

# **Birmingham Hip Resurfacing: Long-Term Clinical Outcome with a Minimum 20-Year Follow Up from an Independent Center**

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## **INTRODUCTION:**

The modern concept of metal-on-metal (MoM) hip resurfacing (HR) was introduced in the 1990s. The fundamental idea in HR was the replacement of the native femoral head and mimicking of native hip biomechanics. One of the early, successful implant systems utilizing the concept of native femoral head size with thin acetabular shells made from CoCr alloy was the McMinn prosthesis which later became known as Birmingham Hip Resurfacing (BHR). Following the early results and success of BHR, numerous implant manufacturers introduced their own MoM HR implants. Inappropriate introduction and adoption of new and modified implant technologies resulted to an epidemic of adverse soft tissue reaction which became fully known only 5-10 years after adoption of MoM bearings in different models. The prevalence of adverse reaction to metal debris (ARMD) has been as high as 50% in some MoM hip implants. This led to abandonment of both MoM HR.

BHR has been the most successful and most used HR concept. The concept of HR is intriguing due to the preservation of native biomechanics. This has kept product development active and all-ceramic HRs under investigation. It is, however, important to properly investigate clinical outcomes of previously developed hip arthroplasty concepts. The aim of this study was to investigate the 20-year clinical outcome of BHR from an independent center.

## **METHODS:**

MoM implants were used at our institution between 2001 and 2012. We identified all patients who were operated on with BHR at our institution between May 2001 and June 2003 having a minimum 20-year follow up. Since 2010 all patients with MoM implants have been referred for ARMD screening at our hospital. This involved assessment of clinical outcomes using Harris Hip Score in the beginning and the Oxford Hip Score from 2014 forward. All patients have undergone a routine whole blood (WB) cobalt (Co) and chrome (Cr) measurement. Patients with complaints and/or WB Co/Cr above 5 ppb have undergone a cross-sectional imaging at least once and again if needed. After initial screening, the interval of follow-up assessment, including OHS, WB measurements, and imaging if needed has been under the discretion of the treating orthopaedic surgeon and experienced outpatient clinic physiotherapist. Interval has ranged from 1 to 6 years.

For the purposes of this study, we extracted all available pre-, peri- and postoperative for the study patients from our electronic health records (HER) and data lake. All data has been inputted to these systems prospectively during routine patient care. In May 2023 we assessed the study patients' EHRs and a possible death and date of death was recorded. Any revision done at our institution was also recorded.

## **RESULTS:**

In total 135 hips in 119 patients were operated on with BHR during the study period. Patients were predominantly male (63%) with an average age of 53 years during the surgery. Twenty-five (21%) patients received another MoM total hip arthroplasty in their contralateral hip after the index surgery with BHR.

Nine patients have been lost to follow up. Of these, 4 patients are without any follow-up data and 5 patients were followed up at least once in our hospital and their follow-up time was set to last contact to our hospital. Additional 4 patients live outside our well-being district but have been followed-up at our hospital. Remaining 122 patients are living in our catchment area and their current health and hip status could be verified in May 2023. All these had a minimum 20-year follow up.

Eight patients have died with index resurfacing still in situ. One patient died after revision due to periprosthetic fracture (PPF). In total 16 hips in 16 patients have been revised. Eleven revisions were performed due to ARMD, 4 due to PPF and 1 due to avascular necrosis, respectively. At 20 years, overall implant survival rate was 86.2% (95% CI: 80.3%-92.5%). In male and female patients, the survival rates were 87.1% (95% CI: 79.9%-94.9%) and 84.7% (74.8%-95.8%), respectively. In crude comparison, no clear differences were seen between patients who had been revised due to ARMD and those who didn't require any revision, with regard to age, femoral diameter, anteversion angle, inclination angle, and preoperative range-of-motion.

In the latest follow-up assessment of unrevised patients, median OHS was 46.5 points (IQR: 39-48). Median WB Co was 1.2 ppb (IQR: 0.7 to 1.93) and median WB Cr was 1.3 ppb (IQR: 1.0 to 2.0). Three patients had elevated WB Co above 5 ppb but Wb Cr under 5 ppb.

## **DISCUSSION AND CONCLUSION:**

Overall survival observed in our cohort of BHR patients was similar to that reported in the England and Wales National Joint Registry (NJR). At 18 years, NJR reported all-cause revision rate of 11.3%. Even after 20 years of follow up, we cannot be fully confident that BHR patients would have reached a steady state in terms of ARMD. While the large majority of revisions due to ARMD were done during the first and early in the second decade after primary surgery, one additional

ARMD revision was needed just before the 20-year follow up. Also, one patient with unexplained hip pain has been listed for revision. To sum up, even after two decades after the primary operation, ARMD may still emerge in patients with HR.