

Metals Analysis-Collection and Transport

Due to the methodologies used for metals testing, a significantly abnormal result for an analyte not ordered may be identified. When sample integrity is not in question, a comment will be added to the report to notify the physician of the abnormal analyte, so the appropriate test may be added, if desired.

Periodically, requests are received for metals testing on tissue types that have not been validated or are not appropriate. The only metals tests that can be routinely ordered on tissue specimens are #8350 "Iron, Liver Tissue"; #8687 "Copper, Liver Tissue"; and #89302 "Gadolinium, Dermal, Tissue." The laboratory will not accept requests for any other metals testing without advanced approval from the laboratory director. Such testing is performed on a research basis for clinical uses only; the laboratory does not perform testing for legal or forensic studies.

Analyses for trace metals at Mayo Clinic and Mayo Medical Laboratories are performed in an ultra-clean laboratory environment using a system of positive-pressure filtered air to prevent specimen contamination due to dust. This allows for detection of many metals at the sub-part-per-billion concentration range. Contamination control must be practiced during specimen collection to provide a specimen that will yield clinically useful results. We recommend and strongly urge the use of a specific set of blood collection tubes for specimen collection and that phlebotomists carry out the proven techniques described below.

The Metals Laboratory at Mayo Clinic has tested numerous blood collection tubes and has found most of them introduce contamination when used for trace metal specimen collection. Standard red-topped evacuated clot tubes and all plastic syringes with black rubber seals are grossly contaminated with zinc, and all contain varying amounts of heavy metals (lead, mercury, cadmium, nickel, chromium, and others). All rubber stoppers (except the royal blue-top Monoject® Trace Element Blood Collection Tubes) have significant concentrations of aluminum in the rubber, which is carried into the specimen on the puncturing needle, contaminating the specimen. Most evacuated tubes for plasma or whole blood collection that are not specifically designed for trace metal specimen collection contain anticoagulants contaminated with trace metals. These problems have been noted in numerous publications.¹⁻³

We require the use of EDTA as an anticoagulant for whole blood specimens. Other anticoagulants (heparin, for example) are effective only for 24 to 36 hours. Frequently, transportation time to Rochester exceeds this time; heparinized specimens frequently arrive partially clotted, making analysis and interpretation of results difficult.

When multiple blood specimens are scheduled for collection from 1 patient, the trace metal specimens should be collected first; once the phlebotomy needle has punctured another rubber stopper, it is contaminated and should not be used for trace metal specimen collection.

Always use an alcohol swab to cleanse the venipuncture site. Avoid iodine-containing disinfectants. Use only stainless steel phlebotomy needles.

Do not collect specimens from patients who have received gadolinium-, iodine-, or barium-containing contrast material within 96 hours. Gadolinium, iodine, and barium are known to interfere with most metals tests.

Serum

Blood specimens for serum testing should be drawn in the plain, royal blue-top Monoject® Trace Element Blood Collection Tube, product #8881-307006 (Supply T184). Allow the specimen to clot for 30 minutes; then centrifuge the specimen to separate serum from the cellular fraction. Remove the stopper. Carefully pour the serum into a 7-mL Mayo metal-free, screw-capped, polypropylene vial (Supply T173), avoiding transfer of the cellular components of blood. **Do not** insert a pipet into the serum to accomplish transfer, and **do not** ream the specimen with a wooden stick to assist with serum transfer. Place the cap on the polypropylene vial tightly, attach a specimen label, and send specimen to the laboratory at refrigerated or frozen temperature. All specimens to be stored more than 48 hours should be frozen.

Whole Blood

A specimen for whole blood testing should be drawn in a royal blue-top Monoject® Trace Element Blood Collection Tube, product #8881-307022 (Supply T183), containing EDTA as an anticoagulant. Leave the specimen in the tube, attach an identification label, and send the specimen to the laboratory at cool temperature. Alternatively, pediatric specimens can be drawn in a Becton-Dickinson MICROTAINER®, product #5973, with EDTA anticoagulant. Specimens to be stored more than 48 hours should be stored at 4° C and sent refrigerated.

Urine

Clean, plastic container(s) with no metal cap(s) or glued insert(s) must be used for urine collection. Send specimen in a plastic, 13-mL urine tube or a clean, plastic aliquot container with no metal cap or glued insert.

Do not collect urine specimens in the environment in which exposure is 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 because of metals found in dyes.

Tips to Control Contamination

1. Keep patient specimen area clean and free of dust.
2. It is best to use the Monoject® evacuated blood tubes (Supply T183 or T184), vials, and needles.
3. **Do not** touch specimen with utensils unless they have been acid-washed.
4. Dialysis patients on heparin may form an uncoagulated serum when centrifuging. Pour off serum as soon as possible, invert the clot tube, and repeat centrifugation step to separate cellular fraction if more serum is needed.
5. **Do not** leave serum on cells more than 60 minutes. Centrifuge and pour serum into metal-free vial.

References

1. Moyer TP, Mussmann, GV, and Nixon, DE: Blood-collection device for trace metal and ultra-trace metals specimens evaluated. Clin Chem 1991;37:707-714
2. Boeynaems JM, De Leener A, Dessars B, et al: Evaluation of a new generation of plastic evacuated blood-collection tubes in clinical chemistry, therapeutic drug monitoring, hormone, and trace metal analysis. Clin Chem Lab Med 2004;42:67-71
3. Rodushkin I and 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;14-40-45