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Cementless Extensive Porous-Coated Mono-block Long Stem Hemiarthroplasty versus Proximal femoral Nail for Unstable Osteoporotic Intertrochanteric Fracture in the Elderly Patients: a retrospective study

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Abstract

Introduction: The treatment for unstable intertrochanteric fractures in the elderly patient has always been controversial. The aim of this study was to compare the outcome of porous coated cementless mono-block long stem hemiarthroplasty (CPH) and proximal femoral nail (PFN) on unstable intertrochanteric femoral fracture in the elderly patients.

Methods: From March 2017 and March 2020, 132 elderly patients with unstable femoral intertrochanteric fractures were treated by CPH or PFN. 73 patients were treated using proximal femoral nail (PFN) and 59 were treated using hemiarthroplasty (CPH). Bleeding amount, weight training time, hospitalization time, Harris scores, one-year mortality, pre-existing disease and postoperative complications were analyzed.

Results: The average follow-up time was 23.2 months in the CPH group and 22.9 months in the PFN group. No significant differences was found between the two groups in terms of demographic data. There was no significant differences between the two groups regarding the ASA score, pre-existing disease, postoperative complications, and revision surgery. The mean operation time and the average amount of blood loss were significantly higher in the CPH group ($p<0.05$).

Conclusion: Both PFN and CPH are two satisfactory methods for treating the elderly with unstable IT fractures but in the CPH group, early postoperative mobilization and decreased dependency are the primary advantages.

Key word: unstable intertrochanteric fracture, long stem hemiarthroplasty, osteoporosis, proximal femoral nail, Harris hip score

Introduction

Unstable intertrochanteric hip fracture in the elderly population is a significant public health problem due to its increasing rate [1]. In the elderly population, intertrochanteric (IT) hip fractures account for approximately 50–55% of all hip fractures [2], and 60–70% of intertrochanteric hip fractures are of an unstable form [3]. Therefore, the successful management of unstable IT fracture (IF) in elderly patients may result in early recovery of functionality, low revision rate and lower mortality rate.

Elderly patients are frequently affected by additional diseases such as diabetes, osteoporosis, chronic lung disease and hypertension; hence, hip fractures in these patients often result in low surgical tolerance and a poor general condition. Therefore, they are prone to complications from bed rest after operation. Currently, the optimal treatment option for unstable IF in elderly patients remains controversial. Some authors have shown satisfactory results in the treatment of unstable IF with proximal femoral nail (PFN) [4]. However, the failure rate with internal fixation in the treatment of unstable IF has been reported to be approximately 50% [3]. Many treatment options, such as bipolar hemiarthroplasty, PFN and dynamic hip screw (DHS) were used in the treatment of unstable IF femoral fractures [5,6]. However, due to decreased bone quality in the elderly patients, it is hard to achieve stable fixation in the treatment of unstable osteoporotic IF. Immediate postoperative weight-bearing, lack of risk of complications related to lag screws or fracture nonunion are the advantages of hemiarthroplasty over internal fixation [5]. In recent years, Feehan et al.

reported that cementless bipolar hemiarthroplasty (CPH) could be used for unstable IF, and that it allowed early exercise [7].

We aimed to compare the functional results, and intraoperative and postoperative complications of patients over 75 years of age with unstable osteoporotic intertrochanteric hip fractures, treated with CPH and PFN.

Materials and methods

This retrospective study was approved by the Institutional Review Board and patients' informed consent was obtained for this study. The current study included 132 patients aged 75 years or older who were diagnosed with an unstable IF between March 2017 and March 2020. CPH was performed in 59 patients and IMN was performed in 73 patients (Figures 1 and 2). Inclusion criteria were as follows: patients over 75 years, patients with severe osteoporosis (T < -2.5 SD), patients with an unstable IF (type A2.2–A2.3 according to the AO/OTA classification) treated with CPH or PFN. Exclusion criteria were: pathological fractures, bilateral fractures, age < 75 years, mental disorders, multiple organ dysfunctions and polytrauma. Patients were allocated into two groups according to the surgical method. Before choosing, patients were informed about both surgical treatment options. The radiographic and clinical features of the patients were evaluated preoperatively on first admission, postoperatively at 3, 6 and 12 months, and at the last follow-up retrospectively. Demographic data, time from injury to surgery, operation time, weight training time, hospital stay, surgical method (uncemented CPH or PFN with osteosynthesis), American physical condition classification (ASA), amount of intra-operative bleeding, type of fracture (according to AO/ASIF), blood transfusion, postoperative mortality rates, and complications were recorded.

For the patients in both groups, enoxaparin was started to prevent deep vein thrombosis. Second generation cephalosporin (cefazolin sodium) antibiotic prophylaxis was given 48 h postoperatively to prevent infection. For patients treated with PFN, partial weight-bearing was started on the first postoperative day with a crutch walker and full weight bearing allowed based on fracture healing at an average of 6 weeks. After 3 to 6 months, patients gradually started walking without a walker depending on their fracture healing status. For patients treated with CPH, full weight-bearing was allowed with the help of a walker on the day after surgery. On the first day after operation, passive and active functional exercise was started.

The patients were followed up at 6 weeks, 3, 6 and 12 months, and every year thereafter postoperatively. Complications were analysed, such as venous thromboembolism, bedsores, superficial infection, hip dislocation, cut-out, cut-through, deep infection or nonunion. For the clinical assessment, the Harris Hip Score (HHS) was measured at the last follow-up [8].

Figure 1. (a) Anteroposterior radiograph showing an unstable intertrochanteric fracture (type A2.2 according to AO classification) of the left hip in a 90-year-old female who fell at the ground level at home. She was treated with left cementless bipolar hemiarthroplasty (CPH). **(b, c)** Anterior-posterior and lateral x-ray examination one years after the operation showed that the femoral head prosthesis in a good position, with no loosening or dislocation.

Figure 2. (a) Anteroposterior radiograph showing an unstable intertrochanteric fracture (type A2 according to AO classification) of the right hip in a 81-year-old male who fell at the ground level at home. Proximal femoral nail (PFN) applied to the patient. **(b, c)** Anterior posterior and lateral hip radiography at the sixth postoperative month of the patient and shows a united fracture and without loosening or leakage of internal fixation.

Statistical evaluation

Data were analysed using the medical statistics software SPSS 22.0, and descriptive data were specified as the mean ± standard deviation (SD). Student's t test was used for the numerical data and the Mann Whitney

U test was used for analysing quantitative data. The X^2 test was used to analyse count data and the observed difference was considered to be significant if the p value was < 0.05.

Results

A total of 59 and 77 patients in the CPH and PFN groups, respectively, participated in this retrospective study. The mean follow-up time was 23.2 and 22.9 months in the CPH and PFN groups, respectively. The mean age of patients who underwent CPH was 89.4 years (range, 76–102 years), of which 31 (52.5%) were male and 28 (47.5%) were female. The mean age of patients in the PFN group was 88.1 years (range, 75–99 years), of which 31 (42.5%) were male and 42 (57.5%) were female. No difference was observed in demographic data and ASA scores between the CPH and PFN groups (p > 0.05) (Table 1).

Table1. **Demographic data of CPH and PFN in treating unstable intertrochanteric fractures in the elderly (x ±s)**

	CPH group(n=59)	PFN group(n=73)	P value
Age (years)	89,4±5,4	88,1±6,	0,218
Gender	n; %	n; %	
0.249			
Male	31; 52.5	31; 42.5	
Female	28; 47.5	42; 57.5	
ASA grade			
2	21; 35.6	18; 24.7	0.171
3	38; 64.4	55; 75.3	
AO classification			
TipA2.2	32; 54.2	38; 52.1	0.426
TipA2.3	27; 45.8	35; 47.9	
Comorbidity			
No	19; 32.2	16; 21.9	0.
805			
Yes	40; 67.8	57; 78.1	
Mean ± SD (Median)			

ASA, American Society of Anesthesiologists

According to the AO fracture classification, there were 32 (54.2%) type A2.2 and 27 (45.8%) type A2.3 fractures, and 38 (52.1%) type A2.2 and 35 (47.9%) type A2.3 fractures in the CPH and PFN groups, respectively, with no significant difference (p > 0.05).

In the CPH group, 40 (67.8 %) patients had comorbid diseases and in the PFN group, 57 (78.1%) patients had comorbid diseases, with no statistically significant difference observed (p > 0.05) (Table 1).

The mean operation time was 70.6 ± 10 min in the CPH group and 48.3 ± 9.0 min in the PFN group. In the CPH group, the operation time was higher than in the PFN group, showing a significant difference (p < 0.05) (Table 2). The mean amount of bleeding was 544.5 ± 18 mL and 122.7 ± 48 mL in the CPH and PFN groups, respectively, and the difference was significant (p < 0.05) (Table 2). The average hospitalization time was 8.81 days in the CPH group and 6.97 days in the PFN group, with no significant difference (p > 0.05). The mean time from first admission to surgery was 2.6 ± 0.9 days and 2.5 ± 0.8 days in the CPH and PFN groups, respectively, with no statistically significant difference (p > 0.05).

The average follow-up time was 23.23 ± 6.1 months and 22.97 ± 5.9 months in the CPH and PFN groups, respectively, with no statistically significant difference (p > 0.05).

Revision surgery was performed in nine (15.3%) patients in the CPH group and 12 (15.4%) patients in the PFN group. No statistically significant difference was observed between the two groups (p > 0.05) (Table 2).

Table2. **Operative data and clinical efficacy of CPH and PFN in treating unstable intertrochanteric fractures in the elderly (x ±s)**

	Mean ±SD		
	CPH group	PFN group	P value
Operation time (min)	70.6± 10	48.3± 9.0	<0.05

Bleeding amount (ml)	544.5± 18	122.7± 48	<0.05
Hospital stay (day)	8.81± 1.6	6.97± 2.0	
0.103			
Harris score	58.5±9.4	72.9± 9.0	
<0.05			
Weight training time(day)	2.66±0.7	28.6±4.1	
<0.05			
Average follow-up time (month)	23.23±6.1	22.97±5.9	
0.803			
Time to surgery (day)	2.6 ± 0.9	2.5±0.8	
0.470			
	n; (%)	n; (%)	
Death	17; 28,8	11; 14,1	
0.194			
Revision	9; 15,3	12; 15,4	
0.331			
One-year mortality			
7; 11,9	6; 8,2	0.319	

Mean ± SD (Median)

One-year mortality was 11.9% (seven patients) in the CPH group and 8.2% (six patients) in the PFN group, with no significant difference found between the groups ($p > 0.05$) (Table 2). The Harris hip score (HHS) was 58.5 ± 9.4 and 72.9 ± 9.0 in the CPH and PFN groups, respectively, and the difference was significant ($p < 0.05$). Postoperative complications were seen in 15 (25.5%) patients in the CPH group (five urinary tract infections, two thromboembolisms, two superficial wound infections, three cases of bedsores and three pulmonary infections) and in 11 (13.1%) patients in the PFN group (four urinary tract infections, three deep vein thromboses, one wound infection, two pulmonary infections and one cases of bedsores); no significant difference was found between the two groups ($p > 0.05$) (Table 3).

Table3. **Perioperative comorbidities and Postoperative complications**

	CPH group	PFN group	p value
Pre-existing disease(n)			0.805
Cardiovascular disease	22	26	
Diabetes mellitus	26	32	
Respiratory disease	17	19	
Neurological disease	11	14	
None	9	16	
Postoperative complications(n)	n(%)	n(%)	
Urinary tract infection	5 (8.5)	4 (5.1)	
Pulmonary infection	3 (5.1)	2 (2.6)	
Deep vein thrombosis	2 (3.4)	3 (3.8)	
Bedsore	3 (5.1)	1 (1.3)	
Wound infection	2 (3.4)	1 (1.3)	
Total	15(25.5)	11(13.1)	0.120

Discussion

The main findings of the present study were: (1) lower operation time, lower bleeding, superior functional outcomes and longer weight bearing time in the PFN group; and (2) earlier weight bearing ambulation time in the CPH group.

The goal of treatment of hip fracture in the elderly patients is to prevent the complications of recumbency and achieve immediate postoperative mobilization [9].

The treatment of unstable osteoporotic femoral IF is a clinical challenge. IFs account for 3.6% of all limb fractures in the elderly population [10]. Elderly patients often have osteoporotic bones and poor fracture

healing. After the surgery, early ambulation can be difficult, and the postoperative complications and mortality are high owing to combined disease [11]. Objective and meticulous preoperative assessments are needed for the development of a rational treatment strategy [12]. Widely used IF treatments include plate fixation (DCS, DHS), intramedullary fixation (PFN, gamma nail) and CPH. Some studies have suggested PFN and CPH suitable options for the treatment of unstable osteoporotic IFs [13,14]. PFN can provide safe biomechanical outcomes and result in reliable fixation, making it a favoured method for treatment of IF [15]. However, many problems are associated with osteosyntheses of unstable IF in elderly patients, such as loss of fixation, pseudarthroses, excessive collapse, cut-out of the lag screw and delayed postoperative weight-bearing. Also, some authors have reported that the use of PFN in the treatment of IF has a failure rate of 7.1–12.5% [16,17]. In order to achieve earlier weight-bearing, some surgeons have suggested a long stem prosthesis hemiarthroplasty for the treatment of unstable IF [18,19]. Prosthetic replacement can rapidly recover hip function to the preoperative condition [20].

Zhou et al. [21] compared two groups that underwent hemiarthroplasty and osteosyntheses in the treatment of elderly patients, showing no statistically significant differences between the groups in terms of types of fractures and ASA scores. These results were similar to those found in our research.

In this study, additional diseases were found in 78.1% and 67.8% of the patients in the PFN and CPH groups, respectively, with no significant differences between the groups. It has been stated in the literature that the distribution of comorbidities in the patients is similar for both the PFN and CPH groups [22,23].

Kim et al. [24] compared two groups who underwent hemiarthroplasty and osteosyntheses, finding that the operation times and the amount of bleeding were significantly higher in the hemiarthroplasty group compared to the osteosyntheses group. In the current study, the operation times and the amount of bleeding were significantly higher in the CPH group. Also, the mean length of hospital stay was 8.8 days and 6.9 days in the CPH group and PFN group, respectively, with no significant difference. Zhou et al. [21] also reported that there was no significant difference in hospital stay and pre-operative hospitalization time between the PFN and CPH groups.

This study shows that the postoperative weight bearing time in the PFN group was significantly longer than that of the CPH group ($p < 0.05$). No statistically significant difference was found between the groups in terms of the Harris Hip Score and postoperative complications at one year postoperatively. Lou et al. [24] also found similar results to those of our research.

In the current study, complications requiring revision surgery developed in nine (15.3%) and 12 (15.4%) patients in the CPH and PFN groups, respectively, and there was no difference between the two groups.

In the present study, no significant difference was observed between the groups with respect to the one-year mortality rate.

In this study we found that the HHS in the PFN group was significantly higher than that in the CPH group ($p < 0.05$). Jolly et al. [22] also found similar results to those of our research.

PFN and CPH are suitable options in the treatment of unstable IF, but we recommend CPH for the treatment of severe comminuted IFs, especially in patients with severe osteoporosis and incapability to tolerate long-term bed rest.

Our study has some limitations. First, it is a retrospective study. Second, it has a small sample size, and long-term follow-up is unlikely in elderly patients (the mean age was 88.1 years in our study) due to their short life expectancy.

Conclusion

PFN and CPH are two satisfactory methods for the treating elderly patients with unstable IT fractures. Both treatments can result in reduction of pain, stable fixation and recovery of hip function; however, in the CPH group, immediate postoperative mobilization and decreased dependency are the main advantages.

References

1. Duriez P, Devaux T, Chantelot C, et al.(2016) Is arthroplasty preferable to internal fixation for the treatment of extracapsular fracture of the upper femur in the elderly? Orthop Traumatol Surg Res; 102(6): 689–694.
2. Zuckerman JD (1996) Hip fracture. N Engl J Med. 334:1519-25.

3. Lindskog DM, Baumgaertner MR (2004) Unstable intertrochanteric hip fractures in the elderly . J Am Acad Orthop Surg. 12:179-90.
4. Kim SH, Meehan JP, Lee MA. (2013) Surgical treatment of trochanteric and cervical hip fractures in the United States: 2000-2009. J Arthroplast. 28:1386–90.
5. Fichman SG, Mäkinen TJ, Safir O, Vincent A, Lozano B, Kashigar A, Kuzyk PR (2016) Arthroplasty for unstable pertrochanteric hip fractures may offer a lower re-operation rate as compared to cephalomedullary nailing. Int Orthop. 40:15-20.
6. Gupta KL (2020) Comparative assessment of primary and secondary outcome with PFNA and hemiarthroplasty for senile intertrochanteric fractures management: a prospective randomized clinical study. Int J Med Biomed Stud. 4:205-8.
7. Feehan LM, Tang CS, Oxland TR.(2007) Early controlled passive motion improves early fracture alignment and structural properties in a closed extra-articular metacarpal fracture in a rabbit model. J Hand Surg Am. 32:200–8.
8. Harris WH (1969) 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. 51:737-55.
9. Socci AR, Casemyr NE, Leslie MP, et al. (2017) Implant options for the treatment of intertrochanteric fractures of the hip: rationale, evidence, and recommendations. J Bone Joint ;99:128–33.
10. Kokoroghiannis C, Aktselis I, Deligeorgis A, Fragkomichalos E, Papadimas D, Pappadas I (2012) Evolving concepts of stability and intramedullary fixation of intertrochanteric fractures – a review. Injury. 43:686-93.
11. Gaumetou E, Zilber S, Hernigou P: Non-simultaneous bilateral hip fracture: epidemiologic study of 241 hip fractures. Orthop Traumatol Surg Res. 2011, 97:22-7.
12. Han SK, Lee BY, Kim YS, Choi NY.(2010) Usefulness of multi-detector CT in Boydgriffin type 2 intertrochanteric fractures with clinical correlation. Skelet Radiol. 39:543-9.
13. Setiobudi T, Ng YH, Lim CT, Liang S, Lee K, Das DS. (2011) Clinical outcome following treatment of stable and unstable intertrochanteric fractures with dynamic hip screw. Ann Acad Med Singap.40:482–7.
14. Li J, Chen JK, Zhou K, Shen B, Ni XM, Chen L. (2011) Application of dynamic hip screw with modified reamer in intertrochanteric fracture in the elderly. Zhongguo Gu Shang. 24:362–5.
15. Yang YH, Wang YR, Jiang SD, Jiang LS. (2013) Proximal femoral nail antirotation and third-generation gamma nail: which is a better device for the treatment of intertrochanteric fractures. Singap Med J. 54:446–50.
16. Papasimos S, Koutsojannis CM, Panagopoulos A, Megas P, Lambiris E. (2005) A randomised comparison of AMBI, TGN and PFN for treatment of unstable trochanteric fractures. Arch Orthop Trauma Surg. 125:462–8.
17. Boldin C, Seibert FJ, Fankhauser F, Peicha G, Grechenig W, Szyszkowitz R.(2003) The proximal femoral nail (PFN)--a minimal invasive treatment of unstable proximal femoral fractures: a prospective study of 55 patients with a followup of 15 months. Acta Orthop Scand. 74:53–8.
18. Broos PL, et al. (1991) Pertrochanteric fractures in the elderly. Is the Belgian VDP prosthesis the best treatment for unstable fractures with severe comminution? Acta Chir Belg. 91:242-9.
19. Green S, Moore T, Proano F.(1987) Bipolar prosthetic replacement for the management of unstable intertrochanteric hip fractures in the elderly. Clin Orthop Relat. 224:169-77.
20. Emami M, Manafi A, Hashemi B, Nemati A, Safari S.(2013) Comparison of intertrochanteric fracture fixation with dynamic hip screw and bipolar hemiarthroplasty techniques. Arch Bone Jt Surg. 1:14–7.
21. .Zhou S, Liu J, Zhen P, et al.(2019) Proximal femoral nail anti-rotation versus cementless bipolar hemiarthroplasty for unstable femoral intertrochanteric fracture in the elderly: a retrospective study. BMC Musculoskelet Disord. 20:500.
22. Jolly A, Bansal R, More AR, Pagadala MB (2019) Comparison of complications and functional results of unstable intertrochanteric fractures of femur treated with proximal femur nailsandcementedhemiarthroplasty.JClinOrthopTrauma.10:296-301.

23. Kesmezacar H, Oğüt T, Bilgili MG, Gökay S, Tenekecioğlu Y (2005) [Treatment of intertrochanteric femur fractures in elderly patients: internal fixation or hemiarthroplasty]. Acta Orthop Traumatol Turc. 39:287-94.