

## 대퇴 경부 골절 환자에서 큰 대퇴 골두를 이용한 인공 고관절 전 치환술과 이극성 치환술의 초기 추시 결과

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**목적:** 대퇴 경부 골절에서 큰 대퇴 골두를 이용한 인공 고관절 전 치환술과 이극성 반 치환술 군의 초기 추시 결과를 연구하였다.

**대상 및 방법:** 2004년 2월에서 2004년 12월까지 내원한 전위성 대퇴 경부 골절 환자 40명을 대상으로 하였다. 고관절 전 치환술 군과 이극성 반 치환술 군은 각 각 20명이었다. 평균 추시 기간은 18개월(12-26) 이었다. 임상적인 결과와 수술 후 골 융해, 탈구, 이완, 골절, 탈구 등의 합병증에 대하여 최근 방사선 사진을 바탕으로 면밀히 관찰 하였다.

**결과:** 임상적, 기능적인 결과는 고관절 전 치환술 군에서 이극성 반 치환술 군보다 우수하였다. 평균 수술 시간은 이극성 반 치환술 군에서 유의하게 짧았다. 출혈량은 두 군 사이에 통계학적으로 유의한 차이가 없었다. 수술 후 초기에 환자의 고관절에 운동 제한을 두지 않은 상태에서도 탈구의 예는 없었다.

**결론:** 상기 소견으로 큰 대퇴 골두를 이용한 고관절 전 치환술은 이극성 반 치환술보다 우수한 결과를 보여 대퇴골 경부 골절 환자의 치료에 권장된다.

**색인단어:** 대퇴골 경부 골절, 이극성 반 치환술, 고관절 전 치환술, 큰 대퇴 골두

### Introduction

Femoral neck fractures are common orthopedic injuries. However, there is some controversy regarding the optimal surgical treatment for these injuries<sup>12)</sup>. Prosthetic replacement of the femoral head is one of the options for treating a displaced femoral neck fracture in elderly patients<sup>11)</sup>. The proponents of arthroplasty suggest that replacing the femoral head eliminates the risk of revision surgery due to serious complications such as head necrosis, nonunion of the fracture site, etc<sup>3)</sup>. However, there is some controversy regarding the choice of prosthesis for the joint replacement in patients with femoral neck fractures. Bipolar hemiarthroplasty (BH) has a higher incidence of groin pain secondary to acetabular erosion, as well as increased probability of revision

arthroplasty<sup>13)</sup>. Even though total hip arthroplasty (THA) provides good functional results and long-term survival compared with BH, it has several disadvantages such as component dislocation and decreased functional activity due to a limitation in extreme motion<sup>9,10)</sup>. Larger diameter femoral heads ( $\geq 36$  mm) have a larger range of motion and believed to be a valuable tool for preventing a dislocation in THA<sup>2,6,7)</sup>. Based on this data, it was hypothesized THA with a 36 mm-femoral head will produce superior results without any serious complications compared with BH. To our knowledge, there is a paucity of clinical data on the performance of THA using a large head in patients with a femoral neck fracture. The aim of this study was to evaluate the short-term clinical outcomes of THA with large diameter of head and BH in physiologically active elderly patients with displaced femoral neck fractures.

### Materials and methods

The relevant ethics committee at each participating study center reviewed and approved the study

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protocol, and all patients provided written informed consent before undergoing the screening procedures. This non-concurrent clinical trial included 40 patients with displaced unilateral femoral neck fractures, who had been treated with prosthetic replacement from February 2004 and December 2004. Forty patients underwent either THA or BH. The inclusion criteria were a normal cognitive function (a mini-mental score<sup>5)</sup> of  $>6$ ), an ability to be independent and ambulant prior to the injury, and a fitness for surgery. The mean follow-up period was 18 months (12~26). For the THA group, the mean age of the patients was 71.5 (range, 66-85; 8 male and 12 female). The postoperative leg length discrepancy was 3.4 mm (SD,  $\pm 2.9$ ), and the difference in the abductor offset was 4.0 mm (SD,  $\pm 2.3$ ) shorter than contralateral normal side. For the BH group, the mean age of the patients was 74.6 (range, 60~85; 8 male and 12 female). The postoperative leg length discrepancy was 4.2 mm (SD,  $\pm 2.3$ ), and the difference in the abductor offset was 4.2 mm (SD,  $\pm 2.0$ ) longer than normal side (Table 1). A cementless metal shell with a porous coating (Trilogy<sup>®</sup>, Zimmer Inc., Warsaw, IN) and a highly cross-linked polyethylene liner synthesized by electron beam with an inner diameter of 36 mm (Longevity<sup>®</sup>, Zimmer Inc., Warsaw, IN) with an electron beam was placed in all patients undergoing THA. Based on the surgeon's preference, one or two screw augmentations were performed. Acetabular component was the Multipolar<sup>®</sup> (Zimmer Inc., Warsaw, IN) in BH. Versys<sup>®</sup> Heritage (Zimmer Inc., Warsaw, IN) was used as components in the patients who underwent cemented femoral fixation and FMT (Zimmer Inc., Warsaw, IN) was used as components in the patients who underwent uncemented femoral fixation. All the

surgical procedures were performed by the same surgeon (MRC) using a modified Harding's approach with the patient in the lateral position. All the patients had a capsular repair closure. Prophylactic antibiotics were administered to all patients. The post-operative protocol was the same in all patients. The patients were allowed to sit on the first post-operative day. They were allowed to stand with support when they were able to do so. There was no limitation in the ROM, and an abduction pillow was not used. The clinical radiographic examinations were assessed by an independent surgeon (HSL) with several year experience in the orthopedic department. The clinical outcomes of the two groups of hips were analyzed using the Harris Hip Score<sup>6)</sup> and the Merle d'Aubigne and Postel method. The Harris hip score was classified as excellent (91~100), good (81~90), fair (71~80), and poor (61~70). The Merle d'Aubigne and Postel classification was categorized to six levels according to the level of pain, mobility, and ability to walk. The radiographic examinations included an anteroposterior (AP) view of the pelvis centered over the pubis, and a shoot through lateral of the hip. The femoral components were assessed using Engh's method<sup>4)</sup> in the case with uncemented fixation, and Barrack's method<sup>1)</sup> with cemented fixation at the postoperative radiographs. The patients were followed at 6 weeks, at 3 months, 6 months and then 1 year after the index operation. The latest follow-up radiographs were assessed and compared with the original postoperative radiographs to determine the number of complications such as osteolysis, loosening, fracture, dislocation, etc. We also focused on the development of the early complications such as dislocation and infection. The relationship between the two groups in terms of the

**Table 1.** Data on the total hip arthroplasty (THA) and bipolar hemiarthroplasty (BH) group

	THA group*	BH group <sup>†</sup>
Average age (year, range)	71.5 (66~85)	74.6 (60~85)
Gender	Male (7), female (13)	Male (6), female (14)
Body weight (Kg)	54.3	55.8
Femoral stem	Cementless (8), Cement (12)	Cementless (8), Cement (12)
Leg-length ( $\pm$ SD)	-3.4 mm ( $\pm 2.9$ )	-4.2 mm ( $\pm 2.3$ )
Abductor offset ( $\pm$ SD)	+4.0 mm ( $\pm 2.3$ )	+4.2 mm ( $\pm 2.0$ )
Cases (number)	20	20

\* THA = total hip arthroplasty; <sup>†</sup> BH = bipolar hemiarthroplasty

operation time and intra-operative bleeding volume was assessed using a Mann-Whitney test.

## Results

The Harris hip score of the THA group was excellent in 16 cases(80%) and good in 4 cases(20%). The Harris hip score of the BH group was excellent in 12 cases(60%) and good in 8 cases(40%)(Table 2). However, there was not significantly difference between two groups ( $P=0.97$ ). Merle d' Aubigne and

Postel classification was more than 4 in THA group. However, in the BH group, the level according to the pain factor was 3 in 1 case(5%) and level 4 in 3 cases(15%). For the study on the ability to walk, 1 case(5%) in the BH group was level 4 (Table 3). It was not significantly difference between two groups ( $P=0.86$ ). The mean operation time was 73.75 and 60.5 minutes in the THA and BH groups, respectively. The difference was statistically significant ( $P=0.001$ ). The mean intraoperative blood



**Fig. 1.** AP radiograph of the pelvis of a 78-year-old woman with THA using a 36 mm femoral head. At postoperative 18 months, the Harris hip score was excellent.



**Fig. 2.** AP radiograph of the pelvis of a 78-year-old woman with BH. Even though there were no abnormalities in the radiographic findings, the Merle d' Aubigne and Postel classification was 4 in the pain factor and 4 in the walking ability factor.

**Table 2.** The Harris hip score on the THA and BH group

	THA group*	BH group <sup>†</sup>
Excellent	16 (80%)	12 (60%)
Good	4 (20%)	8 (40%)
Fair	0	0
Poor	0	0

\* THA = total hip arthroplasty; <sup>†</sup> BH = bipolar hemiarthroplasty

**Table 3.** The Merle d' Aubigne and Postel classification on the THA and BH group

	THA group*			BH group <sup>†</sup>		
	Pain	mobility	Walk ability	Pain	mobility	Walk ability
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	1 ( 5%)	0	0
4	0	0	0	3 (15%)	0	1 ( 5%)
5	2 (10%)	0	4 (20%)	2 (10%)	2 (10%)	3 (15%)
6	18 (90%)	20 (100%)	16 (80%)	14 (70%)	18 (90%)	16 (80%)

\* THA = total hip arthroplasty; <sup>†</sup> BH = bipolar hemiarthroplasty

loss was 450 ml and 415 ml in the THA and BH groups, respectively. The difference was not statistically significant ( $P=0.196$ ). No complications including dislocations and infections developed in the two groups. The radiographic exams showed stable fixation in all patients with the uncemented femoral components, and Barrack type A or B in the cemented femoral components. There were no cases of osteolysis, loosening, and fracture in the pelvis or proximal femur (Fig. 1, 2).

## Discussion

The prosthetic replacement of the femoral head in the active elderly patients with femoral neck fractures eliminates the concern regarding the re-operation due to fixation failure, nonunion, and avascular necrosis of the femoral head<sup>3,11</sup>. However, the best choice of the prosthesis for joint replacement in patients with femoral neck fractures is controversial. BH has the advantages of a lower probability of dislocation and being a simple surgical technique. However, the main concern is the possibility of occurrence of the protrusion acetabuli from the acetabular erosion, groin and thigh pain, less survival at the long-term follow-up than THA, and the higher probability of a second operation<sup>13</sup>. Even though the total hip arthroplasty (THA) provides good functional results and long-term survival compared with BH, it can develop serious complications such as a dislocation in the early post-operative period<sup>9,10</sup>. Patients with the femoral neck fractures have a high risk of a post-operative dislocation. The size of the replaced head is a contributing factor to incidence of dislocation<sup>14</sup>. Larger diameter femoral heads are believed to have less chance of dislocation and further more facilitates increased ROM. However, the use of larger diameter femoral head is limited against conventional polyethylene because of the risk of accelerated wear and resulting osteolysis. The development of new polyethylene with improved wear characteristics in the early laboratory and clinical studies could be reduce the this risk. In this series, even though it was not statistically significant, it was found that the clinical and functional results were better in the THA group than in the BH group. Despite there being no limitation of ROM in the early

post-operative period, no dislocation was encountered in either group. However, there is some controversy regarding the use of highly cross-linked polyethylene. The possibility of fatigue failure due to the decrease in yield strength and ultimate tensile strength from high dose radiation emphasize the need for long-term in vivo studies in young active patients. However, the patients with femoral neck fractures caused by osteoporosis often have coexisting medical problems with limited life expectancy, which means that the demands for daily livings are low. Early post-operative complications such as a dislocation are more important factors in their management. From this point of view, a THA with large diameter femoral head is recommended for the management in patients with femoral neck fractures because THA produces a better result than BH. However, it should be noted that this study has limited statistical power because of the small sample size that was not randomized. Even though a highly cross-linked polyethylene shows good short-term results in vivo and long-term in vitro study, a long-term in vivo study will be needed to justify its continued use. Given the relatively decrease in life expectancy of patients with femoral neck fractures, it would be possible to study on the clinical and functional outcomes in the early post-operative period.

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## ABSTRACT

### Early Results after the Treatment with Total Hip Arthroplasty with Larger Diameter Femoral Head versus Bipolar Arthroplasty in Patients with Femoral Neck Fractures

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**Purpose:** To study the short-term clinical outcomes of THA with a large diameter femoral head (36 mm) and BA in physiologically active elderly patients with displaced femoral neck fractures

**Materials and Methods:** This non-concurrent clinical trial included 40 patients with displaced femoral neck fractures, who had been treated with prosthetic replacement from February 2004 and December 2004. Twenty patients underwent either THA or BA. The mean follow-up period was 18 months(12~26). The clinical outcome was analyzed, and the latest follow-up radiographs were assessed to determine the number of complications, such as osteolysis, loosening, fracture, dislocation, etc.

**Results:** The clinical and functional results were better in the THA group than in the BA group. The mean operation time was significantly shorter in the BA group than in the THA group. The mean intra-operative blood loss was similar in the two groups. Despite there being no limitation of the range of motion in the early post-operative period, there was no dislocation encountered in either group.

**Conclusion:** A THA with a large diameter femoral head is recommended for the management of patients with femoral neck fractures because THA produces a better result than BA.

**Key Words:** Femoral neck fracture, Bipolar hemiarthroplasty (BA), Total hip arthroplasty (THA), Large diameter femoral head