

# **Risk of revision in total hip arthroplasty with ceramic-on-polyethylene and metal-on-polyethylene bearings – Results from a common database from four countries**

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## **Keywords**

Total hip arthroplasty; bearings; ceramic-on-polyethylene; metal-on-polyethylene

## **Background**

A challenge in total hip arthroplasty (THA) is to reduce the formation of wear particles from the polyethylene liner in metal-on-polyethylene bearings, potentially leading to osteolysis and aseptic loosening of the implant. Ceramic heads were introduced as an alternative to metal heads in order to reduce wear and subsequently aseptic loosening.

## **Objectives**

To investigate the risk of any revision of ceramic-on-polyethylene compared to metal-on-polyethylene bearings in primary THA and secondly, to investigate the risk of revision due to specific causes.

## **Design and Methods**

Data from the arthroplasty registers in four countries were merged into one database. We included all primary stemmed THAs operated from January 1, 1995 to December 31, 2015 diagnosed with osteoarthritis, femoral head osteonecrosis, arthritis, and sequelae from childhood hip disorders (n=608,951). In case of bilateral THA, the second THA was excluded (n=114,914). THAs with dual mobility cups (n=3,815), other than the two bearings (n=155,066), specific implant brands used in less than 50 THAs in each country (n=3,352), and with missing femoral head size (n=19,429), diagnosis (n=1,557), fixation (n=531), and cup and stem brand (n=110) were excluded. Hence, the study

population consisted of 310,177 THAs with complete information on the confounders that were adjusted for: Sex, age, diagnosis, year of surgery, fixation, and femoral head size. Patients were followed for a minimum of 1 year. The Kaplan-Meier estimator was used to assess the implant survival, and regression with the pseudo value approach was used to estimate the adjusted relative risk (aRR) of revision – both assessed with 95% confidence intervals. Due to differences in follow-up, analyses were made separately for Ceramic-on-conventional polyethylene (CoP) compared to metal-on-conventional polyethylene (MoP), and Ceramic-on-crosslinked polyethylene (CoXLP) compared to metal-on-crosslinked polyethylene (MoXLP).

## **Results**

CoP compared to MoP: 24,018 had CoP and 166,402 MoP bearings and were followed up to 20 years. Median follow-up (interquartile range (IQR)) in years was 10 (6.5-13) for CoP and 9.2 (5.9-13) for MoP. At 20 years, the survivorship was 80% (78-82%) for CoP and 82% (81-83%) for MoP, and the aRR of any revision was 1.04 (1.01-1.07) for CoP compared to MoP. In total, there were 12,417 revisions (6.5%), and for both CoP and MoP the most prevalent cause of revision was aseptic loosening. There was no difference in aRR of revision due to aseptic loosening, prosthetic joint infection (PJI), or the group of “other” causes, but the aRR was significantly higher for revision due to periprosthetic fracture (1.01 (1.00-1.02)) and dislocation (1.01 (1.00-1.02)) for CoP compared to MoP. CoXLP compared to MoXLP: 25,070 had CoXLP and 94,687 MoXLP bearings and were followed up to 12 years. Median follow-up (IQR) in years was 4.0 (2.3-6.3) for CoXLP and 3.7 (2.2-5.6) for MoXLP. At 12 years, the survivorship was 93% (92-95%) for CoXLP and 94% (93-95%) for MoXLP, and the aRR of any revision was 0.99 (0.97-1.02) for CoXLP compared to MoXLP. In total, there were 3,618 revisions (3.0%), and for both CoXLP and MoXLP the most prevalent cause of revision was PJI. There was no difference in aRR of revision due to aseptic loosening, PJI, periprosthetic fracture, dislocation, and “other” causes.

## **Conclusion**

We found that the risk of revision was increased by 4% in CoP compared to MoP THAs at 20 years but no difference was found for CoXLP compared to MoXLP at 12 years. In perspective, the use of ceramic heads did not increase survival of the primary THAs which was expected.