ION RELEASE FROM METAL-ON-METAL HIP RESURFACING IMPLANTS DOES NOT DIFFER FROM STANDARD METAL-ON-METAL TOTAL HIP REPLACEMENT

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INTRODUCTION

Modern metal-on-metal (MOM) hip resurfacing has been introduced as a less invasive method of joint reconstruction for young-active patients (1). Hip resurfacing advantages include: bone stock preservation, wider range of motion, better functional outcomes and lower rate of dislocation. However, considering the large diameter of the coupling components, there are concerns regarding the quantity of metal ion release. The aim of this study was firstly to quantify the production of metal ion release in patients with a MOM hip resurfacing prosthesis and to compare this result with a control group. Secondly, we wanted to compare metal ion release after hip resurfacing with metal ion release after MOM total hip replacement as investigated in a previous study (2).

MATERIAL AND METHODS

The clinical study was approved by the Institutional Ethics Committee on human research and the subjects signed an informed consent form to participate in the study.

We contacted twenty-one subjects (11 female, 10 male) who had undergone either unilateral or bilateral hip resurfacing arthroplasty (16 unilateral and 5 bilateral) with a mean follow-up of 25 months. The prosthesis used in this study was a Birmingham Hip Resurfacing (BHR; Midland Medical Technologies, Birmingham, UK) machined from cast cobalt-chromium-molybdenum (CoCrMo) alloy. Patients completed a questionnaire and provided a sample of blood for serum ion analysis. As we were interested in estimating the systemic release of metal ions from the implanted prostheses, we specifically addressed factors which could have affected the result. These included occupational exposure, the ingestion of prescription or non-prescription medications and the presence of other metal implants within the body. One subject was excluded due to the presence of a metal plate. The reference values were obtained from a population of twenty-four healthy subjects.

Serum Cr and Co content was measured using a graphite furnace atomic absorption spectrometer (GFAAS), equipped with double background correction Deuterium/Zeeman, autosampler and pyrolytic carbon-coated graphite tubes (Unicam Model Solara 939 QZ, Cambridge, UK). Furnace thermal programs and spectrometer parameters are reported in Table 1.

Calibration was performed by applying the Standard Addition Method and by using certified standard solutions at three concentrations for each element (NIST). All the results were calculated using Spearman’s r coefficient. Data were analyzed with the StatView program.

RESULTS

Average serum ion concentrations, expressed as ng/ml, and their standard errors, min-max range and median values are reported in Table 2. Our findings indicate that metal-on-metal bearings produce a significantly higher systemic release of cobalt and chromium (ng/ml) when compared with levels found in the reference group. A highly-significant positive correlation between Co and Cr values was observed in BHR patients (r = 0.80; P value < 0.001), as well as between Cr, Co values and Harris score, by applying the Spearman’s test. On the contrary, no correlation was found between acetabular/hip diameter and ion concentrations. Likewise, no correlation within patients was found between ion concentrations and age of the patients (years), and between Cr, Co values and follow up, expressed as months from implant surgery.

DISCUSSION

This study shows that patients with hip resurfacing implants had a higher metal ion serum-level compared to the control group. However, regardless of the large head diameter (mean bearing surface diameter 48.1mm), median values for both ions were similar to values measured in patients who underwent MOM total hip replacement with a 28mm bearing surface diameter (Metalsul TM, Sulzer Orthopaedics Ltd, CH-8404 Winterthur, Switzerland) and reported in our previous paper (Cr and Co, respectively 1.66 and 0.97ng/ml (2)). This result can be explained according to the classic elastohydrodynamic theory which suggests that fluid-film is more likely in large diameter MOM bearings, and hence it is inferred that wear will be reduced (3), and because of possible differences in the tribology of the two types of prostheses.

At a median of 16 months, Clarke et al. (4) reported higher median cobalt and chromium serum-levels in patients who underwent MOM total hip replacement. Conversely, in this study, we found that in BHR patients, after an initial running-in period characterized by high metal ion serum-levels, they tend to decrease at a longer follow-up and become similar to those measured in small diameter MOM total hip arthroplasties.

REFERENCES