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HEAVY METALS AFFECTING CANINE HEALTH

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A World Health Organization (2015) report estimated that 85% of all human disease is associated with environmental pollution. HTMA testing reveals that the same heavy metals that make us sick also are killing our canines. Toxins are known to be an underlying and aggressive cause of the alarming increase of cancer in animals besides other diseases. Toxic metals are abundant in the environment. Canine toxicity is the result of exposure to a huge number of industrial and common household toxins, such as coal smoke, metal smelting, mining, exhaust fumes, landfills, chemicals, chemical fertilizers, pharmaceutical drugs, immunizations, pesticides, herbicides, fungicides, house dust and drinking water.

The excessive use of heavy metals for human comfort is exposing our dogs to heavy metal poisoning. All are directly toxic to cells, so their presence in the body is always harmful. They also compete with the nutritional minerals in the body. Eventually, if the levels of toxic metals are too high in the body's soft tissues, they will displace vital nutrient minerals, leading to cellular dysfunction, disease that may terminate in death.

Heavy metals can come in the body through inhalation, intestinal absorption and even be absorbed through skin, depending upon their chemical form. Elemental forms of heavy metals are not well absorbed, but organo-metallic forms are lipophilic, and can readily pass through membranes and even cross the blood-brain barrier. Once they absorbed into the body they circulate in various organs, glands and the central nervous system. Some metals are bone seekers and ultimately reconcile into the teeth and skeletal system. Heavy metals then can

effectively influence enzyme systems, augment free radical production and displace or compete with essential elements that make up metallo-enzyme complexes and compete with the absorption of nutritional minerals.

In a study by Purdue University, Department of Veterinary Pathobiology (2000), it was observed that blood and urine samples of dogs of the mining area were contaminated with 35 chemicals altogether, including 11 carcinogens, 31 toxic to the reproductive system, and 24 neurotoxins. The carcinogens are of particular concern as dogs have much higher rates of a variety of cancers than do humans because they are 35 times more susceptible to skin cancer, 4 times more to breast tumors, 8 times more to bone cancer, and twice to leukemia, according to the Texas A&M Veterinary Medical Center (2008). Between 20 and 25 percent of dogs die of cancer, making it the second leading cause of death in dogs.

Interestingly, toxic levels of metals in body tissues increase with every generation, even when exposure levels remain the same. This is because the growing fetus is far more susceptible than the adult and most toxins pass through the placenta in-utero. Since dogs have a little lifespan than humans, this increased concentration over generations happens much more quickly than we see in people. They also live close to the ground, rolling around, licking and eating these toxins and heavy metals that have settled onto our lawns, streets, parks and floors.

Common toxic metals

1. **Aluminum** (Al 13)
2. **Lead** (Pb 82)
3. **Mercury** (Hg 80)
4. **Arsenic** (As 33)
5. **Cadmium** (Cd 48)

These metals contribute to everything from teeth problems and bad breath, to worsening allergies and skin diseases, to serious life threatening illnesses such as cancer, arthritis, kidney failure, congestive heart disease, liver diseases and diabetes. They damage the immune system, reducing defenses against infections as well as bacterial, viral and fungal diseases.

Arsenic

Arsenic is public enemy number one on 'Agency for Toxic Substances and Disease Registry' Priority List of Hazardous Substances list. (Lead is number 2 and mercury is number 3.) Arsenic is a known carcinogen and affects the skin, digestive system, liver, nervous system

and respiratory system. Arsenic compounds can create reactions in the body that disrupt enzymes that are involved in respiration of cells, fat and carbohydrate breakdown and their metabolism. The accumulation of toxic levels of arsenic can result in paralysis, coma, cardiovascular collapse and death. The major sources of arsenic release to the environment are;

1. Coal fired power plants.
2. Arsenic-treated lumber.

Arsenic can be found in many commonly used products including fungicides, pesticides, herbicides, laundry products, cigarette smoke, paints, and wood preservatives. Global industries such as mining and smelting, chemical and glass manufacturing produce arsenic as a by-product. This in turn finds its way into our water supplies and food sources. In addition, water and soil concentrations are far higher in areas where arsenic mineral deposits have been mined. Soil with high levels of arsenic is also an exposure risk for dogs due to mouthing and play activities.

For years the most common cause of arsenic poisoning in dogs was the consumption of rodent trap bait and pesticides such as ant bait which contained arsenic. This type of poisoning is less common since the government started regulating these products. Arsenic does not breakdown and will build up in body tissues over time. Since the lethal dose only is 1 to 12 mg of arsenic per pound of body weight, this buildup of arsenic can cause serious health problems. Therefore it is important to know the symptoms of arsenic poisoning, whether the result of an accidental consumption of a household product or the slow accumulation over time. Symptoms include drooling, vomiting, bloody diarrhea containing mucus, bloody urine, muscle cramps, weakness, hair loss, skin rashes, gastrointestinal pain, convulsions, trembling and staggering.

Aluminum

Aluminum is the most common toxic element found at high levels in their food. Other sources include vaccinations, medications, and in-utero transfer. Aluminum has been described as a protoplasmic poison and a pernicious and persistent neurotoxin. While the body is able to excrete aluminum in its natural form, the element, like mercury, is toxic to all life forms when concentrated in their tissues. It has a tendency to accumulate in the brain and nerve tissues and in the bones and teeth. Aluminum interferes with the absorption of a number of essential elements including, iron, fluoride, phosphorus and calcium. It inhibits gastric muscle contraction and can cause constipation. This disrupting effect on the essential minerals leads to endocrine gland dysfunctions as these glands all depend on balanced mineral ratios. These dysfunctions include hypo- or hyperthyroidism, hypo- or hyper-adrenal, hypoglycemia, diabetes, dry dull coats, dry or

flaky skin, and digestive disorders due to lack of pancreatic digestive enzymes and lowered stomach hydrochloric acid.

Aluminum is a neurotoxin. Central nervous system symptoms found in dogs with aluminum toxicity include chewing wallboards and door knobs and trying to catch imaginary objects in the air, and aggressive, violent behavior. Aluminum's toxic effects on the skeletal system were first recognized in the late 1970s. In animal studies it has been found to induce anemia. Any impairment of kidney function will increase aluminum toxicity as the kidneys are the main route of excretion.

Aluminum can impair cellular energy transfer processes by interfering with phosphate and ATP metabolism. Since aluminum has an affinity for brain and nerve tissue, it can affect any organ in the body via the central nervous system. This can lead to a multitude of health problems and a weakening of the immune response. Aluminum toxic dogs are more susceptible to bacterial, fungal and viral diseases, chronic dermatitis, nasal discharges and loss of black pigment on the nose pad. Other symptoms of aluminum toxicity in dogs include extreme nervousness, weak muscles, seizures, loss of balance, and loss of energy.

Cadmium

Cadmium is a known carcinogen and affects the cardiovascular, reproductive, respiratory and gastrointestinal systems, and has many detrimental effects on development. Cadmium damages the kidneys, lungs, and bones. Long-term exposure to lower levels of cadmium in air, food, or water leads to a buildup of cadmium in the kidneys and possible kidney disease. Other long-term effects are lung damage and fragile bones. Cadmium and cadmium compounds are known carcinogens. It causes a reduction in the production of the critical white blood cells (T-Lymphocytes) which defend the body by destroying harmful free radicals and cancer cells.

A few studies in animals indicate that younger animals absorb more cadmium than adults. Animal studies also indicate that the young are more susceptible than adults to a loss of bone and decreased bone strength from exposure to cadmium. In laboratory animals, cadmium causes decreases in fetal or pup body weight, skeletal malformations, and behavioral alterations. The list of dog diseases that cadmium can promote is extensive, including cancer, diabetes, arthritis, cardiovascular disease, kidney disease, bone disorders, and digestive problems. Cadmium toxicity can even contribute to the loss of the dog's natural and critical sense of smell.

Dogs are exposed by breathing secondhand smoke or living with a smoker. Cadmium aerosols with small particle sizes, such as found in cigarette smoke, is more absorbed than larger

particle sizes. Cadmium contaminated foods are another source, low levels are found in all foods, highest levels are found in shellfish, liver and kidney meats. Cadmium antagonizes and prevents the absorption of important nutrient minerals such as zinc and sulfur. Cadmium displaces zinc, which leads to zinc deficiency, resulting in slow wound healing, premature aging and reproductive problems. Since most commercial dog foods are low in zinc, this is a big concern. Zinc is a component of many vital enzymes promoting a healthy immune system, liver, and bones. Adequate zinc levels will inhibit absorption and retention of cadmium.

Symptoms of high tissue cadmium levels include fatigue, hair loss, increased susceptibility to infection, slow healing of wounds, skin lesions, loss of smell, yellow coloration of teeth, inflammation of mucous membrane of the nose, and loss of appetite.

Lead

Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing. The concentration of lead in polluted air varies inversely with altitude. Because lead is a heavy element, it settles out of the air onto the ground. Consequently, lead poisoning occurs frequently in dogs who spend their lives close to the ground. We are exposed to lead from aviation fuel, paint on older buildings, lead pipes, many industrial uses, coal burning, and pesticides which can contain high amounts of lead. Lead is present in things that dogs might pick up and chew on such as remote controls, cell phones, batteries, golf balls, ammunition fishing lures and sinkers. Lead can come from both the ceramic bowl your dog drinks from and from the water itself. Lead is used in the seams of canned food cans where it leaches into the food.

Calcium inhibits lead absorption and protects against lead accumulation in bones and teeth. Both young children and dogs are naturally fast metabolizers with lower levels of tissue calcium and magnesium. This low calcium to lead ratio leads to higher lead absorption into the tissues. Common storage sites for lead are bones and teeth, where it displaces calcium. During times of stress, when the body would normally release more calming calcium, it will release this stored lead into the bloodstream. This can bring lead into any of the body's organs, leading to cancer and organ failure. Besides calcium, lead also antagonizes and prevents the absorption of other important nutrient minerals such as iron and zinc. Lead interferes with iron metabolism and contributes to anemia. Other nutrients such as magnesium, copper, chromium, vitamin C and the B vitamins have been shown to protect against the effects of lead as well, either by decreasing its

absorption and tissue deposition, or by reducing or blocking the effects of lead upon enzyme systems.

Epilepsy can result from lead toxicity in dogs. In young children, hyperactivity may be the first presenting symptom, so if you have a hyperactive dog you can suspect high tissue lead levels. Other emotional symptoms of a lead body burden include aggression, violent behavior, antisocial behavior, poor concentration or learning capacity. It can take years before lead exposure reaches dangerous levels, so you might not recognize symptoms until your dog is older. Since lead can block and prevent many enzyme functions, lead toxicity can lead to damage to the heart, kidneys, liver, gastrointestinal tract, and central nervous system. Symptoms of lead toxicity in dogs include lack of appetite, vomiting, abdominal pain, constipation followed by diarrhea, crunching of jaws, blindness, seizures or muscle spasms, behavior changes, circling, and loss of balance and agility.

Mercury

Mercury is one of the most studied toxic heavy metals and the lethal effects of both acute toxic exposure and chronic low-level exposures are well documented. Exposure to mercury occurs from breathing contaminated air, ingesting contaminated water and food, and having dental and medical treatments. Mercury, at high levels, may damage the brain, kidneys, and developing fetus.

Methylmercury is the preservative used in most vaccines, mercury can be found in prescription medications, it is present in many commercial dog foods. It is often used in household products that dogs are exposed to such as batteries, light bulbs, fabric softeners, latex gloves, paint, plastics, ink, and solvents. Mercury vapors are released from such things as home renovations involving old paint, broken thermometers and thermostats. It will concentrate at floor level where dogs are lying or walking. Even some cosmetics contain it …consider this when your dog licks your face. Mercury salts are sometimes used in skin lightening creams and in antiseptic creams and ointments. Like other heavy metals, it is in our air, water and ground where our dogs are continually exposed.

Mercury prevents glucose transport, thus reducing cellular energy availability. Mercury antagonizes and prevents the absorption of important nutrient minerals such as zinc, iron, selenium and sulfur. Mercury accumulates in the brain and central nervous system. Mercury also adversely affects your dog's overall immune system by attaching to the immune cell structure

and altering their ability to function normally. Mercury can cause kidney and cardiac diseases, respiratory problems, arthritis, and gum disease in your dog.

Symptoms of high mercury tissue levels include loss of balance, fatigue, vomiting, hair loss, diarrhea, weakness, and excessive salivation. High levels can also interfere with enzyme activity, resulting in blindness and paralysis. It also causes convulsions, anorexia, tremors, swollen gums and behavior problems in animals.

Symptoms: Indicators of toxicity

To understand what's going on inside your canine, pay close attention to their anatomy and physiology. Behavior and symptomatic responses are the best clues to uncovering health mysteries. Here are some symptoms and signs to be observed in suspected dog :

Coat and skin

- bite marks
- color change
- dander
- discharge
- dry or flaky skin
- dull dry coat
- evidence of parasites
- excessive biting
- excessive licking
- excessive scratching
- hair loss
- lumps or bumps
- rashes
- slow wound healing
- tumor(s)

Signs of pain

- crying or whimpering
- excessive drooling
- excessive panting
- food falling out of mouth
- hiding in unusual areas

- lameness in limbs
- listlessness
- sensitivity when chewing
- stiffness when getting up
- uncontrollable shaking

Brain

- aggression
- anxiety
- circling
- depression
- falling
- fatigue
- lethargy
- sleepiness
- stumbling
- trembling
- tremors, seizures
- weakness

Eyes

- discharge
- redness
- swelling

Nose

- crusting
- decreased sense of smell
- discharge
- loss of black color on nose pad
- running

Ears

- debris
- difficulty hearing
- discharge

- odor
- scratching
- shaking
- twitching

Mouth

- excessive tartar
- foul odors
- gum disease
- salivation (drooling)
- yellowing of teeth

Throat

- coughing
- gagging
- retching or vomiting
- sneezing

Chest

- irregular breathing
- prolonged or heavy panting
- shortness of breath

Stomach

- digestive disorders
- lack of appetite
- obesity
- offensive gas
- vomiting

Buttocks

- blood in stools
- blood in urine
- constipation
- diarrhea
- dribbling
- frequent urination

- scooting (scrubbing the floor)
- straining
- worms

Diagnosis

Clinical determination of metal toxicity is based on this tissue level elevation, combined with accompanying signs and symptoms related to the specific metal in question. In contrast, a toxic burden actually falls below a defined limit and exists without accompanying signs and symptoms commonly associated with that specific metal. Under these circumstances, it should be termed a burden or increased burden and should not be referred to as toxicity. This is not to say that the particular metal is not having a metabolic impact or that it should not be addressed. A dog can have a heavy metal burden, while not quite toxicity, but still manifest many signs and symptoms due to an adverse or allergic reaction to that metal.

Most veterinarian offices are not equipped to perform these tests and samples must be sent to appropriate laboratories that perform such testing. For measuring effects due to acute exposures within days or up to several months, blood, urine, and fecal analysis are the most accurate. For long term and cumulative body burden effects, hair and fingernail tests are most accurate.

Blood serum testing

Blood analysis for minerals is a good indicator of the transport of minerals to and from the storage areas of the body. In many cases, the serum level of minerals is maintained at the expense of tissue concentration (homeostatic mechanisms). Serum concentrations may fluctuate with emotional changes, the time of day the blood is drawn, or foods eaten prior to taking a sample. For example, serum magnesium can fluctuate depending upon the blood drawing technique. The longer the tourniquet is applied, the higher the magnesium rises as a result of tissue hypoxia. Minerals may fluctuate between the serum and tissues in acute or chronic conditions. This is seen with copper and iron during infections, inflammatory disorders, and certain malignancies. Also, calcium loss from the body can become so advanced that severe osteoporosis develops without any appreciable changes noted in the blood levels of calcium.

Hair tissue mineral analysis

Hair has been used as one of the tissues of choice by the Environmental Protection Agency in determining toxic metal exposure. Investigators in Japan, Sweden, Canada, and the

United States have shown that the concentrations of elements in the hair provide an accurate and permanent record of exposure. Heavy metals will often be elevated when there has been a chronic exposure. However, the HTMA can indicate the "tip of the iceberg" so to speak, in that heavy metals can be stored or sequestered in organs and tissues throughout the body. Lead and cadmium for instance are bone seekers. Eventually they will be sequestered into the bone. As bone turnover occurs, lead and cadmium will constantly be released back into circulation and continually be incorporated into the hair shaft, therefore, HTMA will reveal the chronic nature of exposure. However, with therapy aimed at rebalancing the mineral pattern, removal of lead and cadmium will be hastened. This will result in even higher levels on follow-up HTMA tests as greater amounts are being released from storage areas.

Advantages of HTMA

1. Concentrations of most elements in the hair are significantly higher than found in the blood and other tissues.
2. Hair analysis is more cost-effective than mineral testing through other means.
3. Hair is invaluable in the assessment of toxic metal levels.
4. Hair provides a record of past as well as present trace element levels, i.e. biological activity.
5. Hair provides information of substances entering the hair from the blood serum as well as from external sources.
6. Hair specimen can be collected more quickly and easily than blood, urine, or any other tissue, using a non-invasive method.
7. Long-term deviations of mineral retention or losses are more easily detected in hair than blood.
8. Unlike blood, hair is less susceptible to the homeostatic mechanisms that quickly affect trace element levels.

Treatment

Nutrients that are known to protect against heavy metal accumulation are calcium, magnesium, iron, copper, zinc, selenium, vitamins A, C, E, B-6, B-12, pectin, lecithin,

glutathione and other antioxidants. Many of the essential amino acids found in whole, unprocessed foods help also. Specialty foods like kelp, garlic, and brewer's yeast can add detoxification benefits. Providing protective nutrients in the optimal amounts and ratios will prevent your canine from becoming undernourished and thus susceptible to the accumulation of toxic metals in their body tissues.

Chelation therapy is a common prescription for detoxification from heavy metal poisoning. Chelation therapy is the introduction of compounds into the body to remove heavy metals by binding to the metal ions and holding them in suspension until they are excreted.

Examples:

1. Ethylenediaminetetraacetic acid (EDTA) is frequently used for severe cases of lead poisoning.
2. Dimercaprol binds to both arsenic and mercury.
3. Dimercaptosuccinic acid, or DMSA, binds to lead, mercury, and arsenic.

The removal of toxic heavy metals through chelation therapy can be extremely difficult for a dog's body and must be administered under the care of a qualified physician familiar with the process of toxin removal. Tests and therapy can be expensive and risky. Chelation therapy can be an effective, and often necessary, treatment for acute poisoning. HTMA nutritional therapy also keeps the body's immune system functioning properly. Low mercury levels can affect fetal development. All of these toxic metals have adverse effects at low levels. HTMA is an effective screening tool for analyzing the body burden of these incessant exposures.

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