



Orthopaedics

A COMPARATIVE STUDY OF PROXIMAL FEMORAL NAILING AND BIPOLAR HEMIARTHROPLASTY IN MANAGEMENT OF INTERTROCHANTERIC FRACTURES IN THE ELDERLY

Dr. A. Sivakanth Reddy*

M.B.B.S. 3rd year post graduate Department of Orthopaedics Santhiram Medical College & General Hospital, Nandyal*Corresponding Author

Dr. M. Mahendra Kumar Reddy

M.S. Professor & HOD Department of Orthopaedics Santhiram Medical College & General Hospital, Nandyal

Dr. P. Sujith devaprasad

D.N.B., Professor Department of Orthopaedics Santhiram Medical College & General Hospital, Nandyal

KEYWORDS :

INTRODUCTION

The incidence of hip fractures is rising due to increasing life expectancy in the elderly population. Also, mortality after proximal femur fracture is increasing with a 1-year mortality rate of 14% to 36%^[1,2]. One of the major problems with these fractures is patients not able to return to their preoperative period level of activity and independence in carrying out daily routines^[3]. 50% of these patients require assistance in their daily living activities, and 25% need to receive long-term care after treatment^[4]. Due to problems caused by these fractures and an increase in the number of the elderly population leading to a significant increase in the incidence of these fractures, it is absolutely necessary to use an effective and appropriate treatment modality for such patients. Many treatment methods have been used for the reduction of intertrochanteric fractures, including dynamic hip screw (DHS), proximal femoral nail (PFN), unipolar and bipolar hemiarthroplasty. However, it is difficult to achieve and maintain a stable fixation in elderly patients due to their poor bone quality^[5,6]. Early mobilization and prompt return to pre fracture activity levels are the main goals of surgery. The treatment of this fracture remains a challenge to the surgeon, and there is still controversy about the ideal treatment modality of hip fractures in elderly patients.

Therefore, the present study was undertaken to compare outcomes of reduction of intertrochanteric fractures using internal fixation with the use of PFN and bipolar hemiarthroplasty (BPH) in elderly patients.

MATERIALS AND METHODS

STUDY DESIGN: Hospital based retrospective study.

DURATION OF THE STUDY: This study was conducted from June 2022 to June 2024.

SAMPLE SIZE: 143 patients.

SOURCE OF THE DATA: Department of Orthopaedics, Santhiram Medical College and Hospital, Nandyal, A.P.

Exclusion criteria consisted of a history of osteoarthritis in the hip joint, pathologic fractures, bilateral fractures, age less than 65 years, rheumatoid arthritis, chronic renal failure, fractures secondary to tumor, Paget's disease or metabolic bone disease.

Patients clinical and radiographical features were evaluated at initial presentation, immediate post op and last follow-up, retrospectively. Collected data were demographics, time between injury to surgery, type of fracture according to AO classification, and the American Society of Anesthesiologists (ASA) physical status classification (ASA grade), type of surgical procedure (osteosynthesis with a proximal femoral nail or cemented or cement less bipolar hemiarthroplasty), duration of surgery, blood transfusion and complications.

In all cases, antibiotic prophylaxis was provided. Antero-posterior and lateral radiographs were obtained 24–72 hours postoperatively and were analyzed for reduction and position of the implant. For patients

treated with PFN, the patients were mobilized with quadriceps strengthening exercises on the 2nd post operative day. Partial weight bearing as tolerated or restricted weight bearing was allowed according to the surgeon's recommendation following the surgery. Full-weight bearing was allowed at 4th week for patients treated with PFN while full weight bearing was allowed in the second post operative day for patients treated with BPH. Complications were classified as varus collapse, implant related problems (lateral sliding or cut out), periprosthetic fractures, infection (deep or superficial), hip dislocation, non-union and systemic problems such as pulmonary embolism, deep vein thrombosis (DVT), cardiac ischemia, pneumonia, and urinary tract infection.

Patients were called back for a last follow-up. Thirty-six patients from the PFN group and 43 patients from the BPH group admitted to the hospital for the last follow-up. Eleven of the patients were dead, 24 of them were living at another city, 15 of them refused to admit to the hospital and the remaining 14 patients could not be reached. Clinical evaluation was made using the Mean mobility score (MMS) and Harris hip scoring system (HHS), which considers pain, walking capacity, and physical examination findings^[7]. Statistical evaluation of the data was expressed as mean (standard deviation [SD]) depending upon overall variable distribution. Normality was assessed using Shapiro Wilk test. Qualitative data was analyzed with Pearson chi-square test. The data were compared through paired samples t-test and unpaired samples t-test between the groups. Correlations were estimated Spearman's rho as appropriate. P<0.05 values were considered as significant.

RESULTS

A total of one hundred and forty-three patients meeting our study criteria comprised our study population. There was no significant difference between the PFN and BPH group in terms of demographic data, pre-existing comorbidities, preoperative MMS, fracture type, ASA classification, and mean time from injury to surgery (Table 1).

The number of patients needing blood transfusion was higher in the BPH group than in the PFN group (p<0.005). Operative details are shown in (Table 2). Details of postoperative complications are shown in (Table 3). PFN group has significantly higher reoperation times and BPH group has significantly higher one-year mortality rates (p<0.05). Differences between the two groups was statistically not significant in other parameters (p>0.05). Superficial wound infection is defined as infection of the wound, in which there is no evidence that the infection extends to the site of the implant, occurred in five patients in the BPH group and in four in the PFN group. Deep wound infection, defined as infection around the implant, occurred in two patients in the hemiarthroplasty group and treated successfully with antibiotics. There was no dislocation in the BPH group. In one case, fracture occurred below the implant and was fixated with plate and screws. In two patients, Hematoma occurred and a successful drainage was performed with no further complications. In the PFN group, there was ectopic new bone formation at the insertion point of stabilization and compression screw in only one patient without affecting the patient's condition. Revision surgery (hemiarthroplasty) was needed due to

pseudoarthrosis in four and cut-out of the implant proximally in one, and avascular necrosis in three patients.

Table 1. Preoperative data of the patients

	Proximal femoral nail group	Bipolar hemiarthroplasty group
Number of patients*	68	75
Mean age in years (SD)*	76.2 (7.9)	77.4 (8.4)
Number of men (%) *	27 (39.7%)	32 (42.6%)
Mean mobility score before fracture (SD)*	3.9 (2)	4.1 (1.7)
Mean ASA score (SD)*	2.82 (0.73)	2.77 (0.88)
Pre-existing cardio vascular disease (%) *	18 (26.5%)	19 (28.3%)
Pre-existing respiratory disease (%) *	14 (20.6%)	12 (16%)
Mean time(hours) from injury to surgery (SD)*	26.9 (10.5)	25.4 (9.3)
Fracture classification*		
3.1A.1 (%)	25 (36.7%)	30 (40%)
3.1A.2 (%)	33 (48.5%)	37 (49.3%)
3.1A.3 (%)	7 (10.2%)	8 (10.6%)

*No significant difference between proximal femoral nail and bipolar hemiarthroplasty groups (p>0.05).

Table 2. Operative details

	Proximal femoral nail group	Bipolar hemiarthroplasty group	p
Number of patients	68	75	>0.05
Operation with spinal anesthesia (%)	46 (67.6%)	54 (75%)	>0.05
Mean (SD) operation time in minutes	32.4 (7.1)	48.7 (10.2)	<0.005
Intra operative blood loss in ml	30.6 (12.5 ml)	136.5 (34.2 ml)	<0.005
Number of patients transfused (%)	6 (8.8%)	41 (54.6%)	<0.005

Table 3. Post operative complications and mortality rates

	Proximal femoral nail group	Bipolar hemiarthroplasty group
Superficial wound infection a	5	4
Deep wound infection	—	2
Pressure sores a	3	5
Pneumonia a	1	0
Thrombo-embolic complications a	4	6
Neurological complication a	1	2
Urinary tract infection a	5	3
Wound hematoma requiring drainage	—	2
Reoperation b	8 (11.7%)	2 (2.6%)
Number of one year mortality (%) b	6 (8.8%)	11 (14.6%)

a: No significant difference between proximal femoral nail and hemiarthroplasty groups (p>0.05).
b: Significant difference between the groups (p<0.05).

One-year mortality was significantly higher in the BPH group (11/75 [14.6%]) than in the PFN group (6/68 [8.8%]) (p<0.005). Hospital stay was defined as the time from admission to discharge, and it was 15.2 (10.4) days for the PFN and 17.6 (11.6) days for the BPH group without any significant difference (p>0.05). Also, there was no correlation between patients ages, ASA scores, operation time, intraoperative blood loss, and HHS (p>0.05). Thirty-six patients in the PFN group (16.1 (4.4) months follow-up) and 43 patients in the BPH group (14.8 [5.1] months follow-up) were available for a last review. There was no significant difference between the groups in terms of HHS and mean reduction in MMS scores at the last follow-up. Table 4 gives detailed functional assessment of the patients.

Table 4. Follow-up scores

	Proximal femoral nail group	Hemiarthroplasty group
Number of patients*	36	43
Length of follow-up months (SD)*	16.1(4.4)	14.8(5.1)
Harris Hip Score (SD)*	79.7(7.8)	74.7(8.8)
Mean reduction in mobility score (SD)*	1.97(1.05)	2.14(1.14)

*No significant difference between proximal femoral nail and bipolar hemiarthroplasty groups (p>0.05).

DISCUSSION

The results of this study showed that both PFN and BPH are good treatment methods with similar satisfactory postoperative functional results. Significant shorter operation time, less blood loss during operation and lower mortality rates seems to be the main advantages of internal fixation method with PFN while lower re-operation rate is the advantage of BPH for patients with intertrochanteric femur fractures. Similar to our results, studies comparing operative details have concluded that internal fixation is associated with shorter length of surgery, lower operative blood loss, and need for transfusions^[8-10]. The advantages of operative details are balanced with higher reoperation rates for internal fixation group. For the patients treated with PFN, reoperation reasons are re-displacement of the fractures, cut out of femoral head, implant breakage and nonunion. Dislocation may occur in patients treated with BPH. Reoperation rates were 11% in a prospective study performed by Saudan et al^[11]. 14.8% in a randomized study performed by Pajarinen et al^[12]. Papasimos et al^[13] found 12.5% reoperation rates as well. Our study showed high reoperation rates similar to the literature, and these patients were treated effectively by revision to bipolar hemiarthroplasty. Due to high osteoporosis rates in the elderly, we believe that internal fixation is appropriate for younger patients with proximal femur fractures. Hemiarthroplasty has a lower risk of secondary surgery for the elderly patients aged with a displaced intracapsular fracture.

The Cochrane review group has noted 28.6% pseudoarthrosis and 8.3% avascular necrosis with intracapsular femur fractures treated with internal fixation^[14]. Our results showed lower pseudoarthrosis (7.3%) and avascular necrosis rates (4.4%). This would be related to short time period from injury to surgery.

Studies have concluded that cementless hemiarthroplasty is preferred over cemented hemiarthroplasty because of reduced operation time and intra-operative blood loss and lower perioperative mortality rate^[15, 16]. For the ideal internal fixation method, a meta-analysis performed by Zhang et al. has concluded that PFN may be a better choice than DHS in the treatment of intertrochanteric fractures^[17]. In a study of one hundred consecutive patients treated with PFN, Korkmaz et al. have concluded that PFN is a reliable fixation method for proximal femur fractures^[18]. In another meta-analysis of randomized controlled trials, Huang et al. have concluded that PFN fixations shows the same effectiveness as DHS fixation^[19].

According to these studies and meta-analyses, we performed cementless hemiarthroplasty for arthroplasty group and preferred PFN for the internal fixation method. There were no statistically significant differences between the two groups in medical complications such as pressure sores, pneumonia, thromboembolic complications, and neurologic complications reported in a systematic review published by Parker et al^[20]. Moreover, length of hospital stay was similar between the internal fixation and hemiarthroplasty group^[9,21].

In our study, similar to the literature, we found no significant difference between the groups in terms of postoperative medical complications and length of hospital stay as shown in Table 3. In our study, one-year mortality rates were significantly lower in the PFN group than the BHA group. The BHA group was slightly older than the PFN group (77.4 vs 76.2, p>0.05) but this non significant difference may not be related to higher mortality results as both groups had similar comorbidities and preoperative HHS and MMS. Karaman et al. have concluded many factors such as age, ASA score, preoperative comorbidities, type of anesthesia affects the mortality rates but these are similar for the PFN and BPH group in our study^[22]. Our findings are supported by Davison et al. and Kapicioglu et al. who have reported higher mortality rates for arthroplasty group than internal fixation^[23, 24]. On the contrary, other studies found no difference in mortality between internal fixation and

arthroplasty^[25, 26]. There are several limitations to this study. Retrospective nature, small patient group and mid-term follow-up are the main limitations. Long-term analyses were not possible because of short life expectancy in elderly patients. All procedures were not performed by the same surgeon which can lead to a variance in the results. However, usage of the same implants, operating room and fluoroscopy can be considered as advantages of this study.

In conclusion, both PFN and BPH appear to produce satisfactory outcomes in surgically treated proximal femur fractures. Both groups are associated with their own complications, but although internal fixation with PFN had higher reoperation rates, it's less surgery related trauma and lower mortality rates are main advantages. Therefore, the clinician should choose the ideal method for each individual patient, but we think internal fixation may be the effective and appropriate treatment modality for elderly patients with extra capsular proximal femur fractures.

REFERENCES

1. Vestergaard P, Rejnmark L, Mosekilde L. Has mortality after a hip fracture increased? *J Am Geriatr Soc* 2007;55:1720–6. Cross Ref
2. Kesmezacar H, Ayhan E, Unlu MC, Seker A, Karaca S. Predictors of mortality in elderly patients with an intertrochanteric or a femoral neck fracture. *J Trauma* 2010;68:153–8. Cross Ref
3. Blomfeldt R, Tömkvist H, Eriksson K, Söderqvist A, Ponzer S, Tidermark J. A randomised controlled trial comparing bipolar hemiarthroplasty with total hip replacement for displaced intracapsular fractures of the femoral neck in elderly patients. *J Bone Joint Surg Br* 2007;89:160–5.
4. Lu-Yao GL, Keller RB, Littenberg B, Wennberg JE. Outcomes after displaced fractures of the femoral neck. A meta-analysis of one hundred and six published reports. *J Bone Joint Surg Am* 1994;76:15–25.
5. Seyfettinoğlu F, Ersan O, Kovalak E, Duygun F, Ozsar B, Ateş Y. Fixation of femoral neck fractures with three screws: results and complications. *Acta Orthop Traumatol Turc* 2011;45:6–13. Cross Ref
6. Bhandari M, Devereaux PJ, Swiontkowski MF, Tornetta P 3rd, Obremskey W, Koval KJ, et al. Internal fixation compared with arthroplasty for displaced fractures of the femoral neck. A meta-analysis. *J Bone Joint Surg Am* 2003;85:1673–81.
7. Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fractures: treatment by mold arthroplasty. An end-result study using a new method of result evaluation. *J Bone Joint Surg Am* 1969;51:737–55.
8. Parker MJ, Khan RJ, Crawford J, Pryor GA. Hemiarthroplasty versus internal fixation for displaced intracapsular hip fractures in the elderly. A randomised trial of 455 patients. *J Bone Joint Surg Br* 2002;84:1150–5.
9. Parker MJ, Pryor GA. Internal fixation or arthroplasty for displaced cervical hip fractures in the elderly: a randomised controlled trial of 208 patients. *Acta Orthop Scand* 2000;71:440–6. Cross Ref
10. Puolakka TJ, Laine HJ, Tarvainen T, Aho H. Thompson hemiarthroplasty is superior to Ullevaal screws in treating displaced femoral neck fractures in patients over 75 years. A prospective randomized study with two-year follow-up. *Ann Chir Gynaecol* 2001;90:225–8.
11. Saudan M, Lübcke A, Sadowski C, Riand N, Stern R, Hoffmeyer P. Ptertrochanteric fractures: is there an advantage to an intramedullary nail?: a randomized, prospective study of 206 patients comparing the dynamic hip screw and proximal femoral nail. *J Orthop Trauma* 2002;16:386–93.
12. Pajarinen J, Lindahl J, Michelsson O, Savolainen V, Hirvensalo E. Ptertrochanteric femoral fractures treated with a dynamic hip screw or a proximal femoral nail. A randomised study comparing post-operative rehabilitation. *J Bone Joint Surg Br* 2005;87:76–81.
13. Papasimos S, Koutsojannis CM, Panagopoulos A, Megas P, Lambiris E. A randomised comparison of AMBI, TGN and PFN for treatment of unstable trochanteric fractures. *Arch Orthop Trauma Surg.* 2005;125:462–8. Cross Ref
14. Masson M, Parker MJ, Fleischer S. Internal fixation versus arthroplasty for intracapsular proximal femoral fractures in adults. *Cochrane Database Syst Rev* 2006;4:CD001708.
15. Ng ZD, Krishna L. Cemented versus cementless hemiarthroplasty for femoral neck fractures in the elderly. *J Orthop Surg (Hong Kong)* 2014;22:186–9.
16. Cankaya D, Ozkurt B, Tabak AY. Cemented calcar replacement versus cementless hemiarthroplasty for unstable intertrochanteric femur fractures in the elderly. *Ulus Travma Acil Cerrahi Derg* 2013;19:548–53. Cross Ref
17. Zhang K, Zhang S, Yang J, Dong W, Wang S, Cheng Y, et al. Proximal femoral nail vs. dynamic hip screw in treatment of intertrochanteric fractures: a meta-analysis. *Med Sci Monit* 2014;20:1628–33. Cross Ref
18. Korkmaz MF, Erdem MN, Disli Z, Selcuk EB, Karakaplan M, Gogus A. Outcomes of trochanteric femoral fractures treated with proximal femoral nail: an analysis of 100 consecutive cases. *Clin Interv Aging* 2014;9:569–74. Cross Ref
19. Huang X, Leung F, Xiang Z, Tan PY, Yang J, Wei DQ, et al. Proximal femoral nail versus dynamic hip screw fixation for trochanteric fractures: a meta-analysis of randomized controlled trials. *ScientificWorldJournal* 2013;2013:805805. Cross Ref
20. Parker MJ, Handoll HH. Replacement arthroplasty versus internal fixation for extracapsular hip fractures. *Cochrane Database Syst Rev* 2000;2:CD000086.
21. van Dortmont LM, Douw CM, van Breukelen AM, Laurens DR, Mulder PG, Wereldsma JC, et al. Cannulated screws versus hemiarthroplasty for displaced intracapsular femoral neck fractures in demented patients. *Ann Chir Gynaecol* 2000;89:132–7.
22. Karaman Ö, Özkazanlı G, Orak MM, Mutlu S, Mutlu H, Çalışkan G, et al. Factors affecting postoperative mortality in patients older than 65 years undergoing surgery for hip fracture. *Ulus Travma Acil Cerrahi Derg* 2015;21:44–50. Cross Ref
23. Davison JN, Calder SJ, Anderson GH, Ward G, Jagger C, Harper WM, et al. Treatment for displaced intracapsular fracture of the proximal femur. A prospective, randomised trial in patients aged 65 to 79 years. *J Bone Joint Surg Br* 2001;83:206–12. Cross Ref
24. Kapiçioğlu M, Ersen A, Sağlam Y, Akgul T, Kizilkurt T, Yazıcıoğlu O. Hip fractures in extremely old patients. *J Orthop* 2014;11:136–41. Cross Ref
25. Johansson T, Jacobsson SA, Ivarsson I, Knutsson A, Wahlström O. Internal fixation versus total hip arthroplasty in the treatment of displaced femoral neck fractures: a prospective randomized study of 100 hips. *Acta Orthop Scand* 2000;71:597–602. Cross Ref
26. Rogmark C, Carlsson A, Johnell O, Sernbo I. A prospective randomised trial of internal fixation versus arthroplasty for displaced fractures of the neck of the femur. Functional outcome for 450 patients at two years. *J Bone Joint Surg Br* 2002;84:183–8. Cross Ref