

Chromium and Cobalt in Joint Fluid

FOR THE DETERMINATION OF CHROMIUM AND COBALT IN JOINT FLUID FOLLOWING METAL-ON-METAL JOINT ARTHROPLASTY

Test Highlights

- May complement serum cobalt and chromium concentrations
- Measurements obtained using inductively coupled plasma-mass spectrometry (ICP-MS)
- Reportable range of 1 µg/L to 1000 µg/L

Clinical Background

Disease Overview/Clinical Scenario/Clinical Setting

- Recent product recalls associated with specific metal-on-metal prosthetics have heightened concerns regarding metal toxicity.¹ Metal ion release into the blood of patients can be detected with malpositioned or failing metal-on-metal joint prosthetics.² Among the various metal ions that constitute conventional metal-on-metal prosthetics, cobalt and chromium have frequently been associated with metal toxicity and adverse outcomes.

Pathophysiology

- Systemic toxicity associated with cobalt exposure includes altered iron transport, erythropoietic enhancement, hypothyroidism, gout, cardiomyopathy, and allergic contact dermatitis. Chromium is a known carcinogen, and exposure to chromium can result in asthma, kidney failure, and contact dermatitis.³

Epidemiology

- Patients at highest risk for abnormal device wear or adverse reactions to metal debris include:
 - Female patients
 - Highly active patients
 - Patients receiving malpositioned prosthetics
 - Patients receiving bilateral implants
 - Patients with renal insufficiency

Indications for Ordering

Metal ion testing of joint fluid may be complementary to serum testing for patients who have received metal-on-metal prosthetics. Testing joint fluid is most appropriate for symptomatic patients. At the present time, guidelines for testing of asymptomatic patients have not been established.

Interpretation

Concentrations of chromium and cobalt may exceed 100 µg/L in fluid collected from an affected joint. Joint fluid chromium and cobalt levels should be interpreted with caution and in the context of the patient's history and clinical presentation.

Limitations

- The correlations between joint fluid measurements and serum measurements for chromium and cobalt have not been conclusive, nor have guidelines for interpretation of joint fluid concentrations been established. Furthermore, a reference interval for chromium and cobalt in joint fluid from healthy adults has not been reported.
- Serum is the preferred specimen for evaluating metal ion release from metal-on-metal joint arthroplasty.

Methodology

Inductively coupled plasma-mass spectrometry (ICP-MS)

Related Tests

- Preferred tests for evaluating metal ion release from metal-on-metal joint arthroplasty are:
 - Chromium, Serum (ARUP test code [0098830](#))
 - Cobalt, Serum (ARUP test code [0025037](#))

References

1. DePuy. ASR Hip Replacement Recall Guide for Patients. 2011; <http://www.depuy.com/asr-hip-replacement-recall>. Accessed December 9, 2011.
2. U.S. Food and Drug Administration. Concerns about Metal-on-Metal Hip Implant Systems. 2011; <http://www.fda.gov/MedicalDevices/ProductsandMedicalProcedures/ImplantsandProsthetics/MetalonMetalHipImplants/ucm241604.htm>. Accessed December 4, 2011.
3. Nordberg G. *Handbook on the toxicology of metals*. 3rd ed. Amsterdam; Boston: Academic Press; 2007.

Test Information

2005528

Metals, Joint Fluid

For specific collection, transport, and testing information, refer to the ARUP website at www.aruplab.com.

For information on test selection, ordering, and interpretation, refer to ARUP Consult® at www.arupconsult.com.

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