LAB #: U141015-2157-1
PATIENT: Damien Blenkinsopp
ID: BLENKINSOPP-D-00002
SEX: Male
AGE: 39

CLIENT #: 24237
DOCTOR: Anna Davis, MD
Direct Laboratory Services
4040 Florida St Ste 101
Mandeville , LA 70448 U.S.A.

Toxic Metals; Urine

TOXIC METALS		RESULT µg/g creat	REFERENCE INTERVAL	WITHIN REFERENCE / OUTSIDE REFERENCE
Aluminum	(Al)	**< dl**	< 25	
Antimony	(Sb)	**< dl**	< 0.2	
Arsenic	(As)	**180**	< 75	
Barium	(Ba)	**1**	< 7	
Beryllium	(Be)	**< dl**	< 1	
Bismuth	(Bi)	**< dl**	< 2	
Cadmium	(Cd)	**0.2**	< 0.8	
Cesium	(Cs)	**6.7**	< 9	
Gadolinium	(Gd)	**< dl**	< 0.5	
Lead	(Pb)	**4**	< 2	
Mercury	(Hg)	**2.6**	< 3	
Nickel	(Ni)	**4.6**	< 8	
Palladium	(Pd)	**< dl**	< 0.1	
Platinum	(Pt)	**< dl**	< 0.1	
Tellurium	(Te)	**< dl**	< 0.5	
Thallium	(Tl)	**0.7**	< 0.5	
Thorium	(Th)	**< dl**	< 0.03	
Tin	(Sn)	**0.8**	< 4	
Tungsten	(W)	**< dl**	< 0.4	
Uranium	(U)	**< dl**	< 0.03	

URINE CREATININE	RESULT mg/dL	REFERENCE INTERVAL	-2SD -1SD MEAN +1SD +2SD
Creatinine	**54.3**	45 - 230	

SPECIMEN DATA

Comments:

Date Collected: **10/12/2014**
Date Received: **10/15/2014**
Date Completed: **10/16/2014**
Method: **ICP-MS**

pH upon receipt: **Acceptable**
<dl: **less than detection limit**
Provoking Agent: **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.

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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.

ARSENIC HIGH

This inidividual's urine arsenic (As) is higher than expected. Because urine is the major mode of excretion for arsenic, an elevated level reflects increased assimilation of As. Ingestion of organic species of As in seafood is not uncommon and may be associated with very elevated urine As. Arsenobetaine and arsinocholine, commonly found in shellfish are relatively non-toxic and 90% is excreted in the urine with a half-life of about 48 hours.

Sources of As include: contaminated foods (e.g. chicken), water or medications. Industrial sources are: ore smelting/refining/processing plants, galvanizing, etching plating processes. Tailing from or river bottoms near gold mining areas (past or present) may contain arsenic. Insecticides, rodenticides and fungicides (Na-, K- arsenites, arsenates, also oxides are commercially available). Commercial As-containing products include: sodium arsenite, calcium arsenate, lead arsenate and "Paris green" which is cupric acetoarsenite, a wood preservative (pressure treated wood). Undesirable levels of As have been found in many Ayruvedic herbs.

Chronic exposure to or ingestion of inorganic As causes tissue levels to gradually increase as the element binds to sulfur, phosphorus and selenium. An important detrimental effect is inactivation of lipoic acid,a vitamin cofactor needed for metabolism of pyruvate and alpha-ketoglutarate.

Symptoms consistent with mild or moderate As exposure include: fatigue, malaise, eczema or allergic-like dermatitis, and garlic-like breath. Increased salivation may occur. Hair element analysis may provide further evidence of As exposure to inorganic As. Blood As levels are not dose related and may or may not reflect As exposure or net retention of As. Levels of As may exceed the expected range after administration of DMPS or DMSA depending upon cumulative exposures. This does not necessarily indicate As excess to the point of toxic effects or physiological impairment.

BIBLIOGRAPHY FOR ARSENIC

1. Centers for Disease Control and Prevention. Third National Report on Human Exposure to Environmental Chemicals. Atlanta, GA; CDC: 2005. http://www.cdc.gov/exposurereport/report.htm [Accessed 2/01/2009]
2. Carson B.L. et al. Toxicology and Biological Monitoring of Metals in Humans, Lewis Publishers,

Chelsea, MI, pp 27-33, 1987.
3. Tsalev D.L. and Z.K. Zaprianov Atomic Absorption Spectrometry in Occupational and Environmental Health Practice, vol. 1, CRC Press, Boca Raton, FL, pp. 87-93, 1983.
4. Clarkson T.W. et al. eds. Biological Monitoring of Toxic Metals, Plenum Press, NY, NY, pp 309-15, 1988.
5. Harrison's Principles of Internal Medicine, 13th ed., McGraw Hill, New York, NY, pp 2461-62, 1994.
6. Heyman A. et al. "Peripheral Neuropathy Caused by Arsenical Intoxication" New Eng. J. Med., 254 no.9, pp 401-9 1956.
7. Saper RB et al. "lead, mercury and arsenic in U.S.- and Indian-manufactured ayruvedic medicines sold via the internet." JAMA(2008) 300(8):915-23.

LEAD HIGH

This individual's urine lead (Pb) is higher than expected which means that Pb exposure is higher than that of the general population. A percentage of assimilated Pb is excreted in urine. Therefore the urine Pb level reflects recent or ongoing exposure to Pb and the degree of excretion or endogenous detoxification processes.

Sources of Pb include: old lead-based paints, batteries, industrial smelting and alloying, some types of solders, Ayruvedic herbs, some toys and products from China and Mexico, glazes on(foreign) ceramics, leaded (anti-knock compound) fuels, bullets and fishing sinkers, artist paints with Pb pigments, and leaded joints in municipal water systems. Most Pb contamination occurs via oral ingestion of contaminated food or water or by children mouthing or eating Pb-containing substances. The degree of absorption of oral Pb depends upon stomach contents (empty stomach increases uptake) and upon the essential element intake and Pb status. Deficiency of zinc, calcium or iron increases Pb uptake. Transdermal exposure is significant for Pb-acetate (hair blackening products). Inhalation has decreased significantly with almost universal use of non-leaded automobile fuel.

Lead accumulates in extensively in bone and can inhibit formation of heme and hemoglobin in erythroid precursor cells. Bone Pb is released to soft tissues with bone remodeling that can be accelerated with growth, menopausal hormonal changes, osteoporosis, or skeletal injury. Low levels of Pb may cause impaired vitamin D metabolism, decreased nerve conduction,and developmental problems for children including: decreased IQ, hearing impairment, delayed growth, behavior disorders, and decreased glomerular function. Transplacental transfer of Pb to the fetus can occur at very low Pb concentrations in the body. At relatively low levels, Pb can participate in synergistic toxicity with other toxic elements (e.g. cadmium, mercury).

Excessive Pb exposure can be assessed by comparing urine Pb levels before and after provocation with Ca-EDTA (iv) or oral DMSA. Urine Pb is higher post-provocation to some extent in almost everyone. Whole blood analysis reflects only recent ongoing exposure and does not correlate well with total body retention of Pb. However, elevated blood Pb is the standard of care for diagnosis of Pb poisoning (toxicity).

BIBLIOGRAPHY FOR LEAD

1.ATSDR Toxicological Profile for Lead (2007 update) www.atsdr.cdc.gov/toxprofile
2. Centers for Disease Control and Prevention. Third National Report on Human Exposure to Environmental Chemicals. Atlanta, GA: CDC; 2005.

http://www.cdc.gov/exposure report/report.htm [Accessed 02/01/2009]
3. Lead Tech '92, "Proceedings and Papers from the Lead Tech '92: Solutions for a Nation at Risk" Conference, Sept 30-Oct 2, 1992. Bethesda, MD, IAQ Publications, 4520 East-West Highway, Ste 610, Bethesda, MD, 20814.
4. "Preventing Lead Poisoning in Young Children", US Centers for Disease Control, Atlanta, GA, Oct. 1991 Statement, US Dept. of Health and Human Services.
5. Carson B.L. et al. Toxicology and Biological Monitoring of Metals in Humans, Lewis Publishers, Inc., Chelsea, MI, p. 128-135, 1986.
6. Tsalev D.L. et al. Atomic Absorption Spectrometry in Occupational and Environmental Health Practice Vol 1, CRC Press, Boca Raton, FL 1983.
7. Piomelli S. et al. "Management of Childhood Lead Poisoning", J. Pediatr 105 (1990) p. 523-32.
8. Shubert J. et al. "Combined Effects in Toxicology - a Rapid Systematic Testing Procedure: Cadmium, Mercury and Lead" - J. Toxicology and Environmental Health, 4:763-776, 1978.
9. Mayo Clinic. Mayo Medical Laboratories. http://www.mayomedicallaboratories.com/test-catalog/clinical+and+Interpretive/60246 [Accessed 10/25/2011]
10. Saper RB et al. "Lead, mercury and arsenic in U.S. and Indian manufactured ayrevedic medicines sold via the internet." JAMA (2008) 300(8): 915-23.

THALLIUM HIGH

This individual's urine thallium (Tl) is higher than expected, but associated symptoms or toxic effects may or may not be presented. Presentation of symptoms can depend upon several factors including: chemical form of the Tl, mode of assimilation, severity and duration of exposure, and organ levels of metabolites and nutrients that effect the action of Tl in the body.

Thallium can be assimilated transdermally, by inhalation, or by oral ingestion. Both valence states can have harmful effects: Tl+1 may displace potassium from binding sites and influences enzyme activities; Tl+3 affects RNA and protein synthesis. Tl is rapidly cleared from blood and is readily taken up by tissues. It can be deposited in kidneys, pancreas, spleen, liver, lungs, muscles, neurons and the brain. Blood is not a reliable indicator of Tl exposure.

Symptoms that may be associated with excessive Tl exposure are often delayed. Early signs of chronic, low-level Tl exposure and retention may include: mental confusion, fatigue, and peripheral neurological signs: paresthesias, myalgias, tremor and ataxia. After 3 to 4 weeks, diffuse hair loss with sparing of pubic and body hair and a lateral fraction of eye- brows usually occurs. Increased salivation occurs less commonly. Longer term or residual symptoms may include: alopecia, ataxia, tremor, memory loss, weight loss, proteinuria (albuminuria), and possibly psychoses. Ophthalmologic neuritis and strabismus may be presented.

Environmental and occupational sources of Tl include: contaminated drinking water, airborne plumes or waste streams from lead and zinc smelting, photoelectric, electrochemical and electronic components (photoelectric cells, semiconductors, infrared detectors, switches), pigments and paints, colored glass and synthetic gem manufacture, and industrial catalysts used in some polymer chemistry processes. Thallium is present in some "weight loss" supplements (e.g. Active 8) at undisclosed levels ("trade secret").

Hair (pubic or scalp) element analysis may be used to test for suspected Tl exposure. Although urine is the primary natural route for excretion of thallium, the biliary/fecal route also

contributes. Therefore, fecal metals analysis provides a confirmatory test for chronic ongoing exposure to Tl. Clinical findings that might be associated with excessive Tl are: albuminuria, EEG with diffuse abnormalities, hypertension, and elevated urine creatinine phosphokinase (CPK). No provocation agents are currently available to estimate Tl retention by means of urinalysis.

BIBLIOGRAPHY FOR THALLIUM

1. Centers for Disease C ontrol and Prevention. Third National Report on Human Exposure to Environmental Chemicals. Atlanta, GA: CDC 2005. http;//www.cdc.gov/exposurereport.htm [Accessed 2/01/2009]
2. Graef J.W. "Thallium" in Harrison's Principles of Internal Medicine, 13th ed., Isselbacher et al eds., McGraw Hill, pp 2465, 1994.
3. Tsalev D.L. and Zaprianov Z.K. Atomic Absorption Spectrometry in Occupational and Environmental Health Practice CRC Press, Boca Raton FL, pp 196-199, 1983.
4. Carson B.L. et al. Toxicology and Biological Monitoring of Metals in Humans Lewis Publishers, Chelsea, MI, pp 243-254, 1987.