

RESEARCH ARTICLE

Comparison of Intertrochanteric Fracture Fixation with Dynamic Hip Screw and Bipolar Hemiarthroplasty Techniques

Mohamad Emami, MD; Alireza Manafi, MD; Behrooz Hashemi, MD; Ali Nemati, MD; Saeed Safari, MD

Research performed at Shahid Beheshti University of Medical Sciences, Tehran, Iran

Received: 16 July 2013

Accepted: 11 September 2013

Abstract

Background: At present, there is no consensus on an appropriate treatment modality for intertrochanteric fractures in the elderly with background diseases. The aim of the present study was to compare treatment outcomes of intertrochanteric fractures reduced with dynamic hip screws (DHS) and bipolar hemiarthroplasty in elderly patients with background medical conditions.

Methods: In this randomized clinical trial, 60 patients with intertrochanteric fractures, who were 45-60 years old, were randomly divided into DHS and bipolar groups. After treatment, the two groups were compared in relation to complications and mortality rates, functional status using the Harris Hip Score (HHS), range of movement and severity of pain using the visual analogue score (VAS).

Results: HHS (86 ± 9 vs. 75 ± 7.6), range of flexion (105 ± 11 degrees vs. 90 ± 17 degrees) and external rotation (35 ± 7 degrees vs. 20 ± 7 degrees) were significantly higher in the bipolar group compared to the DHS group ($P < 0.05$). However, there were no significant differences in pain severity between the two groups.

Conclusion: Reduction of intertrochanteric fractures in elderly patients with background medical conditions is more effective and less problematic with the bipolar technique compared to DHS and is better tolerated by patients, because this technique is associated with improvements in functional status and hip joint movement range.

Keywords: Intertrochanteric fracture, Bipolar hemiarthroplasty, Dynamic hip screw

Introduction

Hip fractures, including intertrochanteric fractures (ITF), due to falls are one of the most common orthopedic problems in the elderly and inflict heavy financial tolls on orthopedic treatment centers (1, 2). Although reliable statistics are not available in relation to the incidence of this fracture in Iran, patients with these fractures occupy almost 20% of orthopedic hospital beds in the United Kingdom (2). The extent of the problem is manifested by the fact that based on a report by the Royal College of Physicians in the United Kingdom, the annual incidence of hip fractures in the United Kingdom will amount to 117,000 cases in 2016 (1). In addition, it is estimated that the number of these fractures is 1.26 million cases annually worldwide, which is expected to amount to 2.6 million cases in 2025 and to 4.5 million cases in 2050 (3). In fact, there is an increase in the incidence of these fractures in correlation with the aging of the population, especially

at age brackets of over 50 and the odds are doubled with a 10-year increase in age (4, 5). In addition, one of the major problems with these fractures is the rate of patients' return to their preoperative period level of activity and independence in carrying out daily routines (6). After suffering one of these fractures, 50% of these patients require assistance in their daily living activities and 25% should receive long-term care (7).

Reduction of intertrochanteric fractures poses great problems and challenges for orthopedic surgeons due to the special blood supply system of the femoral neck, its anatomic structure and its functional and biomechanical characteristics. Due to problems caused by these fractures and an increase in the number of elderly persons, which leads 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. Various treatment modalities have been introduced to date for the

Corresponding Author: Alireza Manafi, Department of Orthopedic Surgery, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
Email: drmanafi54@yahoo.com



THE ONLINE VERSION OF THIS ARTICLE
ABJS.MUMS.AC.IR

reduction of intertrochanteric fractures, including DHS, proximal femoral nail, bipolar hemiarthroplasty, trochanteric fixation nail (TNF) and external fixation, all of which have their specific advantages and disadvantages (8,9).

Generally, the aims and treatment modalities of intertrochanteric fracture reductions are different in young and elderly patients. These fractures usually occur as a result of high-energy traumas in young individuals and are associated with severe traumas to other organs (4). However, such fractures occur in the elderly due to low-energy traumas and quality (2,10,11). Moreover, there is no consensus in relation to the use of hemiarthroplasty and internal fixation in elderly patients with background medical conditions. Treatment should be defined on an individual basis, depending on fracture pattern, dislocation, activity prior to fracture, level of independence in personal daily activities and the general health status of each patient (4,10,12). Therefore, the present study was undertaken to compare outcomes of reduction of intertrochanteric fractures using internal fixation with the use of dynamic hip screws (DHS) and bipolar hemiarthroplasty in elderly patients with background medical conditions.

Materials and Methods

Sixty elderly patients, 45–65 years of age, who had sustained intertrochanteric fractures (Boyd and Griffin types I and II) were enrolled in this randomized clinical trial. The patients were randomly assigned to DHS or bipolar hemiarthroplasty groups on the condition that they met the inclusion criteria and signed an informed written consent form. Inclusion criteria consisted of the presence of underlying comorbidities, fracture of the intertrochanteric and the ability to walk without assistance before their fracture. Exclusion criteria consisted of a history of osteoarthritis in the hip joint, pathologic fractures, bilateral fractures, and femoral neck fractures located other than the base of the neck. Clinical and radiographic examinations were undertaken upon the patients' arrival at the hospital emergency unit. After the fracture of the intertrochanteric was confirmed and the inclusion criteria were met, the patients were asked to sign an informed written consent form in order to be included in the study. Then the patients were randomly assigned either to the DHS or the bipolar group. During the randomization process the patients were consecutively and alternately assigned to one of the two groups until the population size was achieved in each group. Next, background data, including age, gender, type of the fracture and mechanism of the fracture, and surgical information, including the duration of surgery and possible intra-operative complications were collected. Patients in the bipolar group were treated with distal fitting stems (Stryker Corp., USA). Moreover, all of the patients in both group were treated by one surgeon. After surgery, the patients were visited on a routine basis every week, consisting of clinical and radiographic examinations, until complete recovery. Mean follow up in intertrochanteric fractures was 15.7 ± 2.5 and for the bipolar group it was 16.5 ± 3.3 . Other postoperative data, including mortality, rate of fixation loss, incidence of complications such as infection and deep vein thrombosis, time needed for the healing of the fracture, severity of pain using VAS, the extent of hip joint movement and the time required to return to work, were collected. During the final visit of each

patient, HHS and a 12-question questionnaire were used to evaluate the clinical and functional status and quality of life. Finally, the two groups were compared in relation to the data collected. SPSS version 16 (SPSS Inc., Chicago, IL, USA) software was used for data analysis. Independent t-test, Mann-Whitney U, Chi-squared and Fisher's tests were used for descriptive and deductive statistics.

Results

The background and demographic data of patients are presented in Table 1, demonstrating no statistically significant differences between the two groups.

Table 1. Comparison of demographic and background data of the subjects in the two study groups

Group	Bipolar (n=30)	DHS (n=30)	P-value
Age (mean)	54.5	56	0.53
Sex	Male	12	0.361
	Female	18	
Type of fracture	I	17	0.598
	II	13	
Follow-up (month)	16.5 ± 3.3	15.7 ± 2.5	0.277

The means of HHS in the bipolar and DHS groups were 86 ± 9 and 75 ± 11 , respectively, with statistically significant differences between the two groups ($P < 0.001$). The results of comparison of movement ranges of the hip joints between the two groups are presented in Table 2, demonstrating significantly higher flexion and external rotation in the bipolar group ($P < 0.05$). No significant differences were observed in pain severity between the two groups (2.9 and 3.4 in the bipolar and DHS groups, respectively) ($P = 0.251$).

Table 2. Comparison of active movement ranges between the two groups

Group	Bipolar (n=30)	DHS (n=30)	P-value
Flexion (degree)	105 ± 10	90 ± 8	0.041
Abduction (degree)	30 ± 7	30 ± 6	>0.05
Adduction (degree)	18 ± 8	15 ± 5	>0.05
Internal rotation (degree)	28 ± 9	23 ± 5	>0.05
External rotation (degree)	35 ± 6	20 ± 6	0.037

In the present study, the subjects in the bipolar group had full weight bearing (FWB) 3 days after surgery; however, the subjects in the DHS group had full weight bearing (FWB) 4–6 weeks after surgery. No cases of infection, deep vein thrombosis, prosthetic insufficiency or fracture of the prosthesis were seen in any of the two groups. However, two subjects died due to cardiac complications in the bi-

polar group after 1 year. In the DHS group, 3 patients had screw cut-off, two of whom became wheelchair-bound.

Discussion

Nearly half of all hip fractures are intertrochanteric fractures. Even though fixation with the DHS device has been the gold standard treatment for stable intertrochanteric fractures, there are many complications reported for unstable intertrochanteric fractures (3-26 %) (13-15). Moreover, the therapeutic results of intertrochanteric fractures fixation with bipolar hemiarthroplasty have not yet been determined, exactly.

Currently, the preferred treatment for elderly patients with underlying diseases associated with intertrochanteric fractures has been controversial. However, due to the aging population, there is an increasing incidence of these fractures, so that the statistics published by the Royal College of England predicted the incidence of 116,000 fractures a year in 2016 in the UK (2).

Due to the high risk of surgery for these patients and the impossibility of imposing multiple surgeries on these elderly patients, treatment should exist that can improve their function and quality of life and reduce failure rates and the need for further surgery in these patients.

To date, few studies on treatment outcomes in bipolar arthroplasty and DHS have been conducted and the results are sometimes contradictory and controversial.

In general, device failure depends on several factors including the type of fracture and its stability, the existence of osteoporosis and the incorrect placement of the screw into the femoral head (16, 17).

In a study performed by Nordin et al. on intertrochanteric fractures treated with the DHS device, the incidence of device failure was reported to be 16.7%, although our study obtained a lower rate (10%) (18). However, in comparison with the bipolar group, the rate of complications in patients treated with DHS was higher.

Some reports suggest that fixation with the DHS device is preferable. The placement of the screw near the subchondral bone can improve the fixation and associated weight bearing aids can help in the healing of the fracture (14, 20). On the other hand, Ehlinger et al. reported that about 6%

of patients with intertrochanteric fractures treated with the DHS device suffered from infections; however, no implant loosening was observed (21).

Sinno et al. in 2010 conducted a retrospective study on 102 patients with intertrochanteric fracture and compared the results of bipolar and DHS usage. In this study the function, complication rate and FWB in the bipolar group was significantly better (11).

Shah et al. in 2012 compared open reduction and internal fixation (ORIF) and bipolar outcomes in 124 patients with intertrochanteric fractures. In a two-year follow-up of patients, who were treated with ORIF, there were better results of pain reduction, ability to walk and HHS compared with the bipolar hemiarthroplasty groups (22).

Bhattacharyya et al. in 2012 compared results of bipolar with total hip arthroplasty (THA) in intertrochanteric fractures. In the THA group, duration of surgery, blood loss and need for blood transfusion, patient costs and dislocation rate was significantly higher than the bipolar group. However, the duration of hospital stay, complications, pain and function were not difference between the two groups. They concluded that in patients with intertrochanteric fractures, bipolar is the better treatment in comparison with THA (23).

The most important finding of this study was the fact that in the reduction of femoral neck fractures, bipolar hemiarthroplasty clearly yields much better results. To date, only a limited number of studies have evaluated the treatment outcomes of DHS and bipolar arthroplasty and they have yielded controversial and sometimes contradictory results.

Mohamad Emami MD
Ali Reza Manafi MD
Behrooz Hashemi MD
Ali Nematy MD
Saeed Safari MD

Department of Orthopedic Surgery, Shahid Beheshti University of Medical Sciences, Tehran, Iran

References

1. Court-Brown CM, Caesar B. Epidemiology of adult fractures: a review. *Injury*. 2006; 37(8):691-7.
2. Leighton RK. Fractures of the neck of the femur. In: Bucholz RW, Heckman JD, Court-Brown CM, editors. *Fractures in adults*. 6th ed. Philadelphia: Lippincott; 2006: 1753-88.
3. Zhang Y, Tian L, Yan Y, Sang H, Ma Z, Jie Q, et al. Biomechanical evaluation of the expansive cannulated screw for fixation of femoral neck fractures. *Injury*. 2011;42(11):1372-6.
4. Sendtner E, Renkawitz T, Kramny P, Wenzl M, Grifka J. Fractured neck of femur--internal fixation versus arthroplasty. *Dtsch Arztebl Int*. 2010;107(23):401-7.
5. Tooke SM, Favero KJ. Femoral neck fractures in skeletally mature patients, fifty years old or less. *J Bone Joint Surg Am*. 1985;67:1255-60.
6. Blomfeldt R, Tornkvist H, Eriksson K, Soderqvist A, Ponzer S, Tidermark J. A randomized 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.

7. Lu-Yao GL, Keller RB, Littenberg B, Wennberg JE. Outcomes after displaced fractures of the femoral neck. *J Bone Joint Surg Am.* 1994;76:15-25.
8. 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(1):6-13.
9. Bhandari M, Devereaux PJ, Swiontkowski MF, Tornetta P, Obremskey W, Koval KJ, et al. Internal fixation compared with arthroplasty for displaced fractures of the femoral neck. *J Bone Joint Surg Am.* 2003;85:1673-81.
10. Ly TV, Swiontkowski MF. Management of femoral neck fractures in young adults. *Indian J Orthop.* 2008;42(1):3-12.
11. Sinno K, Sakr M, Girard J, Khatib H. The effectiveness of primary bipolar arthroplasty in treatment of unstable intertrochanteric fractures in elderly patients. *N Am J Med Sci.* 2010;2(12):561-8.
12. Center JR, Nguyen TV, Schneider D, Sambrook PN, Eisman JA. Mortality after all major types of osteoporotic fracture in men and women: an observational study. *Lancet.* 1999;353 :878-82.
13. Clawson DK. Trochanteric Fractures Treated by the Sliding Screw Plate Fixation Method. *J Trauma.* 1964;(4):737-52.
14. Kyle RF, Gustilo RB, Premer RF. Analysis of six hundred and twenty-two intertrochanteric hip fractures. *J Bone Joint Surg Am.* 1979; 61(2): 216-21.
15. Yong C, Tan C, Penafort R. Dynamic hip screw compared to condylar blade plate in the treatment of unstable fragility intertrochanteric fractures. *Malays Orthop J.* 2009;3: 13-8.
16. Wolfgang GL, Bryant MH, O'Neill JP. Treatment of intertrochanteric fracture of the femur using sliding screw plate fixation. *Clin Orthop.* 1982; 163: 148-58.
17. Li P, Yang H, Zheng L, Shan HH. Postoperative complications of Dynamic hip screw and its prevention in the treatment of intertrochanteric fracture. *J Dalian Med Univ.* 2009; 3: 17.
18. Nordin S, Zulkifli O, Faisham WI. Mechanical failure of Dynamic Hip Screw (DHS) fixation in intertrochanteric fracture of the femur. *Med J Malaysia.* 2001; (56): 12-7.
19. Laskin RS, Gruber MA, Zimmerman AJ. Intertrochanteric fractures of the hip in the elderly: a retrospective analysis of 236 cases. *Clin Orthop Relat Res.* 1979;(141): 188-95.
20. Moroni A, Faldini C, Pegreff F, Hoang-Kim A, Vannini F, Giannini S. Dynamic hip screw compared with external fixation for treatment of osteoporotic pertrochanteric fractures. A prospective, randomized study. *J Bone Joint Surg Am.* 2005; 87(4):753-9.
21. Ehlinger M, Adam Ph, Delpin D, Moser T, Bonnomet F. Osteosynthesis of periprosthetic femoral fractures with Locking Plate fixation using an LCP: A consecutive series of 36 fractures with mean 26 months follow-up. *J Bone Joint Surg Br.* 2011; 93: 531.
22. Shah AK, Eissler J, Radomisli T. Algorithms for the treatment of femoral neck fractures. *Clin Orthop Relat Res.* 2002;(399):28-34.
23. Bhattacharyya T, Iorio R, Healy WL. Rate of and risk factors for acute inpatient mortality after orthopaedic surgery. *J Bone Joint Surg Am.* 2002;84:562-72.