Lyme, Mold and Mycotoxins: When and Why You Should Be Concerned

National Autism Association Conference
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Lindsey E. Wells, ND
www.lindseywellsND.com

OUTLINE

• Mold and Mycotoxins
• Lyme Disease
• Evaluation and Testing
• Treatment
MOLD

SOURCEs OF MOLD

- Bathrooms, Laundry rooms, Basements
- Leaking pipes, poorly fitting drains, roof leaks
- Walls
- Air conditioning systems
- Underneath sinks
- Closets
- Window Sills
- Refrigerator
- Mold can be present in areas of home with condensation, poor ventilation, window/air drafts, roofing issues, plumbing leaks, etc.
- Lower risk for mold if humidity < 60% in summer and 45% in winter
SOURCES OF MOLD

- Mattress
- Pillows
- Cups
- Bath toys
- Teething toys
- Rotten foods

MOLD TOXICITY

- This is not a new concept although limited research
- Described in the Old Testament (Leviticus 14)
  - Warns that if a man’s house is contaminated with plagues, mold, and leprosy that “he shall have the inside of the house scraped all around and the plaster that they scrape off they shall pour out in an unclean place outside the city”
- During 1970-1980s US Defense Department had concerns regarding the use of mycotoxins for biological warfare
- Mayo Clinic in 1990 made statement that chronic sinus infections may be due to fungal infection instead of bacteria
**MOLD TOXICITY**

- In 1997, Dr. Ritchie Shoemaker in Maryland observed unusual symptoms in his patients in at the same time there was death of thousands of fish in local environment of Chesapeake Bay
  - Discovered that the illness was due to the presence of toxins created by dinoflagellate Pfiesteria
  - He found that these toxins could be bound by certain binders, such as Cholestyramine
- Mold toxicity can also occur from mold spore fragments, volatile organic compounds (VOCs), and other microorganisms.

**MYCOTOXINS**

- Molds produce mycotoxins as a way to keep other mold out of their ecological niche
- Mycotoxins spores can be inhaled into our lungs, absorbed through our skin by touch, or consumed through food into the GI tract
BIOTOXICITY

- Microbes (i.e. yeast, bacteria, spirochetes, parasites, etc.) can cause illness due to infection.
- When treatment is implemented to kill off these microbes, the microbes can release toxins in response to being killed \( \rightarrow \) biotoxins
- Biotoxins are difficult to detoxify and can accumulate in the system
  - Will accumulate in the liver for excretion and be bound to bile as they move through the GI tract to be excreted. However, the enterohepatic circulation will conserve the bile, therefore recycling the biotoxins as well.
BIOTOXIN PATHWAY

- Mold Toxins are ionophores
  - One end lipophilic (dissolves in lipids)
  - Other end Hydrophilic (dissolves in water)
- After inhalation, ingestion, contact the Ionophores insidiously move throughout the body
- End result is inflammatory immune response

MYCOTOXIN INFLAMMATORY RESPONSE

- Mycotoxins
  - Enter Fat Cell
- Binding releases 2\textsuperscript{nd} Messenger
  - Activates NF Kappa B
- Moves into Nucleus
  - Turns on gene transcription
  - Cytokine production
MYCOTOXIN INFLAMMATORY RESPONSE

Cytokines
- Block Leptin Receptors

Fat cells produce more Leptins
- To override creating Leptin resistance

Hypothalamus no longer makes MSH, VIP
- Critical regulators of neurologic, immunologic, endocrine function

Chronic Illness Associated with Mold and Mycotoxins: Is Naso-Sinus Fungal Biofilm the Culprit?

Joseph H. Brewer, 1 *, Jack D. Thrasher, 2 and Dennis Hooper 3

Abstract

It has recently been demonstrated that patients who develop chronic illness after prior exposure to water damaged buildings (WDB) and mold have the presence of mycotoxins, which can be detected in the urine. We hypothesized that the mold may be harbored internally and continue to release and/or produce mycotoxins which contribute to ongoing chronic illness. The sinuses are the most likely candidate as a site for the internal mold and mycotoxin production. In this paper, we review the literature supporting this concept.
Role of mycotoxins in the pathobiology of autism: A first evidence.
De Santis B1, Brenna C1, Mezzalara A2, Soriceii S1, Cicero E2, Moretti Q1, Debernardi F1, Bonaglia M2, Villa L2, Mattei M3, Rappi ME3.

@ Author Information

Abstract
OBJECTIVES: Gene-environment interaction is an emerging hypothesis to expound not only the autism pathogenesis but also the increased incidence of neurodevelopmental disorders (such as autistic spectrum disorder, attention-deficit, hyperactivity disorder). Among xenobiotics, mycotoxins are worldwide contaminants of food that provoke toxicological effects, crucially resembling several symptoms associated with autism such as oxidative stress, intestinal permeability, and inflammation. Here, we focused on a group of mycotoxins to test their role in the manifestation of autism, try to explain their mechanism of action, and discuss possible preventive and therapeutic interventions.

METHODS: Autistic children (n = 52) and healthy children (n = 58 [31 siblings and 27 unrelated subjects]) were recruited and body fluids and clinical data collected. The diagnosis of autism was made according to DSM V criteria, then with GMDS 0-2, WPPSI, and ADOS. Ochratoxin A (OTA), gliotoxin, zearalenone, and sphingosine/sphinganine ratio were determined by LC analysis in sera and urines. Statistical analysis was performed by the Wilcoxon Rank Sum (Mann-Whitney) test and Spearman test.

RESULTS: By comparing the results of autistic patients with those of unrelated controls, a significant association was found for OTA levels in urines (P = 0.0002) and sera (P = 0.0017), and also comparing patients with siblings and unrelated controls together (P = 0.0081).

DISCUSSION: Our results are the first describing a possible role of OTA in the pathobiology of autism. Recalling the male prevalence of ASD (male/female = 4.5/1), it is noted that, in animal models, OTA exerts its neurotoxicity especially in males. Moreover, in vitro, OTA increases microRNA-122 that is dysregulated in autistic patients and involved in reciprocal regulation of the autism-related genes MeCP2 and PTEN. A personalized diet coupled with probiotic administration, especially OTA adsorbing Lactobacillus, could ameliorate autistic symptoms in OTA-positive patients.

Effects of Mycotoxins on Neuropsychiatric Symptoms and Immune Processes.
Ratnasenan AM1, Tsilioni I1, Theoharidou TC1.

@ Author Information

Abstract
PURPOSE: The effects of air pollutants have been receiving increased attention both clinically and in the media. One such pollutant is mold, fungal growth in the form of multicellular filaments known as hyphae. The growth of molds is omnipresent not only in outdoor settings but also in indoor environments containing excessive amounts of moisture.

METHODS: PubMed was searched for relevant articles using terms such as mold, mycotoxins, fungi, immunity, inflammation, neurodevelopment, cognition, Alzheimer's, and autism.

FINDINGS: Exposure to molds is most commonly associated with allergies and asthma. However, it is now thought to be associated with many complex health problems, since some molds, especially Trichoderma, Fusarium and Stachybotrys spp., produce mycotoxins that are absorbed from the skin, airways, and intestinal lining. People exposed to molds and mycotoxins present with symptoms affecting multiple organs, including the lungs, musculoskeletal system, as well as the central and peripheral nervous systems. Furthermore, evidence has recently implicated exposure to mycotoxins in the pathogenesis of autism spectrum disorder. The effects of mycotoxins can be mediated via different pathways that include the secretion of pro-inflammatory cytokines, especially from mast cells.

IMPLICATIONS: The information reviewed indicates that exposure to mold and mycotoxins can affect the nervous system, directly or through immune cell activation, thus contributing to neurodevelopmental disorders such as autism spectrum disorder.
**SYMPTOMS OF MOLD TOXICITY**

- Electric shock sensations
- Ice pick or lighting bolt pains
- Vibrating or pulsing sensations (especially down spine)
- Muscle weakness
- Numbness and tingling
- Disequilibrium
- Dizziness
- Anxiety
- Muscle Pain
- GI symptoms
- Chest tightness

**SYMPTOMS OF MOLD TOXICITY**

- Chronic Sinus Congestion/Recurrent Sinus Infections
- Brain Fog
- OCD
- Sleep disturbances
- Headaches
- Rashes
**HISTORY**

- Take a careful health history including environmental history
- What year was the house built?
- Is there visible mold in his/her environment?
- Is there a musty odor in his/her environment?
- Any water leaks or flooding in his/her environment?
- Any ventilation issues in his/her environment?
- Do behaviors/symptoms decrease or increase in certain environments?
- Anyone in the family with similar symptoms?

**PHYSICAL EXAM FINDINGS**

- Tenderness of sinuses on palpation
- Nasal Congestion
- Inflammation of turbinates
- Resting tremor, (often subtle, can be Parkinsons-like)
- Cool and/or discolored hands and feet, pallor
- Unilateral weakness, especially in shoulder muscles
  - Note: evaluating the ability to maintain the arms outstretched with downward pressure on the hands and then rechecking this will usually reveal weakness
Mycotoxin Urine Test

- Best done after two week course of oral glutathione, IV glutathione, and/or Sauna
- Watch for worsening of symptoms during challenge
- More specific and less invasive testing
- May worsen at start of treatment
- N of 1 (testing as guide)

Visual Contrast Sensitivity Test

- Biotoxin exposure can impair optic nerves
- Ability to see patterns impaired
- 98% who fail VCS and have 8 symptoms or more, have a biotoxin illness
- Monitor changes over treatment course
- Can be tested online

Mycotoxin Test

- Mycotoxin urine test will screen for eleven different mycotoxins, from 40 species of mold
- First morning urine (10 ml required)
  - Fasting for 12 hours may increase the excretion of mycotoxins from the adipose tissue

<table>
<thead>
<tr>
<th>MycoTox Profile</th>
<th>Common Range of Positive Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspergillus Aflatoxin-M1</td>
<td>0.00 - 3.5 - 20</td>
</tr>
<tr>
<td>Ochratoxin A</td>
<td>6.14 - 4 - 20</td>
</tr>
<tr>
<td>Gliotoxin</td>
<td>1366.35 - 200 - 2000</td>
</tr>
<tr>
<td>Penicillum Sterigmatocystin</td>
<td>2.43 - 0.2 - 1.75</td>
</tr>
<tr>
<td>Mycophenolic Acid</td>
<td>91.04 - 5 - 50</td>
</tr>
<tr>
<td>Stachybotrys Roridin E</td>
<td>0.00 - 1 - 6</td>
</tr>
</tbody>
</table>

- Testing performed by The Great Plains Laboratory, Inc., Lenexa, Kansas. The Great Plains Laboratory has developed and determined the performance characteristics of this test. The test has not been evaluated by the U.S. Food and Drug Administration. The FDA does not currently regulate such testing.

<table>
<thead>
<tr>
<th>Patient Name: Jennifer Nelson</th>
<th>Requisition #: 640040</th>
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<tbody>
<tr>
<td>Requisition #: 640040</td>
<td></td>
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<tr>
<td>Date of Collection: 12/18/2018</td>
<td></td>
</tr>
<tr>
<td>Patient BirthDate</td>
<td></td>
</tr>
<tr>
<td>Time of Collection: 7:00 AM</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Print Date: 12/31/2018</td>
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</table>

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www.GPL4U.com
VISUAL CONTRAST SENSITIVITY

- Nothing visible in Row E
- Barely able in Row D
- Test failed = biotoxicity
- Interpretation – note hand drawn checks & ovals
  - Check = black and white component seen clearly
  - Oval means component not seen

TESTING

<table>
<thead>
<tr>
<th>LAB MARKER</th>
<th>NORMAL RANGES</th>
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<tbody>
<tr>
<td>VIP</td>
<td>23-63 (ARUP labs only)</td>
</tr>
<tr>
<td>MSH</td>
<td>35-81</td>
</tr>
<tr>
<td>MMP-9</td>
<td>85-332</td>
</tr>
<tr>
<td>c4a</td>
<td>&lt; 2380</td>
</tr>
<tr>
<td>TGF-beta-1</td>
<td>&lt; 2380</td>
</tr>
<tr>
<td>Leptin</td>
<td>Male: 0.5-13.8; Female: 1.1-27.5</td>
</tr>
</tbody>
</table>

- C3a – elevated
- C4a – elevated
- TGF beta-1 – elevated
- MMP 9 - elevated
- VEGF – low
- VIP – low
- Leptin - low
- MARCONs Nasal Swab - Multiple Antibiotic Resistant Coagulase Negative Staph
  - Identified by nasal culture; Barrier to immune defenses; colonization (not infection)
**ERMI tests**
- Environmental Relative Moldiness Test
- Vacuumed dust of space (home, office, school, other) examined for 36 mold toxins
- The higher the number, the greater the relative mold burden

**HERTSMI – 2**
- Health Effects Roster of Type Specific Forms of Mycotoxins and Inflamagens
- Looks for 5 Species of Mold (also included in ERMI)
- Scoring system (www.survivingmold.com/diagnosis/hertsmi-2)
  - < 10 – SAFE
  - 11-15 – Borderline; clean and retest
  - > 15 – Dangerous for those with CIRS

**Evaluation by Mold Specialist**

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**TREATMENT**

- Avoid exposure to toxic molds!
  - Leave environment, remediate environment, prevent re-exposure get out
- Increase Essential Fatty Acids
  - 3-4 grams/day
- Use Binders
  - Cholestyramine
  - Activated Charcoal
  - Bentonite Clay
  - Chlorella
  - S. Boulardii
  - Okra
- Add Oral or Nasal Antifungals
  - Oral Antifungals:
    - Prescription
    - Herbals: berberine, oil of oregano, grapefruit seed extract, gymnema, uva ursi, pau d’arco, caprylic acid, garlic, plant tannins
  - Nasal Sprays:
    - Xylitol
    - Argentyn 23

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Shoemaker and House, 2006
Neil Nathan, TOXIC
TREATMENT

- **Break up biofilms**
  - Biofilm enzymes
  - NAC

- **Avoid Constipation**
  - Magnesium, aloe, vitamin C

- **Support liver and detox function**
  - Glutathione, NAC, Milk Thistle, Dandelion, Phosphatidylcholine, antioxidants, oil pulling, ioncleanse

- **Mitochondrial support**
  - CoQ10, MCT oil, PQQ, antioxidants

- Remove gluten if positive; anti-inflammatory, amylose-free diet

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TREATMENT

- Make sure to test/treat for Lyme or Lyme coinfections as this can complicate healing from mold toxicity
  - There is a genetic predisposition in susceptible individuals to biotoxins including Mold and Lyme
    - Consider HLA-DR testing
      - HLA DR8 and DQ
      - 4/3/53
      - 11
      - 12/3/52G
      - 14/5/52B
LYME DISEASE

CDC estimates 300,000 new cases of Lyme Disease are discovered each year in the United States.

20% of population will have tick-borne diseases and up to 35% in some areas (like CT)
LYME HOSTS

• > 22 species of borrelia (burgdorferi, afzelli, garinii, miyamotoi…)
• Ixodes transmitted tick borne diseases
  • Borrelia burgdorferi, miyamotoi, mayonii
  • Babesia, Ehrlichia, Barotella, Anaplasma species
• Ixodes ticks bite a variety of hosts
  • Mice, rats, squirrels, shrew
  • Incidental hosts – humans, domesticated animals, lizards
  • Gestational
• Tick dispersion over wider distances
  • Many species of songbirds
  • Deer

LYME TRANSMISSION

• Tick saliva injected into dermis – it is not just about the infection (anesthetic, anticoagulant, immune modulating properties)
• Borrelia Myomata - Can be transmitted without a full tick (that has NOT eaten)
• Gestational and Perinatal Transmission

Risk very small if < 24h attachment but not fictitious
**LYME RASH**

- “Typical” rash – EM (Erythema Migrans)
  - Central clearing, raised expanding border
  - Oval, erythematous, spreading
  - Painless, warm, may be itchy, raised
- < 32% have “classic” bulls-eye rash
  - Any shape possible
  - Faint pink – deep scarlet; can be solid coloring
  - Vesicular (especially on legs)
  - Check skin folds, hairy areas

**LYME SYMPTOMS**

**BORRELIA**

- Flu-like symptoms
- Bulls-eye rash (erythema migrans)
- Nerve pain
- Peripheral neuropathy
- Vertigo
- Headaches (whole head hurts)
- Neck pain
- Joint pain
- Cardiac symptoms
BARTONELLA SYMPTOMS

- Sensitivity to noise/light/chemicals/smells
- Pain in soles of feet
- Sensation of vibration/trembling
- Numbness/tingling
- Joint/muscle pain
- Emotional instability
- Anxiety, panic attacks
- Headaches (located in back of head)
- GI symptoms
- Pelvic/bladder symptoms

BABESIA SYMPTOMS

- Night sweats
- Shortness of breath (“air hunger”)
- Headaches (frontal)
- Cognitive dysfunction
- Hallucinations
- Cognitive impairment
**EHRLICHIA SYMPTOMS**

- Headache
- Myalgias
- Malaise
- Vomiting
- Cough, pneumonitis
- Repetitive stress injuries

**Signs:**
- Initial leukopenia, thrombocytopenia
- Then leukocytosis, elevated liver enzymes

**PHYSICAL EXAM**

- Erythema Migrans – BORRELIA
- Striae that blanches – BARTONELLA
- Swollen Lymph Nodes
- Heart rhythm irregularities
- Facial palsy and neuropathy
- Swelling of joints
TESTING

- Testing (not positive for several weeks after tick bite)
  - Extended western blot (18, 23-25, 31, 34, 37, 39, 83, 93)
  - Coinfections (babesia, bartonella, ehrlichia)
  - CD57 (decreased levels, inaccurate, not sensitive)
  - PCR (poor sensitivity < 30%)
  - Inflammatory and immune markers (ANA, ESR, hsCRP)
  - Metabolic markers (homocysteine, B12 (MMA), plasma zinc, RBC magnesium, T3, T4, thyroid antibodies)
  - Mitochondrial markers (carnitine, ammonia, lactate, CK, amino acids, urine organic acids)
  - Other germs (mycoplasma, viruses, strep and yeast)
  - Intracellular infection – VEGF, TGF beta, C3a, C4a)

TREATMENT

**Initial treatment for Lyme (4-6 weeks of oral agent)**
- Doxycycline (preferred antibiotic)
- Amoxicillin
- Cefuroxime
- Azithromycin

**Babesia Treatment**
- Atovaquone and Azithromycin OR Clindamycin and Quinine (CDC 2015 Treatment Guidelines)
- Bioavailability of atovaquone is low and variable and is highly dependent on formulation and diet
- Atovaquone should be taken with fatty food
  - With food, bioavailability is approximately 47%
  - Without food, bioavailability is 23%

**Ehrlichia Treatment**
- Doxycycline and Rifampin (Dumler 2009)

**Bartonella Treatment**
- Treatment - no single treatment is effective; (Spach 2015)
  - Rifampin and Bactrim; Rifampin and Azithromycin; Bactrim and Azithromycin
LYME TREATMENT

- Japanese Knotweed
- Cat’s Claw
- Teasel
- Andrographis
- Biocidin
- Samento
- Banderol
- Cumanda
- IF YOU FIND A TICK – CONSIDER LEDUM 30C (Homeopathic Remedy)

LYME CO-INFECTION TREATMENT

Babesia
- Cryptolepis
- Chinese Skullcap
- Bidens pilosa
- Artemisinin
- Red Sage
- Sida Acuta

Bartonella
- Japanese Knotweed
- EGCG with quercetin
- L-arginine
- Cordyceps
- Sida Acuta
- Red Root
- Argentyn 23
- A-Bart

Ehrlichia
- Cordyceps
- Red sage
- Houttuynia
- Chinese Skullcap
- Astragalus
- Kudzu
- Quercetin
HERXHEIMER REACTION

• Herxheimer” reaction
  ~20% of patients
  • First described with PCN treatment of syphilis
  • Intensification of baseline symptoms
  • Variable duration, onset often within hours

• Herx Support:
  • Epsom salt baths
  • Activated charcoal
  • Burbur pinella
  • Alkalization
  • Other binders

Pound MW. J Clin Pharm Thera. 2005
NUTRITION

• Remove sugars, processed food, GFCF
• Stevia – antimicrobial benefits
• Pomegranate Juice – antimicrobial benefits
• Increase antimicrobial spices and herbs in diet
  • Oregano, cinnamon, clove, garlic, ginger, rosemary, etc.
• Add bone broth, fermented foods
• Increase foods high in antioxidants (berries, nuts, green leafy vegetables, etc.)

PREVENTION

• Know Endemic areas
• Clothing Protection
  • Tuck in pants
  • Hats
  • Long sleeves
• Use Natural Tick Spray
  • Recipe:
    • 25 drops Geranium essential oil
    • 10 drops Citronella essential oil
    • 5 drops Lemon essential Oil
    • 2 oz of Witch Hazel
    • 2 oz Water
• Make sure to do tick checks!
IMPORTANCE OF PROPER TREATMENT

CHRONIC INFLAMMATORY RESPONSE SYNDROME

Toxins and/or microbes

Stimulated Immune Response

INFLAMMATION
CHRONIC INFLAMMATORY RESPONSE SYNDROME

- Symptoms in 6 clusters
- Commonly up to 10

CIRS Symptom Clusters

<table>
<thead>
<tr>
<th>Fatigue</th>
<th>Red Eyes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weakness</td>
<td>Unusual skin sensitivity</td>
</tr>
<tr>
<td>Decreased assimilation of knowledge</td>
<td>Tingling</td>
</tr>
<tr>
<td>Aches</td>
<td>Blurred Vision</td>
</tr>
<tr>
<td>Headaches</td>
<td>Sweats (right)</td>
</tr>
<tr>
<td>Light Sensitivity</td>
<td>Mood Swings</td>
</tr>
<tr>
<td>Memory Impairment</td>
<td>Low-pick Pain</td>
</tr>
<tr>
<td>Decreased Word Finding</td>
<td>Shortness of breath</td>
</tr>
<tr>
<td>Sinus congestion</td>
<td>Abdominal Pain</td>
</tr>
<tr>
<td>Difficulty Concentrating</td>
<td>Cough</td>
</tr>
<tr>
<td>Excessive thirst</td>
<td>Disorientation</td>
</tr>
<tr>
<td>Confusion</td>
<td>Metallic Taste</td>
</tr>
<tr>
<td>Joint Pain</td>
<td>Appetite Swings</td>
</tr>
<tr>
<td>A&amp;M stiffness</td>
<td>Difficulty regulating body temperature</td>
</tr>
<tr>
<td>Cramps</td>
<td>Increased agitation</td>
</tr>
</tbody>
</table>

Cluster table © R. Shoemaker

TREATMENT

Stepwise Treatment Protocol for CIRS

CIRS Treatment Steps © K. Berndtson and R. Shoemaker
CLOSING REMARKS

There is a relationship between Lyme and Mold Toxicity

Multisystem treatment is needed

Treat the whole child and the whole illness (your N of 1)

Identify underlying problems by looking at INDIVIDUAL history, physical exam clues and laboratory data

Think environmental exposures (i.e mold and Lyme) when not making progress with treatment as expected

Best to include herbals and supplements in treatment plan for successful long term outcomes!

THANK YOU!

www.lindseywellsnd.com

Instagram: @lindseywellsnd
Facebook: Lindsey Wells ND, LLC