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Original article

Small diameter metal-on-metal total hip arthroplasty at 13 years – a follow-up study

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ABSTRACT

Introduction: Theoretically, the properties of second-generation metal-on-metal (MoM) bearings are better for wear, osteolysis and longevity. However, follow-up studies of more than 10 years are rare, in particular with hybrid fixation (cemented stainless steel stems and cementless cup), therefore we evaluated the results of this combination after a mean follow-up of 12.8 years: (1) to analyze the survival rate, (2) to compare it with the survival rate in the same series after 6.4 years (95.8% cup, 94.8% stem), (3) to evaluate clinical and radiographic outcome and (4) to analyze these failures.
Hypothesis: The number of revisions would increase after 10 years.
Materials and methods: We evaluated 106 total hip arthroplasties (THA) (Cedior™ press-fit cup with cemented Acora™ ($n = 50$) and Exafit™ ($n = 56$) stems and 28 mm Metasul™ bearings performed between January 1999 and December 2002. The survival rate was calculated by the Kaplan-Meier method. The clinical assessment included the Postel Merle d'Aubigné (PMA) and Oxford scores. The radiographic assessment evaluated radiolucencies and osteolysis on standard X-rays. A histological analysis was only performed during revision THA.
Results: After a mean 12.8 years of follow-up (10–16), 53 THA were reviewed in 48 patients. Thirteen THA revisions (14%) were performed including 11 aseptic revisions (5 stem fractures, 2 cases of impingement and 3 loosenings [1 bipolar and 3 cups] and one case of osteolysis). Overall survival, taking into account revision for aseptic loosening, was 87.6% (CI 95% = 77.3 to 99.3%). The mean PMA and Oxford scores at the final follow-up were 17.6 ± 0.8 points (16–18) and 16.5 ± 5.2 points (12–38) respectively. The radiological follow-up mainly identified radiolucencies around the stem in Gruen zones 1 and 7 (17 and 21% respectively).
Discussion: The survival rate of hybrid MoM THA in this series decreased after 10 years and is lower than studies evaluating cementless THA with the 28-mm Metasul™ bearings (90.9 to 100% survival). Although the clinical results are satisfactory, survival is lower. However, the role of MoM bearings is relative in these failures, in particular because trunnionoses (stainless steel stem with 28-mm head), impingement and especially 5-stem fractures were the main causes of failure.
Level of evidence: IV: retrospective study.

1. Introduction

Theoretically, second generation metal-on-metal (MoM) bearings provide interesting tribiological properties for wear, osteolysis and thus longevity of total hip arthroplasties (THA) [1–3]. An intermediate term study performed in our unit reported the results of 94 MoM THA using Metasul™ heads (Zimmer, Winthertur, Switzerland) associated with a press-fit Cedior™ cup (Zimmer, Winthertur, Switzerland) a cemented Acora™ or Exafit™ femoral stem (Zimmer, Winthertur, Switzerland) after a mean 6.4 years of follow-up [4]. The survival rate was 95.8% (91.8–99.8) for the cup and 94.8% (90.3–99.2) for the femoral stem. Based on these encouraging results, we decided to continue using the MoM bearing in young, active patients.

Although there are nine studies in the literature on survival of the 28-mm Metasul™ system after more than 10 years [5–13] follow-up, with a survival rate of between 90.9 and 100%, most of these used cementless femoral fixation with a titanium alloy. Thus, the results in cemented stainless steel stems with the Metasul™ bearings are not precisely known and we performed this follow-up study of our initial series with the following goals: (1) to analyze the rate of survival of 28-mm MoM THA with hybrid fixation, (2) to

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compare survival in this series to that after 6.4 years of follow-up (95.8% cup, 94.8% stem), (3) to evaluate the clinical and radiographic results and (4) to analyze the failures. Our hypothesis was that the number of revision THA would increase after 10 years.

2. Materials and methods

2.1. Patients

Between January 2012 and March 2014, clinical and radiological follow-up was performed a mean 12.8 years after primary THA in patients who underwent MoM THA and based on the same protocol as the intermediate term study [4]. From January 1999 to December 2002, 106 THA with high carbon concentration MoM (Metasul™) bearings were performed in 95 patients by two senior orthopedic surgeons (PO and PB). The patients' mean age was 59.2 years old (range 37–69, median 56) at THA. There were 55 men and 40 women. The etiology of hip arthritis was: primary arthrosis in 82 cases (77%), necrosis of the femoral head in 11 cases (11%), arthrosis secondary to dysplasia in 10 cases (9%) and post-traumatic in 3 cases (3%).

2.2. Methods

An anterolateral approach was used in all cases (Hardinge approach). Components included a cemented stainless steel femoral stem with a 8/10-mm morse taper (Acora-Zimmer™ ($n = 50$) or Exafit-Zimmer™ ($n = 56$) with a 28-mm Metasul™ head and a press-fit Cedior-Zimmer™ cup including a Metasul™ liner. This titanium alloy cup had three unsealed screw holes in the polar zone and twelve 1.5-mm flanges in the equatorial section. No screws were used in our series. The cup contained a Metasul™ liner set in a polyethylene (PE) sandwich. The Metasul™ head was composed of a chromium-cobalt ally with a high carbon content (0.2%) [1].

2.3. Clinical and radiological follow-up

The clinical follow-up was performed by an orthopedic surgeon who was not the operating surgeon. The Postel-Merle d'Aubigné (PMA) [14] score and the validated French Oxford score [15] were calculated for each patient.

A standard radiographic follow-up was performed at the final follow-up consultation including: a pelvic AP X-ray and AP and lateral X-rays of the prosthesis. Radiolucencies and periprosthetic osteolysis were identified according to the zones described by Gruen et al. [16] for the stem and DeLee and Charnley [17] for the cup. Osteolysis was defined according to the criteria identified by Zicat et al. [18] as a focal area of bone loss at least 2 mm wide. Loosening of the stem and the cup was defined according to criteria by Gruen et al. [16] and DeLee and Charnley [17] respectively. Additional CT images were only obtained in case of progressive periprosthetic radiolucencies or inguinal pain. A histological analysis of periprosthetic tissue and the synovial capsule was systematically obtained during revision THA. We did not perform ion blood measurements.

2.4. Statistical analysis and survival curves

THA survival was calculated at the final follow-up by the Kaplan-Meier [19] method with a confidence interval of 95% (CI 95%), using SPSS software 10.0 (SPSS, Chicago, Illinois, USA). The date of the last consultation or death was used to determine the length of follow-up in lost to follow-up patients and in patients who had died, respectively. The survival rate was calculated for the revision of one or both THA components whatever the cause (septic or aseptic), for aseptic revisions and aseptic loosenings (which do not include isolated femoral stem fractures). The types and causes of revision THA were determined.

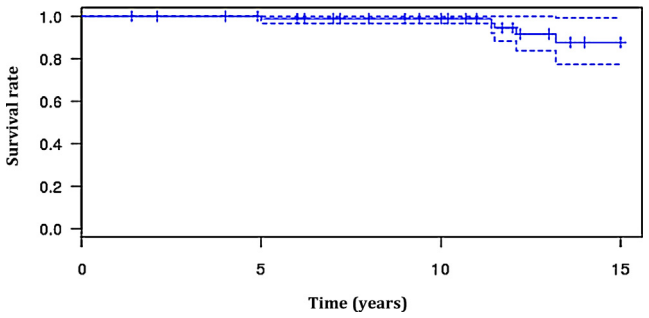

Fig. 1. Kaplan-Meier survival curve (stem + cup) for revision THA due to aseptic loosening. The confidence interval is represented by the dotted lines.

3. Results

3.1. Survival analysis

After a mean 12.8 years of follow-up (10–16 years), overall survival of THA for revision for all causes and of the stem alone was 79.3% (CI 95% = 68.7 to 91.5%); 81.5% (CI 95% = 71.0 to 93.5%) for aseptic revision and 87.6% (CI 95% = 77.3 to 99.3%) for aseptic loosening (Fig. 1). Survival of the cup alone at 12.8 years was 83.4% (CI 95% = 72.8 to 95.4%) for revision for all causes and 87.6% (CI 95% = 77.3 to 99.3%) for aseptic loosening.

3.2. Clinical and radiological results

After exclusion of 13 revisions (2 septic and 11 aseptic), 48 (53 THA) out of 85 patients (94 THA) evaluated during the intermediate term follow-up study were available for clinical and radiological assessment after a mean 12.8 years (10–16 years) (Fig. 2). Clinical and radiographic scores were available for all 48 patients. Patients' mean age at the final follow-up was 68 years old (47–78). None of the 12 deaths that occurred since the intermediate term study were related to THA. None of the patients complained about their hip at the moment of death.

The mean PMA score had not changed since the 6.4-year intermediate term follow-up study in the 48 patients seen at the final follow-up. It went from a preoperative score of 11 ± 2.3 (8–14) to 17.8 ± 0.5 (17–18) points at 6.4 years and 17.6 ± 0.8 (16–18) points at 12.8 years. The mean Oxford score was 16.5 ± 5.2 (12–38) points at the final follow-up for a maximum score of 12 points. It was not determined at the 6.4-year intermediate term study.

The radiological results in the 48 patients seen at 12.8 years of follow-up are presented in Fig. 3. Periprosthetic radiolucencies were mainly observed in the proximal metaphysis around the stem with 17 and 21% respectively in Gruen zones 1 and 7. Table 1 compares the radiological results of the studies at 6.4 and 12.8 years. Cup inclination had not significantly changed in the 48 patients between 6.4 and 12.8 years of follow-up ($45.7^\circ \pm 4.5$ and $47.4^\circ \pm 6$ respectively).

3.3. Revisions

Thirteen out of 94 (12.5%) of the series of MoM THA had undergone revision THA at the final 12.8 year follow-up (Fig. 2): two patients (2%) for septic loosening and eleven patients (10.5%) for mechanical failure including 5 femoral stem fractures (5.3%) (Table 2).