Original articles

Closed reduction and internal fixation versus total hip arthroplasty for displaced femoral neck fracture

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【**Abstract**】**Objective:** To compare the clinical effects between closed reduction and internal fixation (CRIF) and total hip arthroplasty (THA) for displaced femoral neck fracture.

Methods: In this prospective randomized study, 285 patients aged above 65 years with hip fractures (Garden III or IV) were included from January 2001 to December 2005. The cases were randomly allocated to either the CRIF group or THA group. Patients with pathological fractures (bone tumors or metabolic bone disease), preoperative avascular necrosis of the femoral head, osteoarthritis, rheumatoid arthritis, hemiplegia, long-term bed rest and complications affecting hip functions were excluded.

Results: During the 5-year follow-up, CRIF group had significantly higher rates of complication in hip joint, general complication and reoperation than THA group (38.3% vs. 12.7%, $P<0.01$; 45.3% vs. 21.7%, $P<0.01$; 33.6% vs. 10.2%, $P<0.05$ respectively). There was no difference in mortality between the two groups. Postoperative function of the hip joint in THA group recovered favorably with higher Harris scores.

Conclusion: For displaced fractures of the femoral neck in elderly patients, THA can achieve a lower rate of complication and reoperation, as well as better postoperative recovery of hip joint function compared with CRIF.

Key words: ***Femoral neck fractures; Arthroplasty, replacement, hip; Fracture fixation, internal; Prospective studies; Randomized controlled trial***

Chin J Traumatol 2014;17(2):63-68

Fracture of the femoral neck has a high incidence around the world and increases every year. It is assumed that there might be 63 million patients with fracture of the femoral neck in 2050, 4 times greater than the level in 1994.[1] The proportion of elderly patients aged above 80 years is up to 62%, and the patients aged below 40 years only account for 0.6%.[2] Thus, the treatment for elderly patients with femoral neck fracture has been given increasing attention. At present, the surgical techniques for femoral neck fracture (especially for displaced fracture) are mainly closed reduction and internal fixation (CRIF) and total hip arthroplasty (THA). Although successful cases have been reported, there are some deficiencies in both surgical techniques.[3-5] A number of related studies have been conducted, but few prospective randomized studies have been reported. In this study, we compared the clinical efficacy of the two surgical techniques with regards to complication, mortality and functional recovery.

METHODS

Patients

In this study, 331 patients with femoral neck fracture (classified as Garden III or IV) admitted from 2001 to 2005 were screened according to the following criteria. Inclusion criteria included: 1) patients aged above 65 years; 2) admitted at 1-3 d after bone fracture; 3) in a normal mental state, with independent living ability. Exclusion criteria included: 1) patients with pathological fractures, such as bone tumors, metabolic bone disease; 2) preoperative

DOI: 10.3760/cma.j.issn.1008-1275.2014.02.001

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avascular necrosis of the femoral head; 3) osteoarthritis or rheumatoid arthritis; 4) hemiplegia or bedridden for various reasons; 5) other complications affecting hip function. Totally 46 cases were excluded among which the operations were cancelled in 10 cases due to the lack of anesthesia, 9 cases were lost, 8 cases were not in accordance with inclusion criteria, 15 cases was discontinued, 4 cases died during surgery. Additionally, 26 patients could not attend a 2-year follow-up due to poor physical state, and their outcomes at one-year follow-up were collected in this study.

Among the 285 patients included in this study, 153 were female (54%) with an average age of 77.1 years, and 132 male (46%) with an average age of 75.2 years. In our series, 127 cases were classified into Garden III, while 158 Garden IV. In total, 196 cases were complicated with hypertension, diabetes, coronary heart disease and chronic bronchitis. There were no significant differences observed among the treatment groups regarding age, gender, fracture type or underlying disease. Randomization was made using identical sealed opaque and numbered envelopes. All together, 128 cases were in CRIF group, including 69 females (54%). THA group comprised 157 cases, including 84 females (54%).

Perioperative management

This study was approved by the Clinical Ethics Committee, and obtained patients' informed consent in the presence of a third party. Patients in both groups underwent surgical operations by one surgical team. All the patients undergoing CRIF were placed on an orthopedic traction table in the supine position. Internal fixation was carried out under C-arm X-ray, with a small incision in the lateral femur, which was then internally fixed with three hollow compression screws. THA was carried out with an uncemented prosthesis via posterior approach to the hip joint, with the patient in a lateral position. For both surgical treatments, the surgeons were expert technicians and well experienced. The postoperative monitoring results between both groups revealed no significant difference.

Follow-up

All the patients underwent annual physical and imaging reexamination within 5 years after surgery. Postoperative follow-up was performed by telephone and written correspondence. Postoperative complications were comprehensively evaluated by inquiry, physical examination and imaging results at outpatient review. Postoperative hip function was estimated by an international Harris score[6] from four aspects (pain, function, deformation and motion of the joint): 90-100 points defined as excellent; 80-89, good; 70-79, fair; less than 70, poor.[1] The criteria for failure of the operation in CRIF group were as follows: 1) fracture nonunion; 2) collapse of the femoral head; 3) displaced broken ends of fractured bone; 4) deep infection; 5) loosening of the end part of the screw; or 6) localized inflammation. For THA group, the criteria for failure of the operation included: 1) two or more prosthesis dislocations; 2) prosthesis loosening; 3) deep infection; 4) periprosthetic fracture. Determination of death was made by cardiopulmonary criteria. In total, 5.3% of the admitted 285 patients failed to be followed up.

Based on the principle of intention-to-treat analysis, each patient remained in the original group for result analysis once randomized, regardless of whether they had completed the trial or received other treatments during the trial. For example, the patients in the CRIF group undergoing hip replacement during follow-up were still defined as the CRIF group. If patients underwent at least one reevaluation but died during follow-up, the results of the latest follow-up were included in the study analysis.

Statistical analysis

All the data were processed by SPSS 18.0. Student's *t*-test was used for comparing mean values between both groups. Postoperative 5-year cumulative survival rate was demonstrated on the Kaplan-Meier curve and analyzed using the log-rank test. Frequency of postoperative 5-year complication and unsuccessful operations were compared between both groups by Chi-square test. The Fisher's test was applied to analyze the incidence of single complication. $P<0.05$ was defined as statistical significance.

RESULTS

Perioperative condition

The general status of patients before surgery