EDITORIAL

The Great Masquerader: Mycotoxins

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Mycotoxins can cause many diseases, and this is why the World Health Organization named it "The Great Masquerader" of the 21st century. Patients affected by mycotoxins present to their healthcare providers with a number of nonspecific clinical signs and symptoms, and mycotoxins are not routinely suspected. Many patients may be misdiagnosed with having chronic Lyme disease, Chronic Fatigue Syndrome, Fibromyalgia, autoimmune disorders, and others with psychiatric disorders such as adjustment disorder and depression.

Mold spores can be found in many indoor spaces; however, they are dormant until they come into contact with moisture or water and start producing spores and releasing them into the ambient air. Mold spores are like a packet of seeds: put them in a container with soil, water them, and you get results. The Environmental Protection Agency, the Centers for Disease Control and Prevention, and the National Institutes of Health all agree that molds start to grow and sporulate when they have been wet for 24 to 48 hours.

It has been well documented in the medical literature that water intrusion from leaky roofs, pipes, windows, poorly maintained flashings, and flooding from leaking washers, dishwashers, ice makers, etc., in the home as well as in the workplace cause mold growth with the subsequent exposure to mycotoxins. Reports of such exposures include homes, office buildings, courthouses, hospitals, hotels, schools, and university dormitories.

Mold spores carry with them mycotoxins. Mycotoxins have potent toxic effects on humans. To use an analogy, molds are the gun, and mycotoxins are the bullet. It is common that one mold produces a number of mycotoxins, and different molds make one mycotoxin.

Mycotoxins are what mold spores produce to weaken and destroy health. Mycotoxins are very strong and powerful and destructive to organs and systems. The alteration of immune responses due to mycotoxin exposure may also adversely affect the ability of the immune system to respond to other environmental challenges. This may explain why patients complain of increased sensitivity to chemical irritants. These patients may report more sensitivities to a number of foods, chemicals, odors, etc.

The adverse health effects of mycotoxins range from acute toxicity to long-term effects such as:

- Autism
- Multiple sclerosis
- Alzheimer's disease
- Parkinson's, amyotrophic lateral sclerosis
- Postural Tachycardia Syndrome
- Chronic Fatigue Syndrome
- Fibromyalgia
- Small Intestinal Bacterial Overgrowth,
- Irritable Bowel Syndrome
- Inflammatory Bowel Diseases
- Mast Cell Activation Syndrome
- Autoimmune disorders
- Immune dysregulation
- Cancers

The effects of filamentous molds and mycotoxins on human health have been written about for centuries. An excellent protocol on what to do with a dwelling affected by mold can be found in chapter 14 of Leviticus in the Bible. An Assyrian table discusses a "noxious pustule in the ear of grain," referring to ergot. Consuming bread made from flour contaminated with ergot from the fungus Claviceps purpurea that infects rye and other cereals causes ergotism and its earliest reference is the Annales Xantenses for the year 857. In the Middle Ages, it became known as St. Anthony's Fire, and its symptoms include seizures, diarrhea, psychosis, headaches, dry gangrene of fingers and toes, nausea, and vomiting.

Molds produce toxins known as mycotoxins. Molds are always present in homes or workplaces that are water damaged and they are always producing mycotoxins.

It is well established in medicine and science that exposure to molds and mycotoxins indoors is hazardous, and more so in children and the elderly. How a person reacts to molds and mycotoxins depends on that person's health and

nutritional status, if they have other medical conditions, how long is or was the exposure, the person's genetic makeup, and the nutritional status of the patient. There is no published scientific or medical evidence that genetics play a role.

Many people cannot see any indoor mold growth: the E.P.A. cautions that approximately 50% of the fungal growth can be hidden, i.e. hidden from view. When people smell something "musty", they are actually smelling VOC's (volatile organic compounds) produced by molds. Chronic exposure to even low levels of molds, mycotoxins, and VOC's, can cause serious health problems. Even small amounts of mold growth in the air conditioning or ducts will result in the occupants being chronically exposed, constantly breathing mold spores and their mycotoxins, causing illnesses.

Blood serum testing for mycotoxin antibodies have been used for the last 20 years and are currently the most accurate test available for mycotoxins. The specificity and sensitivity of blood serum testing for the presence of IgG and IgE antibodies to mycotoxins in the blood are of the highest degree. The other available testing is urine, which tests for mycotoxin metabolites and not mycotoxins themselves. A recent study by Garg stated that: "The variability of mycotoxin concentration in urine and its volume is based on daily intake and demands urine sampling at different time points during the day." Moreover: "The ELISA method to detect mycotoxins in human serum comes with significant accuracy, precision, and specificity." The laboratory that does this testing in the United States and internationally is Mymycolab.

According to the National Institute for Occupational Safety and Health (NIOSH), a part of the Centers for Disease Control and Prevention (CDC), low levels of mycotoxins are found in many foods. For that reason, they are routinely present in the urine of healthy people. Therefore, it does not mean the person suffers from any disease or disorder related to molds or mycotoxins. Please see:

"Use of Unvalidated Urine Mycotoxin Tests for the Clinical Diagnosis of Illness—United States, 2014." Centers for Disease Control and Prevention, Morbidity and Mortality Weekly Report, http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6406a7. htm

The most important point is that if you have mycotoxins in urine, it is a good thing: the body is doing its job of getting rid of mycotoxins from foods and beverages.

Urine levels of mycotoxins mean excretion; it does not mean pathology. Laboratories offering urine mycotoxin testing are measuring this minute quantity of metabolites of mycotoxins, not the mycotoxins. Furthermore, some mycotoxins, such as ochratoxin, cannot be measured in urine. Almost all, 99.8% of the body's ochratoxin is tightly bound to the body's main protein, albumin, so it cannot be excreted through the kidneys. It is reabsorbed from all parts of the nephron by active and passive transport and passive diffusion. Yet it is the most commonly found mycotoxin in urine, which raises a lot of questions on the accuracy of the testing.

HORMONES AND MYCOTOXINS

Mycotoxin toxicity can affect hormones in men and women. The enzyme aromatase is upregulated, which is responsible for the last steps of estrogen biosynthesis from androgens (i.e., testosterone), resulting in the increased conversion of testosterone to estrogen.

All estrogens need the appropriate function of the liver and of cytochrome P450 enzymes to enable them to be metabolized. Cytochrome P450 enzymes are essential for the body to detoxify.

T-2 mycotoxin, part of the trichothecene family, has been shown in studies to decrease testosterone biosynthesis and secretion. Alternariol mycotoxin is antiandrogenic, meaning it reduces the effects of testosterone, as does Ochratoxin A and deoxynivalenol (DON), aka vomitoxin.

All estrogens need the appropriate function of the liver and of cytochrome P450 enzymes to enable them to be metabolized. Cytochrome P450 enzymes are essential to the body to detoxify. Mycotoxins block P450 enzymes, making it much more difficult for the body to get rid of toxins and also affecting estrogen. This results in abnormal levels of estrogen and progesterone, leading to abnormalities in menstruation, abnormal uterine bleeding, and to infertility.

Treatment Guidelines:

It is very important to control and minimize environmental exposure to many toxicants:

- Pesticide exposure.
- Heavy metals.
- Living near golf courses, factories, agriculture areas where pesticides are regularly used.
- Processed foods.
- Artificial sweeteners.
- Artificial food flavorings, colorings, and preservatives.
- EMF exposures.

First and foremost: apply the first rule of toxicology: get the patient away from the toxin or the toxin away from the patient.

Second: simultaneously build up the immune system while killing the fungi.

Probiotics: use spore forming bacilli.

Boosting the immune system: immunotherapy with nutrients, vitamin D3 and B complex, omega 3's, CoQ10, zinc, melatonin, and others.

Anti-fungal treatment: itraconazole.

For cognitive issues: phosphatidyl serine and slow-release magnesium.

Infrared sauna: start low and go slow.

If a brain SPECT scan shows decreased perfusion, I recommend nitric oxide, specifically N_1O_1, for its documented effects.

Eighty percent of the immune system is in the gut, so this is a primary place to begin. The main components are

diet, supplements, and probiotics.

Diet: Try gluten free for 90 days. Avoid dairy, soy, and sugar.

Use: Broccoli, resveratrol, tomatoes for lycopene.

A publication from Reading University with the Food Safety Authority of the United Kingdom, in essence the FDA in England, showed that less than 10% of the usual commercial strains of Lactobacilli and Bifidobacterium in probiotics are able to get to the colon.

Studies in humans show the following benefits from Bacillus spores:

- Effective treatment for small intestinal bacterial overgrowth (SIBO).
- Reduced incidence of irritable bowel syndrome diarrhea.
- Improvement in pain scale in Rheumatoid arthritis patients.
- Immune modulation for childhood allergies.
- Immune stimulation of peripheral T-lymphocytes and B-lymphocytes.

NUTRITION

An important component of treatment is not to add more substances that cause the immune system to react, especially chemicals or foreign substances in foods and beverages. Artificial coloring, artificial flavoring, artificial sweeteners, chemical preservatives, should be eliminated from the diet. Organic foods are preferred. Healthiest cooking methods are boiling, oven cooked meals, and broiling. Coated pans and cooking utensils should not be used. Plastic bottles and canned foods may contain bisphenols which are endocrine disruptors, and should be avoided. Liquids should be limited to water from glass bottles or containers.

BOOSTING THE IMMUNE SYSTEM

This is best done with supplements and depends on each patient's immune status. Choosing a supplement from a reputable supplier is paramount: over-the-counter supplements are discouraged, as their origin is unknown. Melatonin, vitamin D3, vitamin C, and B complex vitamins are all very helpful. Zinc is an essential nutrient of the immune system.

ANTI-FUNGAL MEDICATION

A broad-spectrum anti-fungal medication such as itraconazole is part of the treatment. It may be necessary to use such an anti-fungal for longer periods of time, depending on each patient's response. The most effective antifungal is itraconazole, and it is well tolerated. Fluconazole does not work against multicellular fungi such as Aspergillus, Penicillium, Stachybotrys, etc.; it only works against single-cell fungi, which are yeasts, such as Candida.

Binders are not recommended for the following reasons: a study by Rogawska and colleagues showed that binders rely on the absorption of mycotoxins from the gut, preventing them from getting into the bloodstream. These binders include kaolinite, clays, activated charcoal, zeolite, bentonite, and aluminosilicates. They are effective in neutralizing aflatoxin, which is rarely found in indoor environments. They are ineffective in all other mycotoxins. In addition, this study showed how they bind vital vitamins and macro- and micro-elements.

1. Cholestyramine cannot be taken by patients with the following conditions:

- Patients with hypothyroidism
- Diabetes
- Nephrotic syndrome
- Liver disease
- Kidney disease
- Alcoholism
- Dysproteinemia

2. Binders interfere with the absorption of the following medications:

- Estrogens and progestins
- Thyroid medication
- Oral diabetes drugs
- Penicillin G
- Phenobarbital
- Spironolactone
- Tetracycline
- Thiazide-type diuretic pills
- Warfarin
- Leflunomide
- Digitalis

Satratoxin is a trichothecene mycotoxin mainly produced by Stachybotrys, also known as "black mold". It causes fatigue, headaches, nosebleeds, pulmonary hemorrhage, chest pain, moist dermatitis, and fever. It is neurotoxic and causes neurocognitive symptoms.

Verrucarin and Verrucarol are trichothecene mycotoxins mainly produced by Fusarium and Aspergillus species and are known to cause tremors, immune toxicity, and inflammation, they are cytotoxic and are potent protein synthesis inhibitors.

Ochratoxin: causes immune suppression, lung disease, and urinary tract tumors, and is nephrotoxic (kidneys), hepatotoxic (liver), genotoxic (genes), and carcinogenic (causes cancer). This is due to its ability to form DNA adducts and inhibit protein synthesis. Ochratoxin can potentiate the effects of IL-1β on IL-8 secretion with a range of 35% to 138% increase and augments the transepithelial passage of commensal bacteria with a 12- to 1522-fold increase. Ochratoxin's major targets are:

1. Liver
2. Kidney
3. Brain

4. Skeletal muscle
5. Fat tissue
6. Ochratoxin crosses the placenta.

The highest Ochratoxin levels is found in breast milk.

Studies have shown it causes leaky gut syndrome and changes the nutrients that are absorbed from foods.

T2 Toxin: are trichothecene mycotoxins and are the only mycotoxins that have been used in biological warfare. They can cause diarrhea, vomiting, and intestinal hemorrhage, as well as changes in reproductive cycles and infertility. This mycotoxin is known to decrease testosterone.

Vomitoxin aka Deoxynivalenol: are trichothecene mycotoxins that destroys intestinal barrier function, resulting in anorexia, inflammatory bowel disease and celiac disease. They are able to increase IL-8 secretion with a 10- to 15-fold increase. This mycotoxin adversely affects both estrogen and testosterone.

Cladosporium Toxin: The airborne spores of Cladosporium species are significant allergens, and they can severely affect asthmatics and people with respiratory diseases. Cladosporium also produce volatile organic compounds (VOCs), which are neurotoxic.

Alternaria Toxin: Alternariol is cytotoxic (toxic to cells), mutagenic (causes mutations), genotoxic (genes), and causes immune suppression. This mycotoxin is also known to form reactive oxygen species (ROS) and to lower testosterone.

Aspergillus Toxin: Aspergillus Hemolysin: causes immune dysregulation and is carcinogenic.

Aspergillus Auto-Toxin: Sterigmatocystin: carcinogenic (causes cancer), mutagenic (causes mutations), and teratogenic (causes malformations of the fetus), hepatotoxic (liver); can cause autoimmune diseases.

Penicillium Toxin (mycophynolic acid): causes immune suppression.

Aspergillus/Penicillium Neuro Auto-Toxin (Gliotoxin): causes immune suppression, neurotoxicity, has been linked to multiple sclerosis, immune toxicity.

Stachybotrys Toxin (Trichothecene): is a trichothecene mycotoxin that can cause the following:

- Vascular system: increased vascular fragility (blood vessels), pulmonary hemorrhage or hemorrhage into body tissues.
- Nervous system: tremors, headaches, seizures, sleep disturbance, incoordination, and depression. It can also cause demyelination of nerves leading to Chronic Inflammatory Demyelinating Polyneuropathy (CIDP).
- Digestive system: vomiting, diarrhea, liver toxicity, intestinal hemorrhage, and anorexia. It is a cause of intestinal permeability
- Cutaneous (skin) system: rash, photosensitization, sloughing of skin, burning sensation.
- Endocrine system: decrease in testosterone in men and women; increase in estrogens in men and women.

In conclusion, the World Health Organization has given mycotoxins a well deserved name: The Great Masquerader of the 21st Century.

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