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Original article

Comparison of dual mobility total hip arthroplasty and bipolar arthroplasty for femoral neck fractures: A retrospective case-control study of 199 hips

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ABSTRACT

Background: The choice between performing total hip arthroplasty (THA) or hemiarthroplasty (HA) is not straightforward in older patients with femoral neck fracture, particularly when co-morbidities are factored in. This led us to carry out a case-control study to determine (1) the rate of mechanical complications for these two types of implants, and (2) the rate of medical complications and mortality.
Hypothesis: THA with dual mobility cup (DM) will result in fewer mechanical complications than HA.
Patients and methods: This was a single-center, retrospective case-control study. Between 2010 and 2015, all patients with a femoral neck fracture treated by HA or DM THA were included. The primary outcome was the occurrence of any type of surgical complication. The Charlson Co-morbidity Index (CCI) and the independence during Activities of Daily Living (ADL) score were calculated for every patient. Two subgroups of patients were made based on whether they met frailty criteria. The effect of covariates on 1-year mortality was controlled using Cox's proportional hazards regression model.
Results: The cohort consisted of 101 HA and 98 THA procedures in 193 patients (139 women, 54 men) with a mean age of 80.6 years (range, 76–101). The mean follow-up was 24.2 months (range, 0–83) with a median of 14.5 months. Fifteen of the HA hips (15%) had surgical complication, of which 10 were posterior dislocations (10%). Ten patients in the HA cohort had a serious medical complication (10%). Ten of the THA hips (10%) had a mechanical complication, including three posterior dislocations (3%) and four infections (4%). Nine patients in the THA cohort had a medical complication (9%). There were significantly fewer posterior dislocations in the THA hips ($p = 0.05$). In the subgroup analysis, the 117 patients (58%) who met the frailty criteria had a significantly lower dislocation rate after undergoing THA ($p = 0.048$). After adjusting on age, ADL and CCI score, the dislocation rate no longer differed significantly between the two groups ($p = 0.1$). The dislocation rate was lower in the THA hips only in the "frail" patients (Odds ratio = 0.137, 95% CI: [0.003–0.97] ($p = 0.04$)). There was no difference in the dislocation rate in the "non-frail" patients. The overall 1-year mortality was 85% [95% CI: 78–94%]. It was 78% [95% CI: 69–86%] for the HA hips and 88% [95% CI: 82–95%] for the THA hips ($p = 0.01$). After factoring in the impact of age, CCI and ADL, the differences in the 1-year mortality between HA and THA were no longer present ($p = 0.42$). Thus, there is no increased risk of mortality in THA patients.
Discussion: When the CCI and independence level are taken into consideration, the frailest patients can undergo DM THA to reduce the dislocation risk, without increasing the mortality rate at 1 year. Patients who are not frail will benefit equally from undergoing HA or THA.
Level of evidence: III, case-control study.

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1. Introduction

The decision to perform arthroplasty in patients with a femoral neck fracture is currently not well standardized. Unipolar hemiarthroplasty (HA) or bipolar hemiarthroplasty (BA) with a mobile cup has long been the preferred treatment, and is performed in 75% of cases [1]. It is justified by the reasonable operating time, low blood loss and acceptable functional outcomes. In the 2000s, total hip arthroplasty (THA) emerged as a relevant alternative to HA [2–7].

Since then, there is an on-going debate on the best implant to use. Age, co-morbidities, patient independence and potential surgical complications must be taken into account when deciding between implants. The risk of dislocation is a key deciding factor because of its well-described consequences [2–6]. Up to the early 2010s, the THA procedures described in these studies used a fixed cup. In some cases, this resulted in the dislocation rate being higher than with HA [2–6]. The emergence of dual mobility (DM) cups has reduced the dislocation rate. However, the relative role of DM THA and BA is not well defined in the context of co-morbidities [7–9].

This led us to carry out a retrospective, comparative case-control study to determine whether, based on the patients' independence and co-morbidities, DM THA leads to different outcomes than BA in terms of (1) mechanical complications, (2) medical complications, particularly mortality and infection. We hypothesized that the mechanical complication rate would be lower in DM THA cases than in BA cases.

2. Materials and methods

2.1. Patients

This was a single-center, retrospective study of patients treated between 2010 and 2015. All patients over 75 years of age who underwent arthroplasty (THA or BA) because of a femoral neck fracture were included. Between 2010 and 2013, the surgeons in our unit treated all older patients with a femoral neck fracture with cemented BA. Cemented THA was indicated only for patients in good general condition or those with hip osteoarthritis. Between 2013 and 2015, the make-up of the surgical team changed. This resulted in systematic use of cementless DM THA in these patients, except when contraindicated (requirement for abridged surgery, life expectancy less than 6 months). The cohort consisted of 193 patients (199 hips): 139 women (72%) and 54 men. The mean age was 80.6 years (range, 76.4–101). The patients were separated into 101 BA hips (controls) and 98 DM THA hips (cases).

2.2. Methods

All patients were operated through a posterolateral approach. The following implants were used: stems - Sem3 (cemented) or Louxor (cementless) (SEM, Créteil, France), cups - DM Galliléa (cemented) or Evora (cementless) (SEM, Créteil, France) in HA cohort, bipolar heads (SEM, Créteil, France) in BA cohort. The acetabular cup was cemented secondarily when the press-fit of the trial cup was estimated to be insufficient. Cementing of the femoral stem was planned preoperatively when the cortices were determined to be too thin by the surgeon, or decided intraoperatively when the stability of the trial stem was insufficient. All patients were treated with the same protocol: intraoperative antimicrobial prophylaxis, prevention of thromboembolism complications, abduction pad and full weight-bearing postoperatively. The patients were allowed to stand on Day 1 when their general condition allowed it. A physical therapist guided their resumption of walking, while teaching the patients to avoid positions that could contribute to dislocation.

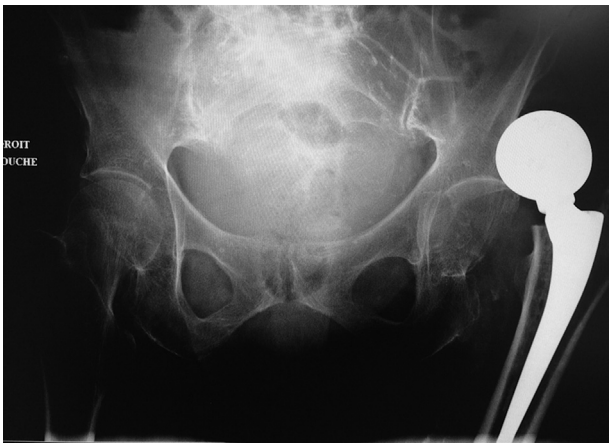

Fig. 1. Early dislocation of a hemiarthroplasty implant in a bed-ridden patient after femoral neck fracture.

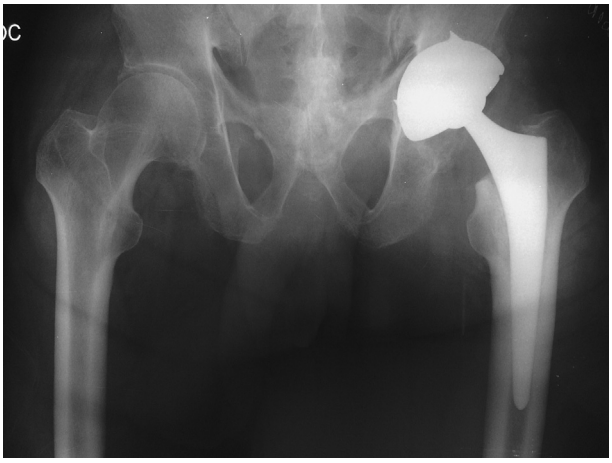

Fig. 2. Conversion of a bipolar hemiarthroplasty to total hip arthroplasty due to repeated dislocations.

2.3. Methods used to evaluate outcomes

The primary outcome was the occurrence of a surgical complication or medical complication.

Surgical complications were defined as a dislocation (Figs. 1–3), periprosthetic fracture, or surgical site infection (SSI) requiring surgical revision. The number of reoperations was reported separately. Medical complications included ones that were not life threatening, such as deep venous thrombosis and ones that were life threatening, such as myocardial infection, acute mesenteric ischemia, stroke, pulmonary embolism (PE) or any other ailment requiring a stay in the intensive care unit.

Several secondary outcomes were determined. The first was the Charlson Co-morbidity Index (CCI) [10,11], which is a validated scale for measuring general co-morbidity, including in a geriatric population. This index is graded on a scale of 0 to 37 and predicts 10-year survival in patients with multiple co-morbidities. The second was the Katz index of independence in activities of daily living (ADL) [12,13] which was used to estimate the independence of patients immediately before their fracture occurred. This index evaluates whether the patient requires assistance for

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