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Ceramic-on-Ceramic Bearing in Total Hip Arthroplasty Reduces the Risk for Revision for Periprosthetic Joint Infection Compared to Ceramic-on-Polyethylene: A Matched Analysis of 118,753 Cementless THA Based on the German Arthroplasty Registry

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Abstract

Periprosthetic joint infection (PJI) is one of the most common complications in total hip arthroplasty (THA). The influence of bearing material on the risk of PJI remains unclear to date. This registry-based matched study investigates the role of bearing partners in primary cementless THA. Primary cementless THAs recorded in the German Arthroplasty Registry since 2012 with either a ceramic-on-ceramic (CoC) or ceramic-on-polyethylene (CoP) bearings were included in the analysis. Using propensity score matching (PSM) for age, sex, obesity, diabetes mellitus, Elixhauser comorbidity index, year of surgery and head size, we compared the risk for revision for PJI for CoC and CoP. Within the 115,538 THAs (87.1% CoP; 12.9% CoC), 977 revisions were performed due to PJI. There was a significantly higher risk for revision for PJI for CoP compared with CoC over the whole study period ($p < 0.01$) after 2:1 matching (CoP:CoC) with a hazard ratio of 1.41 (95% confidence interval (CI), 1.09 to 1.80) After 3 years, the risk for revision for PJI was 0.7% (CI 0.5–0.9%) for CoC and 0.9% (CI 0.8–1.1%) for CoP. The risk for revision for all other reasons except PJI did not significantly differ between the two groups over the whole study period ($p = 0.4$). Cementless THAs with CoC bearings were less likely to be revised because of infection in mid-term follow-up. In the future, registry-embedded studies focusing on long-term follow-up, including clinical data, as well as basic science studies, may give a deeper insight into the influence of the bearing partners.

Keywords: periprosthetic joint infection; primary total hip; bearing; ceramic-on-ceramic

1. Introduction

Periprosthetic joint infection (PJI) is one of the most common reasons for revision in primary total hip arthroplasty (THA) and causes devastating complications for patients as well as high costs for health systems [1,2]. Multiple risk factors for PJI have been identified, whereby diabetes and obesity may be the most important patient-related modifiable ones [3,4]. The rate of PJI after THA for patients with primary osteoarthritis, however, has stayed between 1 and 3% over the last 30 years [5,6,7], so research is increasingly focusing on innovative aspects such as the actual prosthesis, the fixation method or the material of bearing partners. Metal-on-metal (MoM) bearings are said to be associated with a higher risk of infection [8,9]. This may be due to a change in periprosthetic tissue or an altered immunologic response because of metallic debris, thus leading surgeons to abandon stemmed MoM THA [10]. The other hard-on-hard bearing, ceramic-on-ceramic (CoC), is said to outperform metal-on-polyethylene (MoP) and ceramic-on-polyethylene (CoP) regarding wear and longevity, and has been often used, especially in young patients, since the 1990s [11,12]. However mechanical problems such as squeaking, breakage, incorrect ceramic insertion or impingement postoperatively display the technical expertise regarding surgical technique [13]. Low wear is less likely to cause synovitis, effusion and hyperemia, and ceramic particles are more biocompatible than metal debris [14], raising the question of the influence of CoC on infection. However, there are limited data on CoC reducing the rate of PJI, as recent studies investigating this topic may not have precisely captured important covariables [15,16]. A current meta-analysis including 11 randomized controlled studies and six

observational studies did not demonstrate a significant difference in risk of PJI in relation to bearing combination in THA [17]. Studies based on registry data are an appropriate methodology to further analyze this connection, as registries have been shown to be superior for detecting early trends. The German Arthroplasty Registry uses an elaborate system to capture almost all revision surgeries regardless of which hospital in Germany they were performed in [18,19].

The current study investigates the risk of PJI in relation to the bearing partner in primary cementless THA based on data from the German Arthroplasty Registry. We hypothesized that CoC bearings would have a lower risk for revision for PJI compared with CoP.