HAIR TOXIC ELEMENT EXPOSURE PROFILE

DOCTOR'S DATA INC.

LAB#: H000000-0000-0
PATIENT: Sample Patient
SEX: Female
AGE: 4

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

POTENTIALLY TOXIC ELEMENTS

TOXIC ELEMENTS	RESULT µg/g	REFERENCE RANGE
Arsenic	0.017	< 0.20
Lead	1.0	< 4.0
Mercury	0.04	< 2.0
Cadmium	0.13	< 0.50
Chromium	0.51	< 0.80
Beryllium	< 0.01	< 0.050
Cobalt	0.068	< 0.090
Nickel	2.4	< 1.0
Zinc	560	< 270
Copper	69	< 40
Thorium	< 0.001	< 0.010
Thallium	0.001	< 0.020
Barium	3.9	< 4.0
Cesium	0.002	< 0.010
Manganese	0.85	< 1.2
Selenium	0.88	< 2.7
Bismuth	0.14	< 0.50
Vanadium	0.069	< 0.30
Silver	0.89	< 0.90
Antimony	0.031	< 0.17
Palladium	0.011	< 0.010
Aluminum	25	< 22
Platinum	< 0.003	< 0.010
Tungsten	< 0.01	< 0.020
Tin	0.29	< 0.80
Uranium	0.014	< 0.20
Gold	0.12	< 0.40
Tellurium	< 0.05	< 0.050
Germanium	0.041	< 0.085
Titanium	1.6	< 2.0
Gadolinium	0.002	< 0.008

SPECIMEN DATA

Comments:

Date Collected:	10/12/2006	Methodology:	ICP-MS	Sample Type:	Head
Date Received:	10/13/2006	µg/g = ppm		Hair Color:	Brown
Date Completed:	10/14/2006	Sample Size:	0.201 g	Treatment:	
				Shampoo:	Loreal

Metals are listed in descending priority order based upon data from the Agency for Toxic Substances and Disease Registry, which considers not only the relative toxicity per gram metal, but also the frequency for occurrence of exposure.

HAIR ELEMENTS REPORT
INTRODUCTION

Hair is an excretory tissue for potentially toxic elements and essential and nonessential elements. In general, the amount of an element that is irreversibly incorporated into growing hair is proportional to the level of the element in other body tissues. Therefore, the Hair Toxic Element Profile provides an indirect screening test for physiological excess of elements in the body. Clinical research indicates that hair levels of specific elements, particularly potentially toxic elements such as cadmium, mercury, lead and arsenic, are highly correlated with pathological disorders. For such elements, levels in hair may be more indicative of body stores than the levels in blood and urine.

All screening tests have limitations that must be taken into consideration. The correlation between hair element levels and physiological disorders is determined by numerous factors. Individual variability and compensatory mechanisms are major factors that affect the relationship between the distribution of elements in hair and symptoms and pathological conditions. It is also very important to keep in mind that scalp hair is vulnerable to external contamination of elements by exposure to hair treatments and products. Likewise, some hair treatments (e.g. permanent solutions, dyes, and bleach) can strip hair of endogenously acquired elements and result in false low values. Careful consideration of the limitations must be made in the interpretation of results of hair analysis. The data provided should be considered in conjunction with symptomology, occupation, diet analysis and lifestyle, physical examination and the results of other analytical laboratory tests.

Caution: The contents of this report are not intended to be diagnostic and the physician using this information is cautioned against treatment based solely on the results of this screening test.

Cadmium

Hair Cadmium (Cd) levels provide an excellent indication of mild to moderate body burden. Very high exposure and assimilation of Cd destroys the hair follicle. Cd is a toxic heavy metal that has no metabolic function in the body. Moderately high Cd exposure may be associated with hypertension, while very severe Cd toxicity may cause hypotension. Cd adversely affects the kidneys, lungs, testes, arterial walls, and bones and interferes with many enzymatic reactions. Chronic Cd excess can lead to microcytic, hypochromic anemia and proteinuria with excretion of beta-2-microglobin, and functional zinc deficiency. Cd excess is also commonly associated with fatigue, weight loss, osteomalacia, and lumbar pain.

Occupationally, inhalation of Cd is the primary route of exposure. Otherwise the most significant source of exposure is due to contaminated food and water. Cd occurs at relatively high levels in human biosolids that are used as fertilizer.

Cd absorption is reduced by zinc, calcium, and selenium. Oral absorption of Cd is generally higher in females than in males due to differences in iron stores. Cd is found in varying amounts in foods, from .04 µg/g for some fruits to 3-5 µg/g in some oysters and anchovies. Refined carbohydrates have very little zinc in relation to Cd. Cigarette smoking significantly increases Cd intake. Other sources of Cd include drinking water, fungicides, rubber products (tires), welding rods, and silver solders, and interestingly, old metal refrigerator shelves that have been utilized as grills for outdoor cooking. Cadmium toxicity is common among welders and construction workers (cement dust).

If hair zinc is not abnormal, external contamination may have caused the elevated hair Cd level. A confirming test for elevated body burden of Cd is urine analysis following administration of appropriate chelating agents: EDTA, DMPS. Excretion of Cd via the feces is about 90%; therefore, fecal Cd levels are useful as indication of oral Cd intake and an approximation of assimilation. Serum alkaline phosphatase activity is commonly elevated with cadmium toxicity.

Nickel

Hair is a reasonable tissue for monitoring accumulated body stores of Nickel (Ni). However, hair is OFTEN contaminated with Ni from hair treatments, dyes, and hair products.

There is substantial evidence that Ni is an essential element which is required in extremely low amounts. However, excess Ni has been well established to be nephrotoxic, and carcinogenic. Elevated Ni is often found in individuals who work in the electronic and plating, mining, and steel manufacture industries. A cigarette typically contains from 2 to 6 mcg of Ni; Ni is absorbed more efficiently in the lungs (~35%) than in the gastrointestinal tract (~5%). Symptoms of chronic Ni exposure include dermatitis, chronic rhinitis, and hypersensitivity reactions. Ni can hypersensitize the immune system, subsequently causing hyperallergenic responses to many different substances.

Symptoms of Ni toxicity are dermatitis and pulmonary inflammation (following exposure to Ni dust, smoke). Long term or chronic Ni toxicity may lead to liver necrosis and carcinoma.

A confirmatory test for elevated Ni is the measurement of urine Ni before and after administration of complexing agents that mobilize Ni (e.g., DMPS, EDTA).

Zinc

A high level of zinc (Zn) in hair may be indicative of low Zn in cells, and functional Zn deficiency. Zn can be displaced from proteins such as intracellular metallothionein by other metals, particularly cadmium, lead, copper, and mercury (Toxicology of Metals, 1994), resulting in paradoxically elevated hair Zn. Zn may also be high in hair as a result of the use of Zn-containing anti-dandruff shampoo. Rough or dry, flaky skin is a symptom of Zn deficiency, so it is not uncommon for Zn deficient patients to use an anti-dandruff shampoo. A result of high hair Zn warrants further testing to assess Zn status.

Zn is an essential element that is required in many very important biological processes. However, Zn can be toxic if exposure is excessive. Although uncommon, high hair Zn might be indicative of Zn overload which could result from Zn contaminated water (galvanized pipes), welding or gross, chronic over-supplementation (100 mg/day). Other sources of Zn exposure include: manufacture of brass, bronze, white paint, pesticide production, galvanization of steel and iron products, dry cell batteries, and use in rubber, textile, and ceramic industries. Symptoms of Zn excess include: gastrointestinal disorders, decreased heme synthesis (copper deficiency), tachycardia, blurred vision, and hypothermia.

Confirmatory tests for Zn status are whole blood or packed red blood cell elements analysis, and serum ceruloplasmin (low with Zn induced copper deficiency). Urinary Zn will be elevated to some extent post EDTA/DMPS even in patients who do not have Zn overload.

Copper

An elevated level of copper (Cu) in hair may be indicative of excess Cu in the body. However, it is important first to rule out exogenous contamination sources: permanent solutions, dyes, bleaches, swimming pool/hot tub water (very common), and washing hair in acidic water carried through Cu pipes. In the case of contamination from hair treatments, other elements (aluminum, silver, nickel, titanium) may also be elevated.

Copper is used extensively in sanitation and in the production of kitchen utensils, and thermal and electric conductors. Copper solutions are used in industrial processes such as electroplating, printed circuit production, textile production, and as catalysts in chemical processes. Albeit reduced, Cu-sulfate is sometimes used in agriculture (vineyards, orchards). Other sources of Cu exposure include contaminated food or drinking water, and excessive Cu supplementation, particularly in combination with low intake of zinc or molybdenum. Insufficient intake of competitively absorbed elements such as zinc or molybdenum can lead to, or worsen Cu excess. Cu toxicity significantly compromises zinc homeostasis.

Medical conditions that may be associated with excess Cu include: biliary obstruction (reduced ability to excrete Cu), liver disease (hepatitis or cirrhosis), and renal dysfunction. Symptoms associated with excess Cu accumulation are muscle and joint pain, depression, irritability, tremor, hemolytic anemia, learning disabilities, and behavioral disorders.

Confirmatory tests for Cu excess are a comparison of Cu in pre- vs. post-provocation (D-penicillamine, DMPS) urine elements tests and a serum, whole blood or blood cell elements analysis. Fecal Cu levels can be measured as indication of exposure and approximation of assimilation.

Silver

Hair Silver (Ag) levels have been found to reflect environmental exposure to the element. However, hair is commonly contaminated with Ag from hair treatments and swimming pools or hot tubs.

Ag is not an essential element and is of relatively low toxicity. However, some Ag salts are very toxic.

Sources of Ag include seafood, metal and chemical processing industries, photographic processes, jewelry making (especially soldering), effluents from coal fired power plants and colloidal silver products.

The bacteriostatic properties of Ag have been long recognized and Ag has been used extensively for medicinal purposes; particularly in the treatment of burns. There is much controversy over the long term safety of consumption of colloidal silver. Very high intake of colloidal silver has been reported to give rise to tumors in the liver and spleen of laboratory animals (Metals in Clinical and Analytical Chemistry, eds. Seiler, Segel and Segel, 1994). However, these data may not have relevance to the effects of chronic, low level consumption by humans.

Dithiol chelators effectively bind Ag and DMPS increased survival in rats that received injections of silver nitrate. However, there are currently no labs that can accurately measure Ag in urine due to technical difficulties.

Palladium

The relationship between the levels of Palladium (Pd) in hair and exposure to the metal has yet to be determined. Pd compounds are rarely encountered by most people. Palladium compounds should be regarded as toxic and carcinogenic. There have been numerous reports of allergic contact dermatitis to Pd. The main contact sources are jewelry and dental materials (gold alloys).

The characteristics of Pd (ductile, malleable, resistant to corrosion, easily fused and welded) make it an acceptable material for jewelry making and dentistry. Palladium is used in the field of communications in facing electrical contacts in automatic switch gear. The nonmagnetic springs in clocks and watches as well as special coatings for mirrors are also made of Pd. The chemicals industry uses Pd as a catalyst. Palladium is often found associated with platinum in Australia, Brazil, Russia, Ethiopia, and North and South America, as well as with nickel and copper deposits in Canada and South Africa.

Palladium was formerly used as a treatment for tuberculosis (0.065 g per day). DMPS, like other chelating agents studied, demonstrate no effects on mortality of mice with acute Pd poisoning.

Aluminum

The Aluminum (Al) level in hair is a reliable indicator of assimilation of this element, provided that hair preparations have not added exogenous Al. Al is a nonessential element that can be toxic if excessively assimilated into cells.

Excess Al can inhibit the formation of alpha-keto glutarate and result in toxic levels of ammonia in tissues. Al can bind to phosphorylated bases on DNA and disrupt protein synthesis and catabolism. Al excess should be considered when symptoms of presenile dementia or Alzheimer’s disease are observed. Hair Al is often elevated in children and adults with behavioral/learning disorders such as ADD, ADHD, and autism. Individuals with renal problems or on renal dialysis may have elevated Al.

Al is one of the most abundant metallic elements and due to its light weight, tensile strength and corrosion-resistant oxide coat, it is utilized in a wide variety of industrial and household applications (packing materials, containers, kitchen utensils, automobile and airplane components, and building materials). Commercial Al alloys commonly include copper, manganese, zinc, silicon, and magnesium. Inorganic aluminum compounds are found in drinking water, skin tanning solutions, cosmetics, mordants and coagulating agents. Al is used as a catalyst in the production of marble cement, concrete, and in the paper and enamel industries. Organoaluminum compounds are utilized to adjust the viscosity of varnishes, to impregnate textiles, and for antitransparents is cosmetics. Other sources of Al include antacids, baking powder, process cheese and other foods, and some vaccines. Analyses performed at DDI indicate extremely high levels of Al in the majority of ”colloidal mineral” products.

Al has neurotoxic effects at high levels, but low levels of accumulation may not elicit immediate symptoms. Early symptoms of Al burden may include: fatigue, headache, and symptoms of phosphate depletion.

A post-Desferrioxamine or EDTA urine elements test can be used to corroborate Al exposure. Al can be effectively complexed and excreted with silicon (J. Environ. Pathol. Toxicol. Oncol., 13(3):205-7, 1994). A complex of malic acid and Mg has been reported to be quite effective in lowering Al levels (DDI clients), and appears to be very effective in the treatment of fibromyalgia.