

Estimation of the Clinico-Radiological Outcome of Intertrochanteric Fracture Fixation by Using the Proximal Femoral Nail in Adults

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Abstract

Introduction & Aim: Intertrochanteric fractures are common in old age group, but it is not uncommon in younger age group. The proposed study aims to estimate the clinico-radiological outcome of the intertrochanteric fracture fixation by using the PFN in adults.

Materials and methods: The clinical and radiographs outcomes were prospectively analyzed following treatment of 51 cases of unstable intertrochanteric fractures by initial debridement and Proximal Femoral Nail fixation over an eighteen-month period. The functional outcome including time to partial and complete weight bearing in fractures treated by PFN was determined. They were followed up for a mean period of 6 months and evaluated at follow ups at 6 weeks, 3 months and 6 months using SWS and RUSH score.

Results: In our series of 51 cases there were 30 male and 21 female, and mean age of 58.7 yrs. 42 cases (82%) had SWS scores above 20 points at 6 months (20/40). 1 case had RUSH scores below 18 at 6 months predicting a probable radiographic nonunion. The majority of the cases (98%) had RUSH scores above 18.

Conclusion: The conclusion drawn from this sample study is that proximal femoral nail can be considered as an excellent choice of implant for the treatment of intertrochanteric fractures after proper training.

Level of evidence: Level 4.

Keywords: Proximal femur nailing, Intertrochanteric fractures, Salvati Wilson score, RUSH score.

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Introduction

Intertrochanteric fractures are common in old age group, but it is not uncommon in younger age group [1]. Conservative line of treatment is sufficient for proper union of fracture line in some cases, but there is fear of complications like, osteoarthritis following avascular necrosis of head of femur, external rotation deformity, coxa

vara, malunion, medialization of shaft resulting in shortening of limb and limp [2]. Avoidance of secondary complications should be the primary goal of treatment of intertrochanteric fractures.

Intertrochanteric fractures can be treated using various operative techniques with

different implants. Earlier secondary complications resulted from delay in active treatment for as long as 3 to 4 weeks.

Open reduction and internal fixation with early mobilization have the potential to minimize secondary complications. Intertrochanteric fractures may be repaired with either a sliding hip screw, trochanteric nail or Gamma Nail due to shorter operating time, less blood loss and earlier mobilization with these devices. Predictable union occurs with the use of sliding hip screw, but one of the major issues with sliding hip screws is loss of hip offset and shortening of the limb due to collapse of the femoral neck. Even though a slight amount of sliding is expected, excessive sliding would adversely affect hip function. Therefore, a new intramedullary device-Proximal Femoral Nail was designed in 1996 which gives an advantage of minimally invasive esurgery[3].

A form of pre-operative assessment and final assessment has been used. Fractures has been classified according to the AO classification into 3 groups, The results have been studied in depth with a view to outline guidelines for better management of these fractures.

This study is an attempt to evaluate the long-term results of operative management of unstable intertrochanteric fractures by the Proximal Femoral Nail (PFN) in a standardized and objective manner. Factors affecting the quality of fixation and hence patients' ambulation have been analysed.

Materials and Methods:

. This study was done on the patients undergoing fixation of intertrochanteric fractures with PFN at the Department Of Orthopaedics in K.V.G Medical College and Hospital, during the course period of November 2018 to April 2020. It is a prospective study. 51 patients admitted and

operated during this period satisfied the inclusion criteria and were informed about the study in all respect and informed consent was obtained from each patient. The data was collected from the patients in a specially designed case record form (CRF) by taking history of illness, clinical examination and relevant investigations. The patients were followed up at 3 weeks, 3 months, and 6 months. Ethical approval was obtained from the institutional ethics committee prior to embarking on the study.

Inclusion criteria:

- All unstable intertrochanteric fractures
- Patient should be an adult.
- Those who sign informed consent.
- Patients who met the medical standards for routine elective surgery.

Exclusion criteria:

- Pathological fractures.
- Patients who are not willing to give consent.
- Patients who are medically unfit for surgery.

Results:

This study was a prospective, time bound, hospital-based study conducted in K.V.G. Medical College Hospital. The study included 51 patients with unstable intertrochanteric fracture of femur that were treated with PFN. The analysis of the patient data, intra operative data & post-operative outcome was as follows.

The age distribution of our study was from 20 years to 88 years. The mean age being 58.6 years. There were 30 (59%) males and 21 (41%) females in our study population. Fractures were classified according to AO/OTA classification in our study. We found significantly more cases of unstable intertrochanteric fractures Type AO31-A2.2 (47.0%) ($p < 0.0001$) were common in the present study [Table 1]

Table 1: Distribution of type of fracture AO/OTA Classification

Type	No. of cases	%
A2.2	24	47.0
A2.3	11	21.6
A3.1	2	3.9
A3.2	4	7.8
A3.3	10	19.6
Total	51	100

Functional outcome of surgery was checked by Salvati-Wilson hip evaluation at 6 weeks, 3 months, 6 months. 42 cases (82%) had scores above 20 points at 6 months (20/40). This is comparable with Al-Yassan et al. in which 78% had scores above 20 points. Majority of the cases in the present study had good SWS score (33.4%). Radiological outcome was assessed by

RUSH scoring at 6 weeks, 3 months, 6 months. The RUSH scores became progressively better with time in majority of the cases. In the present study, 1 case had RUSH scores below 18 at 6 months predicting a probable radiographic nonunion. The majority of the cases (98%) had RUSH scores above 18. These cases either healed well or had delayed healing.

Table 2: Mean Salvati Wilson Score recorded during follow-ups at 6 weeks, 3 months and 6 months

SWS Score	6 weeks	3 months	6 months
Minimum	12	14	16
Maximum	17	25	34
Mean	14.5	19.3	24.9
S.D	1.58	3.01	4.49

Table 3: Distribution of sample by Salvati-Wilson hip evaluation at 6 months

	No. of cases	%
Excellent	5	20
Good	26	33.4
Fair	16	30
Poor	4	16.6
Total	51	100

Table 4: Final RUSH Scores recorded during follow-ups at 6 weeks, 3 months and 6 months

RUSH Score	6 weeks	3 months	6 months
Minimum	10	14	17
Maximum	13	20	26
Mean	11.5	17.2	23.2
S.D	1.10	1.58	1.91

All patients were allowed to weight bear partially by 4 weeks. In the present study, we found most of the patients (33) were allowed to partially bear weight bear at 6 weeks. Three patients were not allowed to weight bear. In the present study, we find most of the patients (19) were allowed to full bear weight bear at 12 weeks

Table 5: Time taken for partial and full weight bearing

Maximum	Minimum	Mean
8 weeks	4 weeks	5.92± 1.1973 weeks
Partial weight bearing (at weeks)	No. of cases	%
<= 4	10	19.6
6	33	64.7
8	8	15.7
TOTAL	51	100

Table 6: Time taken for partial and full weight bearing

Maximum	Minimum	Mean
16 weeks	8 weeks	11.6± 2.1421 weeks
Full weight bearing (at weeks)	No. of cases	%
8	6	11.8
10	12	23.5
12	19	37.3
14 or more	11	21.6
TOTAL	48	94

In the present study, we find most of the patients (4) with poor functional outcome had RUSH scores in the lower range (16-20), whereas most of the patients (5) with excellent functional outcome had RUSH scores in the higher range (26-30). Majority of the patients had good or fair outcome (42) with RUSH scores in the range of 21-25 [Table]. This finding was statistically significant ($p < 0.00001$).

Table 7: Distribution of sample in comparison of RUSH scores with functional outcome

RUSH Score	SWS score			
	Excellent	Good	Fair	Poor
16-20	0	0	0	4
21-25	0	26	16	0
26-30	5	0	0	0
Total	5	26	16	4

Discussion:

The mean age in our study was 58.6 years. Whereas the western literatures have reported higher mean age incidence for unstable intertrochanteric fractures. Our study results are comparable with Sharma [4], Kiran Kumar [5]. Majority of cases occurred in older individuals because the average life expectancy of an Indian is 10 years less than western standards, malnutrition and osteoporosis go hand in hand. In the present study male: female sex ratio was 59:41. There was a male sex preponderance seen in our study. This is in

contrast to female preponderance as observed by various other authors like in the study by Al-yassari et al. [6] showed females were 53 [75.7%], males 17 [24.3%], whereas in the study conducted by Simmermacher et al. [3] females were 138 [72.6%] in no. and males 52 [27.4%]. This may be because Indian males are more active & mobile than females and Indian females are mainly confined to household activities and are less prone to sustain an extracapsular fracture of hip.

Unstable intertrochanteric fractures are more common in persons aged above 60

years, most common mode of injury for such fractures was trivial fall. Road traffic accident was the cause in 7 cases. Our study results in terms of mode of injury is comparable to the study by Al-yassari[6]. In the present study out of 51 cases, Right hip fractures were seen in 28 cases and Left side were 23. In studies conducted by V. Pushkarna [7] right sided fractures were more common, whereas in studies made by A Sharma et al. [4] left sided fractures were common.

Majority of the patients had AO31-A2.2 (47%) type of fracture in our study followed by A2.3 (21.6%), A3.3 (19.6%), A3.2 (7.8%), A3.1 (3.9%). Overall A2 type of fractures were more common than A3. In the study done by J. Mandice et al. it was found that 37.5% cases had A2.2 type of fracture followed by A2.3 (29.2%), A3.3 (25%), A3.1 (8.3%), A3.2 (0%). Overall type A2 fractures were more common than type A3 in the study. [8] Al- Yassari found that fifty-four fractures were type 31-A2 (77%) and 16 were type 31-A3 (23%).52 Whereas, Boldin et al. found that 4 patients had Type A2 fracture and 34 patients had type A3. [6] This finding in our study is consistent with the findings in most other similar studies [7-12].

The start of partial weight bearing was based on if we had achieved good reduction and stable fixation as well as tolerance of patients. Use of an assistive device to fully support and unload the repaired extremity is limited due to the lack of upper extremity strength and associated co-morbidities. In our study all patients were allowed to weight bear partially. Partial weight bearing started at 4 weeks or less in 19.6 % patients. We found most of the patients (33) were allowed to partially bear weight bear at 6 weeks. One of our patients had a screw cut-out initially possibly because of early weight bearing. In the study by Vishal Pushkarna et. al. [7] partial weight bearing was allowed by 3rd week, and in the B. L. Chopra et. al. [14] series partial weight

bearing was allowed at 1 month according to pain tolerance in 13% of patients. Our partial weight bearing started comparatively later because we were considering RUSH scores to help us decide how much union had occurred and if the patient was fit to weight bear, hence we got a comparatively better functional outcome as seen from the SWS scores. Full weight bearing is started after evidence of good radiological union. In the present study RUSH scores helped in taking the decision to fully weight bear, which started at 8 weeks. 3 patients were not allowed to fully weight bear due to very low RUSH scores and post-operative complications. Most of our patients were allowed to fully weight bear by 12 weeks. In the study by Vishal Pushkarna et. al. full weight bearing was allowed in 50% patients by the end of 10 weeks. [7] Following the RUSH scores as criteria to decide on weight bearing served as advantageous because of the reduced number of cases which were sent for revision surgery due to early mobilization.

In the present study 20% excellent 33.4% good results, 30% fair and 17% poor functional outcome was seen according to SWS scores. 47 cases (92%) cases had scores above 20 points as compared with Al-Yassari et al. in which 78% had scores above 20 points. [6] The better SWS scores may be attributed to application of proper technique. 3 cases had implant failure, accounting for 5.9% of the cases. Mulholland and Gunn [18] (1972) reviewed 350 cases. A failure rate in 332 hips was 4.8%. GS Kulkarni et al [19] (1983) reported a failure rate of 6.3%. Mean RUSH scores in the present study at 6 weeks, 3months and 6 months were 11.5, 17.2, 23.2 respectively as compared to the study by Prithviraj P et al. [20] where the RUSH scores at the same follow up interval were 13.8, 19.1, 25.4. In the present study, 1 case had RUSH scores below 18 at 6 months predicting a probable radiographic nonunion. The majority of the cases (98%)

had RUSH scores above 18. These cases either healed well or had delayed healing. Better functional outcome as depicted by the SWS scores was found in patients of fracture type AO31- A2.2 and RUSH scores above 21 points. Such association between SWS scores or functional outcome and RUSH score has never been done in any other existing literature.

Conclusion

In short, the PFN is a better implant with distinct advantages over the DHS. With adequate surgical technique, the advantages of the PFN increases and the complication rate decreases. The conclusion drawn from this sample study is that proximal femoral nail can be considered as an excellent choice of implant for the treatment of intertrochanteric fractures after proper training.

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References:

1. Kenneth J, Cantu RV. Intertrochanteric fractures. In: Bucholz RW, Heckmen JD, Court-Brown CM, editors. Rockwood and Green's Fractures in Adults. 6th ed., Vol. 3. Philadelphia: Lippincott Williams and Wilkins; 2006. p. 1793-825.
2. Pajarinen J, Lindahl J, Michelsson O, Savolainen V, Hirvensalo E. Pertrochanteric femoral fractures treated with a dynamic hip screw or a proximal femoral nail: a randomised study comparing post-operative rehabilitation. *The Journal of bone and joint surgery. British volume.* 2005 Jan;87(1):76-81.
3. Simmermacher RK, Bosch AM, Van der Werken CH. The AO/ASIF-proximal femoral nail (PFN): a new device for the treatment of unstable proximal femoral fractures. *Injury.* 1999 Jun 1;30(5):327-32
4. Sharma A, Mahajan A, John B. A comparison of the clinico-radiological outcomes with proximal femoral nail (PFN) and proximal femoral nail antirotation (PFNA) in fixation of unstable intertrochanteric fractures. *Journal of clinical and diagnostic research: JCDR.* 2017 Jul;11(7):RC05-RC09.
5. Kumar GK, Sharma G, Khatri K, Farooque K, Lakhota D, Sharma V, Meena S. Treatment of unstable intertrochanteric fractures with proximal femoral nail antirotation II: our experience in Indian patients. *The open orthopaedics Journal.* 2015; 9:456.
6. Al-Yassari G, Langstaff RJ, Jones JW, Al-Lami M. The AO/ASIF proximal femoral nail (PFN) for the treatment of unstable trochanteric femoral fracture. *Injury.* 2002 Jun 1;33(5):395-9.
7. Pushkarna VA, Thadamalla V. Results of proximal femoral nail in unstable intertrochanteric fracture of femur. *International Journal of Orthopaedics Sciences.* 2019 Oct; 5(4): 177-183.
8. Mandice CJ, Khan R, Anandan H. Functional outcome of unstable intertrochanteric fractures managed with proximal femoral nail: a prospective analysis. *International Journal of Research in Orthopaedics.* 2018 Nov;4(6):945.
9. Schipper IB, Bresina S, Wahl D, Linke B, Van Vugt AB, Schneider E. Biomechanical evaluation of the proximal femoral nail. *Clin Orthop Relat Res.* 2002 Dec;(405):277-86.
10. Radford PJ, Needoff M, Webb JK. A prospective randomised comparison of the dynamic hip screw and the gamma locking nail. *The Journal of Bone and Joint Surgery. British volume.* 1993 Sep;75(5):789-93.
11. Halder SC. The Gamma nail for peritrochanteric fractures. *The Journal of bone and joint surgery. British volume.* 1992 May;74(3):340-4.

12. Domingo L, Cecilia D, Herrera A, Resines C. Trochanteric fractures treated with a proximal femoral nail. *International orthopaedics*. 2001 Oct 1;25(5):298-301.
13. Yaozeng X, Dechun G, Huilin Y, Guangming Z, Xianbin W. Comparative study of trochanteric fracture treated with the proximal femoral nail anti-rotation and the third generation of gamma nail. *Injury*. 2010 Dec 1;41(12):1234-8.
14. Chopra BL, Kumar K, Khajotia BL, Bhambu R, Bhatiwal S, Shekhawat V. Proximal femoral nail-outcome and complications: a prospective study of 125 cases of proximal femoral fractures. *Int J Res Orthop*. 2017 Sep;3(5):973-8.
15. Koyuncu Ş, Altay T, Kayalı C, Ozan F, Yamak K. Mechanical failures after fixation with proximal femoral nail and risk factors. *Clinical interventions in aging*. 2015;10:1959.
16. Wolfgang GL, Bryant MH, O'Neill JP. Treatment of intertrochanteric fracture of the femur using sliding screw plate fixation. *Clinical orthopaedics and related research*. 1982 Mar 1(163):148-58.
17. Gadegone WM, Salphale YS. Proximal femoral nail—an analysis of 100 cases of proximal femoral fractures with an average follow up of 1 year. *International orthopaedics*. 2007 Jun 1;31(3):403-8.
18. Mulholland RC, Gunn DR. Sliding screw plate fixation of intertrochanteric femoral fractures. *Journal of Trauma and Acute Care Surgery*. 1972 Jul 1;12(7):581-91.
19. Kulkarni GS, Limaye R, Kulkarni M, Kulkarni S. Current Concept review Intertrochanteric fractures. *Indian Journal of Orthopaedics*. 2006 Jan; 40(1): 16-23.
20. Raj PA, Siva Swaminathan D, Kumar G, Krishnan P. Analysis of the functional and radiological outcome of unstable intertrochanteric femur fractures treated with the proximal femoral nail or the dynamic hip screw. *International Journal of Orthopaedics*. 2019;5(2):288-91.