MAYO CLINIC LABORATORIES

Metals Analysis Specimen Collection and Transport

Introduction

Trace metals exist in our environment at concentrations many-fold greater than their concentrations in blood, urine, or tissues. Analyses for trace metals at the Mayo Clinic Metals Laboratory are performed in an ultra-clean laboratory environment with a positive-pressure filtered air system to prevent specimen contamination. This allows for detection of many metals at the sub-parts-per-billion concentration range. Preanalytical steps are the steps most likely to affect the quality of trace metals analysis in clinical specimens. Specimens must be collected and processed using the instructions outlined below to ensure contamination does not occur during these steps.

Serum, plasma, or whole blood specimens received in most tubes or vials will not be rejected and will be analyzed. However, if a specimen is received in a nonmetal-free container, abnormal results will be reported with a disclaimer that the specimen was not received in a metal-free container. These results must be interpreted with caution.

General Instructions for All Specimens

Do not collect specimens for trace metal testing from patients who have received gadolinium- or iodine-containing contrast material within the past 96 hours. These metal-based contrast agents are known to interfere with laboratory techniques commonly used for trace metals analysis.

Because of the sensitivity of the technology used for testing, the laboratory may observe a significantly abnormal result for a metal that was not ordered. In such an event, the laboratory will note the findings on the ordered metal's report, but only if the specimen was submitted in a metal-free container. If the ordering physician deems that the metal is of clinical significance, the ordering physician may elect to submit an order for that metal so it can be reported.

Tips to Control Contamination of Specimens for Metals Testing

1. Keep the specimen handling area clean and free of dust.
2. Clean the venipuncture site with alcohol. **Do not use** povidone-iodine swabs or pads.
3. Use only the supplies listed in this document.
4. **Do not** ream a serum or plasma specimen with a wooden stick to remove clots.
5. **Do not** insert any utensil or pipet into the specimen. Transfer specimen by pouring from one tube to another.

Blood Collection General Instructions

The Mayo Clinic Metals Laboratory has tested numerous blood collection tubes and found that many of them introduce contamination when used for trace metals specimen collection. Contamination from blood collection tubes and specimen vials has also been noted in numerous publications.[1-3] To ensure that specimens are not contaminated by the collection tubes, specimen vials, or other supplies, only use the supplies listed in these instructions.

Order of Draw

When multiple blood specimens are scheduled for collection from a patient, the royal blue tube should be drawn first within its additive group.

Blood Collection Supplies

- BD Vacutainer Plus with K2 EDTA Royal Blue Stopper, 6-mL Blood Collection Tube. Product number 368381 (T183 Metal Free B-D Tube [EDTA] 6-mL) for whole blood tests **except antimony**.
- Greiner Bio-One VACUETTE TUBE 6 mL NH Trace Elements Sodium Heparin tubes for blood (T819 Metal-Free [Antimony Only]) for antimony blood only.
- BD Vacutainer with Clot Activator Plus Royal Blue Stopper, 6-mL Blood Collection Tube. Product number 368380 (T184 Metal Free B-D Tube [No Additive] 6-mL) for serum tests.
- BD Vacutainer Plus with K2 EDTA Tan Stopper, 3-mL Blood Collection Tube. Product number 367855 (T615 Metal Free [Lead only] EDTA Tube 3-mL) for lead blood only.
- BD Microtainer with K2 EDTA. Product number 363706 (T174 Microtainer [EDTA] Tube 0.5-mL) for capillary collection of lead blood specimens only.
- Regular sodium heparin blood collection tube for fluoride test only.
- Regular phlebotomy needle or butterfly needle.
- Mayo Metal-Free Specimen Vial (T173).
- Alcohol prep pads or wipes.
- Certified trace metal pipette tips may be used.

If a syringe is required for collection, the HSW Norm-Ject disposable syringe is recommended. Immediately transfer the entire blood specimen to the appropriate royal blue stopper tube for processing.

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Metals Analysis Specimen Collection and Transport (continued)

Venous Whole Blood Collection

1. Prepare the patient for phlebotomy following your normal protocol, using alcohol to disinfect the collection site. **Do not** use iodine-containing products.
2. Draw blood in a BD Royal Blue with K2 EDTA Vacutainer tube (T183).
   - Use a Greiner Bio-One VACUETTE TUBE 6 mL NH Trace Elements Sodium Heparin tube for blood (T819 Metal-Free [Antimony Only]) if the specimen is for antimony testing.
   - Lead blood specimens may also be drawn in a BD Tan with K2 EDTA, lead only (EDTA) Vacutainer tube (T615).
3. Immediately mix blood sample by inverting gently 8 times.
4. Leave the specimen in the tube, attach a specimen identification label, and send the specimen to the laboratory at refrigerated (preferred), ambient, or frozen temperature. Specimens to be stored more than 48 hours should be stored at 4 degrees C and sent refrigerated.

Capillary Blood Collection for Lead Testing

Use the BD Microtainer with K2 EDTA (T174) supplied by Mayo Clinic Laboratories. Follow the instructions from the Centers for Disease Control (CDC) for collecting capillary blood specimens for lead testing.4,5

Note: If the lead result from a capillary specimen is greater than 3.4 mcg/dL for ages 0 to 5 years or greater than 4.9 mcg/dL for ages 6 years and up, the comment, "Capillary blood levels greater than 3.4 mcg/dL (or 4.9 mcg/dL) may be due to contamination from the finger surface and should be confirmed by venipuncture redraw using a certified trace-element-free EDTA collection tube." will be added to the report.

Serum Collection

1. Prepare the patient for phlebotomy following your normal protocol, using alcohol to disinfect the collection site. Do not use iodine-containing products.
2. Draw blood in a BD Royal Blue with Clot Activator Vacutainer tube (T184).
3. Allow the specimen to clot for at least 30 minutes, but no more than 4 hours.
4. Centrifuge the specimen to separate serum from cellular fraction.
5. Attach a specimen identification label to a Mayo Metal-Free Specimen Vial (T173).
6. Remove the collection tube stopper. Carefully pour the serum into the vial, avoiding transfer of the cellular components of blood.
   - **Do not** insert a pipette into the serum to accomplish transfer.
   - **Do not** ream the specimen with a wooden stick to assist with serum transfer.
   - Blood from a dialysis patient on heparin may produce an uncoagulated serum that forms a fibrin clot after centrifugation. Pour off serum as soon as possible, and repeat centrifugation step if more serum is needed.
7. Place the cap on the vial tightly and send the specimen to the laboratory at the temperature indicated in the test's transport instructions.

Plasma Collection (Fluoride Test Only)

1. Draw blood in a sodium heparin blood collection tube.
2. Centrifuge the specimen to separate plasma from the cellular fraction.
3. Attach a specimen identification label to a plastic vial. **Do not** use a glass vial to store or transport the plasma.
4. Remove the collection tube stopper. Carefully pour or pipette the plasma into the plastic vial, avoiding transfer of the cellular components of blood.
5. Place the cap on the vial tightly and send the plasma specimen to the laboratory at refrigerated (preferred), frozen, or ambient temperature.

Urine Collection General Instructions

- **Do not** collect urine specimens in an environment in which exposure is most likely to occur. It is important that dust from clothing not contribute to the specimen contents.
- **Do not** collect urine in metal-based containers such as metal urinals or pans.
- **Do not** collect or transport urine in colored containers or caps unless they are provided by Mayo Clinic Laboratories. These containers have been evaluated and found to be clear of contamination.

Urine Collection

1. Collect urine in a clean, all-plastic container without a glued cap insert (T309 Urine 24 Hour Container).
2. Mix urine well before aliquoting.
3. Attach a specimen identification label to a plastic 5-mL or 10-mL (T068) urine aliquot tube.
4. Pour urine into the aliquot tube.
5. Place the cap on the tube tightly and send to the laboratory at the temperature indicated in the test's transport instructions.

Metals Analysis Specimen Collection and Transport (continued)

Synovial Fluid General Instructions

- Specimens collected for trace-metals analyses must be protected from contamination during collection.
- Conduct specimen collection in a clean, dust free environment using appropriate certified metal-free collection containers.
- To reduce specimen contamination, powder-free gloves are recommended during collection.
- Heavy metals are present in the black rubber plunger seals found in most disposable syringes. As a result, synovial fluid should not be collected in these devices as contamination may occur.

Synovial Fluid Collection

1. Collect synovial fluid in a Metal Free BD Royal Blue EDTA Vacutainer tube product number 368381 (T183) either intraoperatively (avoiding dilution with blood from the surgical dissection) or by needle aspiration.
   - While synovial fluids may not be found in large volumes, make every effort to collect as much as possible.
2. Attach a specimen identification label to the tube and send it to the laboratory refrigerated (preferred), ambient, or frozen.
   - Specimens may also be poured into a Mayo metal-free vial (T173) for transport.

Kidney Stones

See Kidney Stone Packaging Instructions for specific information.

Tissue Testing

The Mayo Clinic Metals Laboratory provides validated testing of liver tissue for iron and copper, and hair and nail testing for arsenic, lead, and mercury. See tissue collection instructions on individual test pages for specimen requirements. No other tissue testing is offered.

Hair and Nails Collection Instructions

See Collecting Hair and Nails for Metals Testing for specific instructions.

References

1. Moyer TP, Mussmann GV, Nixon DE. Blood-collection device for trace metal and ultra-trace metals specimens evaluated. Clin Chem. 1991;37:707-714
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3. Rodushkin I, Odman F. Assessment of the contamination from devices used for sampling and storage of whole blood and serum for element analysis. J Trace Elem Med Biol. 2001;15(1):40-45
4. CDC. June 1, 2009. Guidelines for Collecting and Handling Blood Lead Samples (video). Retrieved May 29, 2012. Available at www.cdc.gov/nceh/lead/training/blood_lead_samples.htm
5. CDC. Capillary blood sampling protocol. Atlanta, GA: U.S. Department of Health & Human Services, CDC; 1997