

URINE TOXIC METALS



LAB#: U000000-0000-0
PATIENT: Sample Patient
SEX: Male
AGE: 52

CLIENT#: 12345
DOCTOR:
Doctor's Data, Inc.
3755 Illinois Ave.
St. Charles, IL 60174

POTENTIALLY TOXIC METALS

METALS	RESULT µg/g CREAT	REFERENCE RANGE	WITHIN REFERENCE RANGE	ELEVATED	VERY ELEVATED
Aluminum	< dl	< 25			
Antimony	9.4	< 0.6			
Arsenic	32	< 120			
Beryllium	< dl	< 0.5			
Bismuth	< dl	< 10			
Cadmium	0.3	< 2			
Lead	3.9	< 5			
Mercury	18	< 3			
Nickel	1.2	< 10			
Platinum	< dl	< 1			
Thallium	< dl	< 0.7			
Thorium	< dl	< 0.3			
Tin	11	< 9			
Tungsten	< dl	< 0.7			
Uranium	< dl	< 0.1			

CREATININE

	RESULT mg/dL	REFERENCE RANGE	2SD LOW	1SD LOW	MEAN	1SD HIGH	2SD HIGH
Creatinine	93	45- 225					

SPECIMEN DATA

Comments:
 Date Collected: **1/29/2008** Method: **ICP-MS** Collection Period: **timed: 2 hours**
 Date Received: **2/1/2008** <dl: **less than detection limit** Volume: **100 ml**
 Date Completed: **2/5/2008** Provoking Agent: **DMPS** Provocation: **POST PROVOCATIVE**

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.

V10.00

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.

ANTIMONY HIGH

This individual's urine antimony is significantly higher than expected. Symptoms or toxic effects depend upon the amount and chemical form of absorbed antimony. Antimony (Sb) has two valences, Sb+3 and Sb+5. Sb+3 is the more toxic but is mostly excreted in feces. Sb+5 is less toxic, binds less well to body tissues, and is mostly excreted in urine. Most orally ingested Sb+3 and Sb+5 is not absorbed from the gut with organic forms being most bioavailable, followed by soluble salts. Oxides are least absorbed.

Sb dusts may be inhaled as oxides or salts in industrial areas where smelting or alloying is done (usually with copper, silver, lead, tin). A rather toxic vapor form is stibine, SbH₃, which occurs when Sb₂O₃ is reduced with hydrogen and can be formed by some species of mold. Electrodes and batteries may contain antimony. Ceramics, fireproofed textiles, solders, and pigments may also contain antimony. Exposure to antimony can also occur with handling of gun powder and frequent use of firearms.

Inhalation of antimony dust causes irritation of respiratory tissues, and chronic inhalation may cause pneumoconiosis. Dermal contact can cause "antimony spots" or rashes which resemble chicken pox. Exposure to stibine causes hemolysis of erythrocytes. Less acute exposures or ingestion of bioavailable Sb can result in enzyme inhibition and impaired cellular metabolism. Sb inhibits phosphofructokinase ("PFK"), monoamine oxidase ("MAO"), and enzymes that bear sulfhydryl groups (-SH). Numerous symptoms of Sb ingestion are possible and include: nausea, GI distress, anorexia, metallic taste, fatigue and muscle weakness, and myopathy. Cardiovascular effects are possible in chronic Sb poisoning including: hypotension, cardiac pain (like angina pectoris), and faulty ventricular polarization.

Hair analysis is a corroborative test for Sb excess, which is common among patients with Autism Spectrum Disorder. Other confirmatory tests include fecal metals analysis, and urinary antimony post-DMP5 or DMSA. Other clinical findings that would be consistent are: subnormal blood platelet MAO functional activity, erythrocyte fragility and hemolysis, gout and signs of PFK inhibition such as elevated ammonia and hypoxanthine in venous blood, and inverted T-wave on EKG.

BIBLIOGRAPHY FOR ANTIMONY

1. Carson B.L. et al. Toxicology and Biological Monitoring of Metals in Humans, Lewis Publishers, Chelsea MI, pp 21-26, 1987.
2. Tsalev D.L. and Z.K. Zaprianov. Atomic Absorption Spectrometry in Occupational and Environmental Health Practice. CRC Press, Boca Raton FL, pp 85-87, 1983.
3. Scriver C.A. et al The Metabolic Basis of Inherited Disease, 6th ed. McGraw-Hill, New York NY, pp 2349-50 on PFK deficiency. 1989.

MERCURY HIGH

This individual's urine mercury equals or exceeds twice the maximum expected level. Presentation of symptoms associated with excessive mercury can depend on many factors: the chemical form of absorbed Hg and its transport in body tissues, presence of other synergistic toxics (Pb, Cd have such effects), presence of disease that depletes or inactivates lymphocytes or is immunosuppressive, organ levels of xenobiotic chemicals and sulfhydryl-bearing metabolites (e.g. glutathione), and the concentration of protective nutrients, (e.g. zinc, selenium, vitamin E).

Early signs of mercury contamination include: decreased senses of touch, hearing, vision and taste, metallic taste in mouth, fatigue or lack of physical endurance, and increased salivation. Symptoms may progress with moderate or chronic exposure to include: anorexia, numbness and paresthesias, headaches, hypertension, irritability and excitability, and immune suppression, possibly immune dysregulation. Advanced disease processes from mercury toxicity include: tremors and incoordination, anemia, psychoses, manic behaviors, possibly autoimmune disorders, renal dysfunction or failure.

Mercury is commonly used in: dental amalgams, explosive detonators; in pure liquid form for thermometers, barometers, and laboratory equipment; batteries and electrodes ("calomel"); and in fungicides and pesticides. The fungicide/pesticide use of mercury has declined due to environmental concerns, but mercury residues persist from past use.

Methylmercury, the common, poisonous form, occurs by methylation in aquatic biota or sediments (both freshwater and ocean sediments). Methylmercury accumulates in aquatic animals and fish and is concentrated up the food chain reaching high concentrations in large fish and predatory birds. Except for fish, the human intake of dietary mercury is negligible unless the food is contaminated with one of the previously listed forms/sources. A daily diet of fish can cause 1 to 10 micrograms of mercury/day to be ingested, with about three-quarters of this (typically) as methylmercury.

Depending upon body burden and upon type, duration and dosage of detoxifying agents, elevated urine mercury may occur after administration of: DMPS, DMSA, D-penicillamine, or EDTA. Blood and especially blood cell analyses are only useful for diagnosing very recent or ongoing organic (methyl) mercury exposure.

BIBLIOGRAPHY FOR MERCURY

1. Suzuki T. et al eds, *Advances in Mercury Toxicology*, Plenum Press, New York, 1991.
2. World Health Organization: "Methylmercury" *Environ. Health Criteria* 101 (1990); "Inorganic Mercury" *Environ. Health Criteria* 118 (1991) WHO, Geneva, Switzerland.
3. Tsalev D.L. and Z.K. Zaprianov, *Atomic Absorption Spectrometry in Occupational and Environmental Health Practice*, CRC Press, Boca Raton FL, pp 158-69, 1983.
4. Birke G. et al "Studies on Humans Exposed to Methyl Mercury Through Fish Consumption", *Arch Environ Health* 25, 1972 pp 77-91.
5. Pelletier L. "Autoreactive T Cells in Mercury-Induced Autoimmunity", *J. Immunology*, 140 no.3 (1988) pp 750-54.
6. Werbach M.R. *Nutritional Influences on Illness*, 2nd ed, Third Line Press, Tarzana CA, pp 249, 647, 679, 1993.

TIN HIGH

Tin is elevated in this individual's urine, and urine accounts for at least 80% of excreted tin that is ingested and absorbed from the gastrointestinal tract. Ingested tin is not significantly absorbed if it is an inorganic form. Oxide coatings readily form on metallic tin, and salts can quickly oxidize making them insoluble. Organic tin, however, is bioavailable and more readily absorbed. Some organic tin compounds such as short-chain alkyltins can be absorbed transdermally and can cause degeneration of myelin.

Food and drink usually provide small daily intakes of (nontoxic) tin, with amounts depending upon type of food, packaging, quality of drinking water and water piping materials. Total daily intake is expected to vary from about 0.1 to 15 milligrams. Tin is present in many metal alloys and solders; bronze, brass and pewter contain the element. Dyes, pigments and bleaching agents often contain tin. Anticorrosion plating of steel and electrical components may also use tin. "Tin cans" are tin-plated steel with a thin outer oxide layer allowing the surface to be shiny but inert. Modern food-containing cans usually have polymer coatings that prevent food-metal contact. In the past some toothpastes contained stannous fluoride, a soluble fluoride source for strengthening tooth enamel. Currently most brands of fluoridated toothpastes contain sodium fluoride. Organic tins, the usually toxic forms, are: biocides (triphenyltin and alkyltins) used against rodents, fungi, insects and mites; curing agents for rubbers and silicones (dialkyltin); and methyltin formed bacteriologically (similar to methylmercury).

Mildly elevated levels of tin in urine may reflect sporadic dietary intake and excretion; there may be no associated symptoms. A two- or three-fold increase in urine tin levels is not uncommon following administration of EDTA or with sulfhydryl agents (DMSA, D-penicillamine, DMPS). Early signs of chronic organic tin excess can be: reduced sense of smell, headaches, fatigue and muscle aches, ataxia and vertigo. Hyperglycemia and glucosuria are reported. Also, for organic tin exposure, there can be irritation of contacted tissues (eyes, skin, bronchial tubes, or GI tract). Later, immune dysfunction may occur with reduced lymphocytes and leukocytes; mild anemia may occur. A hair element analysis can be used to corroborate tin excess. Tin is commonly elevated in urine from autistic patients following administration of DMSA or DMPS.

BIBLIOGRAPHY FOR TIN

1. Winship K.A. "Toxicity of Tin and Its Compounds", Adverse Drug Reactions and Acute Poisoning Reviews, 7 no.1, pp 19-38, 1988.
2. Gray B.H. et al. "Inhibition of Tributyltin Mediated Hemolysis by Mercapto Compounds" J. Applied Toxicology 6 no.5 pp 363-70, 1986. Discussed BAL, DMSA, DMPS relative effectiveness in inhibiting a toxic effect of tin.
3. Ganguly B.B. et al "Cytotoxicity of Tin in Human Peripheral Lymphocytes in Vitro" Mutation Research, 282 no.2, pp 61-67, 1992.
4. Tsalev D.L. and Z.K. Zaprianov, Atomic Absorption Spectrometry in Occupational and Environmental Health Practice, vol. 2, CRC Press, Boca Raton, FL, pp 199-204, 1983.
5. Carson B.L. et al. Toxicology and Biological Monitoring of Metals in Humans, Lewis Publ., Chelsea MI, pp 260-63, 1987.