Long-Term Follow-Up of Patients with Metal-on-Metal Total Hip Arthroplasty

INTRODUCTION

Metal-on-metal (MoM) articulations in total hip replacement (THR) have become an attractive option for young, active patients partly due to decreased volumetric wear rates when compared to conventional THR with metal-on-polyethylene bearings [1]. Our increased understanding of tribology from hip simulator studies has lead to the improved manufacturing of the MoM components. These bearings, made with cobalt and chromium alloys, have the potential to release metal debris in the surrounding periprosthetic tissues [2]. Short-term reports have already demonstrated elevated systemic metal ion levels in the blood and urine [3,4]. Disseminated concentrations of cobalt and chromium have raised concern regarding cellular toxicity, chromosomal damage and adverse local soft tissue reactions [5-7].

Long-term studies are required to support the increased use of MoM bearings in younger patients given their potential deleterious effects. The purpose of the current study was to report the 7-13 year clinical, radiographic, and metal ion results in patients following MoM THR.

MATERIALS AND METHODS

We prospectively followed 165 patients (196 hips) after second-generation MoM THR between July 1997 and November 2003. Functional outcome was measured using the Harris Hip Score (HHS) and the University of California Los Angeles (UCLA) Activity Score. Radiographic analysis was performed using Einzel-Bild-Roentgen-Analyse (EBRA) and EBRA-femoral component analysis (EBRA-PCA) by two of the authors blinded to the study. Cobalt and chromium metal ions were measured from whole blood and analyzed using inductively coupled plasma-mass spectrometry as previously described [8].

RESULTS

Twenty patients were lost to follow-up, 2 died for causes unrelated to their surgery, and 11 failed between 0.4 to 2.8 years (mean, 1.1 years) due to manufacturer’s recall. This provided 163 prostheses to analyze. The mean age at surgery was 50.8 years (17 to 66). Of the 163 hips, there were 80 females and 83 males. The mean follow-up was 8.87 years (range, 7-13 years). Four hips (2.5%) were revised: 2 for infection at 0.2 and 7 years; 1 for a loose stem at 1.3 years; and 1 for a loose cup at 9 years. One patient received wound debridement for a superficial infection and did not have any components revised.

The mean HHS and UCLA scores at the last follow-up were 91 and 6.8, respectively, from pre-operative values of 38 and 4.2. During the follow-up, the mean HHS varied from 90 to 94 while the mean UCLA score varied from 6.7 to 6.9. The mean acetabular inclination and anteversion was 40 degrees (range, 24 to 57), and 19 degrees (range, 3 to 39), respectively.

Median cobalt levels peaked at a value of 2.87 µg/L at 4 years (p<0.0001 vs. pre-operative) and subsequently decreased to 2.0 µg/L after 9 years (p=0.002 vs. 4-years) (Figure 1). Median chromium levels maximally increased to 0.75 µg/L after 5 years (p<0.0001 vs. pre-operative) and tended to decrease thereafter to values of 0.56 µg/L after 7 years (Figure 2).

DISCUSSION

Little is known about the long-term clinical and radiographic results, survivorship and metal ion release following MoM THR. Given the increased use of MoM bearing surfaces, especially in younger patients, it is important to understand how they behave over time. Furthermore, it is imperative to study and appreciate the potential consequences of increased local and systemic metal ion levels.

The present 7-13 years follow-up study of MoM THR indicates that the clinical and radiological results are satisfactory with low revision rates, similar to the clinical findings by Neumann et al. [9]. Furthermore, our study demonstrates the trend of metal ion levels in whole blood over a long-term. Both cobalt and chromium ion levels peaked at 4 and 5 years, respectively, and gradually decreased thereafter.

REFERENCES