ABSTRACT

Purpose. To evaluate the chromium level of the salvaged blood in patients undergoing revision total hip arthroplasty (THA).

Methods. Records of 7 women and one man aged 54 to 83 (mean, 64.3) years who underwent revision THA for aseptic loosening of the acetabular component (n=6), osteolysis of the acetabulum (n=1), or migration of the outer head (n=1) were reviewed, as were 2 controls who underwent primary THA. The initial THA entailed a metal-on-metal prosthesis (n=4), a metal-on-polyethylene prosthesis (n=3), and a bipolar head prosthesis (n=1). Chromium levels in the preoperative peripheral blood and intraoperative salvaged blood were measured using atomic absorption analysis.

Results. For controls and the patient with a bipolar head prosthesis, the mean chromium level in salvaged blood was 0.4 (range, 0.2–0.6) μg/l, which was significantly lower than that in the remaining 7 patients undergoing revision THA (mean, 5.6 μg/l; range, 1.2–9.8 μg/l).

Conclusion. Salvaged blood of patients with a metal-on-metal prosthesis undergoing revision THA contained higher levels of chromium.

Key words: arthroplasty, replacement, hip; chromium; operative blood salvage; reoperation

INTRODUCTION

Blood loss during revision total hip arthroplasty (THA) can be substantial and necessitate perioperative blood transfusion. Preoperative donation of autologous blood1–4 and intra- and/or post-operative blood salvage5–13 can reduce the need for allogenic blood transfusion.

The articular surfaces of worn implants release metal particles secondary to mechanical stress and fatigue.14,15 Serum metal ion levels are elevated in patients with a metal-on-metal prosthesis16–21 or a loosened metal-on-polyethylene prosthesis.21–23 Metal debris might be scattered around the prosthesis and contaminate the salvaged blood. This study evaluated
the chromium level of the salvaged blood in patients undergoing revision THA.

**MATERIALS AND METHODS**

Records of 7 women and one man aged 54 to 83 (mean, 64.3) years who underwent revision THA for aseptic loosening of the acetabular component (n=6), osteolysis of the acetabulum (n=1), or migration of the outer head (n=1) were reviewed, as were 2 controls aged 62 and 69 years who underwent primary THA.

In 4 patients, the initial THA entailed a metal-on-metal prosthesis (Metasul). The acetabular shell had a 2.4-mm-thick CoCr articular surface moulded inside an ultra-high-molecular-weight polyethylene liner backed with titanium alloy. The femoral head was made of Co-Cr alloy and the stem was made of titanium alloy.

In 3 patients, the initial THA entailed a metal-on-polyethylene prosthesis. The acetabular component had a threaded-ring design and was fixed with screws and without cement. The acetabular shell and the stem were made of titanium alloy, and the femoral head was made of Co-Cr alloy.

In the remaining patient, the initial hemiarthroplasty entailed a bipolar head prosthesis. The outer part of the femoral head was made of ceramic, and the inner part was made of Co-Cr alloy.

Blood was collected using a heparinised double-lumen suction catheter and filtered through a 180-μm filter to remove large particles. The filtered blood was washed with normal saline and centrifuged. Aggregated red cells, platelets, white blood cells, fibrinogen, free haemoglobin, and other proteins in the supernatant were discarded. The remaining packed red blood cells were resuspended in saline.

Chromium levels in the preoperative peripheral blood and intra-operative salvaged blood were measured using atomic absorption analysis. The detection limit was 0.2 μg/l.

**RESULTS**

For controls and the patient with a bipolar head prosthesis, the mean chromium level in salvaged blood was 0.4 (range, 0.2–0.6) μg/l, which was significantly lower than that in the remaining 7 patients undergoing revision THA (mean, 5.6 μg/l; range, 1.2–9.8 μg/l). The mean chromium levels in patients with a metal-on-metal prosthesis and a metal-on-polyethylene prosthesis were 5.9 (range, 1.2–9.8) and 5.2 (range, 4.5–5.8) μg/l, respectively (Table).

In 2 patients with a metal-on-metal prosthesis, the chromium levels in preoperative peripheral and intra-operative salvaged blood were significantly higher than in other patients. However, the chromium levels were not as high in the patient with metallosis, in whom the polyethylene liner was severely worn out and the acetabular shell was broken by the metal femoral head (Fig.), and in the patient with osteolysis, in whom the metal liner was subluxated from the shell, but the acetabular and femoral components were well fixed. There was no impingement of the metal liner onto the neck of the femoral component.

**DISCUSSION**

In patients with intra-operative blood salvage, there is a 59% reduction in the mean volume of allogeneic...
blood transfusion, compared with those without blood salvage. However, it is unknown whether filtration and washing during blood salvage removes metal debris from the prosthesis. Peripheral blood metal ion levels are elevated in patients with a metal-on-metal prosthesis, and a loosened metal-on-polyethylene prosthesis. In such patients, corrosion products and wear debris, including titanium, cobalt-chromium alloy, and stainless steel have been detected around the hip prosthesis, in urine, bone marrow, abdominal lymph nodes, spleen, and liver. The chromium level in salvaged blood during revision THA is likely to be affected. Metal particles may spread further to various organs through transfusion of salvaged blood.

DISCLOSURE

No conflicts of interest were declared by the authors.

REFERENCES


