

URINE TOXIC METALS



LAB #: U000000-0000-0
PATIENT: Sample Patient
ID: PATIENT-S-00004
SEX: Female
AGE: 83

CLIENT#: 12345
DOCTOR:
 Doctors Data, Inc.
 3755 Illinois Ave.
 St. Charles, IL 60174 USA

POTENTIALLY TOXIC METALS

METALS	RESULT µg/g creat	REFERENCE RANGE	WITHIN REFERENCE RANGE	ELEVATED	VERY ELEVATED
Aluminum	89	< 35			
Antimony	0.2	< 0.4			
Arsenic	18	< 117			
Barium	3.7	< 7			
Beryllium	< dl	< 0.25			
Bismuth	3.7	< 15			
Cadmium	3.8	< 1			
Cesium	6.7	< 10			
Gadolinium	260	< 0.4			
Lead	59	< 2			
Mercury	3.7	< 4			
Nickel	18	< 12			
Palladium	< dl	< 0.3			
Platinum	< dl	< 1			
Tellurium	< dl	< 0.3			
Thallium	0.4	< 0.5			
Thorium	0.04	< 0.03			
Tin	2.2	< 10			
Titanium	9.7	< 15			
Tungsten	0.1	< 0.4			
Uranium	< dl	< 0.04			

URINE CREATININE

	RESULT mg/dL	REFERENCE RANGE	2SD LOW	1SD LOW	MEAN	1SD HIGH	2SD HIGH
Creatinine	29.9	35- 225					

SPECIMEN DATA

Comments:
 Date Collected: 12/8/2009 pH upon receipt: 5.3 Collection Period: **timed: 10 hours**
 Date Received: 12/11/2009 <dl: less than detection limit Volume:
 Date Completed: 12/20/2009 Provoking Agent: **EDTA DMSA** Provocation: **POST PROVOCATIVE**
 Method: **ICP-MS**

Toxic metals are reported as µg/g creatinine to account for urine dilution variations. **Reference ranges are representative of a healthy population under non-challenge or non-provoked conditions.** No safe reference levels for toxic metals have been established.

V12

INTRODUCTION

This analysis of urinary elements was performed by ICP-Mass Spectroscopy following acid digestion of the specimen. Urine element analysis is intended primarily for: diagnostic assessment of toxic element status, monitoring detoxification therapy, and identifying or quantifying renal wasting conditions. It is difficult and problematic to use urinary elements analysis to assess nutritional status or adequacy for essential elements. Blood, cell, and other elemental assimilation and retention parameters are better indicators of nutritional status.

1) 24 Hour Collections

"Essential and other" elements are reported as mg/24 h; mg element/urine volume (L) is equivalent to ppm. "Potentially Toxic Elements" are reported as µg/24 h; µg element/urine volume (L) is equivalent to ppb.

2) Timed Samples (< 24 hour collections)

All "Potentially Toxic Elements" are reported as µg/g creatinine; all other elements are reported as µg/mg creatinine. Normalization per creatinine reduces the potentially great margin of error which can be introduced by variation in the sample volume. It should be noted, however, that creatinine excretion can vary significantly within an individual over the course of a day.

If one intends to utilize urinary elements analysis to assess nutritional status or renal wasting of essential elements, it is recommended that unprovoked urine samples be collected for a complete 24 hour period. For provocation (challenge) tests for potentially toxic elements, shorter timed collections can be utilized, based upon the pharmacokinetics of the specific chelating agent. When using EDTA, DMPS or DMSA, urine collections up to 12 hours are sufficient to recover greater than 90% of the mobilized metals. Specifically, we recommend collection times of: 9 - 12 hours post intravenous EDTA, 6 hours post intravenous or oral DMPS and, 6 hours post oral bolus administration of DMSA. What ever collection time is selected by the physician, it is important to maintain consistency for subsequent testing for a given patient.

If an essential element is sufficiently abnormal per urine measurement, a descriptive text is included with the report. Because renal excretion is a minor route of excretion for some elements, (Cu, Fe, Mn Zn), urinary excretion may not influence or reflect body stores. Also, renal excretion for many elements reflects homeostasis and the loss of quantities that may be at higher dietary levels than is needed temporarily. For these reasons, descriptive texts are provided for specific elements when deviations are clinically significant. For potentially toxic elements, a descriptive text is provided whenever levels are measured to be higher than expected. If no descriptive texts follow this introduction, then all essential element levels are within acceptable range and all potentially toxic elements are within expected limits.

For essential elements, the mean and the reference ranges apply to human urine under non-challenge, non-provocation conditions. Detoxification therapies can cause significant deviations in essential element content of urine. For potentially toxic elements, the expected range also applies to conditions of non-challenge or non-provocation. Diagnostic or therapeutic administration of detoxifying agents frequently raise the urinary levels content of potentially

toxic elements. Descriptive texts appear in this report on the basis of measured results and correspond to non-challenge, non-provocation conditions.

CAUTION: Even the most sensitive instruments have some detection limit below which a measurement cannot be made reliably. Any value below the method detection limit is simply reported as "< dl." If an individual excretes an abnormally high volume of urine, urinary components are likely to be extremely dilute. It is possible for an individual to excrete a relatively large amount of an element per day that is so diluted by the large urine volume that the value measured is near the dl. This cannot automatically be assumed to be within the reference range.

ALUMINUM HIGH

This individual's urine aluminum is higher than expected; urine is the primary mode of excretion for absorbed aluminum.

Common sources of bioavailable aluminum include: aluminum cookware, flatware and especially coffee pots; aluminum hydroxide anti-acid formulations; some types of cosmetics, especially deodorants; some colloidal minerals and some herbs or herbal products. Aluminum cookware is particularly of concern if acid foods are cooked such as tomato paste (contains salicylates). In cosmetics and deodorants, aluminum chloride may be present as an astringent. In water purification, alum (sodium aluminum sulfate) may be used to coagulate dispersed solids and improve water clarity. Alumina or Al_2O_3 is very stable chemically and not bioavailable. Silica limits the solubility of aluminum and aluminum silicate is not very bioavailable. Clays, bentonite for example, contain aluminum that has poor bio-availability. Aluminum food containers are manufactured with polymer or plastic coatings that prevent direct food-aluminum contact provided such coatings are not damaged.

In the GI tract, phosphates react with aluminum ions forming insoluble aluminum phosphates. If this phosphate-blocking were 100% efficient, then virtually no aluminum would be absorbed. Evidently, this phosphate-forming process is incomplete because body tissue levels (such as hair) usually contain measurable amounts of aluminum. In the body aluminum follows a path of increasing phosphate concentration: plasma, cytosol, cell nucleus. Once in the nucleus, it adversely affects protein formation. Long-lived cells such as neurons are susceptible to long-term accumulation. Al is considered neurotoxic. Without intervention, aluminum accumulates continually in the body with the highest concentration occurring at old age or death.

A hair element test can be used to corroborate increased body burden of aluminum. An oral provocation with the amino acid glycine, 80 mg/Kg body weight (in divided doses) 24 hours before a diagnostic EDTA chelation with subsequent urine collection can be done to confirm aluminum excess. (Eliminate food/beverage sources of Al during this procedure.)

BIBLIOGRAPHY FOR ALUMINUM

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4. Fulton B. and E.H. Jeffery, "Absorption and Retention from Drinking Water", Fund. & Appl. Toxicology 14 pp 788-96 1980.

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CADMIUM HIGH

This individual's urine cadmium level equals or exceeds twice the maximum expected level. This element is insidiously toxic with chronic accumulations affecting renal function, pulmonary and cardiovascular tissues, bone, and the peripheral nervous system. Without intervention, the biological half-life of Cd in humans exceeds 20 years (Harrison's Principles of Internal Medicine, 13th ed, pp 2463-64).

Chronic manifestations associated with this degree of cadmium excess include: hypertension, weight loss, microcytic-hypochromic anemia, lymphocytosis, proteinuria with wasting of beta2 microglobulin, emphysema and pulmonary fibrosis (if inhalation was a route of contamination), atherosclerosis, steomalacia and lumbar pain, and peripheral neuropathy. Acute inhalation of Cd dusts, fumes or soluble salts may produce cough, pneumonitis and fatigue. Manifestations of Cd toxicity may be lessened or delayed by an individual's protective and detoxication capacities. Zinc and vitamin E are protective; metallothionein and glutathione bind Cd and help detoxify it initially.

Smoking can be a source for as much as 0.1 mcg Cd per cigarette (HEW Pub. No. NIOSH 76-192, US Govt. Printing Ofc., 1976). Some medical authorities consider Cd to be a carcinogen for lung cancer (Harrison's Principles, 13th ed, op. cit. pp 2463). Other occupational or environmental sources include: mining and smelting activities, pigments and paints, electroplating, electroplated parts (e.g., nuts and bolts), batteries (Ni-Cd), plastics and synthetic rubber, photographic and engraving processes, old drums from some copy machines, photoconductors and photovoltaic cells, and some alloys used in soldering and brazing.

Depending upon body burden and upon type, duration and dosage of detoxifying agents, elevated urine cadmium may occur after administration of: EDTA, DMPS, DMSA or D-penicillamine. A confirming test for Cd excess is elemental hair analysis, barring exogenous contamination. Blood Cd measurement may not be indicative (Harrison's Principles of Internal Medicine, 13th ed., pp 2463).

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Gadolinium High

This individual's urine level of Gadolinium (Gd) is higher than expected. Gadolinium is one of the most abundant "rare-earth" elements but is never found as a free element in nature. Gadolinium has no known biological role in humans.

Toxicity due to Gd is rare due to its poor gastrointestinal absorption (it is suspected that very little Gd is absorbed from the gastrointestinal tract (<0.05%), similar to other rare earth metals) and there is no information on the tissue distribution of Gd. Most likely Gd is excreted slowly through the fecal and urinary routes. If exposure to high enough doses and/or if absorption does occur, symptoms of acute parenteral toxicity may develop, including abdominal cramps, diarrhea, lethargy, muscular spasms, and even eventual death due to respiratory collapse. Gadolinium salts can cause irritation of the skin and eyes and are suspected to be possible carcinogens. As reported by Perazella (2009) Gadolinium-based contrast (GBC) agents have been linked on occasion with a rare systemic fibrosing condition called nephrogenic systemic fibrosis (NSF) and their use in patients with advanced kidney disease should be avoided.

Gd is often used in alloys, improving the workability and resistance of metals (e.g. chromium, iron). Other technical uses include the phosphors of color television tubes and in making magnets and electronic components such as recording heads for video recorders and in the manufacture of compact disks and computer memory. In medicine Gd, chelated with diethylenetriaminepentaacetic acid (DTPA), is used as a non-radioactive contrasting agent in magnetic resonance imaging and has a half life in blood of about 90 minutes. It is also used in control rods for nuclear reactors and power plants, in making garnets for microwave applications.

In vitro evidence suggests that EDTA may effectively bind to Gd therefore urinary Gd might be higher than average post-Ca-EDTA provocation.

References:

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Perazella M. Current Status of Gadolinium Toxicity in Patients with Kidney Disease. Clin J Am Soc Nephrol 4: 461-69, 2009.

LEAD HIGH

This individual's urine lead exceeds three times the upper expected limit per the reference population. Because most of the body burden of lead is excreted in urine, this finding indicates significant burden with attempted detoxication of lead.

Sources of lead include: old lead-pigment paints, batteries, industrial smelting and alloying, some types of solders, glazes on (foreign) ceramics, leaded (antiknock compound) fuels, bullets and fishing sinkers, artist paints with lead pigments, and leaded joints in some municipal water systems. Most lead contamination occurs via oral ingestion of contaminated food or water or by children mouthing or eating lead-containing substances. The degree of absorption of oral lead depends upon stomach contents (empty stomach increases uptake) and upon the body's mineral status. Deficiency of zinc, calcium or iron may increase lead uptake. Transdermal exposure is

slight. Inhalation has decreased significantly with almost universal use of non-lead automobile fuel.

Lead has physiological and pathological effects on body tissues that may be manifested from relatively low lead levels up to acutely toxic levels. In children, developmental disorders and behavior problems may occur at relatively low levels: loss of IQ, hearing loss, poor growth. In order of occurrence with increasing lead concentration, the following can occur: impaired vitamin D metabolism, initial effects on erythrocyte and erythroid precursor cell enzymology, increased erythrocyte protoporphyrin, headache, decreased nerve conduction velocity, metallic taste, loss of appetite, constipation, poor hemoglobin synthesis, colic, frank anemia, tremors, nephrotoxic effects with impaired renal excretion of uric acid, neuropathy and encephalopathy.

Confirming tests for lead excess are: urinary lead following provocation with intravenous EDTA or DMPS, or oral DMSA, and hair element analysis. Whole blood analysis can be expected to reflect only recent exposures and does not correlate well with total body burden of lead (Carson, Ellis and McCann, Toxicology and Biological Monitoring of Metals in Humans, Lewis Publishers, p. 130, 1987). Increased blood protoporphyrins is a finding consistent with lead excess, but may occur with other toxic exposures as well. Also, zinc protoporphyrin measurement may yield a false negative result in zinc deficiency. Preliminary studies performed at DDI indicate a significant increase in the biliary/fecal excretion of lead following intravenous administration of vitamin C.

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NICKEL HIGH

This individual's urine nickel is elevated which may or may not be of significance. Urinary excretion of nickel bound to cysteinyl or thiol compounds (such as glutathione) or to amino acids (histidine, aspartic acid, arginine) is the predominant mode of excretion. With the exception of specific occupational exposures, most absorbed nickel comes from food or drink, and intakes can vary by factors exceeding 100 depending upon geographical location, food type, and water supply. Depending upon chemical form and physiological factors, from 1 to 10% of dietary nickel may be absorbed from the gastrointestinal tract into the blood. Urine reflects recent exposure to nickel and may vary widely in nickel content from day to day due to the above factors.

Sources of nickel are numerous and include the following.

- . Cigarettes (2 to 6 mcg Ni per average cigarette)
- . Diesel exhaust (particulates may contain up to 10 mg/gram)

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- . Foods, especially: cocoa, chocolate, soya products, nuts, and hydrogenated oils
 - . Nickel-cadmium batteries
 - . Nonprecious, semiprecious dental materials
 - . Nickel-containing prostheses
 - . Electroplating, plated objects, costume jewelry
 - . Pigments (usually for ceramics or glass)
 - . Catalyst materials (for hydrogenation processes in the food, petroleum and petrochemical industries)
 - . Arc welding
 - . Nickel refining and metallurgical processes

Most clinically observed nickel contaminations are manifested as dermatoses - contact dermatitis and atopic dermatitis. However, Ni hypersensitizes the immune system causing hyperallergenic responses to many different substances. Because nickel can displace zinc from binding sites on enzymes, it can have inhibiting or activating effects on such enzymes. Nickel sensitivity is observed to be three to five times more frequent in women than in men.

Other laboratory tests or clinical findings that would be indicative of nickel excess are; hair element analysis, presentation of multiple allergic sensitivities, dermatitis, positive patch test for "Ni allergy", proteinuria, hyperaminoaciduria (by 24-hour urine amino acid analysis). Detoxification treatments with administration of EDTA or sulfhydryl agents (DMPS, DMSA, D-penicillamine) may increase urine nickel levels depending upon: body burden and mobility in tissues, duration of treatment, dosage and other factors.

BIBLIOGRAPHY FOR NICKEL

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5. Ambient Water Quality Criteria for Nickel, US EPA NTIS, Springfield, VA. Publ No. PB81-117715, 1980.

THORIUM HIGH

This individual's urine thorium is higher than expected. Because most thorium salts are excreted via urine, a high urine thorium level indicates exposure and probably increased body burden of this element. Thorium is considered mildly toxic for two reasons, low-level radioactivity and slight biochemical toxicity.

Thorium is a radioactive element having 7 isotopes with half lives that exceed one hour. Th232 constitutes 99% of the naturally occurring thorium and this is the isotope measured at DDI and reported for this individual. Th232 has a half life of 1.4x10 to the tenth years. It decays by alpha emission to produce radon, Ra228. In turn Ra228 (half life 6.7 years) decays to other radioactive isotopes, eventually reaching lead. This radioactive decay process produces alpha, beta and

gamma emissions. Several decades ago, a thoria (ThO₂) suspension ("Thorotrast") was used diagnostically as a radiopaque agent. After a long period of latency, an unusually high proportion of individuals who received this procedure have developed leukemias, granulomas, and malignant liver tumors. These are slowly-developed diseases often with 20-30 year periods before onset or definite diagnosis.

The biochemical effects of thorium are mild. Reactive thorium salts at high levels may inhibit amylase and phosphatase enzymes. Most orally ingested thorium, if not excreted in urine, binds to bone tissue where it has a long biological half-time (years). There is a literature report for abnormal lymphocytes in animals following a purposeful thorium challenge.

Thorium has about the same abundance in the earth as does lead and is encountered in mining activities for titanium and rare earth elements. Commercially, thorium is used in incandescent gas lantern mantles, refractory materials (thoria melts at 3300°C), and as a coating for tungsten in electronic applications. It is present in nuclear fuels (U²³⁵ decays to Th²³¹). Thorium may also be present in tungsten-inert-gas ("TIG") welding electrodes.

A hair element analysis can be done to corroborate elevated thorium.

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