Hemiarthroplasty vs Primary Total Hip Arthroplasty For Displaced Fractures of the Femoral Neck in the Elderly

A Meta-Analysis

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Abstract: Current updated meta-analysis was designed to compare clinical effects of hemiarthroplasty (HA) vs primary total hip arthroplasty (THA) for displaced femoral neck fractures in elderly patients. Five randomized and 4 quasi-randomized controlled trials with a total 1208 patients were included for final analysis. It showed that mortality and postoperative infection between HA and THA had no statistical differences, that long-term reoperation rate of HA was higher than that of THA, that medium-term dislocation rate of HA was lower than that of THA, and that pain rates of HA in short-term and long-term were both higher than THA. Summarily, treatment of THA for elderly displaced femoral neck fracture could provide better results of reduced reoperation rate and pain relief; however, HA yielded a lower incidence of postoperative dislocation. **Keywords:** femoral neck fractures, total hip arthroplasty, hemiarthroplasty, the elderly, meta-analysis.

Because of the growing aging population and high prevalence of osteoporosis, the incidence of femoral neck fractures shows a rising trend. In North America, for example, there are 280 000 hip fractures that require treatment every year [1], and by 2050, this number is expected to rise to 700 000 cases annually. It has been estimated that the annual medical costs owing to hip fractures will be more than 15 billion US dollars at this time [2].

Hemiarthroplasty (HA) and total hip arthroplasty (THA) are common methods for hip joint restoration [3]. Hemiarthroplasty and THA treatments for displaced femoral neck fractures in elderly patients both present advantages and disadvantages [4-6]. For displaced intracapsular fractures in elderly patients, if they have lower functional demands, there seems to be a consensus that HA is the preferred treatment [1]; however, for active, mentally alert, and relatively healthy elderly patients with displaced femoral neck fractures, the decision regarding whether to select HA or THA is controversial [1,7,8].

To provide a useful quantitative assessment regarding outcomes of HA or primary THA for displaced femoral neck fractures in patients older than 60 years, we performed a meta-analysis based on randomized and quasi-randomized controlled trials studies published up to December 2010.

Methods

Inclusion Criteria

Only studies meeting the following criteria were included in this meta-analysis: (1) randomized controlled trials or quasi-randomized controlled trials comparing HA with THA, (2) patients with displaced fracture of the femoral neck (Garden stage III or IV), and (3) reported clinical outcomes. All patients in these studies were having their first HA or arthroplasty surgery.

Exclusion Criteria

Patients with the following conditions were excluded from the study: (1) undisplaced femoral neck fracture,

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(2) pathological fracture secondary to malignant disease, and (3) osteoarthritis or rheumatoid arthritis of the hip.

Search Strategy

ZSA and YSG independently performed a systemic search of the English medical literature of HA and primary THA for treatment of displaced femoral neck fractures in the elderly published between January 1966 and December 2010. Sources include the Cochrane database of randomized trials and PubMed. The search strategy was based on combinations of "femoral neck fracture," "hemiarthroplasty," and "total hip arthroplasty or total hip replacement." Citations that included the key terms in the title, abstract, article, or medical subjects heading terms were retained. In addition, these searches were supplemented with manual searches of references within the published articles, major orthopedic textbooks, and principal journals. When necessary, the study authors were contacted for further information.

Data Abstraction and Assessment of Methodological Quality

Two of the authors (ZSA and YSG) independently extracted relevant data in duplicate, including fracture classification, mean age, sex distribution, prefracture comorbidity, cognitive function and mobility, average duration of the follow-up, and type of prosthesis.

Two reviewers (ZSA and YSG) independently assessed the methodology of the selected articles according to method by Juni et al [9]. Quality criteria included treatment assignment, concealment of allocation, description of entry criteria, adherence to the intention-of-treatment principle, blinding, and handling of withdrawals. The reviewers resolved disagreements by discussion.

Outcome Measures

The outcome measures of this study included mortality rate at different follow-up times, pain, and main complications, which included infection (superficial and deep), dislocation, and reoperation.

Statistical Analysis

Meta-analysis was done with Review manager 4.2 (version 4.2 for Windows XP; Copenhagen: the Nordic Cochrane Centre, the Cochrane Collaboration, 2003). For categorical variable data, relative ratio (RR) and 95% confidence intervals (CIs) were calculated. Relative ratio is the risk of an event (or developing a disease) relative to exposure, which is the ratio of probability of the event development in the exposed vs a nonexposed group. For indicators of heterogeneity of pooled effect sizes, we calculated I^2, which indicates the heterogeneity in percentages, and we tested whether the level of heterogeneity was significant using the Q statistic. If the hypothesis of homogeneity was not rejected, the fixed-effected model (Mantel-Haenszel test) [10] was used to calculate the summary RR and the 95% CI. In all other cases, a random-effects model (DerSimonian-Laird method) was used [11].

Results

Study Characteristics

After the inclusion and exclusion criteria outlined above, 2 reviewers (ZSA and YSG) independently read the title and/or abstract combined with manual search and references of retrieved articles and included 9 articles in this meta-analysis. All literatures involved THA vs HA surgeries for displaced femoral neck fractures in elderly patients, and the main outcome measures were postoperative complications and function recovery. The sample size of the data ranged from 40 to 252 cases with an average age of 69 to 81years and a follow-up time of 12 to 156 months. Both the THA and HA groups used were either cemented or uncemented. Detailed characteristics of the 9 studies are listed in Table 1. Based on the 9 studies, 1208 patients were available for analysis [12-20]. Of these, 561 patients received THA and 647 patients received HA.

All 9 studies were randomized or quasi-randomized, and 5 studies had adequate randomization procedures [15-18,20]; the other 4 studies [12-14,19] were randomized based on odd and even hospital number (1), the day of the week (2), or fixed alternating sequence (1). Of the 9 studies, 5 studies [15-18,20] had concealment of allocation, whereas the other 4 studies [12-14,19] did not; 5 studies [15-18,20] had intent-to-treat analysis, whereas the remaining 4 studies [12-14,19] did not; 4 studies [12-14,19] had a loss of follow-up, whereas the other 5 studies [15-18,20] had complete follow-up; 2 studies [15,19] had a blinded outcome assessor, whereas in the remaining 7 studies [12-14,16-18,20], the outcome assessor was not blinded. Each study had specified entry criteria and defined outcome measures, and the detailed methodological qualities are listed in Table 2. As the follow-up time in each trial was different, the 9 trials were divided according to length of follow-up: within 1 year, within 5 years, and within 13 years (3 subgroups). Meta-analysis was carried out on each subgroup, and a comprehensive meta-analysis was also performed.

Outcome Measures

Mortality

Mortality data were provided in 8 studies (1168 patients, 443 events): the number of events was 209 for HA (n = 624) and 194 for THA (n = 544). Effects sizes were homogeneous (χ^2 = 12.66, I^2 = 44.7%, P = .08). There were reductions in mortality rates within 5 years in patients who were treated with HA (RR, 0.88; 95% CI, 0.71-1.08; P = .23); however, these were not statistically significant. There was less mortality 1-year and 13-year postsurgery in patients with THA (RR, 1.14; 95% CI, 0.71-1.85; P = .58; RR, 1.06; 95% CI, 0.93-1.21; P = .39, respectively), but these results were not