Survival of Total Hip Arthroplasty with Ceramic-on-Ceramic Bearings

INTRODUCTION

In general, the prognosis after total hip arthroplasty (THA) is good with a 10 years survival rate around 90% in national registry studies. In younger patients 15-20 % of the patients might risk revision within 10-15 years. Much effort has been put into reducing wear which motivated the introduction of ceramic bearings in 1970. The purpose of this population-based follow-up study was to study short- to medium-term survival of THAs with ceramic-on-ceramic (CoC) bearings and to investigate the revision causes. The null hypothesis was that there was no difference in survival of THA with CoC, ceramic-on-polymethylmethacrylate (CoP), metal-on-polymethylmethacrylate (MoP), and metal-on-metal (MoM) bearings.

METHODS

From Danish Hip Arthroplasty Registry (DHR) 51,412 primary THAs operated between the 1st of January 2002 and 31st of December 2009 have been identified. Only first primary THA for each patient was included into the study. 37,425 THAs were registered with a precise couple of bearings, and the remaining 13,987 THAs were excluded from the study. At birth, every Danish citizen is issued with a personal ten-digit identification number coding for date of birth and gender. This provides exact linkage between the medical and demographic databases in Denmark. Together with DHR, two other databases were used: From the National Registry of Patients, all discharge diagnoses since 1977 and all diagnoses for outpatient visits since 1995 prior to surgery were collected for patients entered into the study, and the Charlson comorbidity index score was calculated. The patients were classified according to three levels of comorbidity: low-index (individuals with a score of 0 prior to the time of surgery), moderate (individuals with 1 or 2 points), and high-index (individuals with more than 2 points). Data from the Civil Registration System was used to determine the risk time for the statistical analyses.

Patients’ records were collected for patients registered with component failure as revision cause, and the incidence of ceramic head and liner fracture for both CoC and CoP THA was calculated. Survival curves for uncemented THA have been constructed by the Kaplan-Meier method. Patients have been censored at death, emigration, revision, or end of study period (the 15th of September 2010), whichever came first. Cox multiple regression analysis have been used to calculate hazard ratio used as a measure of relative risk (RR) of any revision or specified revision causes as endpoint with 95% confidence interval (CI). Adjustments have been made for the following patient- and surgery-related confounders: Gender, age, diagnosis for primary THA, comorbidity according to the Charlson comorbidity, year of surgery, type of component fixation, femoral head size, and duration of surgery. Chi-square test was performed to compare proportions. A p-value<0.05 was considered significant.

RESULTS

In the study population 2,129 (5.7%) had CoC THA, 8,519 (22.8%) had CoP THA, 25,384 (67.8%) had MoP THA, and 1,317 (3.5%) revisions were identified in the study population with the following revision causes: Aseptic loosening, osteolysis without loosening, deep infection, femoral fracture, dislocation, component failure, pain, and other. The revision causes were divided into Group A (component failure, pain, and other revision causes) and Group B (aseptic loosening, osteolysis without loosening, deep infection, femoral fracture, and dislocation). When comparing Group A and Group B for CoC bearings separately with CoP, MoP, and MoM bearings it was shown that CoC bearings had significantly higher rate of the Group A revision causes: p=0.006 for CoC THA compared to CoP THA, p=0.001 for CoC THA compared to MoP THA, and p=0.004 for CoC THA compared to MoM THA.

The overall 8.7 years survival for uncemented THAs was 95.2% (95% CI, 93.8-96.3%) for CoC bearings, 96.1% (95% CI, 95.5-96.7%) for CoP bearings, 95.1% (95% CI, 94.5-95.6) for MoP bearings, and 96.8% (95% CI, 95.6-97.7%) for MoM bearings (Fig.). The RR for any revision of THA with CoP bearings was significant lower during follow-up (Table).

DISCUSSION

This nationwide population-based short- to medium-term follow-up study showed that there was no difference in survival of THA with CoC bearings compared to THA with MoP and MoM bearings, but THA with CoP bearings had a decreased risk of revision. Furthermore, the frequency of specific revision causes differed within the four types of bearings.

The strengths of the present registry study include the population-based design with prospectively collected data, large sample size and complete follow-up limiting possible selection and information bias. The medical databases providing data to this study have overall documented high to moderate validity, and the data are registered independently of the aim of this study. The study also has some limitations: In DHR, registration of an unambiguous couple of bearings for every THA has not been completed, and the incidence of ceramic head fracture was 0.28%. For CoP THA the incidence of ceramic head fracture was 0.14%. For CoC THA the incidence of ceramic head fracture was 0.082%.

Significance

According to the results of this study, the higher rates of revision because of component failure, pain and other revision causes for CoC THA should be taken into account, as well as THA with CoP bearings should be used preferably.