Available online on <u>www.ijpcr.com</u>

International Journal of Pharmaceutical and Clinical Research 2023; 15(6); 454-464

Original Research Article

Functional outcome of Subtrochanteric Fracture of Femur Treated with Long Proximal Femoral Nail at Bundelkhand Medical College Sagar (M.P.)

Rajesh Kumar Meena¹, Gaurav Agarwal², Anshul Gupta³, Roopa Agrawal^{4*}, Mansi Gupta⁵

¹Post Graduate Student, Department of Orthopaedics, Bundelkhand Medical College, Sagar (M.P.), India

²Assistant Professor, Department of Orthopaedics, Bundelkhand Medical College, Sagar (M.P.), India

³Associate Professor, Department of Orthopaedics, Bundelkhand Medical College, Sagar (M.P.), India

⁴Associate Professor, Department of Paediatrics, Bundelkhand Medical College, Sagar (M.P.), India

⁵Demonstrator, Department of Microbiology, Bundelkhand Medical College, Sagar (M.P.), India

Received: 27-03-2023 / Revised: 21-04-2023 / Accepted: 25-05-2023 Corresponding author: Dr Roopa Agrawal Conflict of interest: Nil

Abstract

Background: Subtrochanteric fractures are one of the common fractures encountered in orthopaedic practice and one of the important causes of morbidity and mortality in elderly patients¹. Early surgical intervention is needed in majority of the patients to avoid the major complications and hence, subtrochanteric fractures are mainly treated with plates, screws and proximal femoral nailing.

Objectives: To assess the functional outcome of proximal femoral nailing among patients with sub-trochanteric fractures.

Material and Methods: This was a single centre, hospital (inpatient) based, prospective, observational study. All those patients who were more than 18 years and less than 80 years of age with subtrochanteric fracture and treated with Proximal Femoral Nailing within 2 weeks of injury were included and followed up for a period of 6 months. Functional outcome was assessed by Harris hip Score.

Results: Total 50 patients were included in the study. Most of the patients were from age group 41-50 Years. Male constituted 22 (44%) of the study group. Majority of number of cases were due to road traffic accident (54%). According to the Seinsheimer Classification, 3A constituted majority of patients (34%). After surgery, neck shaft angle ranged from minimum 110° to maximum 138°, average being 128°. The average limb length discrepancy noted was 0.288 cm. The radiological union signs were seen at average 12 weeks and weight bearing of patients was started in average 14 weeks. Harris hip Score was >90 in 58%, followed by 81-90 in 28%, 70-80 score was observed in (6%), whereas <70 was observed in 8.0%.

Conclusion: Proximal femoral nail is a very good implant in treating subtrochanteric fracture as it is a load sharing implant and it is a closed procedure.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0) and the Budapest Open Access Initiative (http://www.budapestopenaccessinitiative.org/read), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Subtrochanteric fractures are one of the common fractures encountered in orthopaedic practice and one of the important causes of morbidity and mortality elderly patients[1]. in Subtrochanteric region is area below the inferior border of lesser trochanter extending distally 5 cm to the junction of proximal and middle third of femur. These fractures account for 10% to 34% of all hip fractures[2]. Overall, the incidence of these fractures has been estimated to be approximately 15-20 per 100.000 individuals[3]. These fractures have a bimodal distribution and are seen in two populations, older osteopenic main patients following low energy falls and younger patients with high energy trauma[4]; individuals younger than 40 vears old account for approximately 20% of subtrochanteric fractures. while individuals older than 50 years account for over 2/3 of subtrochanteric fractures[5]. At younger ages, the incidence of these fractures appears to be nearly equal between male and female; however, with increasing age, the incidence among females increases disproportionately to Additional Subtrochanteric males[6]. fracture risk factors include patients undergoing treatment of osteoporosis with bisphosphonates, low total bone mineral density, and chronic diseases such as diabetes mellitus[7].

The treatment of hip fractures often requires a multidisciplinary approach that includes addressing underlying medical conditions and providing appropriate surgical fixation, early mobilization, and rehabilitation to ensure a return to baseline functional mobility and independence.

Suboptimal treatment of hip fractures may result in debilitating complications such as avascular necrosis (AVN), fracture nonunion or malunion, or hardware failure. Therefore, early detection and classification of hip fractures are essential for guiding early appropriate treatment[8]. One of the most frequently used classifications is the Seinsheimer classification[9] which classifies into S1, S2A, S2B,S2C, S3A, S3B, S4 and S5. According the Seinsheimer to classification, the 2-part fractures (S1 and S2) are defined as potentially unstable. The 3-part fractures and the comminuted fractures (S3-S5) are defined as unstable.

Early surgical intervention is needed in majority of the patients to avoid the major complications that can occur due to long term immobilization which include deep vein thrombosis, thrombophlebitis, urinary and lung infections and ulcers. Although these fractures are the most difficult to manage, our improved understanding of the complex biology and biomechanics of the trochanteric region as well as the rapid development of orthopaedic principles and implants has led to consensus on the treatment of sub-trochanteric fractures[10]. However, the appropriate implant for the internal fixation of sub-trochanteric fractures remains debatable: and ิล multitude of different intra- and extra medullary devices for their surgical fixation have been advocated[11].

Over the past two to three decades subtrochanteric fractures are mainly treated with plates and screws such as dynamic hip screws, condylar screws or cephalo-medullary nails[12]. Proximal femoral nailing is a technique introduced in the year 1997 by an orthopedic association. Advantages of PFN include the shorter lever arm, load sharing device producing less stress on implant, introduction without exposing fracture site, transmits weight close to calcar, distal locking screw provides length and rotational control permits early weight bearing. It also causes less soft tissue damage and devascularisation of the fracture fragments[13]. After its introduction few studies were conducted to

assess its efficacy; so the present study was conducted to assess the functional outcome of proximal femoral nailing among patients with sub-trochanteric fractures.

Material & Methods

This was prospective observation study conducted in the Department of Orthopedics, Bundelkhand Medical College Sagar, from October 2021 to September 2022 for a period of 12 months. All those patients who were more than 18 years of age with subtrochanteric fracture and treated with Proximal Femoral Nailing within 2 weeks of injury were included and followed up for a period of 6 months. While those who were less than 18 years of age, or more than 80 years of age and with open fractures were excluded. Also, those who had infection pre-operatively at surgical site and those who were lost to follow up were also excluded. So, a total of 50 patients were included in study.

Study Methodology

After getting approval from ethics committee, patients were recruited as per inclusion and exclusion criteria and informed consent was taken. A semistructured questionnaire was designed to collect the socio-demographic details and the clinical history including comorbidities from all the patients with subtrochanteric fractures. Their fracture was classified as per Seinsheimer Classification.

The operative procedure was done under spinal/epidural anaesthesia. After placing the patient on the fracture table, the affected limb was slightly adducted and a lateral incision of 4-6 cm was made proximally, then the gluteus maximus muscle was dissected along with the line of its fibers which paved the way for the entry of proximal femoral nail at the tip of the greater trochanter. After fixing the appropriate sized nail on the insertion device the nail was then slowly introduced manually into the shaft of femur with a help of guide wire using C-arm. The hip pin was initially introduced just about 25 mm medial to the fracture line, and then the neck screw was inserted according to the size required. Depending on the type of fracture, distal interlocking was done. Total duration of surgery was noted.

Post-operatively patients were treated with analgesics and antibiotics and proper wound dressing was applied. The operated limb was kept in an elevated position in order to reduce swelling and facilitate drainage. Transfusion requirements and adverse events were recorded for each patient. Limb length discrepancy was assessed, and neck shaft angle was noted. Mobilization was initiated based on the fracture patients pattern, in noncomminuted fractures weight bearing was initiated early whereas in comminuted fractures it was delayed till the formation of callus.

All the patients were followed up monthly for a period of six months and during follow-up visit, sign of radiological union was assessed by X-ray and functional outcome was assessed by Harris hip Score. Any complication if occurred was also recorded.

Result & Statistical Analysis

findings were recorded on a The predefined Performa. The collected data were compiled in a Microsoft Excel sheet and subsequently statistically analysed. Descriptive and inferential statistical analyses were carried out in the present study. Results on continuous measurements are present on Mean \pm SD (Min.-Max.) and results on categorical measurements were presented in number (%). The statistical software SPSS version 20 (The Standard Protocol for Social Sciences) and Medcalc 19.5 were used for the analysis. The chi-square test was used derive the statistical inference to considering p<.05 statistically as significant.

Results

Total 50 patients were included in the study. Most of the patients were from age group 41-50 Years (36%), the mean age of patient was 42.12±13.19 year. Male constituted 22 (44%) of the study group. Majority of number of cases were due to road traffic accident (54 %) (high velocity trauma), and rest 46% were due to accidental slip and fall by self (low velocity). 70% of cases were injured in their right side, whereas 30% were injured at left side. According to the Seinsheimer Classification, 3A constituted majority of patients (34%), followed by 2C, 2A, 2B, 5, 4 and 3B as 20%, 12%, 12%, 10%, 8.0%, and 4.0 %, respectively. Diabetes (14%) was the major comorbidity, whereas hypertension was observed in only 4% of patients.

During surgery, maximum blood loss was 500 ml and minimum was 50ml (Figure). The average blood loss came out to be 205.7 ml. Blood was required in 16% patients.

The neck shaft angle ranged from minimum 110° to maximum 138°, average being 128°. The average limb length discrepancy noted was 0.288 cm.

The average radiological union signs were seen at 12 weeks, the range was from 8 to 24 week. We started weight bearing of patients in average 14 weeks and range was from 8 to 24 weeks.

Among early complications, open reduction, difficult reduction and infection were in 6.0%, 8.0% and 12.0% respectively, whereas in late Z Effect, infection, and varus collapse were found in 4.0%, 8.0% and 6.0% respectively.

On follow up, 92.0% patients were able to squat. And 82.0% patients were able to sit cross legged whereas 10.0% had difficulty and only 8% was not able to sit cross legged. Harris hip Score was >90 in 58%, followed by 81-90 in 28%, 70-80 score was observed in (6%), whereas <70 was observed in 8.0%.

Gender	Frequency	Percentage
Male	22	44%
Female	28	56%
Age	Frequency	Percentage
<30 years	10	20%
31-50	33	66%
>50 years	7	14%
Side of injury	Frequency	Percentage
Left	15	30%
Right	35	70%
Mode of injury	Frequency	Percentage
Accidental slip & fall	23	46%
Road traffic accidents	27	54%
Comorbidities	Frequency	Percentage
Hypertension	2	4%
Diabetes	7	14%
None	41	82%
Seinsheimer Classification	Frequency	Percentage
4	4	8%
5	5	10%
2A	6	12%
2B	6	12%

 Table 1: showing characteristics of patients before treatment.

International Journal of Pharmaceutical and Clinical Research

2C	10	20%
3A	17	34%
3B	2	4%





Clinical Photographs Of Case No.20









Post-OP



1 month follow up



Follow up At 6 month



Post-OP



1 month follow up



Follow up At 6 month



Figure 2: Squatting



Figure 3: Crossed leg sitting



Figure 4: Hip flexion

Discussion:

Mean age in years for our group was 42.12 years and majority belonged to the age group 41-50. Prakash et al found that the age ranged from aged above 45 years and mean was 61.09 ± 11.69 years [14]. In Nagraj et al series, age ranged from 5th-8th decade of life, mean age being 70.6 years[15]. Endigeri et al found that the mean age in theirstudy was 57 years[16]. So the average age of our study was less than the average age of other studies.

Sex: Most of the patients in our study were males that is 56.0%. This variation is probably because our study measured the male female ratio amongst operated fracture that reported for follow-up and not the actual sex incidence for all subtrochanteric fractures. In Endigeri et al study, they found that the incidence of subtrochanteric fractures in males was more common that is 64 %[16]. Nagraj et al also found that the incidence of subtrochanteric fractures in males was

more common around 60%15. while study by Tank et al. found that the male : female ratio was 2:3[17].

Mode of Injury: mode of injury in our study was fall by Accidental slip and fall in 46%(low velocity trauma) and road traffic accident (high velocity trauma) in 54%. The mode of injury in various study was low velocity trauma mostly fall at home relating to the osteoporotic changes. A study in 2016 by Jonnes et al. they observed that subtrochanteric fractures due to trivial trauma (77%) was more common mode of injuryfollowed by road traffic accidents (23%)[18].

Side: The majority of patients in the study had right sided subtrochanteric fracture that was around 70% and rest 30% had left sided fracture. In James et al series, 54.54% had right sided subtrochanteric fracture[19]. A study in 2016 by Jonnes et al. observed that 50% of the fractures occurred on the left side and 50% on the right side showing no significant

difference[18].

Seinsheimer Classification: Most of the patients belonged to Seinsheimer Classification type 3A that constituted 34%. In James et al. series, the most common type was found to be type III that comprised of 45.45% of the total[19]. In 2016 P Tank et al. found most common type to be type II that is 30% and in this study they excluded type IV that is with subtrochanteric extension[17].

Comorbidities: In our study the incidence of diabetes (14%) was found to be more than hypertension (4%). The same group had more incidence of infection as compared to others. In Tank et al series they found that hypertension was more commoner than diabetes in their study[17].

Time Taken For Surgery: In our study the average time came out to be 100 min that is 1.52 hrs as some of the cases had to be converted to open reduction required more amount of time than usual. Open reduction was done more often in cases of inter-trochanteric fracture involving subtrochanteric extension, when compared with subtrochanteric fractures alone. In Nagaraj et al the average time taken for surgery was 66 min[15]. James et al. found the average time taken for surgery to be 90 min[19]. In Tank et al study the average time taken for surgery was 80 min[17]. A study in 2016 by Jonnes et al. they observed that the average duration of surgery for PFN was 90.6 mins[18]. So our operating time for PFN was little bit more as compared with other studies.

Blood Loss: In our study the average blood loss was 205.7 ml measured by blood in suction machine and one mop equaling 50 ml. James et al in 2015 found the average blood loss to be 100 ml[19]. Study by Jonnes et al. they observed that the average blood loss during PFN procedure was 73ml[18].

Neck Shaft Angle: In our study the average neck shaft angle came out to be 124.24°. Aithala in 2013 found in their

study that the mean neck shaft angle achieved post reduction was 132.4 degrees (38 patients) and at the final follow up was 131.9 degrees (33 patients) with insignificant difference (Mean difference of 0.5 degrees)[20]. In the study by Tandon et al the average neck shaft angle was 128 degrees[21].

Radiological Union: In our study the average time for radiological union was found to be 12.66 weeks evident on disappearance of fracture lines. Salphale et al. found the average union time to be 11.5 weeks[22]. In Nagaraj et al series the average time seen for radiological union was 12 weeks[15]. In 2015 James et al. the average time seen for radiological union was 12 weeks[19]. So in our study the union was seen around the same time as compared to other studies.

Complete Weight Bearing: In our study the average time when we started full weight bearing according to the patients tolerability was found to be 13.34 weeks. In Nagaraj et al study, the average weight bearing was started at 9 weeks[15]. In Tank et al. the average weight bearing was 10 weeks[17]. A study by Jonnes et al. they observed that patients operated for PFN returned to the preinjury walking ability at the end of 8 weeks[18].

Limb Length Discrepancy (LLD): In our study the average shortening seen was found to be 0.288 cm. Shortening more than 0.5cm was in the patients of intertrochanteric fractures with sub trochanteric extension. In Nagaraj et al study the average LLD was less than 2cm15. In James et al study the average was found to be less than 1cm[19]. In Tank et al study the average LLD was less than 1 cm in 13 of 70 patients and more than 1cm in 7 of 70 patients[17]. Study done by Jonnes et al. observed that the shortening was 4.72 mm[18]. So as compared to other studies we found that the average limb length discrepancy was less as comparable to the other studies.

Meena *et al*.

Complications: In our study, Among early complications, Open Reduction, Difficult Reduction and Infection were in 6.0%, 8.0% and 12.0% respectively., whereas in late, Z Effect, Infection, and Varus 4.0%, 8.0% and 6.0% respectively. Edengrin et al in his study found that early complications included inadequate reduction in one patient (2%), failure to put derotation screw in one patient (2%), difficulty in distal locking in one patients (2%), varus deformity in one patient (2%), superficial infection in two patients (4%), implant failure in two patients (4%), and z effect in one patient (2%). Other complications included shortening in one patient (2%) and malunion in one patient (2%). Breakage of nail and inadequate were considered fixation implant failure[16]. Study by Jonnes et al. they observed that out of all the patients, 3 patients had jig miss match (20%), 1 underwent open reduction (6.7%) and in 1 patient only one cephalic screw was placed (6.7%) as the other screw could not be accommodated[18].

Harris Hip Score (HHS): In our study Majority of the patients belonged to the 'excellent' group that is HHS more than 90. The range of movements namely flexion, extension, external and internal rotation were good in most cases, excellent in a few. Poor results were seen in very few patients. Salphale e al. found that the mean Harris hip score was 76.66 (range 70 -93)[22]. In James et al study most of the cases belonged to the good group that is the average HHS was between 80-90 and 45% belonged to this group[19]. In Tank et al study most of the patients belonged to the excellent group that is 51%[17]. Study by Jonnes et al. they observed that the harris hip score at the end of 12 months was 90.3318. So as compared to other studies our group had significantly better Harris hip score

Conclusion

We conclude that proximal femoral nail is

implant in treating verv good ล subtrochanteric fracture as it is a load sharing implant and it is a closed procedure. The blood loss was less. The time duration was less. The incision was small. The complication encountered like broken implant or varus collapse were less. We could achieve excellent range of motion. Early weight bearing was possible. Most of the patients scored excellent results according to the Harris hip score and they returned early to their functional activities.

Therefore, we analyzed that fixation of subtrochanteric fracture with proximal femoral nail is a good option.

References

- Nath RG, Ansari S. Role of Proximal Femoral Locking Plate in treatment of Subtrochanteric Fractures; Case series. MedPulse Int J Orthop. 2017;3(July):1–7.
- Willis C Campbell, Canale ST, Beaty JH. Campbell's operative orthopaedics. 11th ed. Philadelphia, PA: Mosby/Elsevier; 2008.
- Dell RM, Adams AL, Greene DF, Funahashi TT, Silverman SL, Eisemon EO, et al. Incidence of atypical nontraumatic diaphyseal fractures of the femur. J Bone Miner Res. 2012;27(12):2544–50.
- 4. Ibrahim S, Meleppuram JJ. A retrospective analysis of surgically-treated complex proximal femur fractures with proximal femoral locking compression plate. Rev Bras Ortop (English Ed. 2017;52(6):644–50.
- Ng AC, Drake MT, Clarke BL, Sems SA, Atkinson EJ, Achenbach SJ, et al. Trends in subtrochanteric, diaphyseal, and distal femur fractures, 1984-2007. Osteoporos Int. 2012;23(6):1721–6.
- Hu S jun, Zhang S min, Yu G rong. Treatment of femoral subtrochanteric fractures with proximal lateral femur locking plates. Acta Ortop Bras. 2012;20(6):329–33.

- Napoli N, Schwartz A V., Palermo L, Jin JJ, Wustrack R, Cauley JA, et al. Risk factors for subtrochanteric and diaphyseal fractures: The study of osteoporotic fractures. J Clin Endocrinol Metab. 2013;98(2):659–67.
- 8. Grigoryan K V., Javedan H, Rudolph JL. Orthogeriatric care models and outcomes in hip fracture patients: A systematic review and meta-analysis. J Orthop Trauma. 2014;28(3).
- Craig NJA, Sivaji C, Maffulli N. Subtrochanteric fractures: A review of treatment options. Bull Hosp Jt Dis. 2001;60(1):35–46.
- Hodgson S. AO Principles of Fracture Management. Ann R Coll Surg Engl. 2009;91(5):448–9.
- 11. Hotz TK, Zellweger R, Kach KP. Minimal invasive treatment of proximal femur fractures with the long gamma nail: Indication, technique, results. J Trauma - Inj Infect Crit Care. 1999;47(5):942–5.
- Robertson R, Tucker M, Jones T. Provisional plating of subtrochanteric femur fractures before intramedullary nailing in the lateral decubitus position. J Orthop Trauma. 2018;32(4):e151–6.
- Chakraborty M, Thapa P. Fixation of subtrochanteric fracture of the femur: Our experience. J Clin Diagnostic Res. 2012;6(1):76–80.
- 14. Prakash AK, S NJ, Shanthappa AH, Venkataraman S, Kamath A. A Comparative Study of Functional Outcome Following Dynamic Hip Screw and Proximal Femoral Nailing for Intertrochanteric Fractures of the Femur. Cureus. 2022 Apr 4;19(4):805– 8.
- 15. Nagaraj S, Varun R, Shankara K, Lakshmeesha T, Kiran SC.

Trochanteric fractures treated by proximal femoral nail - Our experience Abstract : Results : Int J Res Heal Sci[Internet. 2014;2(2):466–72.

- 16. Endigeri P, Pattanashetty O, Banapatti D, Pillai A, Ullas T. Outcome of intertrochanteric fractures treated with proximal femoral nail: A prospective study. J Orthop Traumatol Rehabil. 2015;8(1):25.
- 17. Tank PJ, Solanki RA, Patel HA, Rathi N, Mistry J, Bhabhor HB. Results of proximal femoral nail in intertrochanteric fracture of femur. IOSR J Dent Med Sci. 2016 Jul 1;15(4):17–24.
- Jonnes C, Shishir SM, Najimudeen S. Type II intertrochanteric fractures: Proximal femoral nailing (PFN) versus Dynamic Hip Screw (DHS). Arch Bone Jt Surg. 2016;4(1):23–8.
- James B, Prasath R, Vijayakumaran M. Functional outcome of proximal femoral nailing in inter trochanteric fractures of femur: A prospective study. Int J Orthop Sci. 2017;3(2e):513–8.
- 20. Aithala P J, Rao S. Proximal Femoral Nailing: Technical Difficulties and Results in Trochanteric Fractures. Open J Orthop. 2013;03(05):234–42.
- 21. Tandon S, Vijayvargiya M, Pathak A. Outcome analysis of proximal femoral nail in stable intertrochanteric femur fractures. J Evol Med Dent Sci. 2015;04(15):2553–60.
- 22. 22. Salphale Y, Gadegone WM, Ramteke A, Karandikar N, Shinde R, Lalwani P. Proximal Femoral Nail in Reverse Trochanteric Femoral Fractures: An Analysis of 53 Cases at One Year Follow-Up. Surg Sci. 2016;07(07):300–8.