International Journal of Orthopaedics and Traumatology

ISSN Print: 2664-8318
ISSN Online: 2664-8326
Impact Factor: RJIF 5.42
IJOT 2024; 6(1): 07-10
www.orthopedicsjournal.in
Received: 05-11-2023
Accepted: 13-12-2023

Dr. Rahul Bindal
Post-Graduate, Department of Orthopaedics, Shri Guru Ram Rai Institute of Medical and Health Sciences, Dehradun, Uttarakhand, India

Dr. Nikhil Singh
Post-Graduate, Department of Orthopaedics, Shri Guru Ram Rai Institute of Medical and Health Sciences, Dehradun, Uttarakhand, India

Dr. Bilal Kaleem
Assistant Professor, Department of Orthopaedics, Shri Guru Ram Rai Institute of Medical and Health Sciences, Dehradun, Uttarakhand, India

Dr. Puneet Gupta
Professor and HOD, Department of Orthopaedics, Shri Guru Ram Rai Institute of Medical and Health Sciences, Dehradun, Uttarakhand, India

Dr. Amandeep Kajla
Post Graduate, Department of Orthopaedics, Shri Guru Ram Rai Institute of Medical and Health Sciences, Dehradun, Uttarakhand, India

Corresponding Author:
Dr. Rahul Bindal
Post-Graduate, Department of Orthopaedics, Shri Guru Ram Rai Institute of Medical and Health Sciences, Dehradun, Uttarakhand, India

Clinical research comparing the efficacy of long proximal femoral nail with short proximal femoral nail in treating unstable intertrochanteric fractures

Dr. Rahul Bindal, Dr. Nikhil Singh, Dr. Bilal Kaleem, Dr. Puneet Gupta and Dr. Amandeep Kajla

DOI: https://doi.org/10.33545/26648318.2024.v6.i1a.37

Abstract
Aim: The purpose of this study was to study and compare the effectiveness and the disadvantages of intramedullary devices, i.e. short vs long pfn in the management of unstable IT fractures.
Methods: The present study was conducted in the Department of Orthopaedics and with trochanteric fractures was operated at our tertiary care hospital. Out of the 200 patients, Group a patients were operated with short Pfn and Group B were operated with long pfn.
Results: Patients in both groups had an average age of 66.34±9.36 years and 64.32±8.42 years, with no significant difference (p = 0.632). Groups A and B included 62% females and 38% males, and 59% females and 41% men, respectively. The majority of patients were AO 31A-2.2. In group B, mean operating time was significantly lower than in group A (34.26±6.0 minutes vs. 42.36±8.16 minutes, $p<0.001$). Shortening (>1 cm) and varus malalignment indicated no significant difference between the two groups, however group B had somewhat lower rates than group A. PFNA had a slightly higher Harris hip score than PFN, but the difference was not statistically significant (p = 0.555).
Conclusion: Use of Long PFN offers benefits over short PFN in terms of the reduced postoperative problems such peri implant fracture and anterior thigh discomfort & better functional result. Successful outcomes require fracture biomechanics knowledge, patient selection, preoperative planning, and accurate instrumentation.

Keywords: Bone nails, fracture fixation, intramedullary, hip fractures, unstable it fractures, short PFN

Introduction
A rise in the number of intertrochanteric fractures has been observed alongside the aging population. Roughly half of these breaks are not stable [1-3]. It is difficult to cure these fractures due to poor bone quality and complicated fracture pattern. Instability, osteoporosis, and fixation complications are the main challenges in treating these fractures. Surgery for this type of fracture aims to return the patient to their preoperative condition by constructing a sturdy framework that allows for early mobility restoration, reduces the risk of complications related to long-term recumbency, and achieves this goal. When faced with such challenging situations, both DHS and PFN have shown remarkable accomplishment. When used in conjunction with osteoporosis, DHS with a fixed-angle locking side plate reduces the likelihood of implant failure and aids in stabilizing fractures. Reduced space between the hip joint and implant provides a more biomechanically sound construction with PFN [4]. By positioning itself intramedullary at the nail-lag screw junction [5-7], PFN prevents the proximal fragment from lateral translation and can withstand bending stress, allowing early weight bearing in unstable ITF [7-9]. However, compared to DHS, PFN is still very expensive. According to the results of the literature review, PFN does not significantly outperform DHS in terms of functional outcomes or complications [10, 11]. The elderly are particularly vulnerable to catastrophic injuries, such as intertrochanteric fractures. As people get older, these fractures become more common. These patients rely on simple and instrumental tasks for their daily lives and are more limited to walking around the house. Forty percent of hip fractures in the elderly are trochanteric fractures, and of those, half are unstable [12]. The sliding hip screw device has been utilized for more than a decade for the treatment of these fractures.

Though Zickel debuted his nail long ago, it was not a particularly popular fixation device owing to a greater frequency of problems. Side plate devices when used for unstable trochanteric fracture which is commonly associated with lateral wall communication results in the excessive collapse of the proximal fragment and gross medicalization of distal fragment resulting in implant failure and delayed union or nonunion at fracture site [13].

The goal of this research was to evaluate and compare the efficacy and the drawbacks of intramedullary devices, i.e. short vs long pfn in the therapy of unstable IT fractures.

Materials and Methods

The present study was conducted in the Department of Orthopaedics and with trochanteric fractures was operated at our tertiary care hospital. Out of the 200 patients, Group A patients were operated with short Pfn and Group B were operated with long pfn.

Institutional ethical clearance was taken. Patients with pathologic fractures, open fractures, polytrauma, neuromuscular disorders or severe cardio-pulmonary insufficiency were excluded. 100 patients fulfilling inclusion and exclusion criteria were randomized into 2 groups. All patients gave written informed consent before the surgery.

Methodology

Surgical exposures were similar to both implants except for the techniques and instrumentation used in either system. Background and demographic variables including age, gender associated comorbidities and pre-injury ambulatory status were recorded. Fractures type was assessed and recorded as per AO/ASIF classification system using orthogonal radiographs of the affected hip.

All patients were administered spinal or epidural anaesthesia and positioned supine on a fracture table prior to closed reduction of fracture. Per operatively, the duration of surgery, amount of blood loss, number of images shot on the image intensifier was recorded. All patients received three doses of prophylactic antibiotics including the pre-op dose given within 30 minutes prior to skin incision. Post operatively all patients received thrombo-prophylaxis with low molecular weight heparin for the duration of hospital stay or first 10 post-op days, whichever was shorter, followed by Aspirin for 4 weeks. All patients were allowed touch down weight bearing ambulation using a walking frame starting from the first post op day till 6 weeks, following which progressive weight bearing was allowed depending on the status of fracture union. Clinical and radiological assessment of fracture union/complications for all the patients was done pre-operatively and post-operatively at 06 weeks, 3months, 6months and 1year. Functional evaluation was done at 1year post op using Harris Hip Score.

Statistical analysis

Statistical analysis was done using SPSS software (IBM Version-20). Statistical difference between continuous variables was assessed using Student t-test. Categorical variables were compared using Chi square test. Statistical significance was set at P value of 0.05 or less.

Results

Table 1: Demography and basic characteristics of the two groups

Basic characteristics	Group A (n=100)	Group B (n=100)	P Value
Age (years)			0.632
Mean ± SD	66.34±9.36	64.32±8.42	
Range (min to max)	(51 to 82)	(51 to 84)	
Gender			1.000
Females	62 (62%)	59 (59%)	
Males	38 (38%)	41 (41%)	
AO classification			
31A-2.2	69 (69%)	75 (75%)	0.432
31A-2.3	19 (19%)	11 (11%)	
31A-3.1	12 (12%)	11 (11%)	
31A-3.2	0	3 (3%)	

The mean age of patients in both groups was 66.34±9.36 years and 64.32±8.42 years respectively and did not differ significantly (p =0.632). Further, the subjects of two groups were also gender matched as the number of females and males 62% and 38% in group A and 59% and 41% in group B respectively. According to AO classification, most of the patients were in 31A-2.2.

Table 2: Operative details of the two groups

Operative details	Group A (n=100)	Group B (n=100)	P value
Duration (Minutes)			
Mean ± SD	42.36±8.16	34.26±6.06	<0.001
Range (Min to max)	(30 to 60)	(30 to 50)	
Blood loss (ml)			
Mean ± SD	78.82±18.32	58.82±15.95	<0.001
Range (Min to max)	(60 to 120)	(40 to 100)	
Images (No)			
Mean ± SD	28.52±4.82	19.61±3.17	<0.001
Range (Min to max)	(24 to 40)	(15 to 26)	

Group A had an average operating duration of 42.36±8.16 minutes, whereas group B had a considerably shorter average operating time of 34.26±6.0 minutes (p<0.001). Group B also had considerably less mean blood loss than group A (58.82±15.95 ml vs. 78.82±18.32 ml, p<0.001). Group B had a considerably reduced mean number of photos obtained each operation (19.61±3.17 vs 28.52±4.82, p<0.001) compared to group A.

Table 3: Loss of reduction

Loss of reduction	Group A (n=100)	Group B (n=100)	P value
Shortening (>1 cm)			
No	85 (85%)	88 (88%)	0.624
Yes	15 (15%)	12 (12%)	
Varus malalignment			
No	93 (93%)	95 (95%)	0.512
Yes	7 (7%)	5 (5%)	

In all groups, there was a loss of decrease, including shortening (>1 cm) (p =0.624) and varus malalignment (p =0.512), however in group B it was somewhat lower than in group A.

Table 4: Final outcome measures

Final outcome measures	Group A (n=100)	Group B (n=100)	P value
Mortality	5 (5%)	7 (7%)	0.525
Persistent pain	15 (15%)	13 (13%)	0.743
Use of walking aids	41 (41%)	25 (25%)	0.412
Return to pre fracture status	70 (70%)	80 (80%)	0.365
Harris hip score (1 year post operatively)			
Mean ± SD	87.3±12.28	86.42±7.53	0.555
Range (Min to max)	(50 to 95)	(64 to 95)	

Surgical complications were not the cause of death for five patients in group A and seven in group B. Thirteen patients in group B and fifteen in group A continued to have hip discomfort at the end of the study, although there was no statistically significant difference between the two groups (p =0.743). At the conclusion of the research period, 41% of patients in group A and 25% of patients in group B required walking aids; nevertheless, there was no statistically significant difference between the two groups (p =0.412). The pre-fracture state was regained by 25 patients in group B and 41 patients in group A. The two groups likewise showed no difference (p=0.365) in the recovery to pre-fracture state. Although the PFNA group had a somewhat higher mean Harris hip score than the PFN group, the difference was not statistically significant (p =0.555).

Discussion

5% of hip fractures are intertrochanteric fractures, with 35-40% of these being unstable three- or four-part fractures, which are linked to high morbidity and mortality rates [14, 15]. Managing unstable intertrochanteric fractures in elderly patients is challenging and controversial due to the difficulty in achieving anatomical reduction [16, 17]. Among the elderly, an intertrochanteric (IT) fracture is a prevalent type of hip fracture. Elevation The increase in the elderly population with osteoporosis is causing a rise in IT fractures. These fractures are more prevalent in women, occurring at a rate three to four times higher than in males. Low-energy trauma, such as a minor fall, is typically the main cause. By 2040, the incidence is projected to double.

The average age of patients in both groups was 66.34±9.36 years and 64.32±8.42 years, with no significant difference observed (p = 0.632). Further, the subjects of two groups were likewise gender matched as the number of girls and men 62% and 38% in group A and 59% and 41% in group B correspondingly. Group B had a considerably shorter mean operational time compared to group A (34.26±6.0 minutes vs. 42.36±8.16 minutes, $p<0.001$). Group B had a significantly lower mean blood loss compared to group A (58.82±15.95 ml vs. 78.82±18.32 ml, $p<0.001$). Group B took significantly fewer images per operation compared to group A, with means of 19.61±3.17 and 28.52±4.82, respectively ($p<0.001$). The loss of decrease involving shortening (>1 cm) (p =0.624) and varus malalignment (p =0.512) were comparable across the two groups albeit they were considerably lower in group as compared to group A. Our findings are comparable with research by Hou Z *et al*. who determined that there were no significant difference between the two treatment methods, complication and reoperation rates for the 2 groups. Treatment with a long nail revealed increase in process time and blood loss [18]. A retrospective research by Boone *et al*. done in 2014 revealed that, statistically significant shorter operational time, Blood loss, and transfusion rate were identified in this study for short intramedullary nails. There were no differences detected in duration of stay or peri implant fracture. The frequency of peri implant fracture and implant failures were extremely low in both cohorts which is consistent to our data [19].

However, retrospective research done by Zhi Li *et al*. revealed that the long nail group had much reduced failure rate and hip discomfort rate than those with short nail. But the operational period was much longer in the former than the later intra-medullary device. This was analogous to our research where mean operative time for long PFN group was longer than that of short [20]. A research done by Nicholas B Frisch *et al*. came up with the finding that small nails had the benefit of a speedier operation and fewer blood loss but had a greater risk of peri-implant fractures as compared to longer intramedullary nails. We got one patient in short PFN group with peri implant fracture [21]. individuals in all died, 5 from group A and 7 from group B, owing to reasons not linked to the procedure. Out of the living patients, 15 in group A and 13 in group B had ongoing discomfort in their damaged hips during the final follow-up. However, this disparity was not statistically significant (p = 0.743). At the conclusion of the trial period, 41 patients in group A and 25 patients in group B required walking assistance. The difference between the two groups was not statistically significant (p = 0.412). 41 patients from group A and 25 patients from group B regained their pre-fracture state. There was no significant difference (p = 0.365) in the restoration to the state before the fracture between the two groups. The average Harris hip score in the PFNA group was somewhat higher than in the PFN group, but the difference was not statistically significant (p = 0.555). Xue-Feng Guo *et al*.'s study found that both intramedullary long and short nail fixation are effective in treating intertrochanteric femur fractures in elderly patients. There were no notable differences seen in terms of therapeutic efficacy, length of hospital stay, and postoperative complications. The occurrence of peri-implant fractures treated with different nail lengths was minimal. Our investigation yielded same findings [22]. AO foundation suggests that a multi fragmented intertrochanteric fracture without distal extension or without additional fracture distally may be repaired with a short intramedullary nail. Before surgery, the curvature of the front part of the femur in the unaffected limb should be examined. When the nail tip aligns with the anterior bow's highest point, it is advisable to use a long nail or plate.

Conclusion

Utilizing PFN offers unique benefits. Patients treated with both short and long PFN may engage in early mobility and weight bearing, which helps reduce the risk of bedsores, lung infections, and deep vein thrombosis. Comprehensive preoperative planning, precise surgical technique, proper

reaming of the femoral canal, accurate implant insertion, careful placement of distal locking screws, and prompt post-operative rehabilitation are crucial for a good result. In conclusion, long PFN is a successful therapy for stable intertrochanteric fractures, leading to good functional outcomes and restoring pre-fall ambulatory status while avoiding comorbidities such as periprosthetic fracture and anterior thigh discomfort seen in the short PFN group. Correct surgical procedure is crucial for obtaining stable fracture fixation and preventing serious consequences.

Conflict of Interest: Not available

Financial Support: Not available

References

1. Simmermacher RK, Bosch AM, Van der Werken C. The AO/ASIF-proximal femoral nail (PFN): A new device for the treatment of unstable proximal femoral fractures. Injury. 1999 Jun;30(5):327-32.
2. Schipper IB, Bresina S, Wahl D, Linke B, Van Vugt AB, Schneider E. Biomechanical evaluation of the proximal femoral nail. Clinical Orthopaedics and Related Research (1976-2007). 2002 Dec 1;405:277-86.
3. Hardy DC, Descamps PY, Krallis P, Fabeck L, Smets P, Bertens CL, *et al*. Use of an intramedullary hip-screw compared with a compression hip-screw with a plate for intertrochanteric femoral fractures. A prospective, randomized study of one hundred patients. J Bone Joint Surg Am. 1998 May;80(5):618-30.
4. Pan XH, Xiao DM, Lin BW, Huang G. Dynamic hip screws (DHS) and proximal femoral nails (PFN) in treatment of intertrochanteric fractures of femur in elderly patients. Chinese Journal of Orthopaedic Trauma. 2004;6(7):785-9.
5. Bridle SH, Patel AD, Bircher M, Calvert PT. Fixation of intertrochanteric fractures of the femur. A randomised prospective comparison of the gamma nail and the dynamic hip screw. J Bone Joint Surg Br. 1991 Mar;73(2):330-4.
6. Kumar R, Singh RN, Singh BN. Comparative prospective study of proximal femoral nail and dynamic hip screw in treatment of intertrochanteric fracture femur. J Clin Orthop Trauma. 2012 Jun;3(1):28-36.
7. Fujii K, Katoh S, Sairyo K, Ikata T, Yasui N. Union of defects in the pars interarticularis of the lumbar spine in children and adolescents. The radiological outcome after conservative treatment. J Bone Joint Surg Br. 2004 Mar;86(2):225-31.
8. Valverde JA, Alonso MG, Porro JG, Rueda D, Larrauri PM, Soler JJ. Use of the Gamma Nail in the Treatment of Fractures of the Proximal Femur. Clinical Orthopaedics and Related Research (1976-2007). 1998 May 1;350:56-61.
9. Pavelka T, Matejka J, Cervenková H. Komplikace osteosyntézy krátkým proximálním femorálním hrebem [Complications of internal fixation by a short proximal femoral nail]. Acta Chir Orthop Traumatol Cech. 2005;72(6):344-54.
10. Suckel AA, Dietz K, Wuelker N, Helwig P. Evaluation of complications of three different types of proximal extra-articular femur fractures: differences in complications, age, sex and surviving rates. Int Orthop. 2007 Oct;31(5):689-95.
11. Reindl R, Harvey EJ, Berry GK, Rahme E. Canadian Orthopaedic Trauma Society (COTS). Intramedullary Versus Extramedullary Fixation for Unstable Intertrochanteric Fractures: A Prospective Randomized Controlled Trial. J Bone Joint Surg Am. 2015 Dec 2;97(23):1905-12.
12. Boyd HB, Griffin LL. Classification and treatment of trochanteric fractures. Archi Surg. 1949;58(6): 853-66.
13. Cheng CL, Chow SP, Pun WK, Leong JC. Long-term results and complications of cement augmentation in the treatment of unstable trochanteric fractures. Injury. 1989;20(3):134-8
14. Gadegone Wasudeo M, Salphale Yogesh S. Short proximal femoral nail fixation for trochanteric fractures, Journal of Orthopaedic Surgery. 2010;18(1):39-44.
15. Gebauer M, Stark O, Vettorazzi E, Grifka J, Puschel K, Amling M, *et al*. DXA and pQCT predict pertrochanteric and not femoral neck fracture load in a human side-impact fracture model. Journal of orthopaedic research: official publication of the Orthop Res Soc. 2014;32(1):31-38.
16. Bazylewicz DB, Egol KA, Koval KJ. Cortical encroachment after cephalomedullary nailing of the proximal femur: evaluation of a more anatomic radius of curvature. J Orthop Trauma. 2013 Jun;27(6):303-7.
17. Kleweno C, Morgan J, Redshaw J, Harris M, Rodriguez E, Zurakowski D, et al. Short versus long cephalomedullary nails for the treatment of intertrochanteric hip fractures in patients older than 65 years. Journal of orthopaedic trauma. 2014 Jul 1;28(7):391-7.
18. Hou Z, Shi J, Ye H, Pan Z. Treatment of unstable intertrochanteric fractures with percutaneous non-contact bridging plates. Int. J Surg. 2014;12(5):538-43.
19. Boone C, Carlberg KN, Koueiter DM, Baker KC, Sadowski J, Wiater PJ, *et al*. Short versus long intramedullary nails for treatment of intertrochanteric femur fractures (OTA 31-A1 and A2). J Orthop Trauma. 2014;28(5):e96-100.
20. Li Z, Liu Y, Liang Y, Zhao C, Zhang Y. Short versus long intramedullary nails for the treatment of intertrochanteric hip fractures in patients older than 65 years. Int. J Clin Exp Med. 2015;8(4):6299-302.
21. Frisch NB, Nahm NJ, Khalil JG, Les CM, Guthrie ST, Charters MA. Short Versus Long Cephalomedullary Nails for Pertrochanteric Hip Fracture. Orthopedics.2017;40(2):83-8.
22. Guo XF, Zhang KM, Fu HB, Cao W, Dong Q. A comparative study of the therapeutic effect between long and short intramedullary nails in the treatment of intertrochanteric femur fractures in the elderly. Chin J Traumatol. 2015;18(6):332-5.

How to Cite This Article
Bindal R, Singh N, Kaleem B, Gupta P, Kajla A. Clinical research comparing the efficacy of long proximal femoral nail with short proximal femoral nail in treating unstable intertrochanteric fractures. International Journal of Orthopaedics and Traumatology. 2024;6(1):07-10.