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## Cobalt Toxicity in Two Hip Replacement Patients

### Introduction

Over the past decade, cobalt-chromium Metal-on-Metal Hip Arthroplasty (MoMHA) has been performed with increasing frequency throughout the United States, particularly in active and younger patients. During a recent review of the Nationwide Inpatient Sample database, 35% of 112,095 primary total hip replacements performed in the United States between October 1, 2005, and December 31, 2006 were MoMHAs.<sup>1</sup> Cobalt and chromium ions are commonly detected in the blood and urine of MoMHA patients as a result of wear at the bearing surfaces over time. The accumulation of metal ions in the areas surrounding the prosthetic joint can cause metallosis, indicated by the formation of giant cells and fibrosis in surrounding tissue. Patients with malfunctioning MoMHAs can have Serum Cobalt Levels (SCoLs) that are more than 100-fold that of physiologic levels.<sup>2</sup>

An essential trace element, cobalt can cause serious adverse health effects at high exposure levels. Serum concentrations  $\geq 1$  mcg/L indicate possible environmental or occupational exposure, and concentrations  $\geq 5$  mcg/L are considered toxic.<sup>3</sup> Signs and symptoms of cobalt poisoning can include visual impairment, cardiomyopathy, cognitive impairment, auditory impairment, hypothyroidism, peripheral neuropathy, and rashes.<sup>4</sup> Three prior case reports note blindness, deafness, heart failure, peripheral neuropathy, rashes, and hypothyroidism in patients with SCoLs  $>200$  mcg/L due to a malfunctioning MoMHA.<sup>5-7</sup> This *Bulletin* describes two Alaska patients who experienced notable neurologic and cardiac symptoms following MoMHA.

### Case Reports

**Patient A**, a fit, otherwise healthy, 49 year-old male received a MoMHA for osteoarthritis. An echocardiogram performed prior to his MoMHA showed normal myocardial function. At 3 months post-op, he complained of bilateral axillary rashes. At 8 months post-op, he reported unaccustomed shortness of breath. Pulmonary function tests and allergy testing for metals were normal. At 18 months post-op, he reported anxiety, headaches, irritability, tinnitus, and hearing loss. An audiogram confirmed high-frequency hearing loss. At 30 months post-op, he reported pain interrupting sleep, hip creaking, hand tremor, diminished coordination, slow cognition, poor memory, and lassitude. At 36 months post-op, a non-refractive loss of peripheral visual acuity was noted; at this time, his SCoL was 122 mcg/L.

The patient was indicated for revision surgery due to progressive hip pain and high SCoLs. An echocardiogram performed prior to the revision showed diastolic dysfunction. The revision was performed 43 months after the first surgery. At revision surgery, the periprosthetic tissues showed necrosis and staining with metal debris and visible wear of the retrieved bearing. At 1 month post-revision, Patient A's SCoL was 14 mcg/L. At 6 months post-revision, he reported that all symptoms were improved except the visual changes.

**Patient B**, a fit, otherwise healthy, 49 year-old male received a MoMHA for a failed arthroplasty. At 12 months post-op, he complained of mental fog, memory loss, vertigo, hearing loss, groin pain, rashes, and breathlessness. At this time, his serum cobalt level was 23 mcg/L. At 18 months post-op, an echocardiogram showed diastolic dysfunction. He was observed until 40 months, when revision surgery was performed for progressive hip pain. Just before the revision, Patient B's SCoL was 23 mcg/L. At revision surgery, the periprosthetic tissues showed necrosis and staining with metal debris and his retrieved bearing showed visible wear. At 2

days post-revision, his SCoL fell to 11 mcg/L. At 3 months post-revision, his symptoms were improved.

### Discussion

MoMHA patients for whom revision surgeries are indicated due to pain often have implant malposition and periprosthetic metallosis. Additionally, these patients often have high SCoLs despite normal renal function and are at risk for cobalt poisoning. Patients with impaired renal function may experience cobalt poisoning without the presence of pain despite a well positioned implant because the cobalt released by normal implant wear is not adequately cleared by their kidneys.

In April 2010, the United Kingdom's Medical Products and Healthcare Devices Regulatory Agency published a medical device alert that recommended following MoMHA patients for cobalt toxicity symptoms at least annually for 5 years post-op.<sup>8</sup> The alert also recommended considering SCoL testing and imaging studies for patients who report painful hip replacements, and performing follow-up SCoL testing 3 months after the first test in patients with SCoLs  $>7$  mcg/L in order to identify patients who require closer surveillance.

These two Alaska case reports underscore the importance of monitoring MoMHA patients for signs and symptoms of cobalt toxicity.<sup>9</sup>

### Recommendations

1. Health care providers should be aware that patients with a MoMHA implant are at risk for cobalt poisoning, and might present for medical attention to non-orthopedists with cardiac or neurologic symptoms resulting from cobalt poisoning.
2. Health care providers should ask MoMHA patients who are known to have shell malposition, persistent or worsening hip/groin pain, and renal insufficiency about cardiac and neurologic symptoms, including tinnitus and hearing loss, and consider obtaining a SCoL.
3. Health care providers should assess cardiac and neurologic function in patients with SCoLs  $>7$  mcg/L.
4. In consultation with the patient's orthopedist, health care providers should develop an individualized plan for symptom monitoring and possible revision surgery in symptomatic patients with an elevated SCoL.

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