

The Rate of Decline in Renal Function after Metal-on-Metal Total Hip Arthroplasty is Improved by Revision Surgery for the Treatment of Adverse Reactions to Metal Debris

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INTRODUCTION:

Metal-on-metal total hip arthroplasty (MoM-THA) requires attention to the postoperative decline in renal function. However, there are no reports on renal function in Japanese patients after MoM-THA. The purpose of this study were 1) to investigate the change of renal function after MoM-THA, 2) to investigate the relationship between adverse reactions to metal debris (ARMD) and renal function, and 3) to investigate the relationship between revision surgery and renal function.

METHODS:

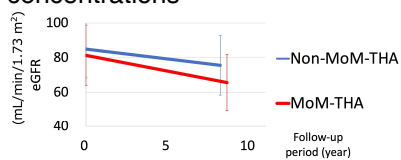
Of 369 MoM-THA cases using one manufacturer's plus cup performed at our hospital from November 2007 to March 2011, 249 cases (28 males and 221 females) were included in this study as the MoM-THA group. Cases with bilateral MoM-THA, with a postoperative follow-up period of less than 1 year, in which dialysis was introduced, or cases in which revision was performed at other hospitals were excluded. Fifty patients who underwent contralateral THA at least 5 years after non-MoM-THA (ceramic on ceramic THA or ceramic on polyethylene THA) at our hospital from June 2002 to February 2017 were included in the non-MoM-THA group. We hypothesized that 1) renal function declines at a faster rate after MoM-THA than non-MoM-THA, 2) renal function is more likely to decline in the presence of ARMD, and 3) renal function improves or declines at a slower rate after revision surgery for the treatment of ARMD. Age, estimated glomerular filtration rate (eGFR, mL/min/1.73 m²) as renal function at primary THA, revision surgery, and last follow up, and serum cobalt (Co) and chromium (Cr) ion concentrations at revision surgery were investigated. Statistical analysis was performed using Spearman's rank correlation coefficient, Mann-Whitney U test, and Wilcoxon signed-rank test.

RESULTS:

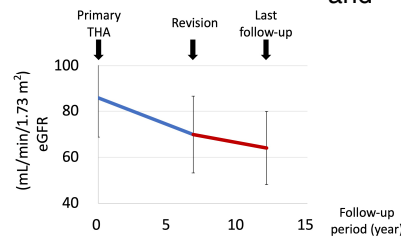
There were no significant differences in age (67.1 years in the MoM-THA group, 63.7 years in the non-MoM-THA group, $p=0.075$) and eGFR at primary THA (81.4 in the MoM-THA group, 85.0 in the non-MoM-THA group, $p=0.224$). The mean follow-up period was 9.9 years in the MoM-THA group and 8.2 years in the non-MoM-THA group ($p=0.001$).

Annual eGFR decline was significantly faster in the MoM-THA group compared to the non-MoM-THA group (-2.0 vs. -1.2, $p=0.003$, Fig.1). One-hundred-forty-eight of 249 cases in the MoM-THA group developed ARMD, and the ARMD- group was older than the ARMD+ group (74.5 years in the ARMD- group vs. ARMD+ group, $p<0.001$) and lower preoperative eGFR (ARMD- group 77.8 vs. ARMD+ group 83.8, $p=0.005$), but no difference in the annual eGFR decline was observed (ARMD- group -2.0 vs. ARMD+ group -1.9, $p=0.603$). Of the 148 patients in the ARMD+ group, 80 underwent revision surgery, of which 53 patients could be followed up for at least 1 year after surgery. The mean follow-up period between primary THA and revision surgery was 6.6 years and the mean follow-up period after revision surgery was 5.7 years, with no significant difference ($p = 0.176$). The annual eGFR decline slowed with revision surgery (-2.1 from primary THA to revision surgery, -0.9 from revision surgery to last follow up, $p=0.006$, Fig.2). No correlation was found between eGFR and Co or Cr ion concentrations at the time of revision surgery in the 55 patients for whom serum Co and Cr ion concentrations could be measured (Co: $r=-0.075$, $p=0.5869$; Cr: $r=0.188$, $p=0.170$, Fig.3).

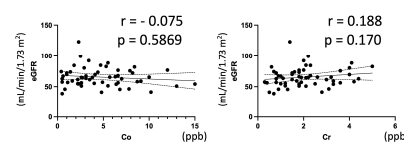
DISCUSSION AND CONCLUSION: The annual eGFR decline in the MoM-THA group decreased about twice as fast as that in the non-MoM-THA group, but the annual eGFR decline slowed with revision surgery. No significant relationships were observed between the presence of ARMD and the annual eGFR decline of eGFR, and between serum Co or Cr ion concentrations



	MoM-THA	Non MoM THA	p value
ΔeGFR /year	-2.0 ± 2.3	-1.2 ± 1.6	0.003



	Primary THA to revision	Revision to last follow-up	p value
Follow-up period (year)	6.6 ± 3.3	5.7 ± 2.9	0.176
ΔeGFR/ year	-2.1 ± 3.3	-0.9 ± 2.2	0.006



and

eGFR.