LAB #: U000000-0000-0
PATIENT: Sample Patient
ID: PATIENT-S-00004
SEX: Female
DOB: 01/01/1973 AGE: 46

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

Toxic Metals; Urine

TOXIC METALS		RESULT µg/g creat	REFERENCE INTERVAL	WITHIN REFERENCE / OUTSIDE REFERENCE
Aluminum	(Al)	**120**	< 35	
Antimony	(Sb)	**0.1**	< 0.4	
Arsenic	(As)	**49**	< 117	
Barium	(Ba)	**8.3**	< 7	
Beryllium	(Be)	**< dl**	< 1	
Bismuth	(Bi)	**0.6**	< 15	
Cadmium	(Cd)	**0.8**	< 1	
Cesium	(Cs)	**5.3**	< 10	
Gadolinium	(Gd)	**0.2**	< 0.4	
Lead	(Pb)	**7.3**	< 2	
Mercury	(Hg)	**21**	< 4	
Nickel	(Ni)	**12**	< 12	
Palladium	(Pd)	**< dl**	< 0.3	
Platinum	(Pt)	**< dl**	< 1	
Tellurium	(Te)	**< dl**	< 0.8	
Thallium	(Tl)	**0.4**	< 0.5	
Thorium	(Th)	**< dl**	< 0.03	
Tin	(Sn)	**0.4**	< 10	
Tungsten	(W)	**< dl**	< 0.4	
Uranium	(U)	**0.1**	< 0.04	

URINE CREATININE	RESULT mg/dL	REFERENCE INTERVAL	-2SD -1SD MEAN +1SD +2SD
Creatinine	**84.3**	35- 225	

SPECIMEN DATA

Comments:

Date Collected: **12/5/2011**
Date Received: **12/8/2011**
Date Completed: **12/9/2011**
Method: **ICP-MS**

pH upon receipt: **Acceptable**
<dl: **less than detection limit**
Provoking Agent: **CAEDTA DMSA**
Creatinine by Jaffe Method

Collection Period: **timed: 6 hours**
Volume:
Provocation: **POST PROVOCATIVE**

Results are creatinine corrected to account for urine dilution variations. **Reference intervals and corresponding graphs are representative of a healthy population under non-provoked conditions.** Chelation (provocation) agents can increase urinary excretion of metals/elements.

V13

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.

Reference intervals and corresponding graphs shown in this report are representative of a healthy population under non-provoked conditions. Descriptive texts appear in this report on the basis of measured results and correspond to non-challenge, non-provoked conditions.

Chelation (provocation) agents can increase urinary excretion of metals/elements. Provoked

reference intervals have not been established therefore non-provoked reference intervals shown are not recommended for comparison purposes with provoked test results. Provoked results can be compared with non-provoked results (not reference intervals) to assess body burden of metals and to distinguish between transient exposure and net retention of metals. Provoked results can also be compared to previous provoked results to monitor therapies implemented by the treating physician. Additionally, Ca-EDTA provoked results can be used to calculate the EDTA/Lead Excretion Ratio (LER) in patients with elevated blood levels.

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 (Al) is higher than expected; urine is the primary route of excretion for absorbed aluminum.

Common sources of bioavailable Al 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 Al that has poor bio-availabilty. Aluminum food containers are manufactured with polymer or plastic coatings that prevent direct food-aluminum contact provided such coatings are not damaged.

In the gastrointestinal tract, phosphates react with Al ions forming insoluble Al phosphates. If this phosphate-blocking were 100% efficient, then virtually no Al would be absorbed. Evidently, this phosphate-forming process is incomplete because body tissue levels (such as hair) usually contain measurable amounts of Al. In the body Al 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 potentially neurotoxic. Al accumulates continually in the body with the highest concentration occurring at old age or death.

A hair element test may be used to further evaluate the extent of Al exposure. Comparison of urine Al levels before and after intravenous administration of EDTA provides an estimate of the net retention of Al over time. Urine Al is commonly increased to some extent after administration of EDTA.

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Barium High

Barium (Ba) has not been established to be an essential element. Elevated levels of Ba often are observed after exposure to Ba (a contrast agent) during diagnostic medical tests (e.g. ”barium swallow”, ”upper GI series”, ”barium enema”, etc.). Elevated levels of Ba may interfere with calcium metabolism and potassium retention. Acutely high intake of soluble Ba-salts (nitrates, sulfides, chlorides) can be toxic. Chronic exposure to Ba may be manifested by muscular and myocardial stimulation, tingling in the extremities, and loss of tendon reflexes. Due to its high density, Ba is utilized to absorb radiation and is utilized in concrete shields around nuclear reactors and in plaster used to line x-ray rooms. Peanuts/peanut butter are very high in Ba so urine Ba may be elevated shortly after consumption of these foods; toxic effects would not be anticipated under such conditions.

The main use of Ba in medicine is as a contrast medium. Long-term retention of Ba can occur - granuloma of the traverse colon has been reported after diagnostic use of Ba-sulfate. Crystalline Ba-titanate is a ceramic compound which is used in capacitors and transducers. Ba is also used to produce pigments in paints and decorative glass. Soluble Ba compounds are highly toxic and may be used as insecticides. Ba-aluminates are utilized for water purification, acceleration of concrete solidification, production of synthetic zeolites, and in the paper and enamel industries.

Although Ba is poorly absorbed orally (<5%) it can be very high in peanuts and peanut butter (about 3,000 nanograms/gram), frozen and fast foods such as burgers, fries, and hot dogs (400-500 nanograms/gram). It is noteworthy that Ba intake is much higher in children than adults (Health Canada 2005, www.atsdr.cdc.gov/toxprofiles/tp24-c6.pdf).

Ba levels (and the levels of 16 other elements) in water can be assessed with water testing as provided by DDI. A possible confirmatory test for excessive Ba retention ismeasurement of blood electrolytes as hypokalemia may be associated with excessive Ba in the body. Hair

LEAD HIGH

This individual’s urine lead exceeds three times the upper expected limit per the reference population. Because a percentage of absorbed or assimilated lead is excreted in urine, the urine lead level reflects recent or ongoing exposure to lead and the degree of excretion or detoxification.

Sources of lead include: old lead-pigment paints, batteries, industrial smelting and alloying, some types of solders, ayruvedic herbs, some toys and products from China, 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-leaded automobile fuel.

Lead accumulates extensively in bone and inhibits formation of heme and hemoglobin in erythroid precursor cells. Bone lead is released to soft tissues with bone remodeling that can be accelerated with growth, menopausal hormonal changes and osteoporosis. 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. At relatively low levels, lead can participate in synergistic toxicity with other toxic elements (e.g. cadmium, mercury).

Excessive retention of lead can be assessed by urinalysis after provocation with Ca-EDTA (iv) or oral DMSA. Whole blood analysis can be expected to reflect onlyrecent exposures and does not correlate well with total body burden of lead.

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MERCURY HIGH

This individual's urine mercury (Hg) far exceeds the expected level for the general population under non-provoked condititons. Presentation of symptoms associated with excessive Hg exposure can depend on many factors: the chemical form of Hg its accumulation in specific tissues, presence of other toxicants, presence of disease that depletes glutathione or inactivates lymphocytes or is immunosuppressive, and the concentration of protective nutrients, (e.g. zinc, selenium).

Early signs of excessive Hg exposure 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/dysregulation. Advanced disease processes from excessive Hg assimilaion include: tremors and incoordination, anemia, psychoses, manic behaviors, possibly autoimmune disorders and renal dysfunction or failure.

Mercury is commonly used in: dental amalgams (50% by weight), explosive detonators; in pure liquid form for thermometers, barometers, and laboratoryequipment; batteries and electrodes, some medicaitons and ayruvedic herbs, and Hg in fungicides and pesticides. The use of Hg in fungicides/pesticides has declined due to environmental concerns, but mercury residues persist from past use.

Methylmercury, the most common, organic form, occurs by methylation of inorganic 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. Daily ingestion of fish can result in the assimialtion 1 to 10 micrograms of mercury/day.

Depending upon the extend of cumulative Hg exposure, elevated urine mercury may occur after administration of DMPS, DMSA, or D-penicillamine. Blood and especially red blood cell elemental analyses are only useful for diagnosing very recent or ongoing organic (methyl) mercury exposure.

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URANIUM HIGH

This individual's urine uranium (U) is higher than expected which indicates higher than expected exposure to U. Renal excretion accounts for most U that is excreted from the body. Uranium is considered mildly toxic for two reasons, low-level radioactivity and moderate biochemical toxicity.

Uranium is a radioactive element with 10 isotopes with half lives exceeding one hour. U238 constitutes about 99% of the naturally-occurring U and this is the isotope measured at DDI and reported for this individual. U238 has a half-life of 4.5 X 10 to the ninth years. It decays by alpha emission to produce thorium, Th234, the initial step in a decay chain that eventually leads to lead. Alpha, beta and gamma emissions occur during this decay process. Because of the very long half-life, the radioactivity danger is only slight. However, exposure to enriched or nuclear fuel grade U (high in U235) does pose a health hazard. The measured result (U238) does not reflect or imply exposure to enriched U235.

The toxochemical effects of U may be more severe than the radiochemical effects for U238. Uranium has four valences (3,4,5 or 6), can combine with phosphate, citrate, pyruvate, malate, lactate, etc. in body tissues, and usually is transported in the blood as a carbonate complex. Uranium that is not excreted in urine can accumulate in bone and kidney tissues as well as in the spleen and liver. In excessive amounts, it can be nephrotoxic. Inhaled U accumulatesin lung tissue. Fatigue is the most common symptom associated with chronic, low-level (natural) U exposure (DDI observations).

Uranium is more common than mercury, silver or cadmium in the earth's rock strata, and may be present, at low levels, in ground (drinking) water. Most commercial use of U is for nuclear fuel, but it may be present in ceramics or colored glass, especially ancient or antique, yellow-colored glassware.

Hair elements analysis may provide further information regarding temporal exposure to U. Whole blood U analysis may provide confirmation of very recent or ongoing exposure to uranium.

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