Potential Cobalt Toxicity from Corrosion of Fractured Cobalt Spinal Rods

Background
Cobalt-based alloys have been used as a common biomaterial for implant instrumentation (e.g., orthopedic, dentistry, and cardiovascular) due their favorable characteristics. 2 Cobalt is an essential trace element that is required for vitamin B12 synthesis and for numerous metabolic reactions. Blood cobalt concentrations ([Co]) are homeostatically controlled at typical exposure levels. Normal [Co] in the general U.S. population is <1.0 µg/L in blood and <2.0 µg/L in urine. 3 Cobalt-based alloys from instrumentation can leach cobalt ions, resulting in elevated blood and urine [Co] and the potential for cobalt toxicity. 3,5

There is considerable variability on what [Co] can cause toxicity-related adverse health effects, which may be influenced by duration of exposure, nutritional status, genetic variability, renal function, hypoaluminaemia, or individual health factors or complications. Moreover, some people might develop a hypersensitivity to cobalt – even at low exposure levels. 6 There are currently no established [Co] thresholds that are reliably associated with systemic toxicity. Cobalt toxicity can cause a range of effects, including soft tissue damage, peripheral neuropathy, hearing and vision loss, impaired renal function, hypothyroidism, cardiac and hematologic problems, and hypometabolism of the temporal lobes and posterior cingulate cortex of the brain. 5 Additionally, neurologic symptoms may precede sentinel symptoms at the location of the implant.

At 27 months post-op, she reported improvements in her tremor, cognitive function, and vision; however, at 48 months post-op, her urine [Co] was 18 µg/L. At this point, the decision must be made on a case-by-case basis.

Recommendations
- Clinicians should be aware that patients with cobalt-based instrumentation might be at risk for cobalt toxicity or hypersensitivity and monitor patients accordingly.
- There are currently no established [Co] toxicity thresholds pertaining to cobalt-based arthroplasties or implants; clinicians should assess patients’ symptoms in conjunction with blood or urine [Co].
- Elevated blood [Co] should not be used alone to diagnose Co hypersensitivity or toxicity. 3
- Clinicians who suspect Co toxicity or hypersensitivity in a patient with a cobalt implant should consult with the patient’s orthopedic surgeon or neurosurgeon.

References