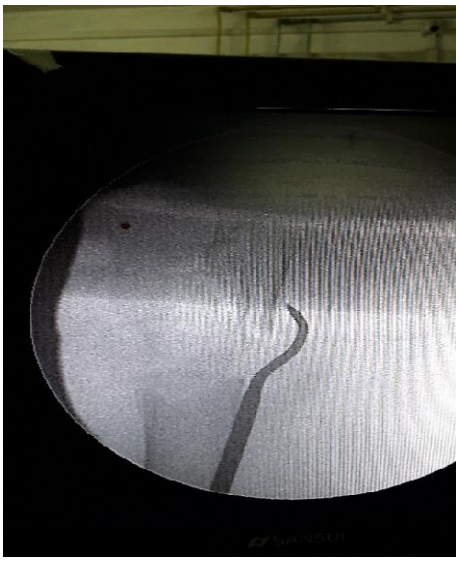


Fig. 1. Reduction image

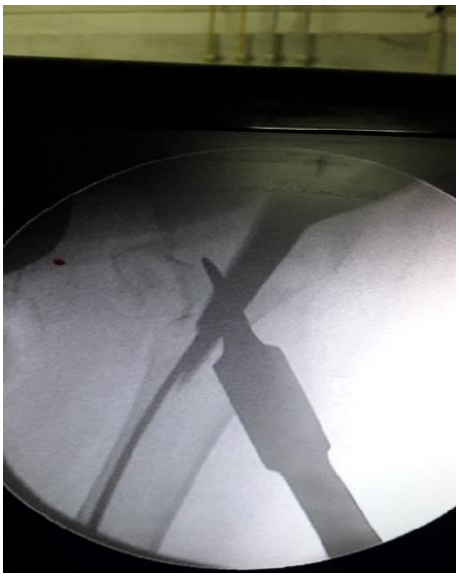


Fig. 2. Entry taken and pin passed

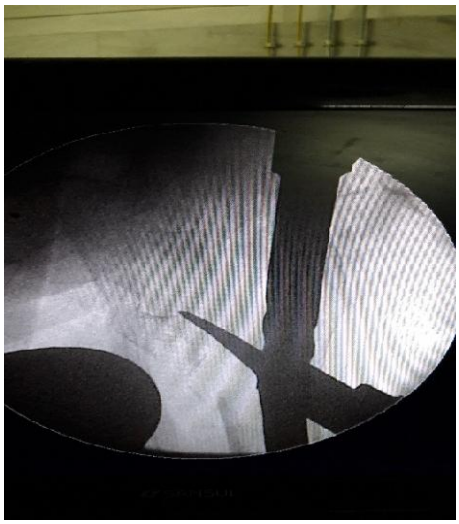


Fig. 3. Nail passed

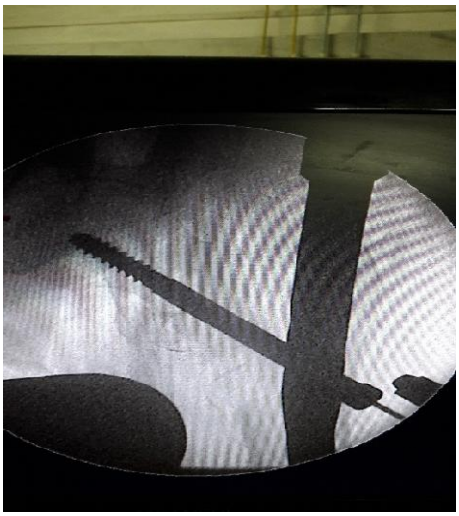


Fig. 4. Proximal screws passed

Fig. 5. Proximal screws and nail

Fig. 6. Distal locking done

3. OBSERVATIONS AND RESULTS

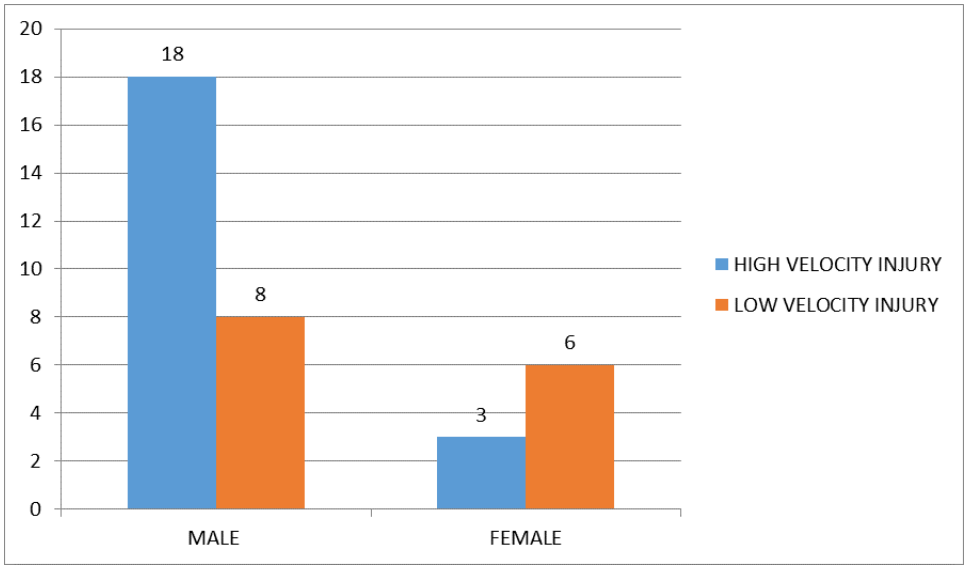
35 patients with subtrochanteric fractures were included in the study, The average age of the patients was 46 ±3.41. In the present series 69.23% (18) males sustained this injury because of high velocity injury. Where as in females they are most often caused by low velocity injury compared to their counter parts. In this study 66.66%(06) females sustained injury because of low velocity injury (Graph 1). Most commonly seen fractures pattern in this study is Seinschemer's type III A (Graph 2). Average time to union is 3.58± 0.54 months.

Majority of the patients in this study had either no pain or slight pain which did not affect their activities. Only one patient had severe pain. 14.28% (05) patients had mild pain which was relieved with analgesics (Table 2). In the current study majority of the patients had no or slight limp that did not affect their activities.4 patients (11.42%) had moderate limp (Table 3). In our study 74.28% (26) patients did not require any support for walking and 5(14.28%) patients required canes for long walks and only one patient was mobilising with the help of crutch (Table 4). In this series 34.28%(12) patients could climb stairs without any support and 51.42%(18) patients required the support of

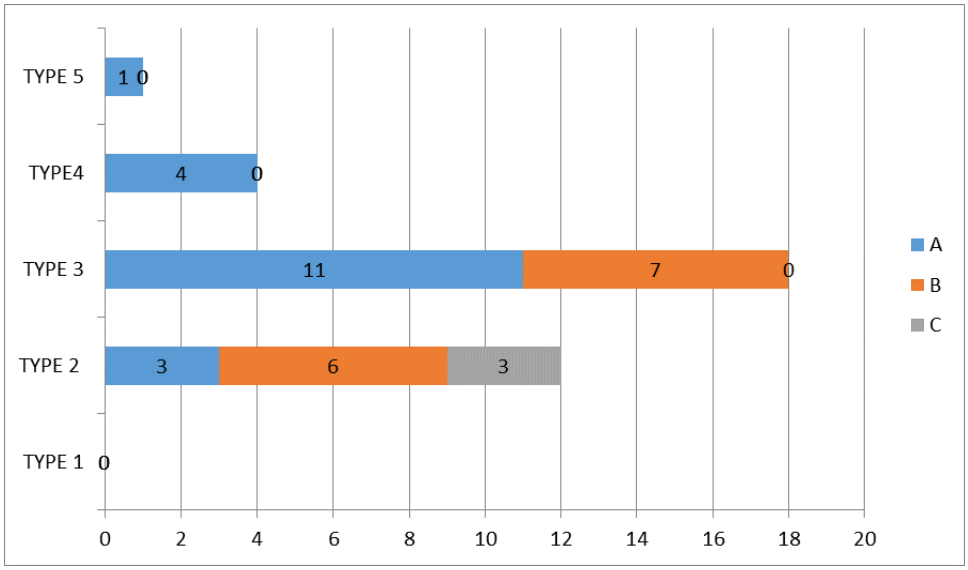
railing (Table 5). Squatting was possible in 15(42.85%) patients with ease and with difficulty in 06 (17.14%) patients. 14 patients were unable to squat (Table 6). In this study sitting cross legged with ease is possible in 18 (51.42%) patients. 10(28.57%) patients were able to sit cross legged but with difficulty. 07 (17.14%) patients were unable to sit cross legged (Table 7).

The complications which we saw in our series of patients include superficial infection in 2 patients, lateral migration or backout of the screws in 2 patients, 1 case of deep infection, one case with fracture of the nail from the distal tip, one case of proximal screw breakage (Table 8). There were no cases of implant failure or non-union after treatment with proximal femur nail overall results based on Harris hip score (Graph 3).

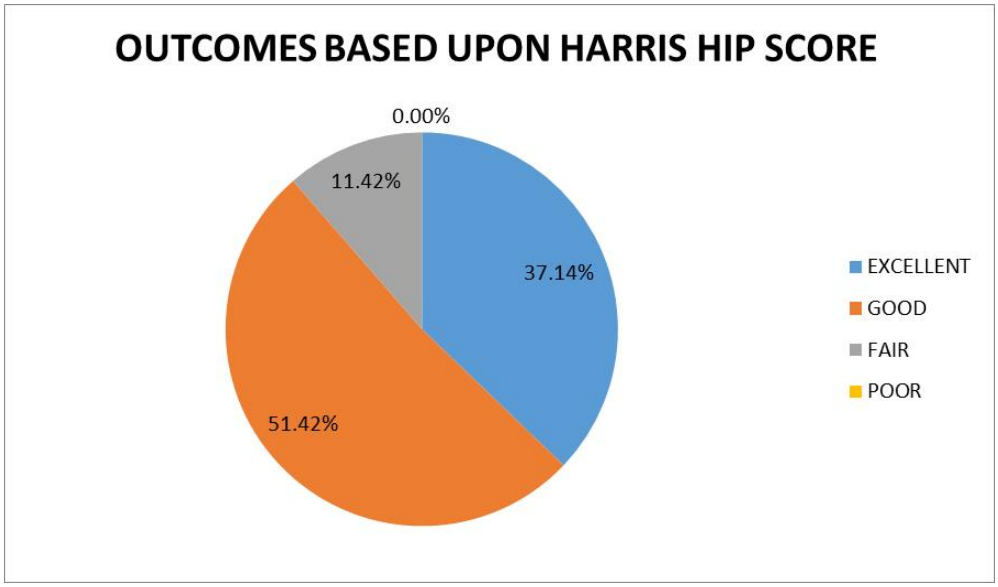
In this study all the patients in younger age groups has excellent and good results and older age group patients has good and fair outcomes (Graph 4).



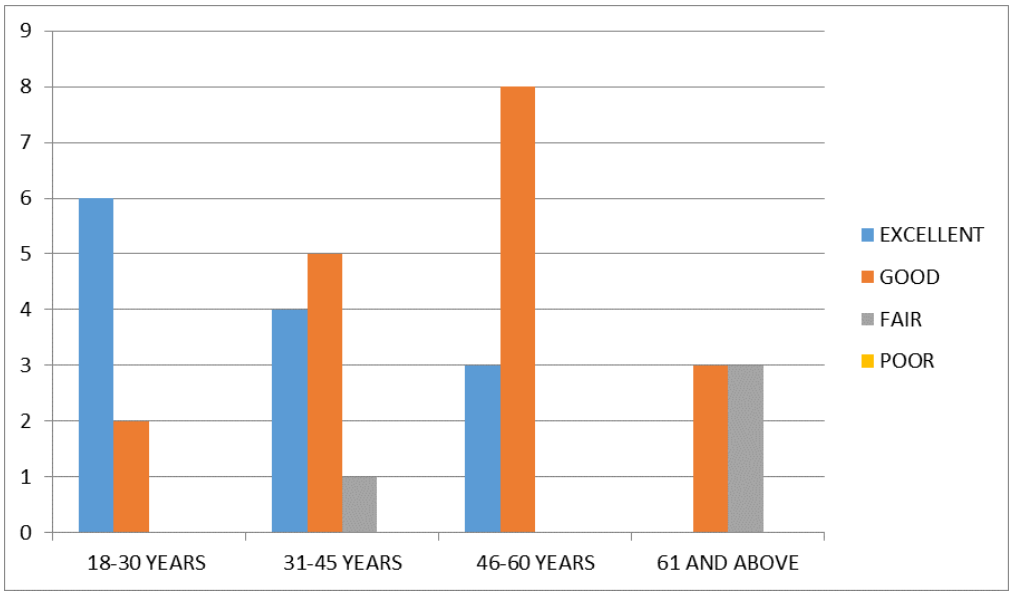
Graph 1. showing distribution of male and female patients as per mode of injury



Graph 2. Showing distribution of the patients as per seinsheimers classification



Graph 3. Showing percentage of patients as per Harris hip score



Graph 4. Showing age wise distribution of patients as per Harris hip score

Table 2. Showing distribution of patients as per pain charecteristics

Quality of pain	No of patients	Percentage
None or ignores	16	45.71
Slight ocassional	09	25.71
Mild	05	14.28
Moderate	04	11.42
Totally disabled	01	2.85

Table 3. Showing distribution of patients as per limping

Limp	No of patients	Percentage
none	20	57.14
slight	11	31.42
modearte	04	11.42
severe	00	00

Table 4. Showing distribution of patients as per walking ability

Walking ability	No of patients	Percentage
None	26	74.28
Cane for long walks	05	14.28
Cane most of the time	03	8.57
Crutch	01	2.85
Not able to walk	00	00

Table 5. Showing distribution of patients as per stair climbing

Stair climbing	No of patients	Percentage
Without using a railing	12	34.28
Using a railing	18	51.42
In any manner	03	8.57
unable	02	5.71

Table 6. Showing distribution of patients as per sqvatting

Percentage	No of patients	
With ease	15	42.85
With difficulty	06	17.14
Uable	14	40.00

Table 7. Showing distribution of patients as per sitting cross legged

Sitting cross legged	No of patients	percentage
With ease	18	51.42
With difficulty	10	28.57
unable	07	20.00

Table 8. Showing complications after fixation with proximal femur nail

Complications	No of patients
Superficial infection	02
Deep infection	01
Back out of screws	02
Breakage of proximal screws	01
Fracture from distal tip of nail	01

4. DISCUSSION

Subtrochanteric fractures of the femur are usually the result of high energy trauma, there is a significant displacement of fracture fragments,closed reduction is not possible in these type of fractures. Because of the high incidence of malunion, non-union and delayed union, there is no role of conservative treatment as previously advocated by Lee etal [5]. Two main operative modalities used for the fixation of subtrochanteric femur fractures are the intramedullary implants and extramedullary implnats. Extramedullary fixation of these fractures with implants like the dynamic hip screw or the dynamic condylar screw is complicated by extensive exposure, more blood loss which then leads on to problems in fracture union and also implant failure. Intramedullary fixation is a more biological fixation and has mechanical benefits over extramedullary fixation [6].

The proximal femoral nail being used for subtrochanteric femur fractures acts like an intramedullary splint and can bear a large axial load, this allows the patient early weight bearing. It is performed through a small surgical incision, so it is minimally invasive and reduces blood loss [7,8]. Proximal femur nail is also associated with cut out of implant and backout of proximal screws [9,10].

In terms of bone union, Borens et al. [11] reported 17.2 weeks of mean union time with long gamma nail. Kim et al. [12] reported 18.5 weeks with an IM nail and he reported that a relatively long union period derives from largely a displaced fracture site or comminution of medial cortical bone. In our study, mean union period was 14.2 weeks ±2.1. Kish et al did a study on 46 patients with unstable pertrochanteric and subtrochanteric fractures [13]. The average age of the patients was 78 years. All the patients in their series were allowed immediate full weight bearing. They concluded that the use of a PFN appears to be advantageous and a beneficial alternative to Dynamic condylar screw in elderly patient's unstable subtrochanteric fractures as it allows the patient immediate full weight bearing thus decreasing the post-operative morbidity. Menezes et al reviewed 155 consecutive patients who were treated with a proximal femoral nail [14]. Failure of fixation occurred in three patients (2%), and a femoral shaft fracture occurred in one patient (0.7%). Fixation failures included one cutout, one delayed fracture healing, and one lateral displacement of the antirotation screw. The low rates of femoral shaft fractures and failure of fixation suggest the proximal femoral nail is useful for treatment of unstable trochanteric and subtrochanteric fractures. Harris et al did a comparative study of the subtrochanteric fractures treated with the 95 degree blade plate and the proximal femoral

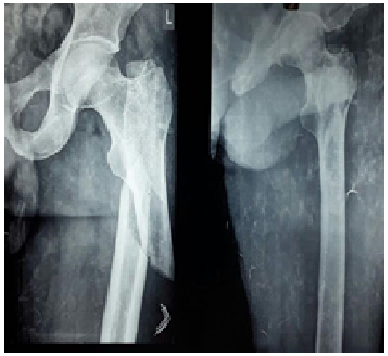


Fig. 7. Preoperative xray

Fig. 8. Postoperative xray

Fig. 9. 6 months follow up

Fig. 10. 1 year follow up

Fig. 11. Squatting

Fig. 12. cross legged sit

Clinical case 1. Pre-operative X-ray (Fig. 7) of left hip joint of a 34-year-old male with subtrochanteric fracture . Post-operative antero-posterior and lateral (Fig. 8) radiographs of left hip showing satisfactorily maintained fracture reduction and implant in situ. Six months and 12 months follow-up antero-posterior and lateral radiographs(figs. 9,10) of left hip showing fracture union with good alignment and Clinical photographs(Figs. 11,12) showing hip and knee range of motion

Fig. 13. Preoperative xray

Fig. 14. Postoperativexray

Fig. 15. 6 months follow up

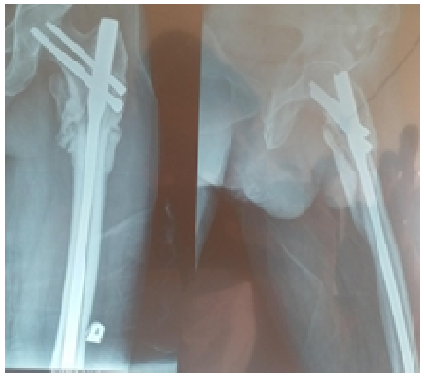


Fig. 16. 1 Year follow up

Fig. 17. Squatting

Fig. 18. Cross legg sit

Clinical case 2. Pre-operative X-ray (Figs. 13) of left hip joint of a 44-year-old male with subtrochanteric fracture. Post-operative antero-posterior and lateral (Figs. 14) radiographs of left hip showing satisfactorily maintained fracture reduction and implant in situ. Six months and 12 months follow-up antero-posterior and lateral radiographs (Figs. 15,16) of left hip showing fracture union with good alignment and Clinical photographs (Figs. 17,18) showing hip and knee range of motion

nail [15]. A total of 41 patients were studied. There was a failure rate of 6 (29%) patients in the patients treated with the 95 degree blade plate whereas there was no failure in the patients treated with the PFN. They concluded that internal fixation of subtrochanteric femur fractures with a 95-degree angled blade plate is associated with increased implant failure and revision compared to closed intra-medullary nailing using a proximal femoral nail. Jiang LS et al. did a study on 49 patients with subtrochanteric fractures treated with the long proximal femoral nail [16]. They achieved union in all their cases but one case had delayed union. They had no complications like cut out or breakage of the implant. They concluded that long proximal femoral nail or long gamma nail is a reliable implant in treatment of subtrochanteric fractures Sahin EK et al. did a comparison of proximal femoral nail antirotation with dynamic condylar screw in the elderly in the treatment of pertrochanteric fracture of the femur [17]. They found that the mean salvati- wilson hip score was 31 in the PFNA group and 26 in the DCS group. They had good results in 73.9% of the patients in the PFNA group and 70% in the DCS group. They concluded that PFNA is a better choice as it has minimal exposure, reduce blood loss and achieves biological fixation.

Limitations of this study are as follows. First, this study is not a comparative study with that of other fixation methods especially dynamic condylar screw or proximal femur plate. Second, this study has a small number of cases and short term follow up period.

5. CONCLUSION

In our study majority of the patients had excellent and good functional outcomes as per harris hip scoring after fixation with proximal femur nails, it requires minimal exposure and achieves biological fixation. It allows early weight bearing which is beneficial and has fewer implant related complications. In our study there is not a single case of implant failure and fixation failure. Proximal femoral nail is a good choice of implant for fixation of subtrochanteric fractures.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Kyle RF, Cabanela ME, Russell TA. Fractures of the proximal part of the femur. Inst Course Lect. 1995;44:227-53.
2. Fielding JW, Magliato HJ. Subtrochanteric fractures. Surg Gynecol Obstet. 1966; 122:555-60.
3. Bergman GD, Winquist RA, Mayo KA. Subtrochanteric fracture of the femur: fixation using the zickel nail. J Bone Joint Surg. 1987;69(7):1032-9.
4. Lee JY, Lee SY. Treatment of the proximal femoral extracapsular fracture with proximal femoral nail antirotation (PFNA): Comparison with proximal femoral nail (PFN) J Korean Hip Soc. 2007;19:183–189.
5. Lee JC, Clanton TO, Rockwood CA Jr. Closed treatment of subtrochanteric fractures of the femur in a modified cast-brace. J Bone Joint Surg Am. 1981; 63:773-9.
6. Brien WW, Wiss DA, Becker V Jr, Lehman T. Subtrochanteric femur fractures: A comparison of the Zickel nail, 95-degree blade plate, and interlocking nail. J Orthop Trauma. 1991;5:458-64.
7. Jiang LS, Shen L, Dai LY. Intramedullary fixation of subtrochanteric fractures with long proximal femoral nail or long gamma nail: Technical notes and preliminary results. Ann Acad Med Singapore. 2007; 36:821–826.
8. Tencer AF, Johnson KD, Johnston DW, Gill K. A biomechanical comparison of various methods of stabilization of subtrochanteric fractures of the femur. J Orthop Res. 1984;2:297–305.
9. Xu Y, Geng D, Yang H, Wang X, Zhu G. Treatment of unstable proximal femoral fractures: Comparison of the proximal femoral nail antirotation and gamma nail 3. Orthopedics. 2010;33(7):473.

10. Kristek D, Lovric I, Kristek J, Biljan M, Kristek G, Sakic K. The proximal femoral nail antirotation (PFNA) in the treatment of proximal femoral fractures. Coll Antropol. 2010;34(3):937-40.
11. Borens O, Wettstein M, Kombot C, Chevalley F, Mouhsine E, Garofalo R. Long gamma nail in the treatment of subtrochanteric fractures. Arch Orthop Trauma Surg. 2004;124:443–447.
12. Kim JW, Chang JS, Lee H, Bae JY, Kim JJ. Clinical results of femoral subtrochanteric fractures. J Korean Hip Soc. 2010;22:222–226.
13. Kish B, Sapir O, Carmel A, Regev A, Masrawa S, Stern A et al. Full weight bearing after unstable per and subtrochanteric fracture using proximal femoral nail. J Bone Joint Surg. 2001;83:289.
14. Menezes, Daniel FA, Gamulin, Axel, Noesberger, Bruno. Is the proximal femoral nail a suitable implant for treatment of all trochanteric fractures? Clin Orthop Rel Res. 2005;439:221-7.
15. Harris I, Rahme D. A prospective randomized controlled trial of subtrochanteric fractures treated with the proximal femoral nail and the 95 degree blade plate. J Bone Joint Surg. 2005;87-B:310-1.
16. Jiang LS, Sheng L, Dai LY. Intramedullary fixation of subtrochanteric fractures with long proximal femoral nail or long gamma nail: technical notes and preliminary results. Ann Acad Med Singapore. 2007;36:821-6.
17. Sahin E, Imerci A, Kinik H, Karapinar L, Canbek U, Savran A. Comparison of proximal femoral nail antirotation (PFNA) with AO dynamic condylar screws (DCS) for the unstable peritrochanteric femoral fractures. Eur J Orthop Surg Traumatol. 2014;24(3):347-52.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle3.com/review-history/46700