



ELSEVIER

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Original Article

The Fate of Elevated Metal Ion Levels After Revision Surgery for Head-Neck Taper Corrosion in Patients With Metal-on-Polyethylene Total Hip Arthroplasty

Young-Min Kwon, MD, PhD^{*}, John MacAuliffe, MEng, Yun Peng, PhD, Paul Arauz, PhD

Department of Orthopaedic Surgery, Massachusetts General Hospital, Harvard Medical School, Boston, MA

ARTICLE INFO

Article history:

Received 8 February 2018

Received in revised form

6 March 2018

Accepted 21 March 2018

Available online xxx

Keywords:

adverse local tissue reaction
head-neck taper corrosion
cobalt and chromium metal ion level
metal-on-polyethylene total hip
arthroplasty
metal ion levels decline

ABSTRACT

Background: Elevated metal ion levels have been associated with the presence of adverse local tissue reactions in patients with metal-on-polyethylene (MoP) total hip arthroplasty (THA) secondary to corrosion at head-neck taper junction. Patients are frequently concerned with their elevated systemic metal ion levels. This study investigated the rate of decline of serum cobalt and chromium ion levels after revision surgery.

Methods: A total of 39 patients with MoP THA were revised because of the presence of symptomatic adverse local tissue reactions on magnetic resonance imaging with elevated serum metal ion levels. The time between initial implantation of MoP THA (index surgery) and revision surgery was considered the duration of metal exposure. The prerevision measure of ion level was considered the intensity of exposure. Prerevision median serum Co and Cr levels, as well as revision serum Co/Cr ratio, were reported.

Results: The median serum levels of cobalt and cobalt-to-chromium ratio significantly decreased from prerevision levels of 8.2 µg/L (0.2–56.1 µg/L) and 5.6 µg/L (0.1–53.3 µg/L) to 3.1 µg/L (0.2–14 µg/L) and 1.7 µg/L (0.4–3.8 µg/L) at postrevision ($P < .01$), respectively. The rate of decline of Co was 0.45% per day during the first month. For chromium, the rate of decline was slower with 0.08% per day during the first month.

Conclusion: At 3 months after revision surgery, cobalt and chromium ion levels declined by 34% and 8% of prerevision level, respectively. This study provides evidence-based practical information for surgeons to provide MoP THA patients when considering revision surgery for head-neck taper corrosion.

© 2018 Elsevier Inc. All rights reserved.

Metal ions are released from the bearing surfaces and corrosion and fretting from modular taper connections. Mechanically assisted crevice corrosion (MACC) in metal-on-polyethylene (MoP) total hip arthroplasty (THA) has been identified as a cause of symptomatic implant failure for contemporary femoral components [1–4], specifically when a cobalt-chromium (CoCr) alloy femoral head is used [2,5,6]. MACC produces cobalt (Co) and chromium (Cr) ions and corrosive debris that may cause adverse local tissue reaction (ALTR)

[2,5,6]. More recently, however, MACC causing an ALTR (pseudotumors) has been recognized as a mode of THA failure in patients with a MoP bearing surface [1,7–11]. Despite the wide adoption of modular femoral heads, reports of MACC at the head-neck junction causing THA failure had primarily been isolated to case reports until recently [12–14].

The true prevalence of corrosion at the head-neck junction has not been well studied; however, the present literature suggests that the prevalence of MACC-associated ALTR causing clinical THA failure may be as high as 1%–2% [3,5,15]. Because the majority of the THAs performed in the United States in the past decade are MoP bearings with a modular femoral head, corrosion at the head-neck junction is emerging as an important mode of failure [7]. Current guidelines recommend revision surgery for symptomatic patients with high metal ion levels and ALTRs [16,17]. In fact, patients are frequently concerned with their elevated systemic cobalt and chromium ion levels. However, the fates of these elevated ion levels

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to <https://doi.org/10.1016/j.arth.2018.03.061>.

^{*} Reprint requests: Young-Min Kwon, MD, PhD, Department of Orthopaedic Surgery, Massachusetts General Hospital, Harvard Medical School, 55 Fruit St, Yawkey Suite 3B, Boston, MA 02114.

<https://doi.org/10.1016/j.arth.2018.03.061>

0883-5403/© 2018 Elsevier Inc. All rights reserved.

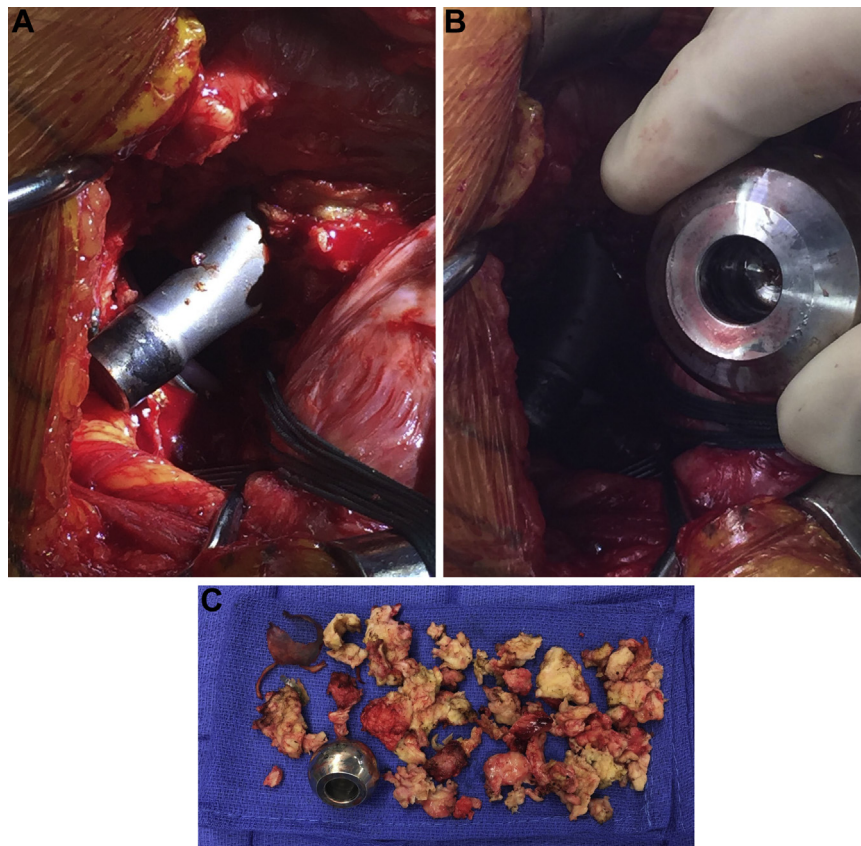


Fig. 1. Intraoperative photographs of corrosion at femoral stem trunnion (A), head taper (B), and debrided local tissue necrosis (C) at the time of revision surgery.

after the revision surgery remain largely unknown. Therefore, the aim of this study was to investigate the rate of decline of serum cobalt and chromium ion levels after revision surgery for adverse tissue reactions in MoP THA patients due to head-neck taper corrosion.

Materials and Methods

Patients

Patients with metal-on-polyethylene (MoP) total hip arthroplasty (THA) secondary to corrosion at head-neck taper junction who underwent revision surgery with both prerevision and post-revision serum metal ion levels were identified from the database of a multidisciplinary referral center at the authors' hospital. The study was approved by the institutional review board. Implant information was recorded and used for analysis. At the time of revision surgery, patient demographics were recorded including age and sex. In addition, all patients underwent serum cobalt and chromium levels. The indication for revision surgery was the presence of symptomatic pseudotumors on magnetic resonance imaging (MRI) with elevated metal ion levels (Fig. 1). All hips had metal-on-polyethylene THA with highly cross-linked polyethylene liners with cobalt-chromium (CoCr) femoral heads on titanium (Ti) alloy femoral stems with only a single site of modularity at the head-neck taper junction. Implants included 19 Versys/ML Taper (Zimmer, Warsaw, IN), 11 LFIT Anatomic/Accolade (Stryker, Kalamazoo, MI), 4 Howmedica/Accolade (Stryker, Kalamazoo, MI), 1 Howmedica/Osteonics (Stryker, Kalamazoo, MI), 2 Pinnacle/Summit (DePuy, West Chester, PA), and 2 Ringloc/Taper Lock (Biomet, Warsaw, IN). The index CoCr femoral head diameter was 28 mm in

2 hips (5%), 32 mm in 15 hips (38%), 36 mm in 17 hips (43%), and 40 mm in 6 hips (15%). The time between initial implantation of MoP THA (index surgery) and revision surgery was 59 months (range 4–182), and this duration was considered the duration of metal exposure. The prerevision measure of ion level was considered the intensity of exposure. Prerevision median serum Co and Cr levels, as well as serum Co/Cr ratio, were used for analysis. Pearson correlation coefficient was used to determine whether duration of exposure or intensity of exposure affect the rate of decline of Co, Cr, and Co/Cr ratio.

Data Analysis

Serum cobalt and chromium levels were measured preoperatively and at the routine clinical patient follow-up at 1, 3, and 12 months. To characterize the postrevision surgery decline of metal ion levels, the postoperative cobalt and chromium levels were normalized to a percent of the preoperative value. A best fitted exponential decay curve was applied to describe the rate of metal ion decline and metal ion half-life after removal of the implants. The percentage rate of decline of cobalt and chromium serum ion level was calculated as a function of time (months) after revision surgery.

Statistics

Paired *t* test was applied to determine if there is a significant difference in prerevision and postrevision metal ion levels. The level of significance was set at $\alpha = 0.05$. All the statistical analyses were performed using SPSS, version 22, software (SPSS Inc, Chicago, IL).

Download English Version:

<https://daneshyari.com/en/article/8799202>

Download Persian Version:

<https://daneshyari.com/article/8799202>

[Daneshyari.com](https://daneshyari.com)