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Case Presentation

# Two Cases of Metallosis from Metal-on-Polyethylene Total Hips: An Emerging Problem

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**Abstract**

This report describes 2 cases of metallosis from metal-on-polyethylene total hip replacements. Case 1 involved a Stryker rejuvenate implant, which has since been recalled. This patient had minimal symptoms, an elevated cobalt level, and loosening. The patient in case 2 had a Dupuys Pinnacle system, with symptoms of weakness, rash, and hip pain. Abnormal laboratory values include elevated sedimentation rate, C-reactive protein, creatinine, cobalt, and decreased hematocrit. Magnetic resonance imaging revealed synovial thickening and extracapsular edema. Although metallosis is a well-established complication of metal-on-metal implants, emerging data reveal that it also may be a problem in non—metal-on-metal implants such as either metal-on-polyethylene or ceramic-on-polyethylene implants, perhaps related to modular corrosion.

## Introduction

There are more than 1,000,000 metal-on-metal (MoM) implants worldwide. Traditional MoM hip implants refer to the elements of the implant: the ball (femoral head), a metal femoral stem in the thighbone, and a metal cup in the hip bone (acetabular). Patients with these MoM implants are at risk for adverse reaction from metal debris (ARMD). This happens when artificial hip implant components wear down and metal particles are released into the surrounding tissue and bloodstream. Wear and corrosion at the connecting site of the metal ball and stem (head—neck modular corrosion) can also occur, and can cause metal ion release [1]. Some implants have a second (neck—body) connecting site.

In recent years, there has been growing awareness of the risks of metal-on-metal implants, including organizations such as the United Kingdom's Medicine and Healthcare Products Regulatory Agency (MHRA), Health Canada, and Therapeutic Good Administration of Australia issuing public health alerts of this occurrence. Similarly, orthopedic literature has well documented this health risk, and the standard of care for metal-on-metal implants include close surveillance for early failures and signs of metal toxicity, often requiring revision surgery [1].

However, there are now emerging data showing that ARMD can also occur in non-MoM total hip replacements from corrosion and wear at the modular junctions.

We describe 2 cases of elevated cobalt levels from defective metal-on-polyethylene hip implants. One patient had minimal symptoms of low back pain and clicking of the hip. There was loosening on plain X-ray. The second patient had symptoms of leg and hip pain, fatigue, rash. There were findings of anemia and elevated creatinine.

Cobalt toxicity can be potentially fatal, although some morbidity such as cardiotoxicity is reversible [2,3]. This underscores the importance of early surveillance for signs and symptoms of cobalt toxicity. Cobalt and chromium levels may be helpful if ARMD is suspected. Imaging with MRI with newer pulse sequences to reduce metal artifact is the preferred imaging modality. Sonography can detect effusions and may become a useful adjunct imaging tool [4].

## Case Presentation

### *Case 1*

The patient was a 57-year-old woman who presented to the inpatient rehabilitation unit for acute

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rehabilitation after a hip revision. She had a hip implant known as Stryker Rejuvenate with a 28-mm cobalt chromium femoral head, which had been recalled. The patient initially had a total hip replacement performed in 2011 with a Stryker Rejuvenate modular hip system. She was discharged from the orthopedist who performed the original surgery and then moved to a new city. Since her surgery, she had been asymptomatic, except for a "clicking noise" and minor discomfort, for which she saw a different orthopedist 2 years later for routine follow-up of her hip implant as well as investigation into the clicking noise. Imaging of her hip revealed loosened femoral neck components. Laboratory workup revealed an elevated blood cobalt level. The extracted prosthesis showed corrosion at both the head—neck taper and neck—stem taper. The hip implant known as Stryker Rejuvenate had been linked to major complications in many patients. The Stryker Rejuvenate implant was voluntarily recalled in 2012; however, the patient reported that she had never received a notice for the recall. She received a revision of her left total hip replacement with exchange of the modular femoral neck component. The patient presented to an acute rehabilitation facility for treatment after her hip revision, and she did well functionally.

### *Case 2*

The patient was an 83-year-old male physician who presented to the acute care/outpatient rehabilitation unit, and who had undergone a left total hip replacement in 2006 with a DuPuy Pinnacle 56 cup and a 15 small Prodigy stem system. The articulation was metal-on-polyethylene with a size 36 + 8.5 head ball.

In March 2011, at the age of 83 years, the patient noted spasms of the left thigh and gluteal muscles while standing. Shaking of the leg relieved the symptoms. There was mild hip pain. His past medical history was significant for probable rheumatic fever, left elbow osteochondromatosis, osteoarthritis, mild hypertension, benign prostate hypertrophy, and glaucoma. Surgical history included a left elbow synovectomy, a right total hip replacement in 2005, and a left total hip replacement in 2006. In May 2012, he began developing chest wall acne vulgaris, which responded to minocycline, doxycycline, and tretinoin. In June 2012, he developed left leg erythema nodosum, which responded to ibuprofen. In August 2012, he developed progressive generalized fatigue, general weakness, left leg weakness, and difficulty dressing shortly afterward. By October 2012, he had progressive hip pain requiring Percocet (acetaminophen and oxycodone) and ibuprofen. Physical therapy did not help. Differential diagnosis included septic left hip and loosening of his hip implant. An MRI of his left hip revealed synovial thickening, mild extracapsular edema which suggested the differentials of early septic arthritis or "particle disease." Blood work was significant for elevated cobalt, chromium, erythrocyte sedimentation rate, and C-reactive protein. He was mildly anemic and had mild renal disease. Thyroid stimulating hormone was normal. Three months after his left hip revision, his cobalt and chromium levels had significantly decreased to 2.7 μg/L and 2.3 μg/L, respectively. Hemoglobin and creatinine levels normalized. (Table 1).

## Discussion

The Stryker Rejuvenate modular hip implant was recalled in 2012 because of evidence that its design has led to complications in many patients. These implants have an increased risk of corrosion at the modular head—neck and neck—body junctions [5]. There have long been concerns over the use of prostheses that feature all-metal designs or parts that produce MoM friction. The Stryker Rejuvenate is not a MoM device; however, it is a dual modular system, and symptomatic metallosis has been reported at both the head—neck and neck—stem junctions [6].

There is recent concern that MoM implants can lead to increased risk of metallosis. FDA recommendations of asymptomatic patients with these particular MoM implants are to follow up every 1 to 2 years with orthopedists to monitor for changes in their hip. The metal ball and metal cup slide against each other during weight bearing, resulting in metal particles shedding into surrounding space, with cobalt and chromium being the most frequently cited metals [1]. As the metal parts of hip prosthesis comprised predominantly cobalt and chromium, these are the most commonly cited metal

**Table 1**
Case 2 laboratory values

| Test | October 8, 2012 | Left Hip Revision, October 17, 2012 | January 28, 2013 | Normal Values |
|---|---|---|---|---|
| Serum cobalt | — | 20.0 μg/L | 2.7 μg/L | 0.1-0.4 μcg/L |
| Serum chromium | — | 3.5 μg/L | 2.3 μg/L | <1.1 μg/L |
| ESR | 85 mm/h | — | 8 mm/h | 0-20 mm/h |
| CRP | 81 mg/L | — | 6 mg/L | <8 mg/L |
| Creatinine | 1.64 mg/dL | — | 1.15 mg/dL | 0.78-1.11 mg/dL |
| HgB | 11.4 g/dL | — | 13.3 g/dL | 13.2-17.1 g/dL |
| | — | — | 0.73 mIU/L | 0.40-4.50 mIU/L |

ESR = erythrocyte sedimentation rate; CRP = C-reactive protein; HgB = hemoglobin; TSH = thyroid-stimulating hormone.