Arch Orthop Trauma Surg (2014) 134:1251–1259
DOI 10.1007/s00402-014-2053-1

TRAUMA SURGERY

Uni- and bipolar hemiarthroplasty with a modern cemented femoral component provides elderly patients with displaced femoral neck fractures with equal functional outcome and survivorship at medium-term follow-up

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Received: 10 November 2013 / Published online: 24 July 2014
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Abstract
Introduction The choice between unipolar and bipolar hemiarthroplasty for treatment of displaced intracapsular femoral neck fractures in elderly patients still remains controversial. Our objective was to compare series of elderly individuals with a displaced femoral neck fracture treated with either a cemented, modular unipolar or bipolar prosthesis with the same femoral component.
Materials and methods A prospective, randomized controlled trial of 175 displaced intracapsular femoral neck fractures in patients over 65 years was randomly allocated to unipolar (88) and to bipolar (87) hemiarthroplasty group. The primary end point was implant survival. Secondary end points included difference in ambulatory ability and mortality. Follow-up evaluations were performed at 2 months, at 1, 3 and 5 years. Implant and patient survival were followed until 2/2012. Survival analyses were performed using Kaplan–Meier curves with log-rank test. Data were analyzed using Chi-square test and Student's *t* test.
Results Unipolar hemiarthroplasty group had a significantly higher dislocation rate when compared with bipolar hemiarthroplasty group. This did not translate into difference in revision rates at 8 years. Prosthetic survival ship was 0.98 (95 % Cl 0.94–1.00) in the unipolar group and 0.97 (95 % Cl 0.93–1.00) in the bipolar group. There were no statistically significant differences in ambulatory ability, possibility to return home mortality or early radiological acetabular erosion. There were significantly more one-time dislocations in the unipolar group, but there was no difference in incidence of revisions due to recurrent dislocations. The overall mortality rate was 6 % at 30 days, 9 % at 90 days, 16 % at 12 months, and 53 % at 5 years. There was no difference in mortality between the groups.
Conclusions Unipolar hemiarthroplasty group had a significantly higher dislocation rate when compared with bipolar hemiarthroplasty group. However, both provide elderly patients with equal ambulatory ability and low revision rate at medium-term follow-up.

Keywords Hip fracture · Surgery · Elderly · Hemiprosthesis · Survival

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Introduction

Femoral neck fractures are among the most common orthopedic injuries in elderly. In 1990, estimated number of femoral neck fractures was 1.66 million worldwide per year. The incidence is increasing and it has been estimated that number of femoral neck fractures reaches up to 6.26 million by the year 2050 [7].

Osteosynthesis with screws is the treatment of choice in non-displaced intracapsular femoral neck fractures in active patients. In displaced femoral neck fractures among elderly patients, the consensus about the right operative treatment is not compatible. Hemiendoprosthesis (HE), whether unipolar or bipolar, has been found clinically more effective and cost-effective than reduction and internal

fixation in elderly patients in numerous studies [3, 9, 11, 13, 16, 18, 21, 25, 26]. Choice between uni- and bipolar prosthesis design is still under debate. Bipolar articulation has a theoretical advantage of translating part of the hip movement to inner bearing of the prosthesis thus reducing movement in the prosthesis–acetabulum interface [12]. This should reduce the amount of acetabular erosion. However, several studies have shown that the inner bearing loses mobility in time and this advantage might be lost [23, 29] or report of polyethylene wear and subsequent osteolysis has also been published [6]. In many countries, the bipolar prosthesis is more expensive and the question whether difference in cost translates to better functional outcome is raised.

In this regard, outcome studies have been performed, but most have been retrospective or un-randomized in design, have had limited number of patient or several femoral components between study groups. More recent study with prospective, randomized design has been published with short-term results. The results of these studies show that differences between unipolar and bipolar HE are minor. The differences include better range of motion and differences in cumulative percent revisions and for example no difference in hip ratings, less acetabular erosion in bipolar HEs or no differences at all. [8, 14, 17, 24].

Aim of the study was to assess whether more expensive bipolar HE would provide superior outcome compared to that of unipolar HE and thus justify its common use. To achieve this goal, we conducted a randomized controlled trial comparing unipolar and bipolar HEs in elderly patients over 65 years of age with displaced femoral neck fractures with same femoral components. The primary endpoint was implant survival. Secondary end points were ambulatory ability, mortality and radiographic evaluation including acetabular erosion between these two groups.

Patients and methods

Trial design

This prospective, randomized, controlled trial was performed between March 2003 and November 2012 (inclusion period March 2003 and June 2006).

Ethics and registration

The study was approved by the local ethics committee. Patients were included after receiving oral and written information before providing their written consent for participation. The study is registered at ACTRN12613 000092796.

Inclusion and exclusion criteria

Patients over 65 year who have sustained a displaced (Garden III–IV) femoral neck fracture were recruited. Exclusion criteria were (a) age less than sixty-five years, (b) fracture of pathological origin (c) non-displaced (Garden I–II) fracture if assumed that patient can follow postoperative weight bearing limitations of internal fixation, (d) alcohol or drug abuse (e) cognitively unintact, (f) known bone diseases or known malignancy, (g) high energy trauma (h) rheumatoid arthritis, (i) osteoarthritis. A senior consulting orthopedic surgeon determined patient inclusion in the trial after classification of the fracture.

Interventions

All patients were enrolled in the study within 24 h of hospital admission. Patients were operated within a mean of 48 h of hospital admission. Prior to surgery and allocation, all patients were preoperatively digitally templated for the stem. At the operation theatre, patients were randomly assigned to receive a cemented Lubinus® (Waldemar Link GmbH & Co, Hamburg, Germany) unipolar HE or bipolar (Vario-Cup) HE.

Beside the prosthesis, both cohorts were treated with the same protocol: all procedures were performed using posterior decubitus approach, with the patient was in lateral position. A Lubinus SP II stem with appropriate size, neck length and neck angel was used in patients. All stems were cemented with Palacos cum gentamycin antibiotic cement (Heraeus Holding GmbH, Hanau, Germany). Unipolar or bipolar heads were available in sizes from 38 to 60 mm. In bipolar heads, the size of the inner head of the bipolar prosthesis was 28 mm. There were multiple surgeons performing the operations, senior consultants did 27 % of the operations and 73 % were done by orthopedic residents. All operations were performed by or under a direct supervision of senior orthopedic surgeon at two participating hospitals. This resembles everyday life in our hospitals.

Spinal anesthesia was used in all cases and one dose of preoperative prophylactic cefuroxime or clindamycin in case of cefuroxime allergy was infused 30 min prior to surgery. All patients were given low-molecular-weight miniheparin starting at six hours preoperatively and continuing for four weeks postoperatively except those with permanent preoperative warfarin treatment when miniheparin was given until the international normalization ratio (INR) had been between two and three for two days. Patients were mobilized to full weight bearing as tolerated from the first postoperative day.

Table 1 Categories of ambulatory ability

1. Independent community ambulatory with regular exercise
2. Independent community ambulator
3. Independent household ambulator
4. Household ambulator with cane
5. Household ambulator with walker/crutches
6. Assisted ambulation only

Outcome measurements

The primary outcome was implant survival, with revision due to any reason as endpoint. Secondary end points included mortality, categories of ambulatory ability, general complications and radiographic analysis.

Patient characteristics that were recorded included age, gender, height, weight, number of associated co-morbidities (0, 1 or 2+), abnormal laboratory findings at the time of admission, previous fractures and ambulatory status. To assess the role of the severity of health problems at the time of admission, the American Society of Anesthesiologist (ASA) classification system was used. ASA ratings were collapsed into two categories: ASA 1 or 2, and 3 or 4. Prefracture data were collected by patient interviews done in person immediately after admission. Hospital data were obtained with a form filled out in the operating room by orthopedic resident or attending physician and a form completed on discharge relating specific details of the patient's hospital stay. Prefracture and post-fracture ambulation was classified based upon as shown in Table 1. Peroperative and immediate postoperative data included operation time, estimated blood loss, drainage discharge and prosthesis characteristics.

Radiographs were taken and analyzed in addition of initial postoperative radiographs at one year after operation. Radiographs were taken postoperatively and at one-year follow-up, when 147 patients: 72 in bipolar group and 75 in unipolar visited outpatient clinic. Hundred and nine out of 147 (75 %) patients completed and comparable radiographs were obtained. 55 (75 %) in the unipolar HE group and 54 (75 %) in the bipolar HE group. The rate of acetabular erosion was measured from standard ap and lateral projections. Cartilage height was measured from line 90° of angle against line from teardrop to superolateral margin of acetabulum in both planes (Fig. 1).

At 3- and 5-year follow-up, the patients were contacted by telephone and interviewed for completion of standard questionnaire concerning overall satisfaction and ambulatory status. Mean follow-up for revision surgery and patients survival was 7.2 years (6.3–9.5 years).

Sample size and power analysis

We expected to reduce the risk of complication by 5 % between different groups, with a standard deviation risk of 10 %. With an alpha of 0.05 and a power of 80 %, there should be 64 participants in both groups. The aim was to include 87 patients into both groups to compensate for possible dropout and early deaths. The total number of patients allocated in two groups was 175.

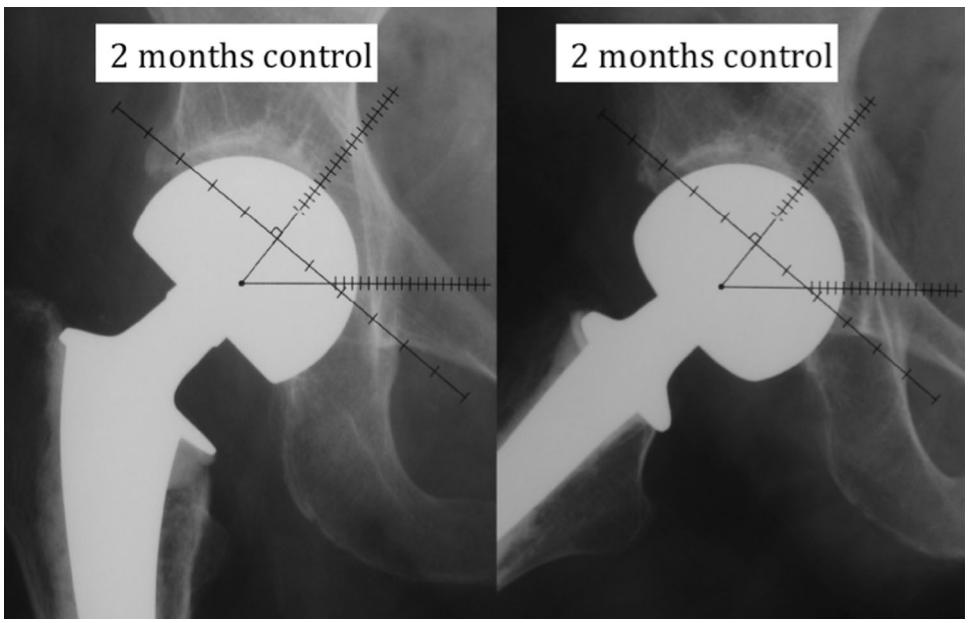

Fig. 1 Radiologic assessment

Table 2 Patient demographics

Baseline characteristics	Baseline data ($n = 175$)		
	Unipolar ($n = 88$)	Bipolar ($n = 87$)	P value
Gender (%)			
Female	72	72	0.84
Male	16	14	
Age (mean in years)	83.9 (±6.5)	81.7 (±6.0)	0.96
BMI (mean)	24.7 (±3.9)	23.8 (±3.7)	0.97
ASA classification			
I/II	11	15	0.49
III/IV	89	85	
Abnormal lab findings (%)			
0	22	15	0.63
1	18	26	
2+	61	60	
Number of comorbidities (%)			
No fracture	82	75	0.42
Distal radius	7	6	
Vertebrae	0	4	
Proximal humerus	0	1	

If the values are given in means, standard deviation is in parentheses

ASA American Society of Anesthesiologist

Table 3 Preoperative ambulatory ability

Ambulatory ability	Unipolar ($n = 88$) (%)	Bipolar ($n = 87$) (%)
Independent community ambulatory w. reg. exercise	17	16
Independent community ambulatory	33	37
Independent household ambulatory	21	12
Household ambulator with cane	11	13
Household ambulator with walker/ crutches	19	18
Assisted ambulation only	0	4

Table 4 Per and postoperative data

Per- and postoperative data	Unipolar ($n = 88$)	Bipolar ($n = 87$)	P value
Operating time [9]	83 (±36)	86 (±35)	0.77
Estimated blood loss (ml)	460 (±299)	430 (±231)	0.54
Drainage discharge (ml)	90 (±104)	115 (±145)	0.77
Dislocation	6	2	0.01
Protrusion	2	2	0.69
Revision	2	3	0.60

Table 5 Outcome measures for the two groups

Comparative data	Surgeon in training ($n = 127$)	Senior surgeon ($n = 48$)	P value
Operating time [9]	89	72	0.003
Estimated blood loss (ml)	446	428	0.68
Drainage discharge (ml)	99	101	0.91
Number of dislocations	3	3	0.21
Revisions	5	1	0.54
Primary complications	5	7	0.27

Randomization

Randomization process for the hundred and seventy-five patients was performed by means of consecutively numbered and sealed opaque envelopes. No stratification was used. The patient was blinded to choice of treatment; surgeons and staff were not blinded. Operations and patient allocation were done in two trauma centers, one secondary trauma centre and one tertiary trauma centre within same city. Patient enrolling, allocation, preoperative investigation, surgery, postoperative mobilization and follow-up were done similarly in both centers. Treatment of complications and revision surgery were all performed in Coxa, the Hospital for Joint replacement. Only two patients were lost in the follow-up, before the first control in two months one in each group.

Statistical analysis

Analyses of outcome were based on the intention to treat principle, and all patients remained in the group to which that they had been randomized. Data were analyzed using a Chi-square test for dichotomized measures or Student's t test for continuous numeric variables. Kaplan–Meier curves with the log-rank test were used for the analysis of implant and patient survival. The level of significance was set at $P < 0.05$. We used SPSS 20.0 for Windows (IBM, New York) for all analyses.

Age, sex, BMI, ASA classification, number of abnormal laboratory findings, ambulatory ability and number of comorbidities demonstrated normal distribution, justifying the use of values for the analyses. (Tables 2 and 3) There was no significant difference between groups with respect to operating time, estimated blood loss or drainage discharge or revisions. Statistical difference was found in number of dislocations favoring bipolar HE over unipolar

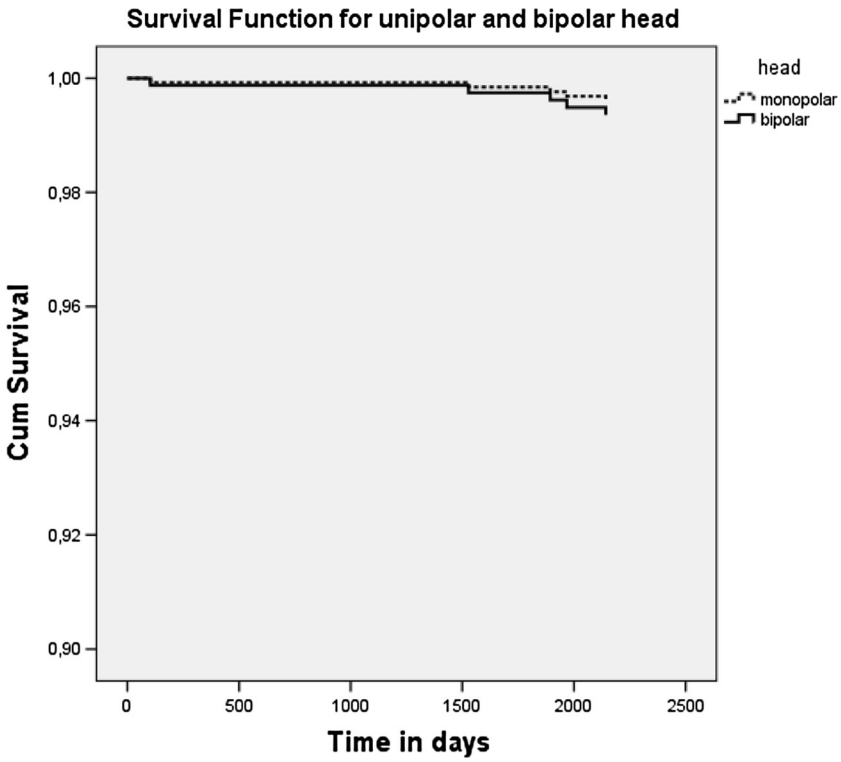

Fig. 2 Implant survival. Endpoint was defined as revision of any component for any reason. Survival rates were obtained from the Kaplan–Meier analysis

HE but this did not affect the revision rate (Table 4). There was also a statistical significance in operating time in favor of senior consultants over surgeons in training but there was no difference in overall result based on surgeon experience (Table 5).

Results

Patient flow and baseline data

One hundred and seventy-five fractures were allocated in the study. 88 patients received Lubinus HE with unipolar head and 87 patients received bipolar head. Eighty-three percent of the recruited patients were woman and 17 % men. Mean age was 81.7 years (range 69.9–96.1 years). All patients received their allocated treatment. Baseline data for randomized groups were similar and are shown at Table 2. Per- and postoperative data are summarized in Table 3.

Primary outcome

Survivorship of unipolar hip replacement was survival in 8-year follow-up 98 % with (95 % confidence interval, of 94–100 %), and that of bipolar group in comparison to bipolar group 97 % (95 % confidence interval, Cl 93–100 %) at 8 years, respectively. There was no difference in survivorship between the groups (Fig. 2). Six patients had on-time dislocations in the unipolar HE group and two in the bipolar HE group; the difference was statistically significant ($P < 0.0.01$). One patient in both categories had dislocation that was not reductable by means of closed reduction. The patient in unipolar HE group had immediate revision with good results. Patient in bipolar HE group had intraprosthetic dislocation and open reduction was made but further dislocations led to a revision arthroplasty. All dislocations occurred before 1-year follow-up; one greater trochanter fracture was observed in unipolar group. There was no deep infection requiring revision surgery. Two patients in unipolar HE group sustained permanent sciatic nerve paresis after primary operation. Revisions were done in unipolar due to recurrent dislocations. One was revised with constrained acetabular component and one with mega size metal on metal acetabular component. In bipolar HEs, the revisions were done due to intraprosthetic dislocations and recurrent dislocations. Intraprosthetic dislocation was treated with a new bipolar head and recurrent dislocations with constrained acetabular components.

Secondary end points

Mortality

Three patients died while in hospital, two in unipolar HE group and one in bipolar HE group, all immediately

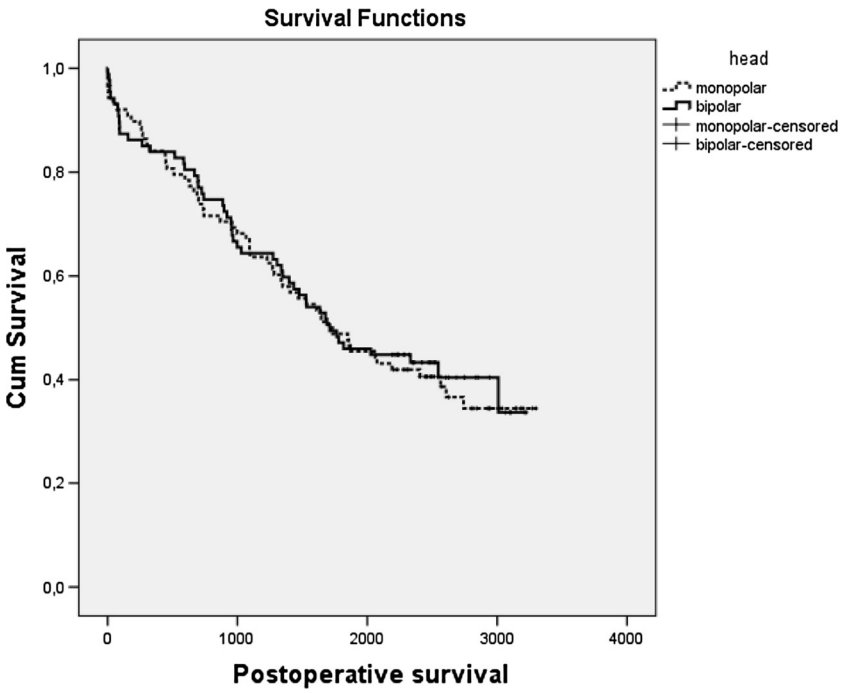

Fig. 3 Patient survival between uni- and bipolar hemiarthroplastias. Survival rates were obtained from the Kaplan–Meier analysis

postoperatively. The overall mortality rate did not differ between groups, $P = 0.71$ at 1 year (Fig. 3). Mortality was six at 1 month, 9 % in 3 months, 16 % at 1 year, 35 % at 3 years and 53 % at 5 years, so 85 patients (47 %) completed final follow-up at 5 years. Survival was equal in both unipolar HE and bipolar HE groups. The overall 8-year follow-up was 35 % with (95 % confidence interval of 26–43 %) in unipolar HE group 8-year survival was 34 % (95 % Cl 24–45 %) and in bipolar HE 34 % (95 % Cl 18–49 %).

Ambulatory ability

Of the 72 patients in the unipolar HE group living in their own home before fracture, 63 (87.5 %) were able to return home after rehabilitation. In the bipolar HE group, 49 (83.0 %) of 59 returned home after rehabilitation. At final follow-up, 65.5 % of surviving patients in unipolar HE group, a 57.8 % in bipolar HE group lived at their own home.

Ambulatory ability is summarized in Table 6. Of the 51 patients with unipolar HE who were community ambulators before fracture, 36 (70 %) remained community ambulators at 1-year follow-up, 17 (33 %) being able to continue their regular exercise. For the patients with bipolar HE, 40 of 56 patients (71 %) retained their prefracture status of community ambulators, 24 (42 %) returning to exercise. Overall, 42 % of patients in unipolar HE group were able to return to preoperative ambulatory status at 1-year follow-up and 48 % in bipolar HE group, respectively. In 5-year follow-up in unipolar HE group 66 % retained their prefracture status of community ambulators and in bipolar HE group 89 %. Differences were statistically not significant, $P = 0.18$ at 1 year and 0.21 at 5 years.

General complications and additional fractures

Postoperatively, the number of general complications excluding mortality did not differ between groups. In the unipolar HE group, there was one pulmonary embolism, one myocardial infarct and two persistent peroneal palsies. In bipolar HE group, there were two pneumonias and one cerebral infarct. In both groups, there were 10 patients (11.4 %) who sustained an additional contra lateral hip fracture. Moreover, five patients had additional fractures requiring operative treatment (distal femur, antebrachium, olecrani, and two proximal humerus) and two surgery demanding subdural hematomas. There were no periprosthetic fractures in either of the groups.

Radiographic analysis

Early protrusion (2 versus 2) was equal in both groups. All of these patients were living in their own home at follow-up and both could walk without external support.

Discussion

Discussion about the best surgical choice to treat elderly patients displaced femoral neck fracture has been going on

Table 6 Pre- and postoperative ambulatory ability

	At 1-year follow-up					
	a	b	c	d	e	f
Percentage in ambulatory ability chance between prefracture status to 1-year follow-up in unipolar group						
Before fracture						
A	17 %	9 %		2 %	6 %	
B			15 %	2 %	14 %	
C						
D			3 %	3 %	2 %	2 %
E					17 %	5 %
F						

	At 1-year follow-up					
	a	b	c	d	e	f
Percentage in ambulatory ability chance between prefracture status to 1-year follow-up in bipolar group						
Before fracture						
A	22 %	3 %	3 %		3 %	
B		12 %	8 %	9 %	10 %	2 %
C			3 %	4 %	4 %	2 %
D				4 %	3 %	
E						
F						

Chi-square test 0.18

	At 5-year follow-up					
	a	b	c	d	e	f
Percentage in ambulatory ability chance between prefracture status to 5-year follow-up in unipolar group						
Before fracture						
A	21 %	5 %	5 %	2 %	6 %	5 %
B			5 %	4 %	11 %	
C			2 %		2 %	6 %
D						
E					8 %	8 %
F						

	At 5-year follow-up					
	a	b	c	d	e	f
Percentage in ambulatory ability chance between prefracture status to 5-year follow-up in bipolar group						
Before fracture						
A	29 %			5 %	10 %	6 %
B			2 %	6 %	6 %	10 %
C				6 %	5 %	
D					2 %	5 %
E						8 %
F						

Table 6 continued

	At 5-year follow-up					
	a	b	c	d	e	f

Chi-square test 0.21

a Independent community ambulatory with regular exercise

b Independent community ambulator

c Independent household ambulator

d Household ambulator with cane

e Household ambulator with walker/crutches

f Assisted ambulation only

many decades. Among elderly patients with displaced femoral neck fracture, endoprosthetic replacement is superior to internal fixation with osteosynthesis in majority of the published data. However, if endoprosthetic replacement is chosen, it is not clear if unipolar, bipolar or total hip prosthesis should be chosen. Total hip arthroplasty (THA) has the best motion and function but suffers from higher complication rate and higher economic costs. Unipolar or bipolar HE is widely used as a standard choice especially in elderly dislocated hip fracture patients. In our study, both unipolar and bipolar HEs did with equal functional results. Overall, the results show that cemented Lubinus HE accompanied with unipolar or bipolar heads is very predictable method in treatment of femoral neck fracture results and low revision risk in elderly even in inexperienced hands.

The goal of this study was to report 8-year follow-up results in implant survival comparing cemented unipolar and bipolar HE as treatment of femoral neck fracture in elderly in prospective, randomized setting with medium-term follow-up. Care was taken to minimize internal bias in study. The groups that we compared were similar at baseline, the analysis was based on intention to treat, and the outcome was evaluated with use of standardized questionnaires. This is one of the few studies that uses same femoral component in both groups. All the patients followed a similar postoperative rehabilitative protocol that consisted of early mobilization with weight bearing as tolerated ambulation.

The strengths of the present study were the prospective randomized controlled design and the medium-term follow-up and the use of intention to treat analysis. The strict inclusion criteria clearly define the population, which resembles the population where it can be generalized. The allocated groups were comparable at the initiation of the study.

A limitation of this study was that, we did not have any specific quality of life measurements. However, we do not find this as a major deficiency, since recent more geriatric

studies have shown that elderly patients are difficult to assess with quality of life questionnaires since they do not differ between acute and chronic disorders [15]. Therefore, we think that our simple method of ambulatory ability in evaluation of patient satisfaction is executable. Another limitation of the study is that X-rays were only taken at 1-year follow-up control outpatient clinic visit.

Acetabular erosion leading to a revision surgery is the menace of HE. Bipolar HE reconstruction was developed to diminish this risk. In one recent report, only 0.6 % of the bipolar prosthesis implanted was converted to THA due to groin pain [1]. In Australian registry, THA had a higher revision rate over to bipolar HE, and the cumulative percent revision was higher in THA and unipolar HE when compared with bipolar HE [17]. In our results, we did not have any differences in acetabular erosion between two groups after one year and neither did we have any differences in revision after 8-year follow-up.

Several prospective, randomized studies have been published to compare functional outcomes of patients receiving either unipolar or bipolar HE. Calder et al. published a prospective, randomized study comparing unipolar Thomson prosthesis with bipolar Monk prosthesis in patients over 80 years. In 2-year follow-up, the only statistically significant difference they found was that patients with unipolar prostheses were more likely to return to their preinjury functional state than patients with bipolar prostheses [5]. Davison et al. compared unipolar HE, bipolar HE, and internal fixation with compression hip screws in patients between 65 and 79 years. They found no difference in functional outcomes between unipolar and bipolar HEs [9]. Cornell et al. published a 48-patient series in which same femoral stem was used and only difference was the prosthesis head design. Patients with bipolar prostheses did better on walk tests and had better range of motion at 6 months but the patient-oriented hip scores did not differ at 6 months between the unipolar and bipolar groups [8]. Raia et al. compared the efficacy of unipolar versus bipolar HE in elderly patients with displaced femoral neck fractures in terms of quality of life and functional outcomes. They found no difference between the groups when estimating blood loss, length of hospital stay, mortality rate, and number of dislocations, postoperative complications, or ambulatory status at 1 year in their 115 patient series [24]. In more recent publication, Hedbeck et al. reported short-term follow-up results with a modern Exeter prosthesis combined with unipolar or bipolar heads. They found equal clinical outcomes after one year, but higher acetabular erosion in unipolar HA group [14].

In our study, the proportion of patients accomplishing the independent living postoperatively was 70 and 71 % in unipolar and bipolar HE groups, respectively. However, even though the results did not gain statistical difference it is noteworthy that more patients reached the status of more active living in the bipolar HE group returning to active exercise. This is in accordance to Hedbecks results where there was a trend towards better HRQoL at 4 months in the bipolar HE group even though they seem to loose the benefit with the time [14].

Controlling elderly patients with any method or questionnaire is challenging. It has been shown that with the passage of time there is gradual worsening in function and health-related quality of life reflecting increased frequency of co-morbidities and natural course of aging. It has been shown that non-responders to questionnaires or lost patients in follow-up include a higher percentage of people with impaired health and more severely ill subjects are unlikely to participate in the study [15]. To get a higher response rate, telephone interviews are often used. However, it has been shown that answers to quality of life questions given by telephone responders may be biased due to the personal interview situation [4]. Our telephone interviews after 5 years postoperatively revealed that a good majority of the patients did not even remember that they have had a fractured hip. So our use of simple outcomes like revision surgery and ambulatory status as primary and secondary end points was intentional.

This study shows that cemented Lubinus HE accompanied with unipolar or bipolar heads is very predictable method in treatment of femoral neck fracture in elderly even in inexperienced hands. Posterior approach gives a certain risk for dislocations, which in our series was in total 4.5 % (6.8 % versus 2.3 % in unipolar and bipolar HE, respectively). The dislocation risk in posterior approach differs in the literature between 0 and 16 % and our results did not differ from results reported [2, 14, 19, 20, 22, 28].

A new hip fracture due to a new fall in the opposite site demanding surgery occurred in 11 % of the patients. A new fall may end up in periprosthetic fracture demanding new surgery. Previous articles have reported an incidence of 1.7–13 % in periprosthetic fractures among HE in elderly. Uncemented prosthesis carries a higher risk for perioperative fracture but also for the postoperative fracture as for example Austin Moore has been reported to have a postoperative periprosthetic risk of 2.3–7 %. The shift towards cemented stems in elderly hip fracture patients has lowered this risk, but polished wedge-type stems have been shown to have a elevated risk for periprosthetic fractures in hip fracture patients as for example Exeter has a fracture risk of 0.5–3 % [10, 14, 22, 27]. In our study, we did not have any periprosthetic fractures, which are supported also by the literature.

Whether unipolar or bipolar prosthesis should be used still remains controversial. We found no statistical difference in returning home after fracture or in ambulatory ability. We had no difference in the acetabular erosions, but

we had lower rate of dislocations favoring bipolar HE which reached significance, but with low numbers. Even though it did not affect the revision rate, a dislocation always leads to an invasive procedure and treatment in hospital thus affecting negatively to a fragile patient and should therefore be avoided.

As a conclusion, we can say that both uni- and bipolar HEs with a modern cemented modular femoral component provide elderly patients with an equal functional outcome and low revision rate at medium-term follow-up. Unipolar HE had a significantly higher dislocation rate when compared with bipolar HE, however further research is needed to clarify whether there is difference in long-term survivorship between these two methods.

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