Crinnion Opinion

# Toxic Metal Test Review

Crinnion's Opinion on the pre and post urine toxic metal (UTM) test

Performed by DDI for Dr. Walter Crinnion on patient Anonymous Patient.

Pre-Chelating Test collected on 7/5/2018, with 121 mg/dL of creatinine in a 60 ml sample.

Post-Chelating Test collected on 7/5/2018, with 26 mg/dL of creatinine in a 2750 ml sample.

## At a Glance

Non-provoked urine metal levels compared to CDC Fourth Report Values
& Total ug of each metal in the sample

| Metal | Level ug/g creat | CDC 50th | CDC 75th | CDC 90th | CDC 95th | Total ug/sample |
|---|---|---|---|---|---|---|
| Antimony | < dl | 0.047 | 0.073 | 0.114 | 0.16 | NA |
| Arsenic | 7.2 | 6.1 | 11.9 | 27.6 | 52 | 0.5227 |
| Barium | 2.8 | 1.24 | 2.33 | 4.06 | 5.54 | 0.2033 |
| Cadmium | 0.8 | 0.138 | 0.288 | 0.563 | 0.8 | 0.0581 |
| Cesium | 4.8 | 4.42 | 6.37 | 8.61 | 10.3 | 0.3485 |
| Lead | 0.2 | 0.313 | 0.519 | 0.823 | 1.16 | 0.0145 |
| Mercury | 0.4 | 0.27 | 0.571 | 1.2 | 1.61 | 0.0290 |
| Thallium | 0.4 | 0.161 | 0.236 | 0.338 | 0.429 | 0.0290 |
| Tin | 0.3 | 0.438 | 0.995 | 2.25 | 3.72 | 0.0218 |
| Tungsten | < dl | 0.065 | 0.124 | 0.224 | 0.332 | NA |
| Uranium | < dl | 0.005 | 0.01 | 0.02 | 0.039 | NA |

Currrent Exposure: Barium, Cadmium, Thallium

Metal Mobilization Test was valid.

| Estimated Body Burden | | | |
|---|---|---|---|
| | Low | Moderate | High |
| Cadmium | | | ✓ |
| Lead | | ✓ | |
| Mercury | ✓ | | |

# Review specifics

This review will focus on the toxic metals with the greatest documented impact on health rather than the less toxic and less commonly found metals.

Know The Metal Exposure History For Anonymous Patient

Knowing the metal exposure history of the patient is important in your interpretation of these results.Those who were raised in a smoking household, were a smoker themselves, had amalgams in their mouth, regularly consume fish, shellfish and tofu would be expected to have above normal levels of cadmium, lead, and mercury.While those who live in areas with higher groundwater arsenic levels would be expected to have higher urinary arsenic as a result. (see map at: https://water.usgs.gov/nawqa/digmap.html (https://water.usgs.gov/nawqa/digmap.html)). Although water arsenic values are not available for every area please find out the relative levels in your state and region.

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# Non-provoked levels (random or first morning)

A comparison of their pre-flush UTM to the Centers for Disease Control's Fourth National was shown in the above graphic. Anonymous Patient has a baseline levels of Barium, Cadmium, Thallium that are higher than most U.S. residents.

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## Arsenic

Their baseline level of arsenic (7.2 µg / g Cr) indicates the patient Anonymous Patient is not having high current exposure to arsenic in their water or diet.

| Table 1. CDC Fourth Report 2017 – Urinary Arsenic in ug/g cr. | | | | |
|---|---|---|---|---|
| Metal | 50th% | 75th% | 90th% | 95th% |
| Arsenic Total | 6.10 | 11.9 | 27.5 | 52 |
| Arsenobetaine | <LOD | 3.89 | 12.2 | 34 |
| DMA | 3.03 | 4.82 | 7.46 | 10.4 |
| MMA | .471 | .761 | 1.16 | 1.42 |
| Arsenous III | .374 | .641 | .944 | 1.16 |
| Arsenobetaine LD50 - >4,000 mg/kg - DMA LD50 – 648 mg/kg - MMAA LD50 – 2 mg/kg - ASIII LD50 – 26 mg/kg | | | | |

Urinary arsenic levels > 5.71 ug/g cr. are associated with increased risk for blood sugar problems.[1] Arsenic levels between 10 – 20 ug/g cr. indicate increased risk for heart disease, lung cancer, COPD and diabetes mellitus.[2] Fortunately, these diseases typically only appear after four decades of exposure to arsenic in tapwater.

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## Cadmium

Their baseline level of cadmium (0.8 µg / g Cr) indicates that the body burden (primarily stored in the kidneys) is at a level that has been associated with kidney damage,[3] and increased rates of both osteoporosis[4] and both prostate and lung cancer.[5] Further assessment to confirm high body cadmium burden and whether or not those health issues are present should be done.

| Table 2. CDC Fourth Report 2017 – Urinary Cadmium in ug/g cr. | | | | |
|---|---|---|---|---|
| NHANES 2011/14 | 50th% | 75th% | 90th% | 95th% |
| All participants | .138 | .288 | .563 | .800 |
| Non-smoker | .160 | .298 | .549 | .753 |
| Smoker | .259 | .528 | .910 | 1.48 |
| (Note: OSHA – Industrial standards for urinary cadmium: < 3 ug/g cr.) | | | | |

Random (baseline) levels of urinary cadmium are widely considered to be a reflection of total body cadmium load. However, current exposure to cadmium (tofu, cigarette smoke and sunflower seeds) can make the total body burden appear artificially high. If Anonymous Patient was not exposed to smoking, tofu or sunflower seeds in the recent past, then this number is a good indication of their total cadmium burden.

## Lead

Their baseline level of lead (0.2 µg / g Cr) indicates normal background levels and means that no current high lead exposure is going on.

| Table 2. CDC Fourth Report 2017 – Urinary Lead in ug/g cr. | | | | |
|---|---|---|---|---|
| NHANES 2013/14 | 50th% | 75th% | 90th% | 95th% |
| All participants | .313 | .519 | .823 | 1.16 |
| Non-smoker | .316 | .526 | .823 | 1.16 |
| Smoker | .375 | .625 | .977 | 1.26 |
| (Note: OSHA – Industrial standards for urinary cadmium: < 3 ug/g cr.) | | | | |

Lead levels between above the 75th percentile in blood have been associated with gout,[6] ADHD in children,[7] hearing loss, reduced IQ in children,[8] as well as depression and panic in adults.[9] Levels above the 90th and 95th percentile have been associated with decreased walking speed in the elderly,[10] imbalance,[11] and increased cardiovascular risk (primarily through a reduction of nitric oxide).[12]

The relationship between urinary lead and total body burden of lead is not clear, but elevated body burden of lead is associated with all of the above problems as well as cognitive decline in adults,[13][14] increased risk for Parkinson's disease,[15] Alzheimer's disease,[16] and renal damage.[17]

The total lead in this non-provoked sample was 0.0145 µg / sample. A total lead of 1 ug was considered to indicate a high body burden requiring chelation[18] and appears to still be the case.[19][20]

## Mercury

Their baseline level of mercury (0.4 µg / g Cr) levels indicate normal background levels and that no ongoing current high mercury exposure is present. As seen in Table 4 those regularly consuming fish (Asian American population) the urine mercury is higher. Anonymous Patient's fish consumption should be addressed. A follow up non-provoked (random or first morning) urine mercury level taken 60 days after stopping fish consumption should reveal approximately a 50% drop in urinary mercury. If the drop does not occur the patient may not have been compliant or there is another exposure source present.

| Table 2. CDC Fourth Report 2017 – Urinary Mercury in ug/g cr. | | | | |
|---|---|---|---|---|
| NHANES | 50th% | 75th% | 90th% | 95th% |
| All participants 2013/14 | .270 | .571 | 1.20 | 1.61 |
| Asian Americans 2011/12 | .450 | .910 | 1.69 | 2.41 |
| (Note: OSHA – Industrial standards for urinary cadmium: < 3 ug/g cr.) | | | | |

Symptoms of low level mercury burden included the following: fatigue, headache, decreased memory, decreased concentration, and muscle or joint pain.[22] Another study indicated that confusion, stomach problems, loss of sense of smell or taste, shakiness in hands and coordination problems, headaches and muscle weakness were associated with low level mercury.[23]

# Other Metals of Note In the Non-Provoked Urine

## Aluminum

The aluminum level is at 2.4 µg / g Cr. The CDC has not measured this metal in U. S. residents. However, it is commonly found in the western diet containing processed foods which is the most likely source for this level. Lab reference values: DDI (< 25), Genova (< 25.2), RMA (< 39)

## Antimony

The antimony level is at (< dl), which is under the CDC 50$^{th}$ % level. Levels of antimony found in the general non-occupationally exposed U.S. population have not been associated with any adverse health risk.

## Barium

The barium level is at 2.8 µg / g Cr, which is in the CDC's 75$^{th}$ % level. Levels of barium found in the general U.S. population have not been associated with any adverse health risk.

## Bismuth

The bismuth level is at (< dl). The CDC has not yet measured this metal in U. S. residents. It is most commonly encountered in bismuth-containing intestinal medications (Pepto-Bismol™). To date no adverse health effects of low-level bismuth have been found in the medical literature. Lab reference values: DDI (< dl), Genova (< 0.7), RMA (< 0.2)

## Cesium

The cesium level is at 4.8 µg / g Cr. The CDC has not yet measured this metal in U. S. residents. Cesium levels above the labs reference values are often found in persons with metal-on-metal hip implants. No good studies about the adverse health effect of non-occupational exposure to cesium have been found. Lab reference values: DDI (< 9), Genova (< 10.5), RMA (< 10)

## Gadolinium

The gadolinium level is at (< dl). The CDC has not yet measured this metal in U. S. residents. Elevated gadolinium levels are found exclusively in persons who have been having diagnostic scans that use gadolinium as a contrast agent. Lab reference values: DDI (< 0.8), Genova (< 0.019), RMA (< 0.040)

## Nickel

The nickel level is at 1.4 µg / g Cr. The CDC has not yet measured this metal in U. S. residents. Levels of nickel found in the general U.S. population have not been associated with any adverse health risk. Lab reference values: DDI (< 8), Genova (< 4.4), RMA (< 14)

## Platinum

The platinum level is at (< dl). The CDC has looked for this metal in the U.S. population, but has only found it present in about 10% of those studied. This metal is mostly found in women who have undergone platinum-containing chemotherapy (cisplatin) for breast cancer. To date no adverse health effects of platinum have been identified in humans. Lab reference values: DDI (< 0.1), Genova (< 0.38), RMA (not done)

## Thallium

The thallium level is at 0.4 µg / g Cr, which is in the CDC's 90th % level. Thallium is being found in higher levels recently and is presumed to be due to consumption of thallium-contaminated leafy greens (such as kale). Low levels of thallium found in the general U.S. population have not been associated with any adverse health risk.

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## Tin

The tin level is at 0.3 µg / g Cr, which is under the CDC 50th % level. Non-toxic tin, as stannous fluoride, has been used in toothpaste for decades. Levels of tin found in the general U.S. population have not been associated with any adverse health risk.

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## Uranium

The uranium level is at (< dl), which is under the CDC 50th % level. The most common source of uranium appears to be groundwater. Levels of uranium found in the general U.S. population have not been associated with any adverse health risk.

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# Post-chelation challenge urine metal levels (Metal Mobilization Test)

**NOTE:** The following interpretation is based upon the assumption that the recommended testing protocol was followed with proper body-weight dosing of the metal mobilizing agents. If this is not the case, please disregard the following.

The provoking agent was DMSA.

| Metal | Pre [Chelating Agent] | Post [Chelating Agent] | Amount of Increase | Total µg of Metal Spilled |
|---|---|---|---|---|
| Aluminum | 2.4 | 5 | 1.08x | 3.5750 |
| Antimony | < dl | < dl | NA | NA |
| Arsenic | 7.2 | 10 | 0.39x | 7.1500 |
| Barium | 2.8 | 2 | -0.29x | 1.4300 |
| Bismuth | < dl | < dl | NA | NA |
| Cadmium | 0.8 | 1.1 | 0.38x | 0.7865 |
| Cesium | 4.8 | 8.9 | 0.85x | 6.3635 |
| Gadolinium | < dl | < dl | NA | NA |
| Lead | 0.2 | 17 | 84x | 12.1550 |
| Mercury | 0.4 | 5.1 | 11.75x | 3.6465 |
| Nickel | 1.4 | 3.6 | 1.57x | 2.5740 |
| Platinum | < dl | < dl | NA | NA |
| Thallium | 0.4 | 1 | 1.5x | 0.7150 |
| Tin | 0.3 | 0.6 | 1x | 0.4290 |
| Tungsten | < dl | < dl | NA | NA |
| Uranium | < dl | < dl | NA | NA |

## Arsenic

Arsenic is not a persistent metal. It's half-life in the body ranges from 4 hours to 4 days, depending upon which form of arsenic it is. Because of this a chelation challenge is unable to assess body load of arsenic. This is primarily done through the pre-provoked urine arsenic levels.

## Cadmium

The post-DMSA cadmium level is 1.1 µg / g Cr, a 0.38x change over the pre-flush level. DMSA typically only increases cadmium by 0.2 -0.5 ug/g cr. However, post provocation cadmium levels hold no meaning for assessing total body burden of cadmium. The non-provoked urine cadmium level gives the best estimate of total body burden and is used in all the studies to identify disease risk.

The post-DMSA cadmium level did not increase significantly from pre-provoked levels which reflects malabsorption of DMSA which makes this post DMSA test invalid as a means of assessing body burden of mercury and lead.

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## Lead

The post-flush level of lead was 17 µg / g Cr. This is a 84x change from the pre-flush level. This is a common increase when DMSA is used. DMSA primarily mobilizes lead from the soft-tissues in the body, where approximately 5% of the total body load of lead is held. While EDTA primarily mobilizes lead from the trabecular bones. The soft-tissue lead is the most likely source for lead-associated health problems such as hypertension and neurologic issues.

The total spill of lead for this DMSA metal mobilization test was 12.1550 µg / sample. This level indicates that they have a moderate level of lead in their soft tissues, which could be a causative factor in their health problems. Post DMSA urine collections containing less than 14 ug of lead would not be considered to have elevated total body lead burden.[24]

It is recommended that the decision to initiate lead chelation include not only a high, or possibly moderate, lead spill but also the presence of lead associated signs and symptoms and other biomarkers of physiologic damage from lead.

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## Mercury

The post-flush mercury level was 5.1 µg / g Cr, a 11.75x change from the pre-flush level. This is a common increase when DMSA is used.

This increase indicates that this was a valid metal mobilization test and therefore would be reflective of the tissue retention of mercury. A total of 0.0290 µg / sample was released indicating a normal background level of mercury. This level of mercury is not considered high enough be a likely contributing factor in their health issues.

It is recommended that the decision to initiate mercury chelation include not only a high, or possibly moderate, mercury spill but also the presence of mercury associated signs and symptoms that coincide with the mercury exposure along with the presence of other biomarkers of physiologic damage from mercury.

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